QUARTERLY

JOURNAL OF AGRICULTURE.

VOL. X.

JUNE 1839—MARCH 1840.

WILLIAM BLACKWOOD & SONS, EDINBURGH:
AND T. CADELL, STRAND, LONDON.
MDCCCXL.

PRINTED BY NEILL & CO., OLD FISHMARKET, EDINBURGH.

CONTENTS.

THE

QUARTERLY

JOURNAL OF AGRICULTURE.

ON THE NATURAL HISTORY AND THE DIFFERENT MODES OF FISHING AND CURING THE HERRING.

By Mr John Mitchell, Merchant, Leith.

I. *Natural History of the Herring.*

Description.—The Herring, *Clupea Harengus*, is a soft-finned abdominal fish of the bony or spinous class, having a serrated mystache branchiostege membrane of eight rays covering the gills; a scaly carinated line runs along the belly from the head to the tail, and the under jaw is longer than the upper. The fins are seven in number, namely, one dorsal of eighteen rays, two ventrals of nine rays each, one anal of seventeen rays, two pectorals of eighteen rays each, and the tail or caudal fin of eighteen rays.* The eyes are placed on the sides of the head, about the middle of its length, the iris being of a silvery-white colour, and the pupil black. The herring, when first taken out of the water, is of a dark bluish and green colour on the back, and silvery-coloured on the sides and belly, the scales having a clear lustrous golden or orange colour of considerable beauty, and lying over each other in regular lines, with the convex edges pointing from the head towards the tail, so that they form small segments or concave edges pointing to the head: the termination of the body at the tail is remarkable in exhibiting a beautiful dark green colour when held before the light. The spine or back-bone consists

* The number of rays sometimes vary. I have counted dorsal 17, anal 14 to 17, pectoral 15 to 18, and caudal 18 to 20; the ventral I have always found to be 9.

of fifty-six vertebræ; the cavity of the belly, terminating at the anal fin, has on each side thirty-five or thirty-six bones or ribs, and the sides next the tail are furnished with several minute bones, terminating in soft elastic muscles at that fin, which must serve to give it strength and elasticity; fifty-two bones have been counted as composing the head. The herring has four gills or bronchiæ on each side, each gill being supported by an arched cartilage; there are, besides, two small imperfect gills not having any bony arch, these join the gill-lid, and apparently regulate its motions; the convex side of the gills is supplied with fringed fleshy fibres, of a red colour when the fish is in a healthy state; the concave side, or that nearest the mouth, is furnished with long serrated spines. In common with most other fishes, the air contained in the water necessary for the support of the herring is furnished by the gills, which serve the same purpose as the lungs of other animals; the water entering the mouth meets the gills, which receive the necessary oxygen, and the gill-opening allows the remaining water to escape. The heart of the herring is situated at the upper part of the stomach, in a cavity near the gills; it is three sided, and consists of a single auricle, and a single ventricle: the auricle receives the blood from the body and sends it to the ventricle, from whence proceeds an artery, extending and connected by minute branches to the gills. The œsophagus or gullet is remarkably short in proportion to the size of the fish; the stomach is thin and membranous, and is capable of great distention; the gut is of uniform size throughout, at the upper end of which are attached the *appendices cæci*. The gall-bladder is small, the bag of a dark green, and the liquid of a light claret colour, having a sweetish and somewhat pungent taste. The air-bag or *vesica natatoria*, is of a silvery-white colour, round, of nearly the length of the stomach, and pointed and narrow at both ends; it is connected with the posterior part of the stomach (which posterior part is shaped like a funnel), by a duct which lies in the female between the roes, and in the male between the milts; the air-bag, it may be supposed, enables the herring to proceed to any depth, or to rise and sink by the power of contraction or expansion, for it has been found, that, if the air-bag of a living fish is pierced in the water, the fish sinks to the bottom. The form and consistency of the nose of the herring proves its use for the purpose of feeling in absence of the cirri or feelers as possessed by other fishes; the skin not being provided with the corpus papillæ, and being besides covered with scales, it is supposed that the sensation of touch is not possessed by the herring, except in a very limited degree. The herring is provided with two nostrils, and from the perfection of the olfactory organ, it is presumed that it is of great use in the selection of its food. The herring has no external organs of hearing, but a fringed orifice appears below the eye, on the inner side of that part of the head which covers the gills. Fishermen affirm that they hear, and state instances of their immediately giving up that pattering sound which they make on the surface of the water on a calm evening, if a loud sound is made on any part of the interior of the boat. The Swedes attribute the departure of the herrings from the neighbourhood of Gothenburg to the frequent firings of the British ships of war which were stationed there, and acting as convoys. As a proof that the fishermen attribute great influence to sound, we are told that in former times the bell which rang the people of St Monance in Fife to public worship, and which hung upon a tree in the churchyard, was removed every year during the herring season, because the fishermen believed that the fish were scared away from the coast by its noise.* There are a few teeth in the upper jaw, four rows in the tongue, and on the lower jaw four or five small teeth.

Food.—Their usual food consists of extremely minute animals, such as the small medusæ, the oniscus marinus, and small cancri and animalcula. On some parts of the Norway coast they eat a small red worm called the roé-aal, which renders the fish not very suitable for curing. Herrings often leap at flies, and they have been frequently caught by hooks baited for the purpose of catching codlings, and even by clear unbaited hooks. A respectable herring-curer of Banff told me that, in June 1824, he caught a quantity of herrings having young sand-eels (*Ammodytes tobianus*) in their stomachs; he counted the number in the stomach of one of the herrings, and found forty-two from one to two inches in length: this was an early period for herrings appearing in the Moray

* Chambers' Picture of Scotland, page 210.

Firth, and the milt and roe were of small size. An intelligent fisherman at Fraserburgh observed one year in August, that the stomachs of many of the herrings were full of young fishes; the number in one instance he counted, and, incredible as it may appear, 700 were found in the stomach of one herring. On July 24, 1830, I examined the stomachs of several herrings caught off Dunbar: I found that those which had the milt and roe small, had their stomachs filled with young sand-eels about three inches in length; while, on the contrary, those herrings in which the milt and roe were full grown, had no sand-eels in their stomachs. In many instances about the time of spawning, herrings are often found with herring-spawn in their stomach, it thus appearing that they devour their own progeny. Off Fraserburgh, about the herring season, and about 15 miles distant, the sea has frequently the appearance of being covered with a small reddish animal, supposed to be the young of some of the cancri. In the end of May 1829, two or three young lads at Banff caught upwards of six dozens of herrings each in a few hours with a fishing-rod and fly-hook; they were of good size, and in every respect of the usual kind.* On 19th July 1836, I examined several herrings fished some miles from the shore of Dunbar: the herrings had the milt and roe small, and many had their stomachs full of young sand-eels of two or three inches in length. On the 2d September 1836, I again examined several herrings from off Dunbar, the milt and roe being large in some, but some were spawned, and in the stomachs of these were portions of the spawned milt and roe. About the end of May of the same year, an enterprising fish-curer wishing to get herrings early forward to the Hamburg market, sent boats with fly-hooks to the distance of about a mile and a half from the shore, where, in the course of an hour, the crew of each boat got from 300 to 500 herrings; there were twenty-seven hooks on each line, and there were generally 17 and 18 herrings on the hooks each dip. On the 21st July 1836, some Fifeshire boats tried the fishing of herrings about one mile to the westward of the Island of May, and with plain clear white tinned hooks, they soon got about 500 herrings into each boat; there were eight or nine boats: at the same time one boat tried with six nets

* Scotsman, 8th July 1829.

and fished 3000 herrings. From May to July 1837, a very considerable take of herrings was carried on in the Moray Firth, solely by means of the fly and clear unbaited hooks. The herring fishing (19th May 1837) commenced in this way at Eyemouth, and the adjoining coast, and was very successful: several boats went off immediately after sunset with lines and hooks unbaited, and in the morning returned generally with from 2000 to 3000 herrings. I have frequently examined the stomachs of the herrings which have come under my observation, and generally found, when the herrings first begin to come near the coast, and when the milt and roe are small, a considerable proportion of them with young sand-eels, or other small fish in the stomach, often quite entire, and sometimes three inches in length. I have often observed the gills covered by a brown slimy substance, which has induced me to suppose, that, when the milt and roe have grown to a considerable size, the herring perhaps possesses the power of retaining the food in its mouth by means of the long serrated spines of the gills, and thus it may obtain sustenance without the necessity of swallowing more material substances. It is pretty evident, however, that the herring does not confine itself to one particular kind of food, but seems to feed on all the various kinds of aquatic crustacea, and that nature has also given it the power of eating the young sand-eel, its own young, and the young of other fish, flies, &c. Lacepede says, (vol. v.) "La nourriture à laquelle il doit ses qualités, consiste communément en œufs de poissons, en petits crabes et en vers." Scoresby says, "these (the herrings) subsist on the smaller cancri, medusæ, and animalcules."* Mr Mackenzie in his essay on the herring, published in the second volume of the Highland and Agricultural Society's Transactions, 1803, in mentioning that herrings are sometimes taken by unbaited hooks, says (page 314), "it seems certain, therefore, that the herrings take these hooks for such animalcules as they, at least, sometimes feed on." Rondeletius says, "the herrings feed largely on the sea-caterpillar:" and another author says, "Their food is insects,"† meaning of course small crustacea.

There has been considerable discussion regarding the

* Account of the Arctic Regions, vol. i. p. 546.

† Sharon Turner's Sacred History, pp. 287-318.

food of the herring, but although some writers assert that the food is unknown, and others that it was unknown until lately, we shall find that many able writers have long since satisfactorily decided this question from actual observation. Neucrantz, an author who wrote an able work De Harengo, and who died in 1671, states, "that he had frequently ascertained the nature of the food from personal observation, and had counted in one herring upwards of sixty minute squillæ or shrimps, and that, when the spawning was complete, there was less food found in the stomach of the spawned herring," and sometimes the ova of its own and other species.* Leuwenhoek, who minutely examined the stomach of the herring, came to the conclusion, that they fed "not only on animalcula, minute fishes or aselli, minute crustacea, squillæ, and even on their own ova, but also, when pressed for hunger, any thing they met with."†

Otho Frederick Müller, in his work published at Copenhagen and Leipsic in 1785 on crustacea, describes the *Cyclops longicornis* as having been found by Guerner "in sinu Drobactiorum," in the stomach of the herring; and the roé-aal, described as worms by some authors, is stated in Sonnini's Buffon, to be one of the crustacea, *Astacus harengum*, which gives a reddish colour to the stomach of the herring;‡ and Fabricius, who wrote a work "De specie insectarum," in 1781, says of the same *Astacus harengum*, "habitat in oceano Norwegico copiosissime, harengum et gadarum esca,"§ namely, that it is most abundant in the Norwegian Sea, and is eaten by the herring and cod; and he also describes another of the minute shrimps, *Gammarus esca*, as existing in the Norwegian Sea, and that it is "harengum cibus gratissimus," most agreeable food to the herring.‖

Latreille, a celebrated entomologist who published his work in 1798, refers to the *Astacus* and *Gammarus*; and Cloquet, in the Dictionnaire des Sciences Naturelles, says of the herring,

* Neucrantz de Harengo, page 28.

† Atqui ita mihi conspicua fuit haleces non tantum vesci exiguis pisciculis atque etiam propriis ovis, sed et quodcunque obvium urgente necessitate versus stomachum demittere.—Leuwenhoek, I. Epist. 97. pp. 52, 53, dated January 1696.

‡ Sonnini's Buffon, vol. lxvii. p. 15. § Vol. i. p. 511. ‖ Vol. i. p. 518.

"Il se nourrit des œufs de poissons, de petits crabes et des vers;" or, they live on the eggs of fishes, small crabs, and worms.* Bosc, in the Nouveau Dictionnaire d'Histoire Naturelle, says, "Ils vivent de petits poissons, de petits crustaces, de vers marins, et de mollusques,"—they live on small fish, small crustacea, sea-worms, and testacea; and several authors, among whom are Mr Low and Dr MacCulloch, state, as before mentioned, that the herring is caught abundantly with the fly. Dr Neill, in his List of Fishes published in the Wernerian Transactions in 1811, says that he found "in the stomach and œsophagus of a large female herring, no fewer than five young herrings, not sprats;" and Mr Stark, who writes an excellent paper on this subject in Blackwood's Magazine for August 1838, page 183, and from which we have taken some extracts, says, "I found in the stomach of the herring two partially decayed young fishes of the same species."

Spawning.—The male herring has two milts of an oblong shape and whitish colour, and the female has two roes which are darker than the milts; the number of eggs contained in a female was found by Dr Harmer† to be 36,960; the weight of its body was 5 oz. 10 dr., and the weight of the roe 480 gr. Herrings have been sometimes found with the roe of the preceding season in a bag, or covered with a skin, in addition to the roe of the following season. At Thurso, in the middle of June, a respectable fish-curer told me that, in the inside of a herring, he found the old roe of the previous season, the eggs of full size, covered over with two layers of fat, and a thick dark film adhering close to the back, and outside of this the two other parts fully formed about three inche in length.

The herring deposites its spawn on hard clayey or rocky ground or gravel, before leaving the bays or rivers where it resorts. The female first ejects the roe, which is afterwards impregnated by the ejection of the male. Sauer describes the mode of impregnation from actual observation, and states, that in the inner harbour of St Peter and St Paul, Kamschatka, the herrings were extremely numerous, and he observed that on the 7th June one herring made circles of about six feet in diameter, and in the middle of this circle at the bottom another

* Vol. i. p. 498.

† Phil. Trans. vol. lvii. p. 280.

was fixed which deposited a yellow coloured substance; when the tide went out he went to the spot, and saw the aquatic plants and the stones covered with the spawn, which was devoured by dogs, gulls, and crows.

We have never had an opportunity in this country of observing so minute a process, but we have fully ascertained that the shoals generally fix in one locality for depositation, and that immediately after spawning the herrings proceed to sea. The nets of the fishermen are then often covered with the detached unfecundated eggs of the female; but these eggs, found loose in the nets, are driven out by the pressure of the twine. The really oviparous fecundated spawn, of which I have specimens in my possession, is of a different description, and wonderfully manifests the sublime behests of creation. The proper incubation (I must use the term for want of a better), as before mentioned, is as follows:—The female remains quiescent at the bottom, the whole of the roe is at once deposited, the milt, thoroughly ripened in the male, has become changed from a solid mass to a liquid of the colour and consistency of rich cream; and, let us mark the wonderful adaptation of "a little leaven leavening the whole lump," the roe, although placed in the briny flood, becomes a firm, united mass, somewhat larger than, but similar in shape to, the roe in a full herring. Cohesion is thus the first result; but a second is embued. This lifeless mass, or egg-bed, has the power of adhesion—it grasps firmly the stones, the rocks, the sea-weed, &c.; so much so, that I have found it difficult to remove or separate them, until the mass was dried or dead—the young being thus protected from the effects of storms and currents, to a certain extent from being devoured by fishes, and being thus firmly fixed probably in a suitable feeding ground.

The eyes are first observable—at least a small black speck is first seen in the egg. Thereafter the head appears, and in fourteen days, or perhaps three weeks after they are found in this state, the young are seen in great abundance near the shore, of a very small size; in six or seven weeks more, they are observed to be about three inches in length, and move about in large shoals in winter and spring on the various coasts, and in the rivers and bays generally resorted to by the herring shoals, and it is likely that they attain to full size and maturity in about eighteen months. Lacepede says, that in North America the spawn of the herrings have been carried by the inhabitants, and deposited at the mouth of a river which had never been frequented by that fish, and to which place the individual fishes from these spawn acquired a habitude of returning each year, bringing with them probably a great many other individuals of the same species. It might perhaps add to our knowledge of the natural history of this animal, if some of the proprietors of sea-water fish-ponds were to make experiments in the same way, by removing the spawn, or even by transporting the herring alive,—for the last-mentioned author states, that in Sweden they have been transported alive to waters where they were awanting ; but, if the latter plan be attempted, great care must be taken to keep the bronchial opening shut in removing the fishes from one water to the other, for herrings soon die in consequence of the drying of the bronchies.

Swimming.—The herring advances through the water by means of the tail, which is moved in rapid elastic flexures, in a similar way to the skulling of an oar: the other fins are evidently adapted for steadying the animal in its progress, and for enabling it to rise and descend in the water. When the herring swims near the surface, if it is calm weather, the sound of their motion is distinctly heard at a small distance, being like the rippling of water, or resembling the pattering of rain, and at night their motion, if rapid, causes a beautiful bright line, from the phosphorescent quality of the skin in connection with the water; and it is also said, when a great body of them swims near the surface, their presence is ascertained by a strong fishy smell. Perhaps our fishermen trust too much to what they call "appearances." In many places, and particularly on the north-west coast of Scotland, the fishermen seldom think of trying the fishing unless they see flocks of gulls, large fishes, and such symptoms; but this is very erroneous,—the healthy herrings generally swim deep, and only the young, the full, and sickly swim near the surface. A strong proof of the ignorance of those concerned in the fisheries on that coast, and of the little attention that ought to be paid to appearances, is the fact, that the busses for the bounty in the end of last centuy cleared from Campbeltown for the fisheries annually on the

12th of September, which was long after the time they ought to have commenced. I have conversed with several experienced masters of the Dutch herring busses, who assured me that they seldom look for appearances, but after coming upon our coasts they select their fishing ground, where, to use their own words, the sea has a dark green, and thick or muddy colour, which they find, by long experience, promises the best fishing.

Weather.—Light and heat appear to have very considerable influence upon the motions of the herring. When the summer has been unusually clear and warm, I have observed that the herrings do not come so near our coasts as they do in ordinary seasons. The cause may be, that a certain portion of light and heat is necessary in spawning, and in such weather they are enabled to keep on the banks more distant from our shores and in deeper water than in ordinary seasons. As a proof of this, the Dutch deep-sea herring-fishermen are often unusually successful in those years when our coast fisheries are quite the reverse. At Liimfiord, at one time the greatest fishing station in Denmark, where the entrance to the fiord or frith is narrow, and the water shallow, the herring fishing often completely failed, when the summer light and heat were excessive, and the experienced fishermen there attributed this to the greater proportion of heat and light than in ordinary seasons. Perhaps, in winter the spawning of herrings is more regular. In the Frith of Forth it is generally found that the herrings deposite their spawn on the grounds or banks between a mile or two to the westward of Queensferry and Inchkeith, being an extent of about ten miles, but many spawned herrings have been sometimes caught considerably to the westward of Queensferry, and in some seasons, shoals of herrings have deposited their spawn on the clayey and rocky bottom immediately east of the Island of May. When the weather is clear and dry, even in common seasons, the herrings keep at a distance from the nets, or at the bottom; but it has been often remarked by fishermen, that when the nets have been in the water for a considerable time at night, and the sky clear, few fishes have come into the nets until the moon rose, when, almost instantaneously, they have filled the nets;—according to the song,

"The herring loves the merry moon-light."

n the coast of North America, lights are frequently used, which are found of use in attracting the herrings to the nets. I have, however, tried lights at night, on board of one of the open boats which fished herrings during the winter season in the Forth, but found no material advantage in so doing. A storm of wind or rain, succeeded by cloudy, calm, or hazy weather, or the wind blowing from the sea, are considered favourable prognostics by the fishermen. During the months of October, November, and December of 1833, the winds continued to blow with little interruption from the west in strong gales: the consequence was, that there was no winter herring-fishing whatever in the Frith of Forth; whereas the prevalence of the same wind on the west coast furnished an abundant fishing to the Clyde fishermen.

II. *Time of its appearance on various coasts.*

1. *Scotland.*—In attempting to give a statement of the visits of the herring upon the Scottish coasts, and describing, as far as it may be possible, the period, size, and quality, it will be best to commence with Shetland, proceed westward round to the Solway Frith; and then return to Cape Wrath, and take the east coast to Berwick, which will of course include the whole coast of Scotland.

Shetland.—It appears that the herrings come near the coast of Shetland about June. The Dutch herring-fishers proceed as far to the north-east of Shetland as barely to be in sight of it, and commence fishing on the 24th of June. The herrings caught here are generally of full size, about 600 or 700 to a barrel, and are always of good quality. About three weeks after the above-mentioned date, the herrings set close in upon the coast of Shetland. The quantity caught by the Dutch off Shetland, is sometimes inconsiderable, and several of the masters of the Dutch busses assured me, that they never saw any of the large shoals so fabulously described in some publications: the quantity caught here by the Dutch, in ordinary seasons, perhaps does not exceed seventy or eighty barrels on an average, for each vessel.

Orkney and Caithness shires.—A small description of herrings appear near the coast of Cape Wrath, Caithness-shire, and the Orkney Islands, and along the coast to Loch Broom, about the beginning of June ; and small herrings of a particularly fat description are caught off Thurso, sometimes as early as May: these are generally full of roe and milt in August. There may be about 900 to 1000 of these in a barrel of cured herrings: they are rich in flavour, but are not well adapted for curing, so as to be preserved for longer than a few weeks. These are usually succeeded by a larger description of very excellent herrings, which, not being so fat, are more suitable for curing. The quantity that come upon this coast in June and July is generally considerable; and between the coasts of Caithness and Orkney, good herrings have been sometimes caught in abundance at Christmas.

West Highlands.—Along the coasts of Sutherland, Inverness, and Argyleshires (including the various islands of these counties) to the river Clyde, herrings usually appear in great quantities in summer, and frequently in winter; they have been caught in some places in the North-West Highlands as early as the beginning of June, and even in May, but the usual time of their coming in shoals upon the coast and into the lochs is the months of July and August: the winter herrings generally appear in November, and continue on the coast till the middle of January. Although no particular loch can be pointed out where their appearance every year is certain, yet Loch Inver, Loch Keunard, Great Loch Broom, Little Loch Broom, Loch Ewe, and Loch Torridon in Ross-shire; and Loch Urn, Loch Moidart, and Loch Kintra in Inverness-shire; and Loch Linnhé, and Loch Craignish in Argyleshire, have been frequently, or are generally abundantly supplied. The time of their appearance, or the resort of herrings to any particular loch in any particular month or year, cannot be predicted by any one. A writer well versed on the subject says:—"the continuance of a shoal in any loch contiguous to the Minch for eight days together, is extremely precarious and uncertain. It often happens, that after a very successful fishing for three or four nights in the lochs along that line of coast, the herrings retire so suddenly to the Minch, that not a vestige of them is to be found in a loch or bay for many weeks."* Another writer states, that the Great Minch, (the sea which separates the Long Island from the mainland)

* Mackenzie's Essay, High. and Agric. Soc. Trans. vol. ii. p. 319.

from the middle of June till the end of September, is crowded with herrings of the best quality.*

The herrings of the North-West Highlands are generally of medium size and excellent quality, although there have been different sizes observed at different periods, and in different lochs; but there can be no doubt, that the herrings caught in the Great Minch, are much superior to those caught in the lochs, or close to the shore, the former not being so ripe for spawning, and consequently, much richer in flavour; indeed, the Minch is so well supplied in general, with the finest quality of herrings, as to point it out as by far the most eligible situation for an extensive national fishery for early herrings. It has been often observed, that the herrings in the Minch, and on the east side of the Long Island, are smaller but much superior in quality, to those coming upon the coast, and into the lochs of the west side from the Atlantic. It may also be remarked here, that the herrings caught upon the west coast of Shetland are smaller and better than those caught upon the east side. At Stornoway the fishing begins generally in June.

Loch Roag is a very considerable lake or arm of the sea in Lewis Island; it is about 12 miles in length; the sea from the Atlantic, in western gales, being very impetuous; but there are a number of small islands which afford shelter, and behind which there is safe anchorage. Before the middle of the eighteenth century, Loch Roag was a well known place for herrings, they being considered of good quality. About 1750 the herrings left it, and seem not to have returned until about 1790, when, for a series of years thereafter, there was annually a very regular fishing during the months of November, December, and January. Again in 1797, the herrings discontinued their visits, but, after the lapse of thirty-two years,

* As a remarkable circumstance connected with the herring, it is worth recording, that, in March 1817, young herrings of about three inches in length fell in a shower near the ferry of Shien, Argyleshire; another shower, but of full sized good herrings, fell near Melford House in the same county, in 1821; and on the 9th February 1830, a number of small herrings, some of them alive, fell on the Island of Ulva, Argyleshire. In the last instance, the day was calm, with a steady even-down pour of rain; and the distance from the nearest part of the sea-shore fully half a mile. The conclusion is, that they must, in all cases, have been projected by water-spouts.—*Caledonian Mercury, April* 1. 1830.

they were again visible in the autumn of 1829 in considerable quantity.* In 1710, Lewis Island was the general resort of boats from the most distant parts of Scotland; and in that year we find that even Easter Anstruther sent thirty boats to the fishing at Lewis.†

In Loch Urn a remarkable peculiarity has frequently been observed in the size of herrings, they being much smaller than those caught in Loch Duich, and on the neighbouring coasts, although Loch Urn is only a few miles westward; the herrings of this Loch being sometimes so small, as to require 1200 to fill a barrel, while the general size of the North-West Highlands' herrings may be about from 600 to 800 to a barrel.

The quantity of herrings caught in the North-West Highlands varies much, not only on account of the uncertainty of their visits, but also from the desultory and irregular manner the fishery is generally attended to in that quarter. The fishing in Loch Broom for several years back has been very inconsiderable, although formerly in this loch, which is not much more than seven miles in length and half a mile in breadth, several hundred vessels have, in a course of successive years, got full cargoes of excellent herrings.

In Loch Torridon they have been often very abundant; one year the boats of twenty-five vessels, each vessel having two or three boats, besides a great many country boats, were often twice loaded in a night; the herrings continued two months, and gave employment to 5000 or 6000 persons.

At Loch Carron, which is about a league in length, and in some places above a mile in breadth, and from four to sixty fathoms in depth, the herrings one year were so plentiful, that the boats were, for five weeks, fully laden every night, and "it was indifferent to the fishers in what part of it to shoot their nets, or what length to give their buoy-strings."

In Caroy Loch, in the Isle of Sky, they were one year so abundant, that, shooting night or day, the nets were always filled, and such shoals of herrings continued to visit the coast many years in succession.

At Loch Slapan, in the Isle of Sky, one year there were 400 vessels, which fished about 96,000 barrels in one season.

* Stat. Account of Scotland, vol. xix. p. 252. Edin. Phil. Journal, No. xv. 1830.

† Sir Robert Sibbald's Hist. of Fife, p. 338.

In December 1837, an immense shoal of herrings, of a fine large size, set into the lochs on the western coast of Harris: one shoal entered a creek in the sound of Harris, the mouth of which dries at half tide, while the depth within the bar is 7 fathoms; about 200 crans were caught in this pool alone.*

Loch Urn appears to have been often visited by large shoals; one year such great quantities appeared as to fill the whole loch from the narrows to the bay-head, and such a quantity ran on shore, that the beach, for four miles round the head, was covered with them from six to eighteen inches deep, and even the ground, under water, as far as it could be seen at low-water. At a subsequent period, another shoal came into Loch Urn, and an equal or greater quantity was left on the beach by the receding tide; but the great shoal soon after left the loch, although as many were left behind as to afford good fishing for several weeks.

Herrings are caught annually, but not inconsiderable quantities, in Loch Fyne and Loch Long, beginning in the month of June, and they sometimes appear in abundance in the river Clyde. Experienced fishermen say that herrings may be caught in Loch Fyne all the year through. In corroboration to a certain extent of this remark, I may state, that, in the beginning of January 1832, the herring fishery was very successful in Loch Fyne, the boats having been generally well filled, and the herrings of good quality. In December 1835, Loch Fyne was visited by a most extraordinary shoal of herrings; they made their appearance in some of the bays in such prodigious quantities, that the usual method of fishing was departed from, and nets of every description were stretched across the bays and enclosed all the fish until the receding of the tide, when the herrings were left high and dry upon the beach. Two boats engaged in this lucrative fishing cleared about L.200; from 20 to 25 maizes (500 to the maize) having been taken by each boat at a time.†

They are frequently found near the Ayrshire coast in June and July, and they have even been caught in considerable quantities off Irvine and Troon so early as the month of May.

* Edinburgh Weekly Chronicle, 16th December 1837.

† Edinburgh Observer, 1st December 1837.

Those of Loch Fyne and neighbourhood have been justly celebrated for their superior quality: they have a whiter colour, a plumper shape, and a much superior flavour, to those caught on the Berwickshire coast; and, with all these good qualities, they keep well when properly cured: the general size of this kind of herring may be about 600 or 800 to a barrel. The quantity of herrings caught in Loch Fyne and adjacent places of late years has been rather on the decrease; but it is not easy to ascertain the number, from the great proportion that is sold fresh, of which no account is kept. A portion of the herrings fished there have been, for many years back, exported to the West Indies—a circumstance of which Lacepede did not seem to be aware, as he says in his work that the exportation of herrings to warmer climates had never been attempted.

The quantity of herrings visiting any locality is generally thought to be indicated by the number caught, but this is by no means always a just mode of judging. Fishermen, as before mentioned, trust too much to the indication of the presence of herrings from the appearance of water-fowl, the larger fishes, &c.; and although there may be great abundance of herrings in one place, they may be misled by appearances, and go to another place, where the sole circumstance of a few sickly herrings swimming near the surface takes them from the proper fishing-ground; but much depends upon the nets and activity of the individual fishermen. I have, at Loch Fyne, frequently seen this proved, particularly by a fisherman from Buckhaven of the name of Deas, who, while in the first of the season the country fishermen caught only about 200 or 300 herrings, used to catch regularly from 1000 to 1500 each night with the same extent and size of nests; this was owing, the fishermen said, to Deas's nets being sharper, that is, the twine was finer or smaller, and better twisted.

Solway Frith.—Herrings of smaller size, but good quality, generally appear in considerable quantities, and are taken principally upon the Scottish side, in the Solway Frith; the usual fishing time is about the month of September.

Isle of Man.—The herrings caught on the west coast of the Isle of Man are generally of medium size and good quality: they come sometimes upon the coast, and are caught there as early as June, but the principal fishing time is about the beginning of September. The herrings fished on the west side of Man are much superior to those taken on the eastern or Douglas Fishery; the first resembles the Loch Fyne herrings, and the latter are either shotten or ready to spawn.

East Coast.—Returning to the east coast of Scotland, as before proposed, we find herrings appear there very regularly, and generally in considerable quantities; they are caught from June till August and September on the coasts from Cape Wrath to Inverness, including the east coasts of Sutherlandshire, Caithness-shire, and Ross-shire. Excellent herrings, and not too fat for curing, and about 600 or 700 to a barrel, being matjes (with milt and roe very small), were caught in May 1829 some miles off Cape Wrath, in the direction of Loch Eribol.

The herrings caught at Thurso and neighbourhood in the first of the season, are of rich quality and small size, about 900 to 1100 to a barrel, and, as before mentioned, they are not always well suited for curing, to keep any length of time; this small-sized shoal is generally succeeded, as already stated, by one of a larger sized herring, much more suitable for curing.

Although at the beginning of the season a similar size and quality to those caught at Thurso are obtained, yet the herrings generally caught at Wick are of good size and excellent quality, say about 600 to 700 in a barrel. This extensive fishery begins about the middle of July, and ends in September.

Farther along the Caithness coast, and in the neighbourhood of Helmsdale, the herrings are smaller in size than at Wick, and average about 700 to 800 in a barrel, and at Lossiemouth, the herrings are generally larger than those caught at Wick; but at the upper end of the Moray Frith, they have frequently been caught of such a very small size as to require from 1000 to 2000 to fill a barrel. From Inverness along the south side of the Moray Frith, including Morayshire, Banffshire, and part of Aberdeenshire, herrings are caught about the same time, as on the north side; the quality is also similar to those caught at Wick, and they are also of a good medium size. They appear upon the coast in June, but are at first so small that the nets cannot catch them, but they begin to be of a sufficient size in July, and in August they are full-sized and come nearer the shore.*

From 1690 to 1709, a very extensive fishery was carried on at Cromarty, whither the herrings annually resorted in considerable abundance. Shortly after the Union, an immense shoal were thrown, or rather ran themselves, on shore, in a little bay to the east of the town. The beach was covered with them to the depth of several feet, and salt and casks failed the packers. The residue was carried away for manure by farmers in the neighbourhood. Strange to say, however, the shoal left the Frith in a single night, and no shoals again made their appearance for more than half a century. In 1780 a body of herrings was seen swimming up the Frith, with all the accompaniments of a large shoal,—whales, porpoises, and sea-gulls; they passed through the roadstead and the strait opposite Invergordon, beating the water for several miles into a foam, and giving it the appearance it presents when ruffled by those sudden land-squalls which blacken the surface. The shoal took up its spawning-ground opposite Ardilly, a villa within three miles of Dingwall, and was fished in immense quantities within 400 yards of the shore. The following year, a similar body returned and rested for some time in the bays of Fortrose and Campbeltown, and then turned down the Frith, after affording an abundant fishing. Shoals of herrings have since occasionally returned to the upper part of the Frith. One season, in the beginning of autumn, the bay of Cromarty appeared as if its countless waves were embodied into fish and birds. No fewer than seven whales, some of them apparently sixty feet in length, were seen within the short space of half a mile; when they spouted, the jet seemed, in the rays of the noonday sun, as if speckled with silver,—occasioned by the small fishes which they drew in with the water and thus ejected.† In 1816, the herrings appeared more regularly; very successful fishings have been carried on up to 1820; but, latterly, the herrings have not appeared in great abundance near Cromarty.

* Letter from a Correspondent at Banff, and one of the principal curers and exporters of herrings to foreign parts.

† I am indebted for the above information to a very talented and graphic description of the Moray Frith Herring Fishery, written by the Author of "Poems by a Journeyman Mason."

The most certain, the most regular, and the most considerable fishery in Scotland, has existed for several years in that arm of the sea extending from Duncansbyhead to Kinnaird-Point, embracing the Dornoch and Moray Friths. Great numbers of fishing-boats proceed every year to Wick, Helmsdale, Banff, Macduff, &c., from various parts of Scotland and England; many of the fishermen are engaged by the fish-curers, and are paid at the rate of from 8s. to 12s. per cran (or barrel of fresh fish) for any quantity they may bring in, not exceeding from 250 to 300 crans each boat; many of the open boats go from the Frith of Forth on such engagements. There are also numerous vessels from Ireland at and near Wick, fishing, purchasing, and curing herrings during the season, and in 1826 a fleet of vessels came even from St Ives in Cornwall to this fishing. The herrings of this arm of the sea are generally of good quality, and the curers are justly entitled to great praise, for the care they bestow in preparing their herrings; they often anticipate the Dutch in the Hamburg market, and one house alone in Banff ships, on an average, upwards of 12,000 barrels annually to Germany.

Along the coast from Banff to Fraserburgh, herrings are generally caught of similar quality, and about the same time as at Banff. Off Buchanness, they generally appear in great abundance every year. The Dutch fishermen get here their greatest supply; who begin fishing at this place about the 1st of July. Herrings appear on the various parts of the coast, from thence to the Tay, about the same time; but those got near the shore are larger, and of a coarser quality, than the herrings of the Moray Frith and neighbourhood, for they are generally as large as only to require 600 to fill a barrel. Formerly in the Tay, for several years successively, herrings appeared in abundance, a good winter fishing having then existed opposite Balmerino and Woodhaven; but of late years the quantity caught there has been very inconsiderable; they are similar in quality to the Forth herrings.* Off the Tay and Forth, a few miles distant from the coast, the Dutch fishermen get considerable quantities of excellent herrings every

* Sibbald's History of Fife (Note by Editor of New Edition), 414.

year in July and August; these are of medium size, or about 700 to a barrel. We find that this fishing must have been very considerable, and known and followed by the Scotch in 1710. Sir Robert Sibbald says,—"Crail has 80 fishing-boats, which, for the most part, are employed in herring fishing, which come upon the coasts yearly about Lammas, at which season there come from the coasts of Angus, Mearns, and Aberdeenshire, about 200 boats more, which the inhabitants of this town furnish with nets and other materials for the herring fishery."*

The Frith of Forth is visited every winter by shoals of herrings; but (if we should judge from the quantity taken) in much greater abundance in some years than others.

Previous to 1793, the mouth of this Frith between the Island of May and the Fifeshire coast was resorted to by a great many fishermen, who caught considerable quantities of lean and shotten fish in February and March, which herrings are now supposed to have been those returning from the higher part of the Frith after spawning. It is remarkable that the visits of the herring higher up the Frith were not known till 1793, the winter fishing having first commenced in that year. The discovery was previously made by a poor man, residing at Donibristle, of the name of Thomas Brown, while fishing small haddocks; he concealed the discovery as long as possible, while he supplied his own wants by the simple means of dipping pails or buckets into the sea at such places and seasons as he found most suitable; it is also said, that, twenty years previous to that year, a seaman having let his sail fall overboard in Inverkeithing Bay, brought several herrings into the boat within its folds, and, although he told several fishermen residing near the spot, none of them could be tempted to make a trial.† Some fishermen at Queensferry were at last, in 1793, induced to commence, and their great success encouraged others; since then, the fishing has been annually resorted to by boats and vessels from various quarters; several hundred boats have in some years come from the west coast of Scotland, and even from Ireland, Wales, and the Isle of Man, to

* Sir Robert Sibbald's History of Fife, p. 346. † Ib. New Edition, 306.

this fishery; for several years lately, however, the fishing has not been very abundant, and it latterly has been confined to the fishermen of this Frith and immediate neighbourhood. These herrings are every year of a uniform size and shape, about 1000 to 1100 in a barrel at the first of the season, and they are somewhat larger before they begin to leave their spawning-ground; they are of a good quality for curing, being not fat though small, and are excellently adapted for the West India market. The fishing commences in the month of November, and generally lasts till February or March, the time that they are generally observed to spawn. It is found that the herrings always spawn before they return down the Frith.

From the mouth of the Forth to Berwick, considerable shoals of herrings appear every year, and although they do not set close in to the coast till about the month of August, yet the fleet of Dutch herring-busses, when it meets with a contrary wind, which prevents their proceeding further north, gets a considerable fishing about twenty miles off that coast, in the end of June and beginning of July. But the herrings caught by our own fishermen close in-shore in August and September, are generally ripe for spawning, and therefore those obtained between the Forth and Berwick-on-Tweed are considered the most inferior in quality of all the various kinds of Scottish herrings. They appear on the coast suddenly in great shoals, and the great quantity caught in the meshes frequently sinks the nets, which are often left a night or even two nights in the water, according as the weather may suit for getting them into the boats: such herrings, when salted and barrelled, must tend greatly to injure the character of those caught on this coast. Although great quantities are frequently fished here, the fishing generally lasts only a few days; they are of large size, say about 600 to a barrel, in ordinary seasons.

2. *England.*—Herrings appear in August and September off Berwick and southward on the Northumberland coast; they are similar to the herrings caught off the coast of Berwickshire, but the fishery is inconsiderable; North Sunderland is the principal station.

Yorkshire.—At Staithes, Runswick, and Robin Hood's Bay, they are caught from the latter part of July to the latter part of September, and of late years have been fished in considerable quantities.

Norfolk.—The herring fishery off Yarmouth is the most important on the coast of England; 500 decked vessels may be seen at this fishing at one time, of which about 100 belong to Yarmouth, and 70 to Lowestoffe. The herrings are of much smaller size than those fished on the Northumberland coast, and the fishery commences in September, and continues for about two months. Great numbers of foreign vessels fish at this locality, the most numerous being Dutch and French. The herrings are found to be smallest near the coast, and the boats therefore proceed half-sea over, as the largest herrings are preferred for smoking,—the whole, or nearly the whole, of the herrings brought to Yarmouth, not sold fresh, being smoked. The boats gradually proceed from west to east as the season advances, the extent of the line being from thirty to forty miles.

Kent.—The fishery off Folkstone is some years very considerable; they commence fishing in the beginning of October, and continue to the end of November.

Sussex.—The herring fishery off this coast is principally carried on by the Hastings boats: they begin fishing in November, and continue until the end of December, and the supply obtained at this fishery is generally very considerable.

Cornwall.—Herrings are caught on the coast of Cornwall in August and September, but not now in any great quantity. The pilchard fishery seems to be the most abundant at present, but, about twelve years since, herrings in considerable quantities were taken near St Ives, and few pilchards. The Penzance and Cornish fishermen are celebrated for the superiority of their fishing boats and materials: they visit at the proper seasons the herring fisheries at the Isle of Man, and on the coast of Ireland.

3. *Ireland.*—The coasts of Ireland are regularly visited by large shoals of herrings. Their most regular visits are on the Atlantic side of the Island. At Killybeg, the herrings are caught generally in great abundance from the end of December to the beginning of March. The herrings are small, and

may be of the size of 850 to a barrel, and boats to the number of 700 to 800 generally attend this fishery, not only from the immediate neighbourhood, but various parts of the island, and even sometimes from the Isle of Man and Cardigan.

West Coast.—The whole coast and bays south to Galway are in the winter visited by great shoals of herrings, which sometimes appear in great abundance in one loch or bay, and sometimes in another. They are fished in Greatman's Bay, at Costello, Roundstone, near Slynehead, at Ballinakill, and Killeries, and in some seasons the herrings may be caught in twenty different bays at the same time; but their visiting any particular bay is uncertain, for instance, there was no fishing at Roundstone from 1827 to 1833. On this coast, besides the winter fishing, appearances strongly indicate that a successful summer fishery may be carried on, on the extensive line of coast from Sheephaven Bay to Broadhaven Bay from May to October.

The herring fishery at Galway is, like the Killybeg fishery, more certain and regular than at some of the other localities, and affords employment and food to a very great number of people, so many as 200 boats being often employed at one time at this fishery. The Claddagh fishermen, forming a great proportion of these, are a peculiar race of men, inhabiting one quarter of the town of Galway; they are a hardy and industrious race, and have laws among themselves regarding the fishery. They make it a rule not to begin fishing till the 4th of September, nor until all the Claddagh boats are ready to proceed to the fishery; and it is their custom, when ready, to apply to the clergymen of West Convent Chapel in Claddagh, one of whom proceeds with them to the fishery the day they begin, and offers up a prayer for an abundant fishing. It is said that they formerly, before beginning, buried a cat on the beach, for the purpose of propitiating a successful fishing The harvest fishing is pretty abundant in the creeks and bays from Galway south to the Clare coast, and north to Rona. So many as 85,000,000 of herrings have been cured in one season in Galway, almost entirely in bulk.

Off Seafield in Kerry there is a fishery of herrings from the middle of January to March: the herrings are larger than, and inferior to, the Galway herrings; at the mouth of the Shannon they are caught from the beginning of July to November.

In Dingle Bay a good fishery sometimes occurs from July to December.

Near Valentia the take of herrings is often very considerable, from the circumstance of the fishermen using deep-sea seines (which will be described elsewhere): one of these nets has been known to take as many as 80,000 to 100,000 herrings at one haul.

South Coast.—Herrings are caught at Kenmare, county Kerry, from July to October, but at Bantry there has been no productive fishery since 1828; the season lasts there from August to Christmas.

East Coast.—Onward to Arklow, herrings are caught at different localities from August to December. At Arklow the fishery was formerly considerable from June to August, but now the fishing begins about the first of October: the Arklow herrings are similar in size to the Loch Fyne herrings. On the Wicklow coast there are sometimes considerable shoals from September to Christmas, and until within these five or six years there was a summer fishing in June and July.

At the Lough of Carlingford the herrings were at one time abundant, but the Channel herring fishery is now considered the most advantageous; it lasts from June to November, and the fishing is pursued less or more by the fishermen at Newcastle, Dundrum Bay, &c.

Ardglass is a very considerable herring station. About 100 Penzance boats (of from 15 to 25 tons), 100 boats from the Isle of Man, and 100 Irish boats, annually pursue this fishery.

The visits of the herring shoals are generally very regular at different parts of this coast, from Ardglass to Carrickfergus, from June to November, and herrings in considerable shoals are said to enter Belfast Lough to spawn in September and October.

Herrings are caught from May to September of superior quality in different localities between Larne and Fairhead, but not in considerable quantities.

North Coast.—From Lough Foyle to Lough Swilly there are two herring seasons namely, in July and August, and again from the middle of November to the beginning of February. As is the case every where, the harvest herrings are larger and finer than the winter herrings. From Lough Swilly to Farland Point the herrings are caught from July to November, and from Christmas to March.

At Rutland, herrings were so abundant about thirty years ago, that 500 vessels were generally laden in a season from November to January: these were of superior quality, and of the size of 500 to a barrel, while the Killybeg herrings at that time were of the size of 800 to a barrel; in 1836, herrings appeared here in great abundance.

It is said that in the months of April, May, July, and August, from Teiling to Malinhead, there are large shoals of herrings, but they are not fished, because it is supposed it would be difficult to cure them.

We have thus made a circuit of the whole Irish coast, and it must be evident that the most abundant and most certain supply of herrings, and which might afford food and employment to a numerous population, is to be found on the coast of the county Down, and on the coasts and in the creeks and bays between Galway and Torry Island.

4. *White Sea.*—Herrings are pretty abundant in the White Sea, Kola being one of the principal fishing stations. They are fished twice a-year, namely, in the month of April, the herrings caught at this season being small and lean; and, secondly, from the beginning of August till the end of September; these are much better herrings, being larger and fatter. Herrings may be fished in this season in almost any part of the White Sea.

5. *Iceland.*—Herrings sometimes appear at Iceland, but seldom in any considerable body; the quality is generally inferior. The principal places of their resort are Westmanoe and Oxefield on the SE. coast, but their visits are irregular. Horrebow, in his History of Iceland, says, "the herrings do not resort to the coast every year." * A shoal appeared at the first-named place in July 1835, and the usual time of their appearance at Iceland is July and August. They are generally full of milt and roe, and of medium size. Olaus Olavius, in his

* History of Iceland, chap. 55, p. 75.

History of Iceland, says, "herrings are only seen there seldom, and have not been caught in the memory of man, except in the year 1773; it is, therefore, supposed that of them there cannot be any considerable quantity."*

6. *Faroe.*—Herrings are seldom seen at Faroe.

7. *Norway.*—They appear on the coast of Norway, at Drontheim and neighbourhood, in great quantities about the middle of June, and continue upon the coast till November. These are generally of medium size and good quality, but they are not considered equal to the Scottish herrings. A larger sized and coarser herring appears on the same coast in December, and they continue till February. Farther along the coast of Norway, near Bergen, they approach the shore in January, and continue during February and March: these are of larger size and coarser quality than those caught by the Dutch off Shetland. The Norwegians have a considerable fishing off Stadtland, where they generally get very large herrings, few being under a foot in length, and many fifteen inches; this kind is what is sent by the Norwegians to the Baltic, and is much inferior to Scottish herrings. The fishermen of Bergen get, also, great quantities of herrings of small size and fat quality in November and December. Both the large and smaller sized herring spawn before leaving the coasts of Norway. The summer herring fishery off Lofoden and the coast of Helgeland (Norway) was formerly very considerable; but they have not come upon this coast for the last twenty years.† A considerable fishery of the Norway herring has existed for several years back near Flekkefiord in Norway. They fish about four miles from the shore, and from 200 to 300 vessels, averaging about 50 tons, get full cargoes, the fishing commencing generally in January, and continuing about three weeks; this fishery was considerable in the beginning of 1836, but has totally failed this year (1839).

8. *Sweden.*—Very few herrings are now caught near Gothenburg. The Swedes attribute their departure (if they really

* Men da silden ikke sees der uden nogen enkelte gange og er ikke bleven fanget uden iaaret 1773; saa formode nogle at dens mængde ei maae vare betydelig.—Olaus Olivius, vol. i. p. 104.

† Bloms Reisebeskrivelse i Nordlandene, 166.

are departed), as already mentioned, to the firing of British and other ships of war attending convoys, &c. Some idea may be formed of the extent of the fishing there from the quantity exported. In the six years from 1775 to 1781, they exported annually, on an average, 122,217 barrels; while the average annual quantity exported in three years from Scotland was then only 32,629 barrels. The fishing of herrings (to any extent) first commenced at Gothenburg in 1752, and the herrings were generally caught among the rocky islands, and few or none out at sea. The fishing extended along the coast from Gothenburg to Stromstadt, a distance of about 105 miles; they were caught in the first years in July and August, but in the later years not till November. The Swedish herrings were generally of good quality, and about 900 to a barrel.

9. *Denmark.*—From Elsinore upwards to Falsterbo, herrings of small size are caught from September till Christmas, but not in such quantities as in former times. The best herring fishery in Denmark was at Liimfiord, on the east coast of Jutland. They were fished twice a-year, beginning in February if the ice was melted, and continued in March and April for the spring season, and fishing in November and December in winter; the latter caught herrings were always the fattest, smallest, and best. The quantity caught in a year was very considerable (perhaps about 200,000 barrels in both seasons); they came up the Liimfiord full of young, and spawned there each season. The entrance of the river leading to Liimfiord, does not exceed 360 feet in breadth, and there is there a comparatively shallow sand-bank; the water being generally clear, and the bottom a fine sand. It was observed by the fishermen there, that the stronger the winds blew up that frith, the more herrings were caught. These herrings were of small size, from 900 to 1100 in a barrel, and generally of good quality.*

* In consequence of the encroachments of the sea on the west coast of Jutland, the Lake of Liimfiord has been destroyed so far as the herring fishing is concerned, the sea having effected an entrance into it on the west coast, and since then it is a remarkable fact, that the herring fishery has ceased or nearly so, in consequence of the herrings having disappeared, and the town of Aalborg, on the east side, at the original entrance of Liimfiord,

In the Great Belt, herrings are caught from the middle of September till December, and they are full of young, and generally of fair quality. There is frequently also a summer fishing, which lasts till June. From the Belt upwards to Kiel, herrings of similar quality are caught, and about the same time.

10. *Baltic.*—At Wismar, herrings of ordinary quality and about 800 to a barrel, are caught with the seine in February and March, but not in any considerable quantity. About 2000 barrels of medium size are caught annually by the inhabitants of the Island of Bornholm in July and August. Higher up the coast, embracing Pomerania, a smaller herring is caught from the beginning of February until April; they may be about 1200 to a barrel. In May, soon after the departure of the shoal, a great abundance of small sized herring (called stromling), sets in upon the coast, and continues till the end of June; they are so small as to require 2300 to a barrel. Further up that side of the Baltic, from Rugen to Danzig, herrings appear in small quantities from September till Christmas, and they are as large as 800 to a barrel; they also set in upon the same coast from February till May. In all these districts in the Baltic the winter caught herrings are the best. Near Riga, some herrings are caught of similar quality to the preceding. Near Biornberg, in the Gulf of Bothnia, herrings of small size are caught in March, April, and May, but not in considerable quantities, and they are generally used fresh. Herrings do not appear in any quantity higher up the coast, nor at any other place above the Sound is the quality good.

11. *Hamburg.*—Up to the year 1822, herrings were caught in considerable quantities off the Elbe near Cuxhaven, from November to March, the quality inferior; but they have now disappeared or are never fished, and we do not find any fishery of consequence, till we come to the Kingdom of the Netherlands.

suffers very much in consequence. This loch may be now termed an estuary, and, therefore, Denmark has one more island added to the numerous list. It is possible the herrings may return; but if they do not, the new circumstance of the sea making an entrance on the opposite coast, and that as yet to a very moderate extent, being the cause of driving the herrings from this their usual haunt, is a curious occurrence in the natural history of this fish.

12. *Holland*—In Ziereck Zee, off Harlingen and Philipina, great abundance of lean or shotten herrings are caught in November and December; and above the Texel, full herrings are caught frequently at the same period. Herrings are caught by the Dutch every year, on the English coast, in great quantities, and they continue fishing, as far as the North and South Foreland, till the 1st of January.

13. *France.*—Herrings are found on the French coast (say extending from Calais to Cape La Hogue) from November till January, they are full of young but of small size, and the quantity is not considerable.*

14. *Kamtschatka.*—In July and August, shoals of herrings annually appear in the Gulf of Okotsk in Russian Tartary; and on the east coast of Kamtschatka they arrive in shoals in April, and remain till June and July.†

15. *Icy Sea.*—In Lat. 69° 27′, Long. 168° 29′, in the Icy Sea, 300 herrings were caught by the seine on the 16th July; the water was fresh enough to dress victuals. They ascend the Kovema in great shoals in September; they are split and dried by the natives. They appear in great shoals in the Bay of Avatska, Kamtschatka, towards the latter end of April, and remain till the beginning of June. They seem to come in shoals in spring and in autumn, there being a considerable difference in the size, the spring fish being largest.‡

16. *Kotzebue Sound.*—Herrings are caught in Kotzebue Sound, above Behring's Straits, by the American Esquimaux, in July, and in Graintley Harbour, Long. 174°, Lat. 65°, in September.§

17. *Polar Sea.*—Captain Franklin states that several herrings were caught in the nets set by his people in Bathurst Inlet, on the shores of the Polar Sea, on the 5th August, in

* From the preceding account it will be observed that there are two varieties of herrings that visit the coasts in summer and in winter, but I cannot find that marked difference which entitles any one to give the characteristics of a new species to the herrings of either season; I therefore venture to doubt the propriety of that able author Yarrell giving the name of "Leach's Herring," *Clupea Leachii*, to the winter herring.

† Tuckey's Maritime Geography, pp. 276, 286.

‡ Billing's Expedition to the Northern Regions, pp. 75, 87, 298, 299.

§ Beechey's Voyages, July 1826 and Sept. 1827.

Lat. 66° 30′ N., Long. 107° 53′ W. A pretty extended description of these herrings was compared with the herrings brought to the London market in January, and found to agree exactly; they appeared to be matjes, the roe or milt having been small.*

18. *United States.*—In the month of January, herrings come upon the coasts of Carolina, and are said to proceed northward. They visit the coast of Virginia in February, and all the bays and rivers as far north as the Bay of Fundy; and they continue spawning till the month of May, and in some places may be caught till July.†

19. *Nova Scotia.*—In St John's River, they also appear about the same time in great abundance; they are of a larger size than the Scottish, but not so fat, nor of such good quality, being not considered worth curing to any extent.‡

III. *Migration of the Herring.*

Various accounts have been given of the visits of the herring upon our coasts. Many writers and scientific works state, that the herring comes from the Arctic Circle, in large shoals of many leagues extent, dividing into lesser shoals on coming towards the north point of Scotland; one body proceeding to the west coast of Scotland and to Ireland, and another to the east coast, the whole directing their course southward. Others state, that although the herrings do not come from the Arctic Circle, they at least come from a considerable distance northward of Scotland. Others consider that the herrings being spawned upon the coasts, and in the rivers and bays, are consequently natives, and that although, after spawning, they do not continue close in-shore, they proceed to sea in the neighbourhood of the coasts, where they continue, and where they feed until the spawning season approaches, when they return again to the shore. The latter is the most rational conclusion, and the following are our reasons against the old theory.

1. The most convincing proof that the herring is truly a native of the neighbouring seas, is, that the herrings resorting to the various localities have marked differen-

* Franklin's Journey to the Polar Seas, p. 377, and App. p. 717.

† American Trans. vol. ii. p. 237.

‡ Dr Walker on Herrings, High. and Agric. Soc. Trans. vol. ii. p. 273.

ces in size, shape, and quality, those of each particular coast having a distinct and specific character which cannot be mistaken; and so well determined is this fact, that practical men can at once pronounce the locality on seeing the herring. We, therefore, find every year, at a certain period of the year, a particular size and quality of herring generally always resorting to the same place; for example, the size of the herrings caught off the projecting coast of Stadtland in Norway, is almost twice that of those caught off Shetland, which kind again is nearly twice as large as those caught off Thurso; and the first caught Thurso herrings are considerably smaller than the Isle of Man, Minch, and Loch Fyne herrings, much smaller than the Caithness and Banff herrings, and not above half the size of the herrings caught off Aberdeenshire, Fifeshire, and Berwickshire. Again, the Yarmouth caught herrings are much smaller than those of Aberdeenshire and Berwickshire, and those caught on the coast of Holland considerably larger than those caught at Yarmouth. A size of herrings similar to the Yarmouth, fish till lately visited Liimfiord in Denmark in great quantity. Now, on the Mecklenburg coast higher up the Baltic, the size of the herrings is one-third larger than those of Liimfiord; and proceeding up the Baltic coast above Mecklenburg, namely, on the Pomeranian and part of the Prussian coasts, the herrings are fully one-third smaller; and again, still farther up, they are larger, and about the size of the Moray Frith herrings. Thus, the theorists who argue that the herrings come from the north, must furnish two rare kinds o herrings, namely, one kind, which, in its progress southward, grows smaller on its journey, and another which grows larger.

2. As to quality, nothing so much proclaims the error of the tale of their southern journey, as the general state of the herring. For instance, as already mentioned, those caught off Shetland are not nearly so fat as those caught about the same time on the coast from Thurso to Loch Broom. In the first of the season, those caught in Loch Fyne are not so extremely fat as the Thurso herrings. The herrings of Loch Fyne are much superior in quality to those of the east coast off Berwickshire and Aberdeenshire. Again, there is a marked difference in appearance and quality (and this is easily distin-

guished by those accustomed to see them), between those got near Caithness and Moray shires, and those caught off Aberdeenshire and Berwickshire. The quality of the Danish and Baltic herrings is much inferior to the Shetland and West Highland herrings, and those caught on the coast of Holland are so very inferior, as not to be pickled at all by the Dutch. The Yarmouth herrings are inferior in some respects to those of the north of Scotland, and the herrings got on the French coasts are also of inferior quality.

3. As to the time of appearance, we find much to prove that the herrings are natives of the seas adjoining the coasts on which they spawn. As a few instances, it may be stated, as well known, that herrings are caught in Loch Fyne in June, before any are caught near Cape Wrath; and off Berwickshire and Aberdeenshire by the Dutch, before any are caught off Caithness; and even off Yarmouth, herrings have been caught in April and May. We find they are not generally caught on the Atlantic side so early as on the east coast of Scotland; and the various times of their approaching the coasts in the Baltic, prove the locality of their places of resort.

4. No well authenticated instance has been offered of the herrings having been seen approaching the south in a high northern latitude; indeed, although I have conversed with many intelligent masters of the Dutch herring-busses, I could not find one who ever *saw* any considerable shoal; and we do not find that any of our Greenland whale-fishers ever saw any of those shoals of the magnitude so fabulously described.

5. None have ever been ascertained to exist in the Greenland Seas, but, on the contrary, no herrings have ever been found in the stomachs of the whales caught there. The food of the *Balæna mysticetus*, or common whale, consists of actiniæ, sepiæ, medusæ, cancri, and helices. The *Narwal* inhabits the seas near Spitzbergen, but only remains of sepiæ were found in the stomachs of several examined by Scoresby. The *Trichecus rosmarus*, *Walrus* or *Sea-horse*, inhabits the icy seas adjacent to Spitzbergen; in the stomachs of those examined, only shrimps, crawfish, and young seals were found. Egede, who resided fifteen years in Greenland, after enume-

rating various kinds of fish caught there, says, "no herrings are to be seen."*

6. We find that those species of whales which feed principally on herrings, frequent our own shores. Scoresby says of the Balæna Musculus, "This species of whale frequents the coasts of Scotland, Ireland, Norway, &c., and is said principally to feed on herrings;"† and the Balæna rostrata inhabits principally the Norwegian seas.

7. Bloch, the celebrated naturalist (with whom Lacepede in this particular statement coincides), has established, that fishes of a similar size, even in fresh water, cannot go above half a mile per day, and that, therefore, herrings could not make, even from spring till autumn, the long voyage attributed to them.

8. The same naturalist farther states, that "herrings may be found in certain localities all the year through," and this coincides with the opinion of the oldest fishermen at Loch Fyne and other places; and it is well ascertained, that herrings, either young or old, may be caught in the Forth any month in the year.

9. The herrings mentioned as coming from the north (as Bloch justly remarks), are never known to return; and it may be added, they are never known to proceed southward, but when proceeding to some coast.

10. The same naturalist demands, "Why the smallest herrings proceed to the Baltic, and the larger to the North Sea?" and supposing, as it is asserted, that the whales are the cause of their flying, "why do the herrings return?" And Mr Yarrell, in his valuable work on Fishes, says, "There can be no doubt that the herring inhabits the deep water all round our coast, and only approaches the shore for the purpose of depositing its spawn within the immediate influence of the two principal agents in vivification, increased temperature, and oxygen; and as soon as that essential operation is effected, the shoals that haunt our coast disappear, but individuals are to be found, and many are caught, throughout the year."‡

11. Various other fishes have similar habits in spawning.

* Egede's Natural History of Greenland.

† Voyage, vol. i. p. 482. ‡ Vol. ii. p. 112.

The salmon ascends rivers from the sea at particular periods, for the purpose of spawning; for this fish no distant residence (if that term may be used) has, however, been assigned. The sprat appears in shoals in various localities of the coasts of the British Islands, from November to March. The shad or alosa is found in shoals in some of our rivers from May to July; in the Severn generally in May, and continues there about two months; in the Mediterranean near Smyrna and Rosetta, and it ascends the Nile as high as Cairo in December and January. The pilchard appears in shoals on the coast of Cornwall from June to the end of the year; and the tunny comes in-shore on the coasts in the Mediterranean in summer: all these fishes appear to have the same habits of gregariously visiting various coasts and rivers at particular seasons for similar purposes as the herring, but no one would, on this account, pronounce them natives or inhabitants of a distant frigid region.

In short, from all the circumstances known of the natural history of herrings, in regard to their visits upon our own coasts, and the coasts of other countries, it is reasonable to conclude, that they inhabit the seas in the neighbourhood of the coasts on which they spawn, and that they come at particular periods near our coasts solely for the purpose of spawning, for every where they leave the coasts immediately after; and perhaps the early or late appearance of the herrings upon different coasts (besides the effects of clear and warm weather, as before mentioned) depends upon the depth of water at the feeding ground, and these circumstances may account for the regularity of their appearance, at certain periods, upon the various coasts which they frequent.

IV. *Of the different Modes of Fishing the Herring.*

1. With regard to the *Scotch method* of catching herring.

Boats.—The fishermen, in fishing herrings on the coast of Scotland, use open boats, the largest being about thirty-six feet in length, and eighteen feet in breadth, having two masts and four sails. The hull of such a boat costs about L.42, and when completely fitted out with sails and other appurtenances 76, besides th- [illegible]

Nets.—The nets are made of strong hempen twine, and are principally netted by the family of the fisherman. Of late, nets have been manufactured by patent, and each net of twelve score of meshes and fifty yards in length is charged L.2 : 2 : 6; and L.2, 15s. for fifteen score of meshes, without the fittings of cordage, buoys, &c. The fishermen find that each net, when properly finished and barked, will cost about L.5; and each boat has from twelve to thirty nets on board. The meshes (or squares) of the net are in some cases one inch, and in others, one and a quarter inch square; therefore a twelve-score net of one inch square is twenty feet in depth,—of one and a quarter inch square, twenty five feet, and a fifteen-score net, twenty-five feet or thirty-one feet in depth. In preparing the net for the fishing, the upper part is fastened to a rope formed of several cords joined together, frequently as many as twelve; this is called the *rope* or *cork baulk*. In some districts (the Moray Frith, for instance), pieces of cork about six inches in diameter are attached to this rope. The sides or ends of each net are strengthened by being attached to a rope (or cords of two or three plies joined together), which ends are termed *lugs*. The lower part of the net is joined to another rope of two or three plies of cord, which of course, in ordinary cases, must strengthen the whole; but when fishermen fear that the nets may come in contact with foul or rocky ground, the cords or rope of the lower part of the net are left off, which prevents the net being torn so much as it otherwise would, when the cords happen to get hold of the rocks at the lower part. At each end of the net, are loops to which sinkers (of stone) can be attached when considered necessary; these sinkers when used weigh about three pounds each.

Buoys.—When about to be used in the water, all the nets are united together at the top. Between each net is fastened a buoy to a rope of generally three fathoms in depth: the buoy attached being frequently an inflated sheep or dog skin; or in some places, four inflated ox-bladders to each net are used as buoys, the buoys being tarred *inside*, and the initials of the owner of the net generally painted on the outside, this being the only distinctive mark by which fishermen, in case of storms or entanglements of nets (and the latter circumstance, from want of proper management, often occurs), can know their own nets.

Fleets or drifts of nets.—The whole of the nets united are termed a *fleet* of nets, and in some places (where the nets are not anchored, and the boat attached to one end of the whole, when they drive along with the wind or tide), they are termed a *drift.*

Before proceeding to the fishing-ground, the whole of the nets are carefully stowed into the boat in regular order, the oldest and frailest being generally piled on the top, and, of course, first thrown overboard.

Fishing-ground.—On arriving at the fishing-ground, and after sunset, while one or two of the men are pulling the boat across the current or stream, the others are carefully shooting or shaking out the nets into the sea ; the whole fleet of nets when thus thrown out is (if not anchored) attached at the stern of the boat to a two and a half inch rope, of about forty fathoms in length ; but in cases where the water is not too deep, the fleet of nets is attached at each end to a rope and anchor thrown into the sea, which retain the whole in a proper position, notwithstanding the winds or currents; but in many cases, the depth of the fishing-ground prevents anchoring, and here is besides another objection to it, namely, the tide or current may be so rapid as to elevate towards the surface the lower part of the net thus opposed to the stream.

Anchor or drift.—In either case, where there are many boats confined to a small extent of fishing-ground, it is absolutely necessary that all the fishermen previously agree whether the nets shall be anchored, or whether they shall drift, as otherwise, the boats and nets drifting, will necessarily come in contact with those anchored; at some of the fishing stations in the north, it is therefore previously arranged among the fishermen which of the plans is to be adopted.

Hauling the nets.—When the fishermen consider that the nets have remained a sufficient length of time in the water, or when they see the buoys sinking with the weight of herrings in the net, or when, by pulling in part of the nets, they see that a sufficiency of herrings is caught, or generally (in ordinary fishing) at daybreak, they haul their nets by bringing the end of the fleet or range of nets to the side of the boat, and, spreading the nets as they take them in, shake the herrings into the boat, at the same time laying the nets regularly above each other. The herrings are then delivered to the purchasers, being in most cases measured by a wooden measure of the size of a herring barrel, called a *cran*, into which the herrings are lifted by shovels; in some cases, particularly on the west coast, when scarce, they are sold and delivered by the number of herrings. This may be considered as the general mode of fishing in Scotland, and the northern parts of England.

Seining.—Seining, or drawing the fish on shore in nets, after performing a semicircle in a similar way to the mode followed in fishing salmon with the seine, is sometimes practised in Scotland, particularly in some parts of the Clyde, but it is considered objectionable.

Yairs.—At Loch Broom, there is a very simple and primitive mode of taking herrings without nets, namely, by means of yairs. These are formed by driving stakes into the ground, at the low water of spring-tide; the stakes are crossed with twigs or brushwood, which together form a kind of wicker-work, that often encloses large quantities of herrings.

Cruives.—The cruives or wicker baskets, sunk in the tideway of the arms of the sea and rivers, as may be seen at the present day in the Forth near Kincardine, is another primitive method of fishing; although not exclusively used for herrings, they often take considerable quantities, as well as sprats, young herrings, and other fish.

2. *Yarmouth Method.*—The fishing off Yarmouth is carried on in a different manner; the herrings caught there by the Yarmouth and English boats being principally smoked and made into red herrings.

Fishing Vessels.—This fishing is carried on in three masted decked vessels, or luggers, of from 20 to 50 tons, having three lugsails, topsails, mizen, foresail, and jib, and they are so strongly constructed as to be able to remain out in any kind of weather. The largest sized vessels have twelve men and a boy; the crew are paid according to the quantity of herrings caught.

Nets.—Every vessel of an ordinary size shoots 100 nets, each 48 feet in length, and 30 feet in depth, and each net is attached by two seizings of one and a half inch rope, having a depth of 18 feet, to a four-stranded (generally four inch) warp of 3600 feet in length, or more properly speaking there are five warps of 120 fathoms each joined together, making the length of 600 fathoms or 3600 feet. This warp, with the net, is made fast to a rope from the bow of the vessel, which, in stormy weather, can be let out, to ease the strain, to the extent of 100 fathoms; but in ordinary weather there is only about 40 fathoms out, that is, the distance from the vessel to the nearest end of the nets is 40 fathoms, or 240 feet.

Spare Nets.—Besides the 100 nets in the water, each boat has generally 100 spare nets on board, to be used in case of injury or loss of the other fleet.

Buoys.—For each net there are two buoys, being barrels of about the size of a half anker, of about 4 gallons measure, attached to the warp; and there are, besides, four buoys, to mark the distances, one at half the length of the whole of the nets, painted half red and half white, and other two at the quarter distances quartered red and white; these are also of a similar size to a half anker cask, and at the extreme end is a smaller cask painted white. All these four buoys have the names of the ship, master, port, and owner, painted on them; each net is, besides, furnished with a sufficiency of pieces of cork to give the upperside the necessary buoyancy.

Time of Fishing.—The vessels of this fishery proceed to sea about the beginning of October, and the fishing lasts two months or more. They fish, about half sea over, in fifteen fathoms water, guided generally by the birds or thickish water: they shoot their nets at sunset; if encouraging appearances exist, the nets are taken in once or twice in the night, and at day-light. With such a great length of nets a considerable quantity may be caught at one time, and therefore as many as ten lasts (about 100 barrels of herrings) have been fished at one haul, and frequently 60 lasts (600 barrels) have been obtained by one vessel in a season. The nets are taken in by means of the capstan, when they come to midships, and are shaken into the main-hatchway where the herrings fall upon a platform, and are immediately roosed (strongly sprinkled with salt,) and put into boxed apartments of the hold on a level with the platform mentioned, but sufficiently elevated to permit the pickle or liquid from the herrings to rún off. The vessels return to port as early as possible in the beginning of the season, in about two or three days, on account of the value of the first herrings both fresh and smoked, say with one and a half or two lasts (15 to 20 brls.); and subsequently about once a-week. Immediately on the vessels coming in, the herrings are washed, spitted, and hung up. They are always smoked with oak-wood only, the earliest cured hanging only one or two days, but the proper time is generally five or six days. We may form some idea of the extent of this fishery, from the circumstance of there being sometimes 500 decked vessels engaged in it. The utmost precaution is necessary to prevent entanglement of the nets, consequently no fishing vessel anchors, excepting during the day, when the nets are not out, or unless the weather is so calm at night as to prevent the possibility of shooting the nets ; and during night each vessel has a lantern at the bow upon a pole sufficiently elevated to be seen at the distance of five miles. It is evident, a unity of purpose and a unanimity in execution are necessary, for if some were to persist in anchoring, and others to fish, serious injury would occur. A very good understanding exists among the fishermen as to stray or lost nets found, namely, that if seen they shall be immediately taken in and delivered to the vessel they belong to, upon payment of only one shilling for each net. During the two months the boats are at the fishing, they gradually proceed as far east as Aldbro', a distance of about thirty-five miles from the spot where they commence. As it is held a universal opinion among the fishermen, that the herrings are smallest near both coasts, they generally go half sea over, to get the largest herrings, which are preferred for smoking. In an ordinary season it is calculated that the Yarmouth herrings cost to the owner of the vessel (calculating the various contingencies), about L.12 per last of 10,000 herrings, and they have been known to bring as high as L.35. The fishermen have frequently observed at this locality, that, *during* a storm or gale of wind, the herrings sink and disappear, but *after* a storm they always count upon an abundant fishing. This fishery has been long frequented by the Dutch and French; the Dutch generally cure them for immediate use, or as red, but the French barrel them. The Dutch have their usual busses suited for that fishery, being flat bottomed; and the French have sometimes vessels as large as 70 tons measurement, manned with thirty-five men.

3. *Hastings' Method.*—They commence fishing herrings off Hastings in November: each boat has from forty-six to sixty nets, 30 yards in length, and 27 feet in depth; and here the fishermen are careful to shoot their nets north and south, or across the tide, which runs east and west, so that they may drift with the ebbing and flowing of the tide. When there is little or no wind, the nets are allowed to sink within a yard or less of the bottom, but they generally place them near the surface, when there is a good breeze. It is observed here by the fishermen, that, if the wind prevails for some time from the north-west, this being off land, and the water of course smooth, the fishing is generally successful, but if a south or south-east wind prevail for some time, the fishermen are unsuccessful, and they consider that the herrings in that case proceed to the opposite coast for shelter.

4. *Irish Method.*—The modes of fishing on the coasts of Ireland are various, and some of them remarkable; the nets and boats are of various dimensions, and their size and number depend on the means of the fishermen.

Nets.—The nets are generally made of flaxen twine (while they ought to be of hemp, this substance being more durable); and they are most frequently tarred, (instead of being barked, the tar must give a disagreeable flavour to the herrings, besides, tarred nets are not so durable). The fishermen in some localities, at Killybegs for instance, generally anchor their nets, proceed ashore, and leave them in the water, and return and take them in the following morning.

Seine or Haul Nets.—At Valentia, on the coast of Ireland, they have a mode of fishing with deep-sea "seines," which is generally very productive. These deep-sea seines or hauling-nets are composed of fifteen drift-nets joined together, five nets in length, and three nets in depth, each single net being 20 fathoms in length, and 170 meshes, or 5 fathoms in depth, so that the whole net when joined is 100 fathoms in length, and 15 fathoms in depth, with a cork-rope at the top, and leaden sinkers at the foot-rope. In attaching them to the rope, seven yards of net are put to four yards of rope in the centre, and at the breasts and wings one-third is taken in, or six yards of net go to four yards of rope; the centre part of the net for about twenty fathoms is stouter than at the breast and wings, three threads being in all the twine, but that for the centre is spun thicker. There are two warps requisite, each about sixty fathoms in length, and there are small half-inch ropes called *brails*, fixed to the foot-rope, that are hauled up to purse the net, and bring in the foot-rope quickly, so as to prevent the fish escaping at the bottom, the top-rope always floating on the surface. These nets are generally furnished by fifteen men, each bringing a drift-net, or piece of netting of the requisite size; in some cases one individual supplies the whole, who, for the use of his nets and boats, gets $\frac{14}{30}$th of the fish, the master-seaman getting $\frac{2}{30}$th, and the other fourteen men getting $\frac{1}{30}$th each. They pull their boats surrounding the shoal, and when they haul in about ten fathoms, they pull upon the foot-rope, and tuck the fish into the largest of the two boats, which always accompany each seine-net; the size of the mesh is from 1 to $1\frac{1}{8}$ inch square: from 80,000 to 100,000 herrings are frequently taken by such a *seine* in one haul; one haul or seine-net complete will cost L.30, and with the boats L.60. These nets are in general use on the coast between Dingle Bay and Kenmare. The whole seine may, if necessary, be separated, and converted into drift-nets by addition of ropes, corks, and leads, to each. But very primitive means are used in fishing herrings in some localities. The *curragh*, or boat made of hoops, and covered with canvas, is much employed in fishing herrings in various parts of the coast, and even this peculiarly antique boat is sometimes not to be had where it could be of use.

Horse-fishing.—Horses are employed instead of boats, but it appears that the fishermen complain of this opposition. In the first report of the Irish Commissioners, page 11, it is stated, that the "fishermen complain a good deal of the practice which the farmers have of shooting their nets off their horses instead of boats!"

Blanket and Sheet Fishing.—An equally striking and unusual mode of fishing is practised in Downing Bay, Here it appears that "the poor people, for want of other means, sew their blankets and sheets together, often to the number of sixty, each getting a share in proportion, and the poor people have nothing to cover them when their bed-clothes are used in this way."*

5. *Dutch "Great Fishery."*—The Dutch great or pickled herring-fishery is that which is carried on in summer and harvest, in the latitudes of Shetland and Edinburgh, and on the coast of Britain, with decked vessels, having keels, which can stow twenty lasts of herrings, at the rate of fourteen barrels per last, in the hold, besides the nets, and manned with not fewer than thirteen persons, and having not less than a full fleet of forty nets on board. The object of this fishery is to fish herrings of the best quality, and to gut, salt, and barrel, them at sea, for foreign sale and home consumption.†

Dutch "Small Fishery."—The small or fresh-herring fishery is that which is carried on to the east of Yarmouth, in deep water, with flat-bottomed vessels, without keels, which do not usually come into harbour but upon the beach. It is forbidden, as of old, to gut such herrings, either at sea or on shore, under pain of imprisonment for one month and the penalty of five guilders for every hundred herrings as well as the confiscation of the herrings, unless special permission is given by the King at the request of the States, in certain circumstances.‡

Dutch "Pan Fishery."—The Pan herring-fishery is that which is carried on in the rivers, inland seas, and on the coast of Holland, not farther than three miles from the shore; it is also forbidden to gut, or barrel as pickled, such herrings, under the penalty of one month's imprisonment, and of five guilders for each hundred herrings, besides confiscation.

The superior mode of curing long gave the Dutch the command of the various markets where good herrings were prefer-

* Lieutenant McGladdery, p. 55.

† Dutch Fishery Law, Art. 12 and 14, Art. 8, p. 17. ‡ Ibid. Art. 15 and 16.

red; but for some years back the number of busses have been diminishing, and the whole number of herring-busses fitted out in Holland do not exceed 350. These busses are strong built vessels, resembling the Dutch galliots or merchant-vessels, and are abundantly supplied with every material necessary for prosecuting the herring-fishery. They have a sufficient number of oak-casks, full hooped at both ends, and a due quantity of St Ubes salt, or of the excellent salt manufactured in Holland, each buss having generally fourteen or fifteen men, namely,

Stuurrman,	Master.
Stuurrmansmaat or Loots,	Mate.
Kok,	Cook.
Wandinneemer,	Net-intaker.
Spillooper (four),	Capstanmen.
Wanstander,	Net-holder.
Oudste alsvoorman (two),	Oldest foreman.
Iongste alsvoorman,	Youngest foreman.
Reepschieter,	Rope-shooter.
Spilreephaulder,	Capstan Rope-holder.
Afthouwer,	Carrier.

Each buss has generally fifty, and must not have less than forty nets of thirty-two fathoms each in length, eight fathoms in depth, and a buoy-rope of eight fathoms; an empty barrel, not quite so large as a herring-barrel, is attached to each buoy-rope. This fleet of nets is again divided into four parts, for the purpose of noticing the position of the nets, and facilitating the taking them in; and to each fourth part a large barrel is attached, and at the extreme end a white painted buoy is attached, having the name of the vessel and master painted on it. The yarn of the nets must be of good unmixed Dutch or Baltic hemp, which, before being used, must be inspected by sworn surveyors; the yarn must be well spun, and each full net, or fourth part of a fleet, must be 740 meshes in length and 68 in depth, and the nets must be inspected and marked before they can be used.* The Dutch always shoot their nets by sunset, and take them in before sunrise,—the nets being thrown to the windward, or in such a way as the wind may prevent the vessel coming upon the nets. The whole

* Dutch Fishery Laws, Art. 83 to 98.

of the nets are attached to four strong ropes, joined to each other, and the nets are taken in by means of the capstan, to which four or five men attend, while the nests are lifted in at the stern, and shaken out by four men. The herrings are immediately thereafter gutted and assorted into the qualities voll (full of milt and roe), matjes (milt and roe small), ylen (shotten or empty), and sick, besides other subordinate descriptions connected with the quality, as may be seen where the Dutch mode of curing is described. Eight men are employed in gutting and four in packing. Jagers (fast sailing vessels) attend to carry the first herrings to the Dutch and Hamburg markets. The law of Holland prohibits fishing before St Jan's day (24th June), and after the 31st December.

The following are the rules to be observed by the Dutch fishing vessels and jagers during the jager time, namely from 23d June to the 20th July in each year.

"(1.) The signals pointing out to what parts the jagers are destined are, to Vlaardingen and Hamburg a blue flag, to Maassluys a Dutch flag, and to Amsterdam a white flag, each having a herring buss painted on it.

"(2.) When herrings are caught by the busses, a flag is hoisted at the topmast, and the jager hoists a flag under the signal to shew that the flag has been observed.

"(3.) The busses are to remain as near as convenient to each other, and to the jagers; and the jagers must be in the latitude of Shetland on or before the 23d of June, and proceed on that day among the busses.

"(4.) The busses not to deliver herrings to any other than the jagers appointed, and not more than 1½ last (each last containing 14 barrels unpacked, and 12 repacked) at a time to each jager, nor more than 3 lasts to all the jagers, excepting in case of a partial fishery which must be proved by written evidence.

"(5.) The jagers shall sail from the fleet in the order, and with such quantities of herrings, as shall be fixed by the Commissioners.

"(6.) A jager commodore is appointed to regulate the proceedings of the jagers, and he may order them to proceed with such quantities and qualities as he may see fit.

"(7.) No herrings are to be delivered to the jagers without exchanging signed jager lists with the date of delivery, stating the quantity and quality, and whether packed or unpacked; and the unpacked can only be given to the two first jagers and those going to Hamburg.

"(8.) No herrings to be considered as packed, unless the barrels have lain a night in the hold, and the day after (or later) repacked. Besides their wonted mark on the side of the barrel, there must also be the first letters of the master's christian and surname, and these under a V for full, and an M for matjes, marked with chalk before being delivered to the jagers.

"(9.) If the barrels are not well filled up, or are scarce of salt or stale, in the first case a deduction to be made in the price, in the latter the inspector may order them to be destroyed.

"(10) Those captains of busses who have not delivered herrings to the jagers, must, on their return, if required, prove that it was not in their power to do so, or they are liable in a fine.

"(11.) During the jager time, no busses shall leave the fishing-grounds before the 16th July, nor proceed into port before the 19th, unless there have been caught by its crew, 18 lasts of herrings of 14 barrels to the last, exclusive of those delivered to the jagers.

"(12.) Each master of the jagers must deliver over the herrings he has on board to the homeward bound jager if required, which must take the herrings offered by the master of each buss indiscriminately.

"(13.) The masters of the jagers must take note of the busses they meet, and of those that do not deliver herrings, and give or send a list of them to the Commissioners on their return.

"(14.) Any contravention of these rules renders the masters liable to be dismissed without wages, and not to be again employed."*

5. *Norwegian Method.*—The herring fishery of Norway is very considerable, and gives employment to a great number of the inhabitants on the sea-coast. The mode of fishing is various, and there is great variety as to the size of boats and number of nets. The general practice is, that, when the herrings are caught near the shore, the boats employed carry the herrings to the curing stations, or if at a distance from the shore, there are large vessels with barrels and salt prepared to buy and cure. The nets and mode of fishing are similar to ours; but there is one mode of fishing in wholesale, which has not yet been practised on our coasts, namely, with a long range of strong nets (having small meshes to prevent the herrings being fixed in the meshes, which would cause the nets to sink, and defeat the purpose for which they are intended), they drive into any of the narrow bays or creeks among the rocks where the herrings abound, an enormous body of herrings, where the nets being made fast, the herrings cannot

* Orders voor Jagers en Stuirlieden behoudene tot de Haaring Visscherij van Zuid en Noord Holland, 1833.

escape, but are taken out and cured at leisure. A friend has sent me the following interesting description of a scene witnessed in the beginning of the year on the coast of Norway, at one of the fishing localities.

"Being desirous of seeing the bustle and details of the herring fishery on the coast of Norway, I proceeded in a boat on Tuesday the 24th January 1833, to the coast near Hitteroe. The morning was beautiful beyond description, there was not a cloud, scarcely one degree of cold, and not a breath of wind, although the sea rose in lofty undulations. The first appearance in rowing out of the bay, was innumerable ships like floating houses, which turned out to be boats filled with empty barrels. The nearer I came to the Sound, the more numerous were the fishing vessels, and the Sound, or narrows, which is about two miles in length, and some hundred fathoms in breadth, was almost covered with a great variety of vessels, namely, of that description which were full of empty casks, large pilot boats from the east coast of Norway, and sloops and other decked vessels. On arriving in the Sound, I observed along the coast of Hitteroe a lengthened range of boats and nets projecting from the shore, and at the extreme end of each net I observed a small buoy. Having sailed out to the Qualsbjerg or Hualsbierg (the whale's-rock) which lies at the outer end of the Sound, I was surprised and delighted at the sublime sight; boats and nets appeared in hundreds upon the beautifully transparent ocean; the busy voices of the men mingled with the shrill pipe of the sea-gull, countless myriads of which were waging war against the herrings along with the fisherman and the whale. The birds in rapid evolutions were whirling in the air or dipping in the wave, their snow-white watery plumage sparkling like diamonds in the sunshine, and in the distance at various intervals, smoky looking columns appeared as if rising from the ocean, caused by the blowing of the numerous whales following the herrings. Having proceeded a little farther on, and while looking at the birds whose eager appetite and rapid motion attracted the eye, suddenly a rushing sound aroused me, and a large wave elevated the boat to an unusual height; turning my head towards the point from whence the noise came, I cried out, "Keep back, there is a rock ahead;" the people in the boat turning round, smiled and said, "It is a whale." Part of its body was raised about eight feet above the water, and as it lay across the bows seemed at least thirty or forty feet in length; the head and tail were not visible; but it was black and in some respects like a rock, and on its back the upraised herrings brightly shone and leaped. My boatmen rowed silently backward, and after the lapse of 30 or 40 seconds the monster sunk slowly about two feet, and in a moment sent up a waterspout of the thickness of about a couple of feet with great force to the height of several fathoms, and with a noise that resounded among the neighbouring cliffs. As it did not again appear, I rowed in among the small islands where the nets were now being taken in, the fishermen having long rollers along the sides of the boat to facilitate their hauling in the nets, the threads of which were not visible from the quantity of herrings. At a distance the net appeared like a white cascade falling into the boat, which shone brilliantly in the sun. The boats were soon loaded, and they were then rowed either to the shore or to the larger vessels which cure or bring the herrings to remote salting places. The herrings are all sold by the number, 24 score being considered a barrel of fresh herrings of ordinary size. The seller counts them out by fours, calling out the number, while on the deck of the buyer's vessel two men stand to see that the counting is correctly done. At every salting station may be seen piles of several thousands of empty barrels, where two persons can prepare twenty-four barrels of herrings per day in gutting, salting, and packing; a barrel will hold about twenty scores, but after remaining in salt eight or ten days, they will sink, and the barrel will then require three or four scores more to fill it, after which the barrel is headed up for sale. On the other side of the Sound we saw what is termed a *lock*, that is, several nets joined together, forming a bar before a small bay into which the herrings were crowded. In this place there were several thousand barrels of herrings so compactly confined together, that an oar could stand in the mass. There were in the neighbourhood of Hitteroe, altogether about four or five thousand nets, and about two thousand boats and vessels, and there were caught, according to the opinion of several intelligent persons, this day, not less than ten thousand barrels."

There is a striking difference in the size and quality of the herrings caught on the coast of Norway. Those caught in January, February, and March, are very large, and average about 13 to 15 inches in length; they are called *Graabeensild*, grey-boned herring, and considered coarse in quality, and not much esteemed. The fishing of this kind of herring extends along the coast from Bergen to Christiansand. The other kind of herring is more like the Scottish in size and quality, and about half the size of the other, and are caught, but in small quantities, from July till October. The quantity caught in the fall of 1832 and the spring of 1833, might amount to about 680,000 barrels, viz. at

Bergen,	about	300,000	barrels.
Stavanger,	...	150,000	...
Egersund,	..	50,000	...
Flekkefjord,	...	120,000	...
Mandal and Christiansand,	...	60,000	...
		680,000	

This is considered a fair average fishing for both seasons.

6. *Prussian Method.*—On the Prussian shores, there are two modes of fishing, which are as follows: When the ice departs in the spring, say from February until June, they fish herrings principally by means of seine-nets; and the seining is always carried on at night: the shores being a fine sandy beach, are well fitted for this operation. There are eight men attached to each net, which is of a very large size, being from 150 to 200 fathoms in length, and from 2 to 4 fathoms in depth, with a deep bag in the centre, the whole buoyed by corks, and the sinkers are generally of stone. The men make signals by means of lights, while the boat is proceeding round the semicircle shooting the net; one man holds the rope attached to the end of the net which leaves the shore; when the rope is fully out or distended from the shore, the man on land shews a light, and when the bag or centre of the net is thrown overboard, a light is shewn in the boat. The boat then proceeds round to the shore, when the rope in the boat, on its coming to land, is taken on shore, and the net is drawn to land by four men at each rope; indeed, the operation is similar to the common mode of seining salmon in this country. Upwards of 300 barrels of herrings have been taken in this way by one draught of the net. These spring herrings being always of an inferior quality, are smoked or used fresh. The other method is practised from September till the winter sets in, and is similar to the common mode of fishing herrings in this country in open boats; these herrings being better than the spring-caught herrings, are salted and barrelled.

7. *Asiatic Russia and North America.*—The natives on both sides of Behring's Straits are accustomed to fish herrings in summer with the seine-net, but a novel method is practised on the river Kovima in winter. The natives place branches or osiers nearly across that river in such a manner as to prevent the herrings passing, but openings are left for weirs and nets to encircle and take the herrings.

8. *Gulf of Bothnia.*—The inhabitants of Russian Finland fish the small herring called *strömling* in spring and harvest generally with seine-nets. In winter, however, one method used by them deserves notice from its novelty and ingenuity. When the gulf is frozen over, and no other mode of fishing can

be adopted, they break a circle of holes at the distance of 8 or 10 feet from each other, and by means of a boat-hook or small spar, they carry round ropes attached to the ends of the net, and thus form a circle with the net in the water under the ice, and drag it out at a large hole at one side. By this means they frequently take considerable quantities of herrings as well as other fish.

V. *Modes of Curing Herrings.*

Having now described, as far as may be considered necessary or useful, the various modes of fishing, I shall now proceed to describe the modes of curing.

1. *Scotch Mode.*—The herrings being brought in the boats alongside the quay or near the curing place, are lifted with wooden shovels into a wooden measure without a bottom called a cran (which measure is branded by the fishery officer, and must contain 36 gallons). The cran is previously placed on the cart or place where the herrings are to be delivered, and upon lifting up the measure, the same having no bottom, the herrings are thereby emptied out of it, without the trouble of tumbling them out, as would have to be the case if it had a bottom. The herrings are then conveyed to the curing yard or shed, and are placed in square pits or in heaps; they are then gutted (almost always now in Scotland with a knife), by taking out the gills and stomach, and those who cure in imitation of the Dutch leave the *Appendices cæci* or crown gut, as it is considered to impart a richer flavour to the herring; they are then roosed (sprinkled with salt), and, thereafter, those employed in packing put a quantity of salt in the bottom of the barrel, and a layer of herrings is then closely laid together on their sides, (if, in imitation of the Dutch, nearly on their backs); and alternately a portion of salt and a layer of herrings, until the barrel is properly packed. After remaining three or five days the barrel is again opened, when the herrings are found floating in pickle; the superabundant pickle is taken out or poured off, and an additional quantity of herrings to fill up the cask is packed in; a quantity of salt is then laid on the top of all, and the barrel is headed up, and it is then ready for branding. According to the existing British fishery laws,

such barrels must be marked in the following manner, to shew the month and day the herrings were taken, cured, and packed, and the mode of gutting and the year, as well as the name and residence of the curer. The following letters denote the different months:—I N for June, I L for July, A V for August, S for September, O for October, N for November, D for December, I Y for January, F for February, M R for March, A P for April, M Y for May. They must be Roman letters, and scratched on the sides of the barrels with a marking iron, as well as figures expressing the day of the month, all which must be done in a distinct, legible, and permanent manner, and every letter or figure must not be less than 2 inches in length; if not scratched, the same may be painted black; but this is never done. The mark to denote that the herrings contained in any barrel were gutted with a knife and packed within twenty-four hours after being taken, shall be three Roman letters, viz. G B K; if gutted with the finger G B F; and the mark to denote that the herrings contained in any barrel were gutted and packed *not* within twenty-four hours after being taken, shall be G; and the mark of cured ungutted shall be U; which marks shall also be scratched on the sides of the barrels with a marking-iron, or painted black, and shall not be less than 2 inches in length. And the name and residence of the curer, and the year when the herrings were cured, must be *branded* with a burning or branding-iron in large legible conspicuous and permanent characters on one or more side-staves of each barrel.*

The preceding is all that can be gathered from the book of "Rules and Regulations" published by the Fishery Board for the guidance of curers, buried under a mass of legislative verbiage and obsolete enactments, and extending to 55 pages. The necessity of a new publication must be obvious when we shew what is farther required.

Barrels.—Each herring-barrel must not be smaller in capacity than 32 gallons old wine measure, or 27 imperial gallons, and half barrels may be used, if of proper size. The cask may be of any kind of wood, fir excepted.

Heads.—The heads or ends must be in pieces not exceeding 8 inches in breadth, and when the herrings are barrelled up,

* 48th Geo. III. cap. 110; 55th Geo. III. cap. 94.

the head must be supplied with a flag or bulrush round the ears or edges, but tow or flax is not objected to as a substitute.

Hoops.—If the herrings are intended for home consumption, or exportation to any place in Europe, the casks must be full bound at one end; and there are generally three at the bilge and four at the top: if the herrings are intended for exportation to places out of Europe, the casks must be full-bound at both ends, and have, besides, two iron-hoops, one at each end.

Dunting.—A dunt or dant is a round solid piece of wood, of nearly the size of the head. Dunting is the placing of this on the top of the herrings in the barrel after being re-packed, and by jumping or standing on it the herrings are pressed down.

Blowing.—After the barrel is packed and headed up, there must be a hole bored in the head of sufficient size to enable the cooper to ascertain, by blowing into it, whether the cask is air-tight or not; this is ascertained by observing if any air escapes, and the crevices or openings, if any, must be filled up or tightened.

Branding.—There ought to be 235 lb. of herrings, washed free of salt and pickle, if intended for home consumption, in each cask; 224 lb. for the European markets, and 212 lb. for places out of Europe. Before any cask of herrings can be branded with the crown-brand, they must lie fifteen free days in the cask, namely, the day of their having been packed and barrelled, and the day they are presented for the brand, are not counted. Herrings for places out of Europe or the West Indies must be repacked; they must not be packed with the original pickle and salt, but must be washed and then repacked with fresh pickle and salt. The appendices cœci or crown-gut, although always recommended by the officers to be allowed to remain for the home and European markets, is taken off if intended for the West Indies or places out of Europe. If the herrings are assorted, namely, the *full* herrings (herrings full of milt and roe) separated from *matjes* (herrings with the milt and roe small), and these separated from *ylen*, empty or shotten herrings; the fishery officer has authority to apply a brand with the word "FULL" to the first, and the word "MATIES" to the second description (the last word ought to be spelled *matjes*), in addition to the crown-brand.

Salt.—The fishery officer does not insist upon any particular quantity or quality of salt being used, but he is entitled to see that there is a sufficient quantity applied for the preservation of the fish.

Brands.—There is a crown-brand of a particular form which must be applied to all crans (the measure for fresh fish) before they can be used. There is the regular crown-brand for properly cured herrings, containing the year and the initials of the officer. There are the two brands, FULL & MATIES, as before mentioned. There is a diamond-shaped brand for surplus herrings repacked for the West Indies, or places out of Europe, having the letters PP, the year, and the initials of the officer. And there is a brand in the form of a star, which is applied along with the crown-brand when the latter has been put on contrary to the opinion of the officer, but allowed because decided in favour of the curer by two arbiters mutually chosen.

The officers recommend the curers to lay the herrings, when packed in the barrel, on their backs when intended for the home or European markets; but that those intended for Ireland to be laid quite flat upon their sides.

From the highly judicious regulations of the Fishery Board, and the careful superintendence of the officers, who are practical men, the Scottish herrings (furnished with the official brands, which are a guarantee of their quality), have attained a high character in the continental markets, and successfully compete with the Dutch: from L.20 to L.50 per barrel being often obtained for them on the Continent.

Nets.—The only rule in regard to the nets is, that the meshes shall be not less than an inch square, namely, an inch from knot to knot, or thirty-six inches in the yard of three feet.

2. *Dutch Mode.*—The herrings are shaken from the nets *immediately when taken out of the sea*, and put into tubs or baskets. The Dutchmen use a knife for gutting, with a longer handle and sharper point than ours; they insert the knife into the neck between the gills and bone, and then, by turning the knife, bring away the gills and stomach, leaving the crown-gut or appendices cœci. They throw the herrings, when

gutted, according to the different descriptions of full, matjes, and ylen, into different tubs or baskets; they are then sprinkled or roosed with salt, and the packers *immediately commence packing them into barrels*, taking care to see that they keep the different descriptions mentioned separate. First, a due proportion of salt is laid in the bottom of the barrel, then a layer of herrings on their backs, the head of the one to the tail of the other; this layer is sprinkled with salt, the subsequent layer is laid across the first, and so on alternately sprinkling each layer with salt, and a larger proportion of salt on the top: the barrel being thus filled is then headed up. Due attention is paid as to the quantity of salt necessary, which is regulated by the fatness, size, and quality of the fish; but not less than four barrels of salt must be used in pickling the last of fourteen barrels of herrings.* Due care is taken in heading up the cask to make it completely air-tight. In this state, neither being packed nor repacked, the first jager attending the fleet takes fifteen to twenty barrels to Vlaardingen in Holland, with as much speed as possible; and the second jager takes fifty to eighty barrels to Hamburg. At the end of three days those casks of herrings intended for the subsequent jagers are opened, the extra pickle poured off, and the casks filled up *with the herrings of the same day's curing*, adding whatever salt may be considered necessary. Into the ends of the casks holes are bored after they are headed up, the cooper ascertaining by blowing into the hole whether the cask is air-tight, and remedies with rushes or tow any defect in the heads or staves.† The repacked herrings are then sent off generally in the following order:—

3d,	Jager to	Maasslius,	50	to	80 barrels.
4th,	...	Vlaardingen,	160	...	200 ...
5th,	...	Amsterdam,	220	...	250 ...
6th,	...	Vlaardingen,	220	...	250 ...
7th,	...	Vlaardingen,	300	...	350 ...
8th,	...	Vlaardingen,	300	...	350 ...

The Dutch fishing commences on the 24th of June, and the Jagttijd, the time during which the jagers are to be supplied,

* Dutch Fishery Laws, Art. 16.

† Having carefully observed the system of curing practised by the Dutch, both on our own coasts and elsewhere, I have endeavoured, as minutely as possible, to describe their whole process.

expires on the 15th of July. Thereafter, every fishing vessel makes up her own cargo, but must not return to any port before the 19th of July, under the penalty of 600 guilders (about L.50), unless the whole of the barrels they have on board are filled. No vessel shall commence fishing before the 24th of June, nor continue after the 31st of December, of each year, under the penalty of 200 guilders, and the confiscation of the fish, and the same must be certified by the oaths of the master and two of the crew; and no boat or vessel shall proceed to the herring fishing before obtaining a licence and copies of the laws on the subject. The herrings caught after the 25th of July, St Jacobi's or St James's day, must not be sold till they have been ten days in pickle. The master or packer must mark the date when the herrings were taken, between the neck and belly hoop, under a penalty of 300 guilders, and if unable to pay the penalty, they are liable to imprisonment, and to be fed on bread and water for a month. The herrings cured before St James's or St Jacobi's day, the 25th of July, must only be cured with Spanish or Portuguese salt, and these are named herrings of the *large salt;* and the full herrings after that date must be cured with Dutch-made small salt, and these are named herrings of the *fine salt.* Each day's fishing shall be cured and kept separately, *and those herrings not gutted and packed the day they are taken must be thrown overboard,* or packed as inferior or wrack herrings, under the penalty of twenty-five guilders for each barrel. In opening the casks and filling up, particular care is taken of the pickle; it is carefully poured off and barrelled up, and the pickle of each day's taking is only applied, when necessary, to the herrings packed on the same day. *When the oil appears at the top on opening the barrels, it is carefully skimmed off with a tin dish.* On landing, the herrings are carefully examined by the inspector, who has the power of seizing the herrings, or fining the curers, masters, or coopers, if they are not properly assorted. The inspector may inspect each barrel twice, and must take out and examine to the bottom at least two barrels in each last. The penalty on the master of the buss for not properly assorting and curing the herrings is 300 guilders, and he is not allowed a licence afterwards. If the herrings are not properly packed in the barrel, he is liable in a penalty of six guilders for each barrel defective; and, besides, those barrels found mixed of different kinds shall only be accounted as being of the quality of the most inferior kind in the barrel, and shall only be paid for as such by the buyers.

The barrels contain about 36 gallons, or about one-eighth part more than ours; *it must be made of new good cooper's oak only*, and have not less than thirteen staves, and the proper kind and number of hoops; the ends must not have more than three pieces, or the cooper is liable in a penalty of six stuivers, if he present defective barrels to the inspector for branding;* and if any herrings are packed in old or insufficient casks, or if the barrels have not been examined and branded by the inspector, the herrings shall be seized, and a penalty exacted of twenty guilders for each stave defective, and the packers or servants who are found guilty must be dismissed; moreover, the barrel inspector is liable in a penalty not exceeding 75 guilders, besides seven days' confinement, if he willingly passes any defective barrels.† The hoops must be whole barrel-hoops, of the proper quality of red hoops, *being of a particular kind of willow*, grown in Holland, called the Dutch willow, a variety of *Salix alba*, with a brownish bark.‡ No barrel shall be exported having fewer than fourteen hoops, and the herrings caught after St Jacobi's day must have sixteen hoops. Each barrel of herrings, as they are cured, must be marked by the coopers or packers on board, and on the inside with their private mark under the inspection of the master, and (besides the other marks) as follows:—The herrings taken after St Margaret's day, or from the 21st to the 25th of July, are to be marked with a V; those taken after St James's day, from 26th July to 25th August, are marked J; those taken after St-Bartholomew's day, from 25th August to 14th September are marked B; and all those taken after the 14th September are called cross-herring, and marked with a cross. The markers, to distinguish the different kinds, must mark the barrels of *matjes* with two scratched arches between the neck-hoops at each end, and the *ylen* or empty herrings, with one circle round the bilge. The herrings

* Dutch Fishery Laws, Art 66 to 74. † Ibid., Art 77, 144.

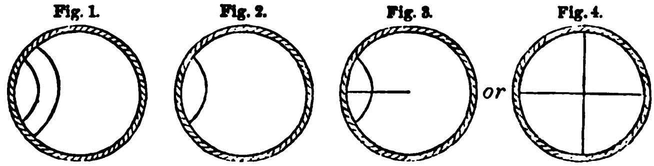
‡ Loudon's Encyclopædia of Gardening, third edit. p. 32.

caught after 20th of July must have marked on each cask the date of their being caught and cured, and each marker to have, besides, a separate distinctive mark of his own, to be applied between the bilge-hoops before landing.

When the herrings are produced to the Inspector, *Bracker*, or *Keurmester*, he compares the marks of the quality with the stock, and upon the end of the barrel cuts with a marking iron the following distinctive marks of the quality.

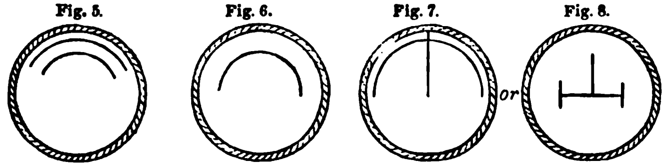
Matjes, if properly cured and assorted, is marked with two quarter arches on the end of the barrel, thus:—fig. 1. Matjes inferior or Matjes wrack, with only one quarter arch, thus:—fig. 2. And it is sometimes marked thus:—fig. 3. or 4.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.



The full herrings are marked with two quarter circles on the end, thus:—fig. 5. Full herrings inferior, or wrack, with one half circle, thus:—fig. 6. Full herrings very inferior, or wrack, thus:—fig. 7. or 8.

Fig. 5. Fig. 6. Fig. 7. Fig. 8.



No herrings can be brought to sale until regularly examined by the inspector, and branded with the name and arms of the place at which they were imported. The provincial states are authorized to fix the nature of the marks, distinguishing the year of fishing and the quality.

The fine salt-herrings, before they can be repacked or branded, must be two days in pickle after they are taken, under a penalty of 20 guilders per last. The inferior or wrack-herrings of the coarse or large salt, must be repacked from 14 barrels to 13 barrels, and branded thus:—

The full wrack	V VR:
Matjes wrack	M VR:
Ylen or empty wrack	Y VR:—

these are not permitted to be sent to the Elbe or the Weser, but may be sent to the Baltic or elsewhere.* The small salt wrack-herrings being full herrings of inferior quality, must be branded

The Vrouwtjes wrack	with	WV.
The Iacobi wrack	...	WI.
The Bartholomew wrack	...	WB.
The Cross wrack	...	W+

besides the provincial or local brands.† Merchants must not send herrings away, either for home consumption or exportation, without applying their customary mark, which mark they must previously communicate to the secretary at the place of their residence, so that the same may be registered.‡ No herring can be branded with the large or Rouen brand excepting good cured *cross* herring.|| The herrings sent to the Elbe and Weser, must be well cured and repacked from the 14 barrels into 12 barrels; provided, that in so repacking them into this quantity, the herrings are not injured; otherwise, no herrings repacked from 14 to 13 barrels, can be sent to the above places.§ Herrings repacked from 14 to 12 barrels, shall be branded with the large branding iron, but those repacked from 14 to 13 barrels, with only the date-iron.¶

The curing in other countries, is generally much inferior to that of the Dutch or Scottish modes.

VI. *Suggestions for the improvement of the Scottish herring fishery.*

1. All British fishing vessels and boats, ought to be exempted from paying any charge whatever, in the shape of harbour-dues, lights, petty customs, or tithes, and an act of Parliament should be passed to this effect; the vested rights as to petty customs or tithes, to be protected by commutation, and paid for by assessment in the towns or communities where such exactions are made.

2. It is of the utmost importance, for the proper preservation of the herring, that it be carefully protected from sun and wind, after being shaken out of the nets into the open boats; this is not at present sufficiently attended to. The boats that proceed to the fishery, having no covering to pro-

* Dutch Fishery Laws, Art. 54. † Ibid., Art. 53. ‡ Ibid., Art. 59.
|| Ibid., Art. 60. § Ibid., Art. 61, 62. ¶ Ibid., Art. 63.

tect the herrings from the sun, the air, or rain, this exposure must tend to prevent the herrings being cured in a proper manner, particularly if they remain long in the boat. I suggest that each boat proceeding to the herring fishing, should be provided with a movable deck or covering, to be applied after the nets are taken in; this ought either to be enforced by law, or the practice encouraged by a small bounty or premium.

3. Considerable shoals of herring often come upon coasts and into bays, particularly in the North-West Highlands, where there are few or no fishing boats, while, at the same time, many fishing boats are lying unemployed, for want of herrings at other localities; it would be highly advisable that means were adopted for securing the communication of immediate intelligence of the arrival of such shoals, to the fishery officers at the nearest stations, who, in such cases, should forthwith send information to the other stations, and the officers should circulate the information by private notices at the different fishing stations, as well as by notices in the newspapers.

4. Encouragement should be given to the fish-curer, to cure the herrings in oaken barrels; the Dutch are not permitted to cure in any other. I am of opinion that oak is not only, from its strength and retentive quality, the best suited for this purpose, but that there is also a preservative quality in the wood, and that it moreover imparts a pleasant flavour to the herring; it would be highly advisable, therefore, that the Government allow all foreign oak-wood fit for herring barrels, namely, under 40 inches in length, to be imported either duty free, or at a very low duty. Birch-wood is at present admitted to entry, at the duty of 20 per cent. *ad valorem;* but this kind of wood is not the best suited for the purpose, and such a rate for a raw material is excessively high, particularly, when it is considered that foreign manufactures, such as woollens, silks, and cottons, may be imported at a similar duty.

5. Every means should be adopted to improve the manufacture of salt; the salt manufactured in this country is of very inferior quality, and the same common process of boiling or evaporation, has been followed for centuries. Simple eva-

poration does not leave the pure preservative salt, or muriate of soda: our common salt is composed of

Muriate of soda, or pure salt,
Sulphate of magnesia, or epsom salt,
Muriate of magnesia,
Muriate of lime,
Sulphate of lime.

The sulphates and muriates of magnesia and lime, are extremely injurious to the process of curing. The muriate of magnesia is partly detached from the common salt in a liquid state, and forms a great portion of the liquid collected at salt-works, called bittern, from which magnesia is made; but it is evident, that a part must remain with the crystals under the common process of manufacture. The sulphate of magnesia or epsom salt, is also contained in the bittern, but part also remains with the crystals. These, as well as the muriate and sulphate of lime, besides giving a disagreeable taste to the common salt of this country, interfere with, or to a certain extent prevent, the antiseptic qualities of the pure salt.

Various plans have been suggested to get rid of these deleterious substances, but unfortunately no process has been adopted in this country for this purpose. The Dutch make their salt of great purity, by melting down the common and rock salt in pure sea-water, brought from the sea at a considerable distance from the shore: they make their different kinds suitable for different purposes of great purity, the secret of making which was purchased by them from the city of Cologne.*

In the present advanced state of the science of chemistry, it certainly would be no difficult matter to discover a simple and cheap process of purifying an article so materially connected with the health and prosperity of the inhabitants of this country.

6. The officers of the fishery should be instructed to explain and teach the proper modes of curing, particularly the Dutch method, and should, where desired, inform as to the proper quantities of salt required for the different kinds of herring; as also the mode of assorting them, of laying them,

* See Prize-Essay by me "On the dairy husbandry of Holland," in The Highland and Agricultural Society's Transactions, No. 23; and also Headrick's History of the Island of Arran.

&c., in the proper manner for the Continental markets, and in the way which is most suitable for the Irish market.

7. The curers ought to be made generally aware of the practice of the Dutch, who, in repacking, carefully preserve the original natural pickle or juices of the herring, by barrelling it up, to be used with the same herrings, or the herrings caught and barrelled the same day, as those from which the pickle had been taken.

8. Being of opinion, from a series of observations for several years back, that the abundance of herrings on our coasts, and in the bays and rivers, much depends on the degree of sunshine and heat in the one or two months previous to the usual time of their approach; namely, that if the one or two months have been dark or cloudy, the fishing will be abundant, and that if sunshine and heat predominate, the herrings will keep farther off the shore, I would respectfully suggest that the Fishery Board instruct their officers at the different stations to keep journals of the wind and weather, distinguishing the days of sunshine from the cloudy days, the quantity caught by each boat, and the usual and actual distance from the shore at which they are caught. Were the theory established, the fish-curers might with greater certainty judge as to the most eligible localities, and the extent of the preparations necessary at such localities; and the fishermen might be taught as to what distance from the shore they would likely meet with the greatest success.

ON THE IMPROVEMENT IN THE STATE OF SCOTLAND SINCE THE END OF THE SEVENTEENTH CENTURY.

The agricultural part of the people of Scotland have lately had a double cause of self-gratulation, first, in the testimony borne to the high state of agriculture in Old Scotia, by the newly formed Sister Society in London, who, at the very commencement of their labours, offered a large prize for an essay "on the improvements which have taken place in the agriculture of Scotland since the formation of the Highland Society," and secondly, in that prize being awarded to Mr Dudgeon of Spylaw, not a learned Professor, not a Doctor of Law or Physic, or some book-worm of the day,—but a rent-paying practical farmer—" one of ourselves." The writer of this article has had no means of knowing the contents of Mr Dudgeon's essay, or of being informed whether it is to be printed or not;* but as it is the property of the English Society, it may not be considered out of place, that another individual should bring before the agriculturists of Scotland a sort of rapid sketch on the same subject, which it shall now be his endeavour to do. It may be well before proceeding, to make our Southern neighbours bear in mind (we, who dwell in the land of cakes, have no need of the reminiscence) the local position of Scotland—its surface, and also the state in which it was some years previous to the birth of the Highland Society—situated in a very high northern latitude—the snow and frozen ice never altogether leaving the chasms in the rocks of her highest mountains—subject to severe frost late in spring, and heavy dews and hoar-frost early in autumn—the sky constantly covered with clouds, and those broken to pieces on the mountain tops, pouring down heavy partial showers on the ground already surcharged with moisture; her agriculturists have to carry on their operations under the worst climate in any part of the civilized globe. Nor was this all in days of yore. The intestine broils produced by the deadly feuds constantly carried on, nay, even fostered by the selfish and warlike chieftains, during the days of clanship, the inroads made by their English neighbours, and the total want of all security or trust in the law, all tended to make the face of the country no better than that of a bleak howling wilderness. Such, at the beginning, or even towards the middle of last century, was Scotland! and well, indeed, might the poet at the Inn window indite—

> " Bleak are thy hills of north,
> Not fertile are thy plains:
> Bare-legged are thy nymphs,
> And bare —— are thy swains;"

while the Southern may exclaim " Mercy on us! who would follow agriculture in such a country?" Let us endeavour to portray Scotland as it now is; for with it disadvantages by nature, and all the miseries which the wickedness of

* This paper was in types before the publication of the Journal of the English Agricultural Society, in which Mr Dudgeon's essay may be found. —Editor.

man had brought upon her, the Lord Almighty had yet blessings innumerable in store for Scotland, and we now behold her no longer sunk in darkness, in the grossest ignorance, and in the most abject poverty, but, in very truth, "a highly favoured nation."

The writer, as one living in this now happy country, would desire to render thanks to Him to whom alone it is due, and say "The blessing of God has done it." But we know that the Allwise Being who rules in heaven, and laughs to scorn the puny efforts of man, always makes use of means. It therefore behoves us to look at *those means;* and in bringing Scotland out of the unsightly chaos in which all Europe beheld her at the end of the 17th century—the union with England seems to be the first in her career of prosperity. Whatever our countrymen of the Emerald Isle may think (or without thinking may bellow) against the act which united Ireland with this country, there is not a single Scot who has a particle of truth in his heart or mouthful of sense in his head, who will not readily own, that the union with England has been the making of his country. This great act gave the death-blow to the feudal system (long a curse to Scotland), and the happy termination of the rebellion of 1745 was the last throe of that direful tyranny, the cause of all those forays and fightings that perpetually devastated the plains and stained the mountain streams with blood. The savage yell of the deadly slogan,* and the plaintive wail of the coronich,† had long been hushed, the once bright claymore had been permitted to rust in the scabbard, and the clansman, wearied of a life of poverty and inactivity, had *ceased to hope* ever again to hear the note of the pibroch to summon him to war—the lowlander, on the contrary, had *begun to hope* that the days of rapine and plunder were over,—when, in 1784, a few gentlemen, full of zeal for their country, and it may be a little love of society, formed themselves into a sort of hole and corner club, in a Coffeehouse called the Exchange, situated in the court of that name near "the market-cross of Edinburgh." Here, in the enjoyment of agreeable conversation, and a good supper, did those worthies talk over plans for the amelioration of the

* War cry of the clansmen rushing to the "onslaught."

† The "Lament" or dirge for the dead sung by the women.

Highlands, and from this nucleus arose the now widely extended and powerful Highland Society. The writer had the pleasure to know several of the original members of the Highland Society, particularly the man who was in fact the prime mover in the business, the late Mr Macdonald of St Martin's, whose picture now hangs in Albyn Place; this gentleman, as well as most of the others, belonged to the profession of the law, he was (what we in Scotland call) a writer to the Signet —(*anglice*, an attorney of the highest grade). No set of men could be more fitted to forward the agricultural interests of the country. At that period, law in all its branches was followed by cadets of old families, sometimes by the eldest sons; thus they were often possessed of landed property themselves, and were entrusted, as agents, with the care of all the estates in Scotland, their education and business habits, giving them a complete command over the ill educated, and, at that time, (proh pudor) drunken Lairds. They were also in this capacity (that of agents), a link between the highland and lowland proprietors, and were enabled to get aid from the latter in the way of subscriptions and countenance in the forwarding of their patriotic schemes. To say what was the state of agriculture in Scotland at the date of the formation of the Highland Society, would (to treat of it minutely) require greater scope than the limits of a periodical admit. The northern part of the kingdom does not at all resemble the southern division; there is not that flat and uniform surface as in England, where much the same sort of agriculture might be followed. In Scotland, we find the flat greasy clays of the carses (as they are called) fitted for wheat and bean husbandry; the more friable loam of the upland country fitted for barley and turnips; and the steep and rocky sides of the mountains covered with heath, fitted only for the flock of the shepherd or the shaggy coat of the West Highland kyloe. But, to take one sweep over hill and dale, corn-field and meadow, we may at once pronounce the agriculture of Scotland at that period, to have been wretched,—execrably bad in all its localities! Hardly any wheat was attempted to be grown, oats full of thistles was the standard crop, and this was repeated on the greater part of the arable land, while it would produce twice the seed thrown into it,—turnips as part of the rotation of crops were unknown, few potatoes were raised, and no grass seeds or clover were sown. The whole manure of the farm being put on a little bit of the best ground near the farmstead, and there they grew some barley of the coarse sort, termed "bere," wherewith to make bannocks, broth, and small-beer, or peradventure the farm lay at the foot of the Grampians, to brew a portion of "mountain dew!" Since the writer can recollect, a great part of the summer was employed, in the now fertile shire of Fife, in pulling thistles out of the oats and bringing them home for the horses, or mowing the rushes and other aquatic plants that grew on the bogs round the homestead. Such was the state of Scotland, with but little appearance of amendment, up to 1792.

But an impulse was *now* to be given to the agriculture of Scotland far greater than could ever have been effected by the paltry prizes, or still more tiny experiments, of the Highland Society, as it was *then* constituted. The French war, which at that time broke out, soon raised the price of all sorts of agricultural produce to a height previously unknown in this country, and soon roused the Scotch, ever alive to their own interests, to greater exertions in agriculture than the elder farmers had imagined to be practicable. There was all the while a deal of by-play going on,—the banks had commenced to give unlimited credit—the lairds were now better educated, they were serving as officers in the ranks of the English regiments, or were returned to Parliament, and mixing with accomplished gentlemen within the walls of St Stephen. Manufactures and commerce were rapidly increasing and still causing a lively demand for the productions of the soil; an increase in the value of land had taken place, and a mania in the purchase, or rather traffic in estates had seized numerous thoughtless speculators, who, on acquiring a property, quickly expended large sums on improvements, such as farm-buildings, plantations of forest trees, draining, &c., and then, partly from the improvements they had made, and partly from the rise in the markets, they demanded, and for a few years got, not unfrequently, nearly double the price they had given. Time, with her "ceaseless wing," had now brought in another century, and on the arrival of the ninteenth, the richer part of the low country had put on another aspect. Beautiful fields of wheat were to be seen,

—drilled green crops and clean fallows every where abounded, —the bogs had disappeared,—the thistles no longer existed. In the Lothians all this was carried on to a great extent; in fact, there was too much of the "*pas accelère.*" The farmers forgot themselves, they were coining money, and "light come light go" was their motto. They went on in the most reckless manner,—they began to keep greyhounds, to be members of coursing clubs, subscribed to the "silver cup" or "puppy stakes," and yelped the same note of folly as their betters in birth, their equals in extravagance and vice. Then followed yeomanry races,—the good sturdy nag that could be of use *at a time* in the operations of the farm was exchanged for a blood-weed, and on market-day, instead of rational conversation about matters connected with their own calling, they began to talk "*knowingly*" about the turf. At this time, that is from 1810 to 1814, the agricultural horizon was the brightest; the gas was fully up, the nation was alive, all was activity and business,—local agricultural associations had been formed, the Highland Society had grown to full maturity, or at least was advancing to it, and the ramification of its members was spread over the length and breadth of the land;—ploughing matches had made the operatives expert,—premiums and competitions had improved the breed of horses and stock, and high prices had given the farmer the sinews to carry on the war; but all this was soon to get a check, perhaps a salutary one. There was too much of a "flare-up," the state of things was not healthy, the recklessness of the richer tenantry was fast spreading over the whole country, and that ruin which was soon to overtake the farmers of the Lothians might have been the fate of all Scotland, but 1815 arrived, and with it came Waterloo, a finisher to the war and an extinguisher to Napoleon. The writer knew the state of things in the county of Haddington well, and it was truly distressing to watch the effects of that memorable battle on this so lately prosperous county; an accurate observer might almost draw a parallel. The glitter of the appointments no longer dazzled the eye, the flash of the gun and turmoil of war and the shout of victory had ceased, all the noise and confusion of the battle was hushed on the heights and in the hollows of

Waterloo. But the trodden grain, the neglected farm-stead, the lifeless carcass, or the crippled soldier, told what had been acted; and although all was now quiet at "the tree,"* the death-pang of the sufferer and the groans of the lately thoughtless wounded made the hospital walls to ring again, and filled many a once happy family with mourning. So was it with the farmer; each fair was a shot that told heavily on his purse, each sale was a shell that scattered ruin, and the prices of the weekly markets were so many bullets through his sinking credit. Then came the return of killed and wounded,—each bankrupt list was in very truth an official notification of them. The smart young farmer no longer galloped along the road on the blood-weed; the coursing clubs fell into desuetude, and the greyhounds were hanged. But all would not do, and we, though distant from the seat of war, had to witness *our* farmsteads neglected, our fields no longer under *bright* culture, while the ruined bankrupt, sold out of his farm, was no better than the clay-cold corpse; some there were who struggled hard, some, in the kindness of their landlords, had their cases taken under consideration, and, in reduction of rent, or converting it into a grain one, had their wounds bound up. Still the sufferers were to be heard complaining of their ruin, with wives and children lamenting the reality of the sad catastrophe; alas! this is no metaphor! It grieves the writer to think of the great change that has taken place in the tenantry of East-Lothian; since 1815 hardly one large farm has the same occupier, men from other counties have started up and filled the gaps which the transition from war to peace had made, and the patronymic of the farm no longer carries to the mind the name of an acquaintance or a friend. Methinks, in merry England even, there may be not a few who, on the retrospect of past times, like the galled jade, feel inclined to wince, and, at the recital above given, it might be said in the words of Horace, "nomine mutata fabula narratur de te;" but enough of this. Agriculture in Scotland, without all doubt, came to a check, as fox-hunters say, and it was a long one, but the game was not up. The national character here came

* The Tree was the spot where the Duke of Wellington stood.

into play; the Scotch, naturally a thinking, calculating people, and, as I said before, ever alive to their own interest, do not fly into absurdities to get themselves out of a difficulty,—they do not, for instance, set to work and burn the notes that they may ruin a bank, or burn all the ricks, along with the thrashing-machines, in order to force the farmer to use the hand-flail; his corn to thrash, and his cash wherewith to pay them, being swallowed up in the conflagration. No, they are not only a thinking, but a moral people, and, it may be hoped, a stronger and a better principle restrained the peasantry from being hurried, by the pressure of the times, into those enormities which disgraced some of the English counties. The Scotch are a religious and a Sabbath-keeping people, and God fulfils his own promise in sending a blessing on such as do what he has commanded. And here let not the meed of praise be withheld in regard to the noble parochial system, by which there is in every parish not only a church but a school, where the youth of every rank may receive a good education and be taught to venerate religion, and to honour the powers that be, because they are ordained of God. Our schoolmasters are, perhaps, one of the most respectable and praiseworthy classes of men in the kingdom—well educated, generally licentiates of the Church of Scotland, they work hard at their posts, and are ever ready to impart (at a very cheap rate) all that can make a man wise either for time or eternity; and to this excellent system is it mainly owing that the Scotch are such an intelligent peasantry—being well educated, the rural population were enabled to turn their minds to the best method of getting a livelihood under the new times.

Some time previous to the era of 1815, the turnip husbandry had got a firm hold in the country,—the benefit accruing from it was so apparent that no convulsion in the market-prices could make the farmers forsake it; but as yet turnips were only used sparingly to *young cattle*, in order to get them up to the age when they could be driven by land to the southern markets. Near the large towns, cattle were at this period fed for local consumption, but in the more distant parts there was as yet no such practice; and there existed two good reasons why it should not be—the farmer could not procure manure enough to raise all the green crop he would have wished, and if he could have procured it, there was no outlet for his fat cattle,—a species of stock that cannot be removed to any great distance without suffering a loss as to weight and quality, as well as a heavy expense from the time required to transport them.

But new discoveries soon took away both those impediments which were retarding the improvement of the more inland parts of the country. The first of these discoveries was the most important that ever occurred in the annals of agriculture, in this or any other country, viz. that of bone-dust.

We all know how very slowly improvements in agriculture proceed; yet so palpable was the benefit to be derived from the use of this new manure, that in a few years there was not a farmer who did not avail himself of it. It is not twenty years since the writer first used bone-manure (roughly broken by hand-labour), and quickly perceiving the advantage, continued to employ it amidst the jibes and taunts of his neighbours, who did not fail to hint that Macadam would prove a bad purveyor of manure! and now what a change do we see, those very men purchasing it every year to a great extent and at a high price!

Well, the farmer could now grow turnips to any extent, and the bare fallow was exploded; and just then there started into existence another powerful *help* (as the Yankees say), to the Scotch agriculturists—the discovery of steam-boats. No longer forced to sell his lean cattle to the English jobber to be driven foot-sore and jaded to the southern fairs, the Scotch farmer is brought in close contact with the London market; and, as a gentleman, in his speech at the great Glasgow show, justly said, "The steam-engine is now our drover," and Smithfield our market-place. The benefits arising from the London trade are very great; the home butchers are now *forced* to give a fair price to the feeder for his stock; the needy farmer can in a moment convert his "beast" into money, certain that by return of post his cash will arrive. Nor is this all, for the wealthy feeder is alike benefited by being enabled to throw his stock into the market whenever the price pleases him, and, on a failure of food, *any one* can clear his yard at a moment's notice, and thereby save the only other resource, that of pinching the store cattle until a purchaser appears to take away the fat ones. There yet remains another epoch in the history of Scotch agriculture to be spoken of,—the thorough or Deanston mode of draining.

This so great benefit, not for Scotland only, but for the whole kingdom, is as yet in its infancy—already the fame and the utility of it is spreading all over the island, and we have not a doubt, in a short time there will not be found a spot (where improvements are carried on) that has not been "made anew," by means of this simple yet powerful and efficient system of draining. It is not possible, in a short article of this sort, to enter into minute details; but to state facts and set people on inquiry for themselves, is the legitimate duty of every writer. Now, no man holding land ought to be ignorant of the thorough or Deanston drain. Those who have not got the little pamphlet published by Mr Smith, may like shortly to know the history. Mr Smith, deeply engaged in the cotton-spinning trade, could not procure a fall of water on the river Teith, ten miles west of the castle of Stirling, without renting along with it a considerable portion of very bad and wet land. Not liking to have a heavy rent to pay for such trash, Mr Smith turned his powerful mind to the subject, and perceiving the folly of throwing away large sums of money on deep and useless drains, with all the stuff of tapping and boring, to *catch* the water as it were a wild beast for which gins and traps must be laid, hit on the idea of making drains in parallel lines in the hollow of every ridge, cutting them to the depth of thirty inches, filling them with small stones half-way to the surface, above this putting a green turf reversed, and replacing the mould. Following up his first discovery by ploughing deep, he has now a farm of the finest land ever seen; and so convinced is the writer of the utility of this mode of draining, that each year he has been increasing the quantity he has made, and during the last twelve months has put in above fifteen miles. Nor is the Deanston drain confined to those parts of the country where stone or gravel can be procured; the same system can be and is followed with the same effect, by using the Marquis of Tweeddale's tile; or even the poorest farmer, who has not capital to undertake costly improvements, can fertilize his farm by making the thirty-inch drains and filling them with brushwood. It is perfectly wonderful to behold the mighty change this thorough-drain system is making in the different parts of the country where it is in operation: wet land is made dry, poor weeping clays are converted into turnip-soil, and even what would formerly have been accounted dry is advanced in quality. Whole parishes in the vicinity of Stirling are completely transformed from unsightly marshes into beautiful and rich wheat-fields, and where the plough could scarcely be driven for slush and water, we see heavy crops per acre and heavy weight per bushel, the quantity and the quality alike improved.

The writer has endeavoured to paint Scotland as it was at the middle of last century, and to carry the reader, step by step, through the various improvements that have since that period taken place. He would now appeal for testimony as to her present flourishing appearance and to the admirable system of Scotch husbandry—not to the simple *ipse dixit* of a single, it may be partial, individual, not to the report of a few tourists, or to Loudon, who says, "the change in the face of the country, in the gentlemen's seats, and even in the cottages, is so great, that one having been absent for a few years, would hardly be able to say he had ever before been in the same locality." No—there is still stronger testimony in the constant wish manifested in England and Ireland to have Scotch farmers, Scotch land-stewards, and Scotch gardeners—and stronger still, in the fine cattle and beautiful samples of Scotch grain, commanding, week after week, the top prices in Smithfield and Mark Lane. But the writer would go a step farther, and, trusting to having been nearly thirty years actively and enthusiastically engaged in practical agriculture, having many times visited every part of the island in quest of agricultural information, and having long been a member of the Highland Society, he would endeavour to point out some of the errors at present existing in England, and some of the good which has been effected by the labours of our great National Society, as well as what may, in like manner, be done by the new-born one in England.

Now, what every calm and thinking man must own to be the greatest fault at the present day in the English agriculturist, is looking to and trusting to Government rather than each man to his own brains. We would assure our brethren of the plough, that it is not in the power of any government, be it conservative or be it radical, to bolster up the state of agriculture. A wise and a good government will not enact laws prejudicial to any part of the community, nor will it seek to break down the safe-guards which our forefathers have built up; but they may be assured, it is not *forcing* wheat to be sold at a sovereign the bushel, or meat at 5s. per lb., that will ever make the agriculture of the country prosper, or the farmer rich. Look at Manchester. Is it by the manufacturer selling his prints at a sovereign per yard that enormous fortunes have been amassed? No—it is the greatest quantity produced at the cheapest rate that will ever make a prosperous trade. If wheat is low in price the farmer must bestir himself. Instead of sitting whole evenings (as many an English farmer does) soaking over a drop of cider or a little home-brewed, while he grumbles and spells the columns of an old newspaper, and abuses Parliament for the "great cry and little wool" in the way of helping "agricultural distress," let him toss aside the speeches of our would-be patriots, and let him to his fields and see if all be right there. Let him remember that if he can but grow one or two quarters more per acre, he will be in a better position even with the low price than he was before. The attempt made last year in London to retard the formation of the New National Society of England, was very much to be lamented; and while this and that about the corn laws and other matters connected with the legislature of the country were made a handle of to frustrate the plans of those true lovers of their country, who wished to organize the Association, it shewed to us, north of the Tweed, that their brethren in the south did not yet know the value of the good old proverb, "Ne sutor ultra crepidam," alike true as to criticism, and the art of making money. If farmers must be politicians, at all events the hall of an agricultural society ought never to be made the arena on which to fight such useless battles. Let statesmen, members of Parliament, and diplomatists, turn their minds to politics, —let us stick to the plough: "hoc age" is the grand thing in every profession, and he alone will prosper in his vocation who follows it. Nor can we suffer it to be said of us Scotch, that we are tame and servile, or that we advocate free trade and such-like nostrums. The Scotch are as lynx-eyed to their rights as any people can be; they know freedom to be the birth-right of every British subject from John o' Groats to the Land's-end. Look, for instance, how instantaneously they responded to Sir Walter Scott, when, but a few years previous to his death, he rang the tocsin of alarm, when the banking system was in danger, aye, and made Government pause, while "nemo me impune lacessit" was sounded in the ears of the Ministry. But politics is a mere thing of *words*, not confined to rank or education—it is seen to rage down to the pot-house, and it is no uncommon occurrence for an orator who cannot sign his own name to make his beer-swilling, smoke-puffing audience, even to boots or the hostler, sit in as great delight as did the admirers of a Fox or a Pit in the days that are gone—and for ever. We would say, then, that want of education is the next great barrier to the advance of agriculture in England,—a good moral and religious education is required for the agricultural part of the population to lift them (as the huntsmen say) over the beer-shop and brute-like existence into which the lower ranks are at present sunk, and to break down the lumbering obsolete practices of the higher orders. Recent events have read a plain and very solemn lesson to the high in rank, the opulent and the powerful of the realm,—a lesson to shew them that blind ignorance and infidel knowledge alike lead men into the greatest crimes. Look at the poor deluded peasantry who suffered themselves to be led by the madman Courtney, and turn on the other hand to the enlightened and march-of-intellect cotton-spinners of Glasgow planning and perpetrating deliberate murder! A good and religious education will give the poorest rustic new ideas, and raise him above "the beasts that perish;" while the higher orders will be enabled to understand much of the more popular parts of science, and the farmer will be able to bring it to bear on his own particular calling. He will then find the *unalterable* and beautiful laws of nature to be far more interesting than the *permanence* of the corn-laws; the fermentation of manure a better topic of conversation than useless discussions on the removal of the tax from fermented liquors. The next obstacle to the prosperity of agriculture in England is an improper expense in the article of horse-labour, and this arises almost entirely from having more than two horses under one servant. There is no ordinary operation on a farm which cannot be carried on with two horses; more therefore are useless,—besides a man is not able to work, groom, and look after more than a pair of horses; hence, if the two-horse plan is not followed, there must be boys and lads, or horsekeepers, all of whom require wages and victuals, and do very little work. Until England adopts the Scotch two-horse system, she can never hope to bring her produce to market at so low a cost as the Scotch;* hence Sawny will be able to undersell John Bull, and have after all more gain to put into his pocket. The next point where England is still behind the practice of Scotland, is the turnip-husbandry—drilled turnips of course, for if the drilling machine and the horse-hoe be not used, it is but the *sham* of turnip-husbandry, and does not deserve the name. It may be said, that much of the soil in several of the English counties is strong clay not fitted for the growth of turnip, and even if they could be grown, how could they be drawn or carted off? It would poach the land and ruin it! That may pass with the fireside farmer, but hundreds of acres can be shewn in Scotland of *naturally* as stiff a clay as any in England, *converted* into turnip-land by means of the thorough drain and the use of lime; in fact, fallow is exploded and most properly. Can any one be found in the 19th century to advocate a system which burdens our crop with the rent of two years? The last error in English farming, springs as a natural consequence

* It does appear to a Scotch farmer most strange, the pertinacity with which this erroneous practice is followed all over England, even where the Scotch plough with two horses has come into fashion. Still, in the cart or clumsy waggon three and four horses are seen creeping along with half the load two good Clydesdale nags would take in a couple of light carts driven by one man.

out of the preceding, viz. a wasteful expenditure of money in the purchase of oil-cake, for unless cake is very low and meat very high in price, it can never repay the farmer to feed with cake—at this moment, from twenty to twenty-four tons of the best turnip can be had for the price of one ton of cake ; now, let any say which is the cheaper feed.* It is true oil-cake is a valuable succedaneum when turnips rot in a late or bad spring. It may be used profitably to finish off cattle when meat is selling at a high price, or to keep valuable high-bred stock from falling away in winter, such as late calves, or the like ; but never can a farmer hope to make rich if he has each year to purchase a considerable portion of the food he requires. But to conclude, let us put the question, In what has the Highland Society contributed to the mighty advance of agriculture in Scotland ? The reader of this article must perceive that nowhere throughout its pages has there been any attempt to arrogate superhuman powers to any set of men ; but without all doubt, the labours of the Society have been productive of much good, and were it only the having banished all political discussions from their meetings, and taught the agriculturists of Scotland that in the hall of the Society they could meet as brethren, it must be acknowledged a great deal of good has been effected. Nor has this beneficial change extended only to the proceedings of the Society, or told only within its own walls, for as the page of history narrates how a wicked Monarch and a dissolute Court spread the virus of a moral pestilence throughout a fated land, till every inhabitant in the darkest lane and lowest cottage was inoculated with the soul-destroying plague—and, turning to the bright side of the picture, a good King and a virtuous Queen, are found not only making a healthier atmosphere in the Court itself, and throwing an aroma (as it were) of purity around their own exalted sphere, but elevating the tone of morals throughout the land—so in like manner has this *now* so powerful body given the tone to all the local associations throughout Scotland, so that in the business as well as social meetings of every one of

* It is not only that turnip as a food is cheaper, but the farmer does not require to lay out his money for it, or (to make use of a phrase of which the Scotch are very fond), the farmer has the one food "within himself," while for the other, he is forced to go to market and pay hard cash.

them, nothing but harmony and unanimity is to be found. Again, in the days of its youth and feebleness, the Highland Society sent the leaven of the turnip-husbandry into all the glens and straths of the north, by offers of small prizes to certain Highland parishes, and the same may be said as to the growth of clover and the finer grasses. As it advanced in strength (as to numbers and as to cash), attention was turned to premiums for stock; then came offers of reward to men of science to discover better implements and machines, to diminish friction, and consequently draught, such as in the thrashing mill and other parts of agricultural machinery. Still advancing in the scale of intellect and of science, premiums were offered for essays to bring to light the facts connected with chemistry and natural philosophy; and, under the auspices of the Society, was set up the Quarterly Journal of Agriculture, a work which has been the vehicle of conveying so much useful information to the agriculturist, that, we humbly venture to say, it ought to appear on the table and book-shelf of every farmer's parlour. After this, the great stock-shows were resolved upon, as another link of union between the Society and the practical farmer, at the same time throwing aside all paltry feeling, and making them open to stock from both sides of the Tweed. How well they have succeeded, let the last one at Glasgow bear witness. Nor has the Society forgotten the beauty of the country, as the premiums offered in regard to planting trees and such like-subjects fully testify; and to sum up all, it may be said, the Highland Society has been a "*point d'appui,*" a rallying point, to which the agriculturists of Scotland might look, and a fostering mother to all who, although strong in talent, were weak in interest to make it public. An ardent lover of the plough and all that can speed it, the writer of this article would advise the Society of England to look into the annals of the Highland Society, and from them to cull whatever may be of use in the advancement of the delightful science, the culture of the fields.

.... "the men
Whom nature's works can charm, with God himself
Hold converse; grow familiar day by day
With his conceptions; act upon his plans,
And form to his the relish of their souls."

ON THE DISCOVERY OF THE TEA PLANT IN BRITISH INDIA.

Through the attentive kindness of the Agricultural and Horticultural Society of India, we have just been favoured with the fifth volume of their Transactions, which, among many other interesting articles, contains one of paramount importance. We allude to the report on the tea plant of Upper Assam, and to the auspicious prospects which it opens up to the enterprise and the industry of our Eastern colonies.

We formerly alluded, in the third of our papers on the agriculture of Hindostan, to the opinions of Mr Graham and others, that many portions of India seemed admirably adapted for the cultivation of the tea plant; and also to the circumstance of its having been introduced by Dr Wallich in 1835,—that indefatigable person having sent parcels of the seeds to such various districts as seemed to him best adapted for their successful cultivation. It was in finding out the peculiarities of the soil, less even than with reference, as it would appear, to climate, that the difficulties lay; and we rejoice now to say, that these speculations and trials have come, in all human probability, to a most favourable conclusion, by the publication of the report to which we have just alluded; and of which we intend to present our readers with a brief abstract—the circumstance being one more likely to influence the whole internal state of Hindostan, and to be more important in its results with reference to our commercial intercourse with the East, than any thing that has occurred for the last half century.

It was not till near the end of the year 1834, that it was discovered that the genuine tea plant was indigenous to Upper Assam; and from the representations of Captain Jenkins, the government agent for the north-east frontier, it was resolved upon, that the districts, or rather tracts, producing the plant in question, should be examined with care, by a scientific deputation appointed for that purpose. This deputation consisted of Dr Wallich and Mr Griffith, who were instructed to inquire into the physical condition of the plant; and Mr M'Clelland, who was to report on the geological properties of the soil whereon it grew.

Leaving Calcutta on the 29th August 1835, the deputation arrived at Sadieja, the frontier station of Upper Assam, early in the following January. Thence it proceeded to the Singhe tracts, and arrived at Kufoo on the 15th of the same month. It was on the day subsequent to this, that, to their great delight, these gentlemen discovered the tea plant growing in its native state.

The deputation, after visiting the tea tract on the Mammoo, then left Sadieja, to which it had returned, and proceeded to Chykwa for the purpose of selecting a proper spot for the rearing of the Chinese plants that had been brought along with them from Calcutta.

Having surveyed a number of localities between Chykwa and Gulroo Purbut, where the tea plant was examined for the fifth and last time, Dr Wallich, attended by Mr Bruce as a guide, left the other gentlemen for the purpose of being present at a general meeting of the authorities of Assam, convened, among other purposes, for that of settling every question regarding the tea. After being four months in Assam, the deputation dispersed—its principal purpose having been happily accomplished.

These gentlemen examined the tea plant in its native state at five different places, where it was found to grow abundantly. Two of these, which are in the Singhe country, and considerably within the British territory, were Kufoo and Ningrew. Nadowan and Tingrei are situated in the Bengmora country, and although it belongs to a nominally independent native rajah, it is considerably within the control of the British authorities. The last place was Gulroo Purbut, which is within the territory of the Rajah Poorundur Singh. It cannot be said that these localities have any particular features in common; and the term of tea forests is a most inapplicable one, as the plant seldom acquires the height of a small tree, and more commonly resembles an ordinary sized shrub. The five places we have mentioned are comprehended in a tract of country situated between the parallels of about 27° 25′ and 26° 45′ north latitude, and 96° and 94° of east longitude. The extremes of longitude are formed by Ningrew and Gulroo Purbut; and the extremes of latitude by Tingrei and Gurloo. It should also be mentioned, that, on returning from the Wishmee hills, Mr Griffith visited a sixth tea tract which had been discovered by Mr Bruce. It is three miles distant from Kufoo-doo, and barely a mile from the line of road by which the deputation proceeded to Ningrew.

We shall now briefly enumerate a few of the peculiarities distinguishing these different districts of tea country.

At *Kufoo* the tea occurs in a jungle about two miles southward from the village, and covers a space of 200 square yards. The plant was here of greater size and growth than in any other of the localities yet discovered. The soil is loose, light, and of a decided yellow; and the ground is intersected with numberless small ravines and curious looking mounds, which are chiefly seen around the bases of the larger trees, or of the clumps of bamboos. The situation is low and damp, and the road winds over low eminences before coming to the tea itself.

Kufoo-doo, the site we have already mentioned as having been pointed out to Mr Griffith by Mr Bruce, is about 150 yards in length, by 40 or 50 in breadth, and lies north and south. The plants were very abundant, and in excellent condition, about the size of middling shrubs. None were at the time arborescent. All were loaded with flowers and young fruits. They cease abruptly in every direction beyond the space mentioned. This spot is also decidedly low, although not usually overflowed during the rains; and the soil is of a cinereous grey on the surface. When dug into for a foot, however, it was found to be brown; and, on proceeding deeper, it appeared more and more of a decided yellow, until at the depth of four feet it passed into sand. It is light, and easily reduced to powder. There were no ravines; but a few mounds were visible about the bases of the larger trees. Mr Griffith thinks, that the excess in the development of the flowers was probably dependent on the moderate exposure of the plants to the influence of the sun.

The tea plant occurs at *Ningrew* on a small elbow of land, nearly surrounded by a little streamlet, called the Mammoo. It is N.N.E. from the village, and about two miles distant. The whole of the tract is elevated, yet still very moist, and the surface is intersected by ravines as at *Kufoo*—the characters of the soil being the same as at that place. The plants, however, although more numerous, are of a smaller size. This locality is close to a portion of the Naga Mountains, forming the southern boundary of the valley of Assam.

The tea patch at *Nadowan* is extremely limited, being only about fifty yards long by twenty-five wide; but, towards the southern extremity, the plants are exceedingly numerous. The soil, particularly that portion of it on which the plants were most abundant, was of considerable depth. It was light, and of a decided yellow, passing below into sand. This patch is about three miles to the south-west of the village of the above name.

The most extensive locality which has yet been discovered is at *Tingrei*, a poor village, ten miles to the south-east of Rangagurrah, the capital of the Muttack country. It is situated on the western bank of a rivulet of the same name, a tributary of the Debroo. The tea is found here growing indiscriminately on rather high ground, and on clumps of earth in low ground, which, in all probability, is occasionally flooded, as it is intersected in every direction by ravines. The plant is here found in greatest perfection on the higher grounds. No arborescent specimens existed at this place; and the plants were, generally speaking, smaller than those at Kufoo or Kufudoo. Mr Griffith, however, considered them the finest he had then seen; their crowns being usually much more developed.

The soil was of a yellowish-brown, friable on the surface, but increasing in tenacity and yellowness to a certain depth, when it passed away apparently into pure sand, as in the other localities. Some of the lower portions had a thin superstratum of black soil, probably derived from decomposition of vegetable matter. The western and eastern limits of this locality were well defined; but, in a southward direction, the plant continued to straggle along the water-course.

The only situation in Assam where the tea has yet been found, is at Gurloo Purbut; and this would indicate the probable ascent of the plant to more elevated situations. It was here found on a rounded hill, 40 or 50 feet in height, running north-west from the village, to which it is quite close. The direction in which the plant occurs is from north-west to south-east; and the patch is distinctly limited, for perhaps two-thirds of its extent, by low swampy ground, used in the culture of rice. The plant was not abundant here, and had lost its tendency to become arborescent. The soil was deep; and, in external characters, approached to that of the tea tract at Tingrei.

From what we have just specified, it is evident, that, in all the above localities, the tea plant only occurs in patches of very limited extent, but it is no proof that they are so in number; and, it is also worthy of notice, that this circumstance points out the absolute similarity of the Chinese and Assamese plants, which, to use Mr Ellis's own words, always occur "in small patches." At the time the deputation paid this visit, it was known that the tea existed at Borhath on the Disung Nuddee, and at Cherabei on the banks of the Debroo; and since then Mr Bruce has ascertained, personally, the existence of several other localities, besides having received information of many more. In fact the tea plant may be now looked upon as a common product of a large portion of Upper Assam.

With reference to the nature of the localities, it may be said generally, that all those discovered are in low spots; the one at Gulroo, being perhaps the only one, which is always exempt from inundation. All were characterized by excess of humidity; and Kufoodoo alone had no stream or water-course near it. In every instance the neighbourhood was clothed with excessively thick tree-jungle; and such shrubs and herbaceous plants as love shade were found abundantly intermixed with the tea. Indeed, these jungles are so thick, that it may be doubted whether the tea plants, not even excepting the arborescent ones, are ever exposed to the direct rays of the sun.

Mr M'Clelland has given some excellent and discriminating remarks regarding the qualities of the soil on which the tea plant seems to thrive. Its prevailing character is lightness and porousness, and its general colour of reddish-yellow, which, up to a certain point, becomes more developed as the depth increases, when it again degenerates into sand. Its external appearance is principally remarkable from its intersections by numerous ravines and hollows, the interspaces frequently assuming a conical shape, and from the mounds round the bases of the trees, or clumps of bamboo. These mounds are accounted for from the lightness of the soil, which, in the descent of heavy rains from the surrounding branches, is apt to be washed away, leaving the cone from which the stem of the tree shoots up.

The deputation found, that, in a general point of view, the tea plant might be said to diminish as they proceeded to the west, and, in a more limited sense, that it was found smaller and more dwarfed at the confines of each locality. The largest plants seen were those of the Kuffoo tract, one being observed to measure 43 feet in length, with a diameter of 6 inches near the base of the stem. Sometimes the plant is seen to reach a height of from 40 to 50 feet, but this is rare, and the average height of a good plant is from 6 to 8 feet. So small were the plants at Gulroo, that it was pointed out to these gentlemen as a new species, or as dwarf tea; but it was considered by them not to be so, only that its growth was regulated by the ordinary causes, which may be always expected to operate towards the boundary lines of the geographical distribution of every plant. Wherever the jungle is thickest, the plants were tallest and most elongated, each struggling as it were to overtop the surrounding brushwood, and obtain the direct solar influence.

During these examinations, the party had opportunities of observing both the flowers and the ripe fruit, the latter having remained over from the preceding season. A variation was also observed between the flowering seasons at the different localities. At Kufoodoo, the flower was in greatest perfection in the middle of December; whereas, at Nadowar, this did not take place till February. The leaves of all the plants were old, and of a dark green, varying in length from 4 to 8 inches. About the month of April, the young leaves begin to unfold themselves.

In commenting on the forms of vegetation, associated with the tea plant in Assam, and in China, Mr Griffith appositely remarks, that the cause that exercises the greatest influence on the distribution of vegetables, is known to be temperature, and that this temperature is influenced at once by latitude, and by elevation. Baron Humboldt has determined the ratio which they bear to each other; having shewn that one degree of retrogressive latitude, near the Tropics, is equal to an ascent of 396 feet; and, that it is owing to this law, that, while we find perpetual snow on the mountain Sulitēlma in Lapland, at an elevation of 3640 feet, it does not occur on the Chimborazo, until we reach an elevation of 15,000 feet. To the same cause the remarkable fact is attributable, that, in ascending from the plains to the mountains of India, we come in succession to the flora of a subtropical, temperate, alpine, and even arctic region in succession; and the same series may be viewed in passing from the equator to the poles, until we get beyond the limits of vegetable existence. In drawing up, on these data, a comparison between the flora of China and of Assam, with reference to their tea districts, the little of difference in point of elevation is only 380 feet, or, in other words, nearly a degree of latitude, which is in favour of the latter country, Mr Griffith is of opinion, that there must exist some peculiarity in the climate of Upper Assam; because a considerable number of forms occur there, which are not to be found in the plains of India; and that these are not to be accounted for, either by the elevation or the latitude. After enumerating the varieties with which the tea plant has been found associated,—780 species being given for Assam, and 623 for China, —this gentleman thinks, that it must be evident that the chief features of either flora are tropical, and that the singularity of either consists in the existence of forms in tolerable frequency, which, reasoning from the latitude and small elevation above the sea, are naturally what might have been expected.

In comparing the climate of Upper Assam with that of the Chinese tea provinces, the data are still more imperfect than for the flora,—the only register relating to the latter country being that of Dr Lynn, which is confessedly a very imperfect one. The tea district of Upper Assam is scarcely a degree of latitude in breadth, and is situated between 26° 45′, and 27° 35′ N. Lat.; so that in this respect it corresponds with part of the black tea district of China. The two most important points of inquiry, therefore, were the temperature and the humidity; and, in particular, the mean summer and winter temperatures. By the tables of Mr Reeves, and of Mr Davis, the mean annual temperature of Canton will be found to be nearly 70° :—the mean of the four hottest months of the year 82°—2, and of the four coldest months 54°. At Sadieja, in Upper Assam, the mean annual temperature was found to be only 67°—2 ; that of the four hottest 80° ; and of the four coldest 57°—8. In Upper Assam, January is the coldest month of the year ; August and September the hottest and most oppressive.

From the imperfection of data, it is found difficult to come to any determinate conclusions regarding the relative humidity of the tea districts of China and of Assam ; but, after examining the accounts of the tea, as given by Sir George Staunton, by Barrow, by Ellis, by Abel, and by Gordon, Mr Griffith is of opinion, that the general supposition, that tea is the product of mountainous districts, is erroneous ; that it is not found on hills at any great elevation, and that at Munneepore, where beyond doubt it is a native, it is confined to low sites, and dies away at any elevation beyond 200 feet.

As this is a point of some importance, we give the words of these different travellers. The tea plant was seen, for the first and only time, by Lord Macartney's embassy, on their return from Pekin, on the river Chen-taun-kiang, in Lat. 29° 30′ N. Sir George Staunton thus writes of it:—

" In a short time after the embassy had proceeded on its journey, the hills receded somewhat from the river, which widened, and at the same time became less shallow. The valleys along the river were cultivated chiefly in sugar-canes, then (Novemb.) almost ripe, and about 8 feet high." " On the sides and tops of earthen embankments dividing the garden grounds, and groves of oranges, the tea plant was, for the first time, seen growing like a common shrub, scattered carelessly about. It is seldom seen on flat or marshy ground, which is reserved for rice." *

Barrow's account is a little more detailed. " A few miles," says that gentleman, " beyond the city (Hang-choo-foo), we again took shipping on the river Tchen-taung-chiong, which might properly be called an estuary, the tide rising and falling 6 or 7 feet at that place of embarkation, which was not very distant from the Yellow Sea."† After seven days the travellers reached the source of the stream. " There was no want of trees," he adds, " among which the most common were the tallow tree and the camphor, cedars, firs, and the tall and majestic arbor vitæ. Groves of oranges, citrons, and lemons, were abundantly in-

* Staunton's Embassy of Lord Macartney, vol. ii. p. 460, 463, 464.

† Barrow's Travels in China, p. 529, 530.

terspersed in the little vales that sloped down to the brink of the river. The larger plains were planted with the sugar-cane. We had thus far passed through the country without having seen a single plant of the tea shrub, but here we found it used as a common plant for hedge rows, to divide the gardens and fruit groves, but not particularly cultivated for its leaves."

Mr Ellis, who saw the plant in various states four times, speaks very decidedly of its "whereabouts." After mentioning his ascent of the range of hills between Talong and Taling-shien, he says,—"Our route lay through a valley, where we saw, for the first time, the tea plant.* It is a beautiful shrub, resembling a myrtle, with a yellow flower, exceedingly fragrant. The plantations here were not of any extent, and were either surrounded by small fields of other cultivation, or placed in detached spots." After three days travel, he again met with it at Woo-sha-kya. "One plantation of tea was here seen," he says, "in full flower.† There are evident traces on this island, as on the others, of their being at times inundated, if not wholly submerged." His third occasion of seeing the tea plant was on his descent from the Lee-shan mountain. "The large temple at the foot of the mountain," Mr Ellis remarks, "was out of repair, and only remarkable for the fine trees in the courts. * * The tea plant was also seen here, but in small patches."‡ The fourth and last station was at Leangkow. "The wild tea was found here. * * * All these mountains were in a state of great disintegration: the soil on them is of a deep red colour, produced, as I conceive, from the red sandstone forming their principal component."

Tea patches were also twice seen by Dr Abel, the naturalist; and Mr Griffith was not able to discover any other accounts which can be depended upon, except that of Mr Gordon, who was the last eye-witness of the tea plant in China; and who thence transmitted two sets of answers to the Tea Company of India,—the one obtained from Mr Thomson, the other from Mr Daniel. From these we gather, that the highest tea plantations were elevated 700 feet above the plain, but that the places generally selected for the cultivation were in the bottoms of hills, where there was a good deal of shelter from both sides, and the slope comparatively easy. In concluding his observations on this important branch of the subject, the Report well observes: "If additional proofs were wanting concerning the precise nature of the stations of the

* Ellis's Journal, vol. ii. p. 46. † Ibid. p. 50-51.
‡ Ibid. vol. ii. p. 120-124.

tea plant, I conceive," says Mr Griffith, "that very satisfactory ones exist in the fact, which Mr M'Clelland has pointed out, that the plant was only seen by the embassies while in boats on the rivers and lakes; that none was seen by Lord Macartney's embassy while crossing the ridge of mountains that separates two of the tea provinces, Che-keang and Kiang-see," although the route crossed these hills in a portion marked in the general chart of China attached to Abel's book as the green-tea districts; and lastly, that none was found on the Mei-lin mountains, which form part of the boundary between the provinces of Kiang-see and Quang-tung.*

The discovery of the tea plant in Assam leads to two important conclusions. The first of these is, that the fact of its occurring as denizen, to a certain extent, of the wooded tracts, is a convincing argument in favour of its being best adapted for cultivation in these tracts; and the second is, that wild stocks have been found reclaimable to a greater or less extent. For both which reasons, the course now to be pursued most certainly is, the procuring from China as many seeds and plants as possible, and at the same time doing every thing that can be done towards reclaiming the wild stocks.

Before concluding his admirable Report, which extends over ninety-six closely printed pages, Mr Griffith thus states his convictions, that the successful cultivation of the tea plant in Upper Assam is certain, for the following reasons:

"1. That the tea plant is indigenous to, and distributed extensively over, large portions of Upper Assam.

"2. That there is a similarity of configuration between the valley of Assam and two of the best known tea provinces of China.

"3. That there is a similarity between the climate of the two countries, both with regard to temperature and humidity.

"4. That there is a precise similarity between the stations of the tea plant in Upper Assam, and its stations in those parts of the provinces Kiang-nan and Kiang-see, that have been traversed by Europeans.

"5. That there is a similarity both in the associated and the general vegetation of both Assam and those parts of the Chinese tea provinces, situated in or about the same latitude."

Within the last two months we have been much amused by observing the *annoncé* of Assam tea for sale in this country.

* Transactions of the Agricultural Society of India, vol. v. p. 153.

Tea plants do not grow up in such a hurry, and we fear that we must wait with patience for them for a few years to come. The present cargo must necessarily, therefore, either have been plucked from the wild-stocks, or showered by some benevolent Peri from the groves of Mount Meru, above the clouds. We repeat, that we rejoice at the field which this discovery has opened up, alike for Indian industry and British enterprise.

Since this article was put to press, a company has been formed in London for the cultivation of the Assam tea; and so great was the avidity to obtain shares, that, before the projectors had time to call a public meeting on the subject, the whole of the shares had been subscribed for.*

AGRICULTURAL CHEMISTRY.—NO. V.

By Henry R. Madden, Esq., L. R. C. S., Edinburgh.

2. *Inorganic or Mineral Manures.*—In our last we completed a short sketch of the composition of the animal, vegetable, and vegeto-animal manures which compose our division of organic manures; we shall, therefore, at once proceed to make a similar examination of those substances belonging to the mineral kingdom, which farmers are in the habit of employing for the purpose of enriching their land.

We have before remarked, that these substances act in a

* We copy the following from an advertisement, which has been going the round of the London daily and hebdomadal press.

"*The Assam Tea.*—Sample parcels, at 2s. 6d. each, may be had so long as they will last, &c. &c. The first produce and whole importation of this newly discovered tea amounted to only eight chests: and though Captain Pidding purchased the whole, with the intention of distributing it in samples, as far as they will go, throughout the empire, eight chests, containing 320 lbs., can only supply a small proportion of those who desire to possess a sample of the first tea ever produced in a British colony. The first applicants will have the preference; and as many noblemen and scientific gentlemen have remitted various sums to Captain Pidding's agent, offering two guineas and upwards per lb. for a quantity, this is to save the trouble, and to give notice that no more than a sample parcel of each kind will be allowed to any one."

Of course, we perfectly acquit Captain Pidding of this rhodomontade; —why should he not have prevented it?

manner totally distinct from organic manures, the reason of which is obvious, because they *cannot* be, from their nature, capable of supplying either of the four elements, viz. *carbon*, *oxygen*, *hydrogen*, or *nitrogen*, which, as we have so repeatedly stated, form the essential constitution of *all* plants: we must therefore look to other circumstances besides the mere nutrition of vegetables, in order to explain the true cause of those beneficial effects which, beyond doubt, result from their judicious employment.

The advantages to be gained by the use of mineral manures may obviously be either direct or indirect, according to the effect which they produce; for example, those substances which either alter the texture of the soil, or more especially such as supply saline matter to the plants themselves, may be said to be *directly* beneficial; whereas those which merely act as chemical agents in hastening the decomposition of the organic matter existing in the soil, can be said to be benefiting the plant in an *indirect* manner only. It will be impossible, however, to form any subdivision of this class of manures, upon the above fact, as many of them act in both ways, and moreover, the whole subject is as yet involved in so much doubt, that we should well deserve the imputation of rashness, were we to attempt any classification of these substances founded upon their mode of action. The more important purely mineral manures are *lime*, its *carbonate*, or *chalk*, its *sulphate*, or *gypsum*, *marl*, *saltpetre*, *common salt*, and *kelp*.

Lime.—This is undoubtedly the most important of this class of manures, from which circumstance alone it well deserves to rank first in the list. Like all great benefits it has been most shamefully *abused*, but I think that it will be by no means difficult to prove that the fault lies entirely with the farmer who unfortunately is far too apt to follow example blindly, in place of really examining the *principle* upon which the *practice* is *founded*, and without which success is always precarious, and often absolutely impossible. In the subsequent remarks which we propose to make upon this class of manures, it will be necessary to enter much more fully into practical details than we have hitherto done, as the whole success or failure of these manures may be said to depend almost entirely upon their mode of application, and I may here premise that many of the *practical observations* which I shall have to make, are derived from the excellent, but now rare, pamphlet on manures by the justly celebrated Arthur Young.

The action of lime upon soil differs entirely according to the state in which it is used, namely, in the form of *true lime*, *hot lime*, or in the state of *mild lime*, as it is termed, in assuming which condition it has undergone some most important chemical changes which we shall mention presently.

The *chemical* properties of lime, and its *chemical* action upon organic matter, must, in the first instance, occupy our attention, in order that the subsequent remarks upon its use as a manure may be clear and intelligible. Lime is ranked by chemists among the *alkaline earths*, by which term is meant those earthy substances which exhibit characters similar in many respects to the true caustic alkalies, *potass*, *soda*, &c.: it is always prepared by heating its native carbonate or limestone, to a temperature sufficiently high to drive off all the carbonic acid and water which it contains, so that were limestone composed of nothing else but *carbonate of lime* and water, pure lime alone would be left after burning; this, however, is never the case, as other substances, especially alumina, silica, iron, and often magnesia, occur mixed with the lime, but in good specimens these should be in very small quantities, as of course, I need hardly say that their presence diminishes the value of the specimen in direct proportion to their quantity. On this account, the proportion of lime contained in any new specimen of limestone should be accurately determined before applying it to agricultural purposes, more especially if there should be any reason for suspecting the presence of magnesia which we have so repeatedly said is injurious to vegetation, particularly in its caustic state. On this account we shall here give a few directions for the examination of limestone, which we trust will not be considered out of place. Let us suppose that the experimenter is not desirous of ascertaining the *exact* constitution of the limestone which he is about to examine, but merely wishes to discover whether it contains any considerable quantity of magnesia, alumina, or iron.

1. Let him take a small quantity of the sample to be analyzed, say 100 grains, and dissolve it in one ounce of strong muriatic acid (spirit of salt) mixed previously with about 2 ounces of pure water; when the effervescence (owing to the escape of carbonic acid) has entirely ceased, if any thing is left undissolved it must be separated from the solution, by filtration through white blotting paper, and the insoluble matter when dried and weighed may be noted down as *silica.*

2. The operator must next add to the filtered fluid successive portions of *strong ammonia (hartshorn)* until the liquid smells of this substance; any thing which is thrown down during this operation must be likewise separated by filtration; this will consist of *alumina* and *iron*, the proportion of the latter being judged by the darkness of the colour (pure *alumina* being white).

3. The next step is to add to the fluid a solution of *oxalate of ammonia* (this should be prepared by a druggist) as long as any precipitate appears; this is the lime in combination with the oxalic acid.

4. Lastly, having again filtered the solution, add a small quantity of *carbonate of soda* (common *soda*) dissolved in water; if the former parts of the process have been performed carefully, no precipitate whatever will now appear, unless *magnesia* is present, so that the quantity of this substance may be judged by the proportion of this precipitate.

Difficult as this process may appear to those who have never performed any chemical analysis, still a very little practice will make it quite familiar, and it is the only method by which the presence of magnesia can be detected with unvarying certainty; at least without making use of chemical tests, which cannot be easily purchased, and are very troublesome to prepare. Should any one wish to render himself expert at the above operation, I should recommend his taking some specimens of limestone, and, repeating the process several times, until he arrives at the same results by each experiment. If the quantity of lime is wished, the precipitate of No. 3 must be carefully collected, dried, and weighed; and then, every 100 grains will denote 34 grains of pure lime, or 61 grains of carbonate of lime in the original specimen.

Whenever lime, in its pure or *hot* state, is exposed to the air, it has a very great tendency to return to the original form of carbonate; in undergoing which change, it first absorbs a large quantity of water, and then assumes the form of slaked lime, or, according to chemical nomenclature, has become a *hydrate;* this hydrate, in its turn, rapidly absorbs carbonic acid from the air, and thus, in no long period, the burnt lime returns to its original condition, with the only difference, that whereas it was formerly in large stony masses, it is now in the state of a fine powder. When the lime is completely slaked, and *partially* carbonated, it forms the substance termed *mild* lime, by farmers.

Of these three conditions of lime, namely, the *hot*, the *mild*, and the true *carbonate*, the first is possessed of by far the most energetic powers. The true carbonate of lime, in fact, differs completely in its action from the others. We must, therefore, of necessity, treat of each separately.

Hot lime.—When any organic matter is mixed with hot lime, it undergoes putrefaction with much greater rapidity than when left to itself. The exact *cause* of this is not well known; but the immediate *changes* which the various substances undergo, especially in the case of vegetable matter, have been pretty accurately examined. Thus, for example, it has been proved, *first*, that *woody fibre*, *gum*, *sugar*, and many other vegetable matters, are converted into *humic acid*, with more or less rapidity, when kept in contact with hot lime, or any other chemical substance which possesses strong alkaline properties. *Secondly*, that this *humic acid*, when formed, unites with the lime, and generates a compound which is not very soluble in water, but is easily diffused through it. And, *lastly*, it has been proved, that a very little lime is required to produce this compound, with a large quantity of humic acid. For example, 28 grains of pure lime are capable of combining with no less than 318½ grains of this acid; so that the lime in this compound amounts to little more than eight per cent.

To apply these facts, therefore, we may remark, that there is very little doubt, that changes similar to those above mentioned take place, when hot lime is applied to soil; or, still more so in the case of lime composts. At the same time, it is exceedingly probable, that during the production of *humate* *of lime* * (the compound of lime and humic acid above mentioned), other compounds are formed, many of which are very possibly soluble in water; at least if we may judge by the appearance presented by vegetable matter, after it has been long exposed to the action of this or any other alkaline matter. From these remarks it would appear, that the most important object to be gained by the application of hot lime, is the decomposition of *woody fibre*, and the consequent formation of *humate of lime*, and various soluble matters.

Mild lime does not act by any means so powerfully as the preceding compound; in fact, it appears to have no effect whatever upon woody fibre. On the other hand, however, it is capable of uniting with the humic acid existing in the soil, precisely in the same manner as hot lime; on which account, Sir Humphrey Davy remarks, that mild lime is useful in preventing the too rapid decomposition of substances already dissolved; the truth of which is evident, when we call to mind the well established fact, namely, that organic substances, which of themselves are extremely liable to decomposition, may be rendered much more permanent, nay, often perfectly so, by entering into *chemical combination* with any *inorganic substance*. Pure carbonate of lime will be treated of under the head of chalk.

So much for the pure chemistry of this most important manure. We must, however, now proceed to what the majority of our readers will consider as by far the most interesting part of the subject, namely, the practical deductions to be drawn from the above remarks; or, in other words, the manner in which practice is to be guided by the principles above laid down.

First.—It is perfectly clear, that *hot lime* will be useful in all cases where there is an excess of undecomposed vegetable fibre, as in peat-soils, moors, heaths, &c.; in fact, in all places where the natural growth has not been interfered with for a great number of years; from which it follows, that hot lime

* I have continued to denominate this acid, humic acid, although I find that, latterly, especially in chemical works, the term *ulmic acid* has been substituted for it. I trust, however, that this will cause no confusion, as the difference is in the name only.

will be a peculiarly useful application to old grass, which has lost heart from age, particularly if it is, at the same time, broken up for tillage.

Secondly.—Sir Humphrey Davy has proved, that hot lime, whether solid or dissolved, is injurious to growing plants. For example, he states, that he has frequently killed grass by watering it with lime-water. From this fact, therefore, it follows, that *hot lime* must be an extremely useful application, when it is desired to free land of its spontaneous growth; as, for instance, in places overgrown with weeds.

Thirdly.—Hot lime is extremely useful in purifying (if we may be allowed the expression) the original herbage of moors, and other *uncultivated* grounds. The mode in which this is effected being somewhat interesting, we shall here say a few words upon the subject. It is generally allowed, that the finer grasses, &c., require richer food than those which are less valuable; and also, that the same remark holds good, the lower we descend in the scale of vegetables: namely, that the lower the plant is, the more easily is it nourished by the contents of the *atmosphere;* and hence the less dependent it is upon the *soil* for its subsistence; the consequence of which is, that when, in the lapse of time, the soil of any spot becomes more and more exhausted, the most valuable and important grasses gradually die away, from the want of sufficient nourishment, and give place to those diminutive species, which so frequently constitute the herbage of the almost barren moors; these again, if moisture be present, give place, in their turn, to various mosses, &c., so that at last, unless the improving hand of man steps in to avert the doom, the spot will return to a state unfit for the support of any living plant, with the exception of those which derive most, if not all, their nourishment from the surrounding air. Should it be otherwise, how different the result! For instance, should *hot lime* be applied, from the looseness of their texture, this destroyer first attacks the mosses and all other useless plants, and thus converts them into useful manure, which, by being washed into the soil by genial showers, revives the seeds of those plants which grew there ages previously, and, in a comparatively short time the lately unprofitable waste glows with the return of its pristine verdure. How beautifully many of my readers must have seen this exemplified, in the crops of white clover which so frequently appear, almost like magic, after the liming of some barren moor!

Fourthly.—*Mild lime* is a most useful application in all cases, where any of the above circumstances occur in *cultivated land.* For instance, if the lime is comparatively fresh, it is much safer to employ it in the mild form, when we desire to destroy weeds or other injurious plants, growing upon richly manured lands, which, from carelessness or other such cause, have been allowed to become foul; for, were the lime, in this instance, applied in its *caustic state*, although it would unquestionably kill the weeds, still, their destruction would be accompanied with a great unnecessary loss of manure.

Fifthly.—It sometimes occurs, more particularly in garden ground, that the crops become rank, from the existence of a superabundance of soluble manure, the evil effects of which can almost always be counteracted by a dressing of *mild lime*, which, by combining with the humic acid, renders a large quantity of the organic matter much less prone to decomposition, and likewise, at the same time, less soluble; *humate of lime*, as before remarked, being by no means very soluble in water. It may very probably be asked here, how can it be advantageous to apply lime in any case to soil, since it tends to render *soluble* matters, *insoluble*, when it has all along been stated that the very reverse is the proper mode of preparing the food for plants? An answer to this question must, therefore, of course, be requisite. It must be observed, in the first place, that we have already stated that lime is useful chiefly in those cases where the organic matter is *insoluble*, because it causes the formation of *humate of lime* and different *soluble* matters; all we have to account for therefore is, how humate of lime comes to be a useful manure? It may be remembered that I stated in No. 2. of this series,* that humic acid was of itself "quite *insoluble* in water:" from the result, however, of some experiments published since that number was written, it appears that this statement is not strictly correct, for humic acid is *soluble* in water (more especially when newly formed),

* No. XLII. p. 241.

except under particular circumstances, so that it is extremely probable that the humic acid derived from the slow decomposition of humate of lime, will, at the moment of its liberation, be capable of dissolving in water, and thus of course become a useful manure. We shall now conclude our remarks upon lime with a few important cautions to be attended to in its application.

Mr Arthur Young remarks, that the best directions for applying lime are those given by Mr Craike of Arbigland, who advises, that the whole quantity of lime that the farmer intends to apply to any field of moderate size, should be carted out, and laid together in a heap, at some spot where water can be obtained with the greatest facility. The whole is next to be thoroughly slaked; and *immediately* after it has cooled, which will take place in a day or two, the lime is to be recarted and spread over the surface of the land as equally as possible. Mr Craike further remarks, that the more common method of laying down the lime in small heaps all over the field, and allowing it to slake by rain, is *very erroneous;* for in this instance it is very liable to get too much rain, which, in place of merely slaking it, and thus reducing it to a fine powder, converts it into "running mortar," in which condition "it will neither spread easily, nor mix with the soil." On the same principle Mr Wight observes, that both the lime and the soil should be perfectly dry at the time of application. The truth of these remarks could have been predicted by scientific examination alone, and it is at all times pleasing to discover that the *results* of successful practice directly correspond with the *indications* of true theory. For example, there are many scientific objections to be made to the plan of laying the lime in small heaps all over the field in order to be slaked by the rain, in addition to the evident one, mentioned by Mr Craike, namely, the formation of "running mortar." These are, 1st, that it exposes a far greater surface for the absorption of carbonic acid, which, as is evident from the remarks already made upon this subject, diminishes materially the effect of the lime. 2d, It must necessarily be exposed for a much greater length of time, and consequently will most probably be entirely converted into *carbonate of* *lime;* or it must be spread upon the land during wet weather, which will of course render it far more difficult to incorporate properly with the soil. And lastly, its being slaked by rain-water is directly injurious, as it has been proved that there is a greater quantity of carbonic acid present in the air, during dull than in bright weather, which gas will of course be absorbed by the rain, and thus carried to the lime, so as to increase still more the chances of its becoming carbonated. On the other hand, however, it is evident that all these objections may be obviated by adopting the simple, and, if we look to the result, the much more economical method proposed by Mr Craike.

As to the period at which the lime should be applied, this must depend so much upon peculiar circumstances affecting each farmer differently, as convenience, leisure, &c., that it is impossible to fix the time so as to suit all persons. When, however, a choice can be made, summer is by far the best season according to Mr Young, the reason of which is obviously because it is the driest period of the year, and likewise, when hot lime is used to destroy weeds, they are generally in their greatest vigour at that time, and consequently are capable of being destroyed more effectually.

The quantity of lime to be used is likewise a subject of considerable importance, but nevertheless is one which is apt to be far too much neglected; upon this subject Mr A. Young is most explicit. "In common cases," says he, "the quantity should be guided by a *chemical analysis of the soil;*" and, beyond doubt, this is the only sure way of applying it with success. What, for instance, can be more absurd, than for a farmer to go on applying lime to his land, time after time, when perhaps his soil is already loaded with calcareous matter? It is a well established fact, that an excess of any of the earthy ingredients of soil exerts a most important influence over the plants which grow there: this is remarkably the case with the natural productions of all soils. To such an extent, in fact, does this hold true, that a good botanist will tell with great accuracy the chemical nature of the soil, by the plants which he finds growing upon it. If this, therefore, takes place naturally, where seeds of all kinds must be constantly deposited on every species of soil; if, I repeat, *nature* thus arranges the plants according to the constitution of the soil, shall we deny that they have any effect upon cultivated plants? Shall we presume to say that *we* can grow all kinds of plants equally upon every variety of soil? most assuredly not. How, then, can that farmer expect to be successful, who, by constantly adding lime to soil already *calcareous*, at length increases this substance to such a degree that it is unfit for the support of any plants, except those which naturally prefer a soil of this description? That the above statement is not a mere *theoretical* objection, is most distinctly proved by many facts. Who, for example, does not know that *wheat* is an unprofitable crop upon light soils? Or, again, who would attempt to cultivate *turnips* upon strong clay? *Chemical analysis*, likewise, of the plants themselves, prove most distinctly the influence which the earthy constituents of soil exert over the saline composition of the ashes of these plants. Thus M. Saussure found, that 100 parts of the ashes of common fir contained 43 parts of carbonate of lime when grown on a limestone hill, whereas the same quantity contained only 29 parts when grown on granite; and again, the ashes of the leaves of the *Rhododendron ferrugineum* grown upon limestone contained 43½ per cent. of chalk, whereas it yielded 16¾ per cent. only of that substance when cultivated upon a granite soil. There can be no doubt, moreover, that the *proportion* of the different constituents of the ashes of plants have the greatest influence upon the vigour and productiveness of the plant itself, and I have no hesitation in saying that the culture of plants (more especially the *garden culture of exotics*) will never be brought to any thing like perfection until they have *each and all* been submitted to *chemical* examination; the proportion of all their saline constituents accurately determined; and the nature of the soil for each chosen upon these grounds. I leave it to those interested in such matters to decide, whether it would not be worth their while to take the requisite steps for the accomplishment of such an undertaking.

On the other hand, however, a very large quantity of calcareous matter may naturally exist in soil, without rendering it unfit for the purposes of cultivation; for instance, it is stated by Mr Cuthbert Johnson, in the "British Farmer's Magazine" for April 1837, that "the richest soils, on the banks of the Parnel, in Somersetshire, contain more than *seventy per cent.* of chalk!" But we are all well aware that there are many peculiarities in the cropping of calcareous soils which must be attended to in order to insure success. Almost all soils, however, contain more or less of this substance, and it is remarked by Professor Low, that it "generally, though not always, exists in larger quantities in the better, than in the inferior soils." None of these remarks, nevertheless, by any means favour the employment of lime upon *calcareous* soil, in addition to which the plea of not being able to succeed without it, will be shewn to be untenable, when we are treating of the "Economy of Manure;" consequently we may rest assured that Mr Young's remark is perfectly true, namely that the quantity of lime must be judged by a *chemical analysis* of the soil.

Lastly, the farmer must always bear in mind that neither *hot* nor *mild lime* can act as a manure until it has become converted into *carbonate* or *humate*, and consequently that the fertilizing effect of these substances are produced *at the expense of the organic matter previously existing in the soil;* so that although lime is directly useful by calling into activity otherwise inert matter, nevertheless it undoubtedly *exhausts* the soil by so doing, and this of course should make the farmer cautious about repeating it too frequently; and he must be particularly careful lest he mistake the diminution of the productive power of soil, caused by the too frequent application of lime, for a proof that more lime is required, as in this way there is no doubt that many agriculturists have as it were *poisoned* their fields, by the very means by which they had hoped to effect a cure. The two apparently opposite effects of lime must also be born in mind, namely, that although it *increases* the solubility of *inert* vegetable matter, still it renders much *less soluble* those parts of the organic constituents of soil which have already become capable of solution.

Carbonate of Lime or Chalk.—This differs from limestone merely in its being of a much softer texture, and hence capable of being broken down with greater facility. In its action it differs entirely from the last substance; thus, it has no effect whatever upon inert vegetable fibre, and I should very much doubt whether it is in all cases capable of uniting with humic acid, so as to render the soluble parts of the manure less prone to decomposition. Its action, however, is nevertheless most beneficial; for example, it tends greatly to alter the texture of the soil to which it is applied, and possesses likewise the very useful property of being retentive of water, without at the same time becoming adhesive; consequently, it can be used with the greatest advantage both to clays and sands, under certain circumstances. If, for example, you wish to open the texture of a clay, and render it more friable, but at the same time are not desirous of diminishing to any considerable extent its retentive powers, you cannot do better than apply chalk; and again, if you are anxious to increase the absorbent power of a sand without at the same time adding to its tenacity, a good dressing of chalk will in most cases produce the desired effect. The advantages of chalk as a top-dressing to meadows is far too well known to require any notice here. It is, however, by no means easy to understand its mode of action, except there were an actual want of that substance in the land previous to its application; in which case, of course, the good effects could be explained upon the principle adhered to throughout all these observations upon Agricultural Chemistry, namely, that we can never expect to be successful in the cultivation of any plant, unless we supply it with *all* the ingredients, whether *organic* or *mineral*, which it contains when growing in a state of nature, upon a soil of its *own choosing*, if we may so express it; the importance of which remark, in reference to chalk, will at once appear, when it is considered that scarcely a plant exists which does not contain more or less of this substance. As the total want of chalk, however, is a very rare occurrence in soil, we must look to other modes of action, in order to explain the frequent beneficial effects which result from top-dressing grass with this substance; and I may here premise, that this subject is one upon which extremely little is known at present, and consequently we can do little more than make a few conjectures regarding the various possible modes of action; these, nevertheless, may be of use in directing the attention of those who should wish to examine the subject to certain points which they might otherwise be apt to overlook.

It will be remembered, that, in enumerating the various constituents of soil, in the first number of this series, I had occasion to mention iron as a constant ingredient of soil, although I at the same time observed that it seldom occurred in any considerable quantity in fertile soils. All my agricultural readers must be well acquainted with the fact, that, when this substance, by any means, becomes soluble in water, it is most prejudicial to vegetation of all kinds. Now, it is extremely probable that this fact will be found of great consequence in explaining some cases, at least, in which the beneficial effects of chalk have been observed. There is no practice more common (and I by no means wish to censure it) than the top-dressing of old pasture-land with farm-yard dung at the interval of a certain number of years; but all animal matters contain more or less sulphur, so that whenever these substances undergo decomposition, *sulphuretted hydrogen* is always one of the products. Now, it is well known to chemists that when *sulphuretted hydrogen* and *oxide* of *iron* (the form in which iron exists in soil) come into contact, a mutual decomposition takes place, and there results *water*, and *sulphuret of iron*. This compound, however, is of itself *insoluble*, so that were no further change to take place, no harm whatever would accrue from this chemical combination; but unfortunately this is not the case, for the *sulphuret of iron*, by exposure to air, gradually undergoes an entire change, and is at length converted into a very soluble substance, namely, *sulphate of iron*, or *common copperas*, or *green vitriol* as it is termed. In this manner, we perceive that, in the progress of time, the application of farm-yard dung or any other *animal* manures to soils rich in *iron*, renders this substance *soluble*, in which state, as before mentioned, it is exceedingly prejudicial to vegetables. How, then, is this to be remedied? or how is it that this does not always take place? In soils rich in calcareous matter, although the change does take place, it is of no consequence whatever, for as soon as the *so-*

luble sulphate of iron is formed, it is acted upon by the carbonate of lime, and the results are *sulphate of lime* or *gypsum*, and *oxide of iron*, or in other words the iron is restored to its original *inoffensive* state; but where there is not sufficient lime in the soil, as, for instance, where there is a large quantity of iron, this substance must be added; the form of chalk being of course preferable, as in this case no action upon the vegetable fibre of the soil will be required. When such intricate and important chemical changes are constantly going on in the soil, and when it is considered that, unless the remedy is at hand, the very *food* given to the plants carries *poison* with it, and, consequently, that unless checked by proper means many valuable pastures would be rendered useless. Who will deny the importance of *chemistry* to the farmer? or who will dare to say that practice *alone* acts more *certainly*, though more slowly than when aided by *science?* Surely it must be evident to every thinking mind, that the practice of agriculture would be upon a much surer basis, were all its votaries acquainted with the principles upon which their art was founded. And if so, Why is there such an apathy evinced by the supporters of this all-important art to the advancement and cultivation of *its science?* To be sure, a slight stir of late has been made among some of the leading societies connected with agriculture, but with what effect *who can tell?* and the reason of this is obvious,—the majority of the agricultural population are by no means devoted to reading, and consequently, though all the agricultural societies in Great Britain were to publish upon the subject, it would be long ere the farmers became acquainted with the fact. To do good they must have the advantages of the science *laid before them practically*, and this can be done only by the establishment of experimental farms under the direct superintendence of both a *practical* and a *scientific* farmer; or by the formation of agricultural schools, in which the youth intended to follow such pursuits shall be properly instructed in the principles which should guide them in the prosecution of their business. That some such decided step will be immediately taken by those capable of rendering its success a comparative certainty, is the most ardent wish of the author of these papers.

Marl.—This substance naturally comes under our consideration here, as it is generally allowed that marls are valuable in direct proportion to the quantity of calcareous matter which they contain. The marls most common in England are the clay, stone and shell marls; they are in general composed, similar to soil, of silica, alumina, carbonate of lime, and frequently oxide of iron, so that, in fact, they might be compared to calcareous soils. The carbonate of lime varies from 20 to 80 per cent. One of the best clay marls quoted by Arthur Young was composed of carbonate of lime 40 per cent. alumina 50, silica 8 or 10, and a distinct trace of iron. The action of this substance is, of course, in the main similar to chalk, but the clay-marls are likewise very beneficial in giving tenacity to loose sands. There are two or three points to be borne in mind with reference to the application of this substance, which we shall here mention.

First, And this is of great importance, marls are often very injurious when applied to the soil immediately after they are dug; whereas this effect is completely prevented by allowing them to remain exposed to the air for a certain length of time, as, for example, by placing them in a heap and turning it frequently. I have never been able to find any attempt to explain this very curious fact, and I candidly confess that I do not know how to account for it. The fact, however, is universally acknowledged, and the only probable plan of discovering the cause of the injurious effect, would be to subject specimens, wherein the evil was known to exist, to careful chemical analysis, and, in this manner, discover in what particular they differ from others which do not possess this injurious property. An investigation of this sort is, however, far too delicate to be performed by any person who does not possess a thorough knowledge of chemistry, and I should therefore recommend the proprietors of marl-pits of this description to employ a professional person to discover the cause of the injury, as in all probability such discovery would point out some means of cure, which would require much less time and trouble,—those invaluable commodities,—than the process by exposure above referred to.

Secondly, The farmer must always bear in mind that marl acts merely on account of the carbonate of lime it contains, unless it is added for the express purpose of altering the texture of the soil, as, for example, when applied to very light sands, in which case it will act beneficially, even although the land should not be in actual want of calcareous matter. In this instance, however, *pure clay* would answer as well, and be more advantageous, inasmuch as the whole quantity carried will be of value, whereas if marl were used, about one-third of the quantity would consist of chalk, which, in this instance, would be of no value. On the other hand, marl is of course far inferior to chalk or lime for clay land; this fact seems well known to farmers, as will be seen by the following rhymes, which occur in a paper upon peat, published by the Rev. Dr Walker in the Transactions of the Highland Society for 1803. In speaking of the application of marl as a manure, he observes that the Lancashire farmer says,

> " If you marl *sand* you may buy *land*,
> " If you marl *moss* you shall have *no moss*,
> " If you marl *clay* you *throw all away*."

Lastly, When marl, or any other substance dug from below the surface of the ground, and used in large quantities, is applied, the farmer must always recollect that surface-soil alone contains organic matter, and that fresh subsoil has the power of combining *chemically* with a considerable quantity of soluble manure, and rendering it much less decomposable, so that, unless the soil is rich in manure at the time of application, the farmer must not expect to see any marked improvement immediately after he has applied the marl; nor should he condemn the practice even although the first crop should be somewhat inferior to those before the marl was used.

Gypsum, or *sulphate of lime*. This substance more properly belongs to a class of manures, which are at present very little known among farmers, but which I trust will soon attract that degree of attention that they undoubtedly merit; I mean those which the ingenious Mr Grisenthwaite denominates *specific manures*, by which term is implied, that the substance in question does not act as organic manure, by supplying organized matter to the plant, nor as many mineral ones, by acting chemically upon the vegetable fibre of the soil; but owe their beneficial effects to their power of supplying the plants with certain *saline combinations* which are essential to their perfection, and are for the most part peculiar to the plant itself, or, in other words, belong to a few plants only. Upon this very interesting topic we have frequently had occasion to throw out a few hints, but have not hitherto made any express remarks, as we considered that they would be much more suited for this place. The subject being almost entirely new, is at present in a very imperfect state, and the subsequent remarks will serve merely to direct the farmer's attention to the point, and I sincerely hope they may be the means of inducing some one to follow out the work in the only way in which it can be achieved, namely, by *chemical analysis*.

It has been proved by chemical analysis, that many plants, probably all, contain some saline substance peculiar to themselves, and consequently of great importance to the well-fare of the plant. These salts are frequently of a kind which by no means constantly occur in soil, as for example, *phosphate of lime*, *sulphate of lime*, *nitrate of potass*, *&c.*, and, of course, the plants which require these cannot be expected to thrive under such circumstances, unless they are supplied artificially with the required substance. It comes, therefore, to be a point of the greatest consequence to the farmer, that a very careful analysis should be made of all the cultivated plants, in order that the exact constitution of the saline matter should be ascertained, and in this manner the farmer will be enabled, in many instances, to grow plants in situations which probably could never before be made to bear them profitably. For example, to apply this remark to the specific manure now under consideration. *Gypsum* has been the subject of several experiments, in order to ascertain its value as a manure, the results of which prove that it is often useful for *grasses*, and always valuable for *clover*, *saintfoin*, *lucern*, and analogous leguminous plants. Now, these are the very plants whose saline matter contains abundance of sulphate of lime. Sir Humphrey Davy's remarks upon this subject are truly valuable. He says, for example, that most grasses, especially *meadow fox-tail*, *cocksfoot*, and *fiorin*, contain gypsum; and he observes that the application of this manure would probably be of great value in restoring lands which have been exhausted by frequent *clover crops* and the like. The reason why this substance is not constantly required is, that most soils contain a little of it, but more especially because *all animal manures* have a certain proportion of this substance, and therefore, cultivated land seldom requires any to be added to it. On the other hand, however, it is well known that there are few crops so uncertain as the clover crop, and consequently it would be of great importance to ascertain how far this failure may depend upon the want of sulphate of lime, as, of course, that could be prevented with the greatest ease. There is one point to be attended to with reference to the use of gypsum, namely, that it is apt to fail in some cases where a farmer would least expect it, namely in soils rich with *animal manures*; chemically, however, this is just what we should have been led to expect; because, during the decomposition of animal matters, *carbonate of ammonia* is produced, which reacts upon the *sulphate of lime*, and produces sulphate of ammonia and carbonate of lime, neither of which are capable of supplying the place of gypsum as a *specific manure*. It is stated that gypsum is particularly useful when it is intended to cut the crops green, as it makes the plants renew their shoots much more vigorously than they otherwise do.

We shall continue the mineral manures in our next.

ON THE AGRICULTURE OF HINDOSTAN.—NO. IV.

Having already said something regarding tobacco, tea, and indigo, in our third paper of this series,—the latter so prominent an item of agricultural speculation in India, and the two former so likely in a very short time to become so,—we intend devoting the present to a brief account of the Hindostanee grains, spices, and drugs, to which we have not yet adverted, reserving a more detailed account of the cultivation and manufacture of silk for our concluding paper.

Millet.—Let us, therefore, begin with millet, or *Holcus sorghum*, a grain so successfully cultivated on the lighter soils and more arid exposures of India and Cochin China; and which, from immemorial time, has formed a staple article of food throughout the sandy wildernesses of Syria.

Although both the *Holcus sorghum* and *Panicum miliaceum* are cultivated alike in Asia and Africa, and go under the common appellation of millet, yet it is principally to the first that we would refer here.

The *Holcus sorghum*, or great Indian millet, before gaining maturity, generally attains, in favourable situations, to a height of sixteen feet in the stalk, which is strong, reed-like, and jointed. At each joint a leaf springs forth, and with its base embraces the stalk. These leaves are about two feet and a half long, by two inches broad, with a midrib hollowed above, and proportionally depressed beneath. A large upright oval panicle terminates the stalk, which droops as it ripens, and assimilates in appearance to the Indian corn. The seeds are spherical, sometimes of a red and sometimes of a milky-white colour, dotted with black. They are enclosed in husks, where long awns or bristles protect them effectually from the voraciousness of the feathered tribes. The common millet is so different from this, that it only attains a height of three or four feet, and its stalk is terminated by a large loose panicle, hanging to one side. Although a native of Asia and Africa, the *Panicum miliaceum* has been acclimatised in Europe, in the southern parts of which it is successfully and extensively cultivated.

Although millet will grow in some localities that, from their aridity, are unfit for almost every other species of grain, yet it thrives best in a light, soft, sandy soil. The same mode of cultivation is pursued with all the varieties of it, only the larger kind is more thinly sown than the others. It is generally sown in June, and comes to maturity by four months. The ground is twice ploughed, and with the last, shallow furrows are made, in which the seed is thinly scattered, and immediately covered up with earth. A month after the appearance of the plants they are thinned and hoed, six or seven inches being left between those of the *Panicum*, and a considerably larger space between those of the *Sorghum*. Weeding is only necessary during the early stages of the growth, as in a short time the abundant vegetation of the grain soon enables it to overtop every thing around it.

At harvest time, the ears are cut off near the top of the culm, and are conveyed in sacks or baskets to the barn, where they are laid covered up in heaps for a few days. They are then spread out on the floor, and thrashed with a flail, after which they are winnowed like other corn.

Millet is one of the best preserving of all grains, but it is necessary that it be thoroughly dry before being put into the granary, else it will soon be spoiled. Not only are its seeds a wholesome article of food, but the leaves and stalks are applied to economical purposes. These are ate by camels, elephants, and bullocks, and afford an excellent provender for them; while, in China, the thick culm is woven into mats, the lower parts of the stalk, together with the root, serving for fuel. As before observed, it is also adapted to all varieties of soil, is very easily cultivated, requires little manure or labour, and is of abundant product.

As might be expected, the soil, season, and climate, have great influence on the produce of millet. In situations favourable to its growth, large returns are obtained; and even in Switzerland, it has returned an hundred and sixty for one. Could the autumns of England be more depended on, it would form a profitable crop for poor or light lands; but it is to be feared that, in average years, there is not enough of dryness for ripening.

Mr Porter says, that "the golden-coloured millet seed, which is occasionally used as a material for puddings in this country, and which is found for sale in the grocers' shops, is the seed of the *Holchus sorghum saccharatus*. This variety is indigenous to India; it is cultivated largely in China and Cochin China, and it has likewise been introduced into Jamaica." *

Sago.—We shall here only notice, that the sago of commerce is the pith of a tree growing in the Indian Archipelago, and principally in that part of it "in which the eastern monsoon is the boisterous and rainy one." † It is found most

* Tropical Agriculturist, p. 222.

† Craufurd's Indian Archipelago.

abundantly in such islands as are most propitious to the growth of the clove and nutmeg trees. In the Isle of Ceram, it is found constituting immense forests, flourishing in all the uncultivated luxuriance of nature. As indigenous to these islands only, and not to Hindostan proper, we pass therefore from sago to the sister subject of arrow-root, a vegetable now in such extensive family use in this country.

Arrow-root.—Some few years ago, the *Curcuma angustifolia* was found by Mr Colebrooke growing wild in the back forests, extending from the Sona to Nugpore, and was by him introduced into the Botanical Garden at Calcutta; and an excellent arrow-root, quite equal to that from Bermuda and elsewhere, was prepared from it. Being of abundant growth on the Malabar coast, it is raised in considerable quantities, and its starchy product has become a profitable item of commerce. Long before it had attracted the notice of Europeans, this root had been a favourite article of food among the natives.

Mr Bell, in his "Comparative View of the External Commerce of Bengal during the years 1832 and 1833," thus notices arrow-root among the exports from that country:—

"We do not advert," he says, "to this as an article likely to be cultivated to any great extent, but to convince the world that, in India, almost any exotic may be produced with common care and attention.

"The exports have amounted already to Bz. mds. 110, value Sa. Ru. 4538. This is by no means even one-fourth of the quantity that has been manufactured. The remainder will no doubt be shewn in our next review. The West India bulb was introduced by the Agricultural Society, and a trial made at their experimental gardens at Akra. The produce from it was so abundant, and the quality found to be so good, that it was eagerly sought after by individuals.

"An extensive cultivation was immediately introduced in the vicinity, and excellent returns obtained; but it would appear that the people in England prefer that it should be sent *in a less refined state*. This caution is probably advised to prevent the possibility of adulteration, which, in its very fine state, is more susceptible of foreign admixture. There cannot be a doubt that the quality is the best. We have ourselves cultivated and manufactured a small quantity experimentally, and would place it against any sample of West India arrow-root."*

We may here mention that the duty on arrow-root is one

* Comparative View of 1832–3, p. 47–8.

In the tables for 1834–5, and 1835–6, Mr Bell's surmises are found to be substantiated, the quantity exported being 351¼ maunds, and the value 7673 rupees.

shilling per cwt. when coming from British possessions, and eighteen and sixpence upon all other sorts. This is certainly something of a protecting duty—but quite right for all that.

Coco-nut.—From a root under the ground, we now turn to a majestic tree above it, the *Cocos nucifera* or coco-nut, a tree rich in its variety of produce, and valuable alike in fruit and flower.

The coco abounds on the coast of Malabar, and in many other parts of Hindostan, where its value has been acknowledged from the most remote antiquity; Brahma, when he divided the people into nineteen castes, having devoted one exclusively to the task of its cultivation, and preparing its produce. So highly is this tree venerated among the Hindoos, that it is sacrilege to cut it down, and it is deified in their mythology.

This beautiful and valuable tree may be almost said to be peculiar to the tropics, for it will not flourish in any region much beyond them. It attains a greater height than any of the other palms, and, although its stem may be less than a foot in diameter, it rises to a height of seventy or eighty feet. This stem is smooth, bare, and marked with circular rings, and its summit is crowned with a circle of pinnated leaves, about eighteen feet long each, by from three to four broad. From the centre nerve of each leaf, long, narrow, sword-shaped leaflets spring on either side, and the flowers grow in clusters, each cluster being enclosed in a long spatha or sheath. These are succeeded by the fruit, which at first is tender and whitish, but by degrees hardens, and becomes larger, leathery, and fibrous, with a smooth exterior, and greyish-brown colour. When ripened, this husk is about an inch thick, and contains a spheroidal nut, with a very hard shell, whose cavity is occupied by a kernel, which is hollow within, and contains a milky fluid. The fruit hangs clustering among the leaves, and is borne throughout the whole year,—the bud, the flower, the drupa, the immature nut, and the fruit ready to drop with ripeness, all appearing at once upon the boughs in the various stages of vegetation.

The coco will thrive almost in any soil, provided it be abundantly supplied with water, but it will be found in its greatest beauty and luxuriance on soft or on sandy land; and it is observed to flourish better near the sea-coast than more inland. Indeed, it may be washed by the brine without injury; and as M. le Goux de Flaix says, "This observation will occur to those who travel along the coast of Malabar, which is covered by immense and thick forests of these palms, and exhibits a most delightful and picturesque scenery."* Bertolacci makes exactly the same remark, with the addition that all the trees nearest the sea bend their heads towards it.† When planted remote from the ocean, it is customary to put as much as half a bushel of salt into the hole which receives the nut. Mr Meleager Hay would call this tree the sea-loving coco.

The duration of the coco-tree is about eighty years, and, if well taken care of, will yield toddy or fruit so early as the fifth or sixth. It grows quickly for the first half of its life, and when about forty is most vigorous and prolific. In about ten years after this date, it begins to yield less abundantly, and then gradually declines. As Wordsworth beautifully says—

> "So fades, so perishes, grows dim and dies,
> All that the world is proud of."

Its splendid crown becomes less verdant, the leaves drop off, general decay takes place, and its extreme old age is alike flowerless and fruitless.

The coco-tree is reproduced from its fruit only, the nut being placed in a hole longitudinally, with the eye uppermost; it is covered with half a foot of earth, which is not, however, trodden down. After this the plantation is watered by irrigation, as any other means might displace the loose earth, and this watering is repeated for six weeks or two months every second or third day. Within twenty days the germ appears, white and smooth, like the small tusk of an elephant, and remains tender for a fortnight more. During this time it has a pleasant saccharine flavour; and, as a great delicacy, whether raw or roasted, is served up at the tables of the luxurious Indo-European. In about a month and a half the tender

* Philosophical Magazine, vol. xx. † Page 147.

leaves shew themselves, the filaments being united into a form like a large goose-egg, of a yellowish colour. This too is cut off, and used as an oriental delicacy, the flavour being said to be more delicate than the finest almonds.

Between the eighth and the eighteenth month, the coco is thought fit for transplantation, and the plants are laid out in holes about twenty inches deep, by the same breadth; a stratum of salt, five or six inches thick, being laid in the bottom of each pit. The earth is then filled in, and watering for a time regularly attended to. Mr Porter remarks, that the Hindoos have an adage concerning the coco, which contains an injunction they scrupulously follow: "Water me continually during the days of my youth, and I will quench thy thirst abundantly during the whole course of my life."*

With most trees, when the operation of lopping is resorted to, the shoots spring forth with redoubled vigour, but not so with the coco. If its top, expressively called by the Hindoos its head, is cut off, the stem immediately dies, and in a week or two crumbles to dust. According to Bertolacci, a full grown tree in Ceylon will yield from fifty to sixty nuts yearly. Humboldt makes the average in South America one hundred.

When in flower, the produce of the coco are toddy and mirra; the first a well-known fermented liquor of the orientals, and the other a milder beverage, without its acidity or spirit. Arrack is distilled from toddy; and a kind of sugar, called jagery, from mirra. The kernel of the nut, and the milk within it, are used as nutritious aliment; and a valuable oil obtained from the kernel is much used both in the east and in this country, to which its importation is yearly increasing in quantity.

Cordage, which is impervious to wet, is manufactured from the fibrous husk, and the leaves, in an entire state, are used as sleeping mats. When split, the leaves form an excellent roofing for houses, and are extensively used for that purpose, especially on the Malabar coast.

Mirra and toddy are alike collected from the bruised *spatha* or flower-bud: the only difference is, that the mirra is collected

* Tropical Agriculturist, p. 204.

twice a-day, and the vessels in which it has been caught are cleaned and dried each time; whereas, when toddy is wished to be obtained, the vessels are allowed to remain till quite full, by which time a fermenting process has commenced. The liquor has a strong acid smell, heat is generated, and the tree stimulated to pour forth a yet greater quantity.

When it is intended to make jagery or sugar out of the mirra, a small quantity of the bark of the hall-grass is scraped into the pot, which fines the fluid, and produces a quicker condensation when it is heated. When evaporated to the thickness of cream, it is poured into coco-nut shells, where in a few minutes it acquires the consistence of cream, and becomes fit for use. Jagery, besides being used by the Indians as sugar, is also employed by them as a kind of indestructible cement for their great buildings.*

Arrack is obtained from toddy in the same manner as brandy is from wine. Four parts of toddy distilled gives one of a weak spirit, from which, when rediluted, one-half of a spirit is obtained, as strong as cognac. It forms a principal article of exportation from Ceylon. According to Mr Porter, "the average quantity shipped for eight years preceding 1813 was 5200 leggas, of 150 gallons each, at 80 rix-dollars prime cost, 25 for the cask, and 8 for the duty."

The coco-palm oil was first introduced into this country in 1814; since which time many plans have been tried to effect the best method of extracting the oil from the kernel. The number of trees in Ceylon is so immense, that if the consumption of this oil were generally adopted in Great Britain, it might be obtained at a reasonable rate, and would be a great source of revenue to the dependency. It is calculated that the various products of the coco annually exported from the Malabar coast alone amounts to one hundred lacs of rupees.

We must now conclude our allusion to the multifarious pro-

* M. le Goux de Flaix says: "I have seen the halves of large arches remaining suspended, though the other half had been destroyed by the effects of mines, employed at the time when Pondicherry was destroyed in 1761. Immense fragments of these arches are still to be seen in the house of the Jesuits, or in the ruins of the superb government house, built by the order of Dupleix." Phil. Mag. vol. xx. p. 331.

ducts of this valuable tree, by mentioning the cordage manufactured from the filaments of the husk of the nut. This cordage, which is termed *coir*, is of amazing strength and durability; besides, is so elastic, that it will stretch from six inches to nine, without giving way, and requires no tar, from not being injured by the effects of sea-water. It has already been begun to be used in the British navy for cables, and for running rigging. When the Dutch possessed Ceylon, the manufacture of *coir* was a monopoly possessed by the company, and it is supposed that 3,000,000 lb. were made annually. The British have, however, very properly thrown the trade and manufacture open, levying on the article an *ad valorem* duty of only 5 per cent.

After food, physic, and now for a few drugs and spices.

Cajeput-oil.—Cajeput-oil is the produce of a gigantic myrtle, which grows in the islands of the Indian Archipelago; and is obtained by distillation of the leaves. The bark is used by the natives of the Moluccas for caulking their canoes. In medicine, the oil has been used externally as a stimulant in rheumatic affections; and internally during the irruption of Asiatic cholera, but with no marked effects. One virtue, however, it indubitably possesses, that of dissolving caoutchouc, and thus forming a very good varnish.

Senna.—Although the senna imported from Alexandria is reckoned the best in the drug market, yet of late years considerable quantities have been imported from India, where it is becoming an article of annually increasing export. It is an annual plant, rising with an upright branching stalk, about twelve inches high. The leaves are winged, and the stalk is terminated by loose bunches of yellow flowers, to which pods of an oblong shape succeed. Although the Indian is not equal to the Egyptian senna, it is consumed, from its being inferior in price, in much larger quantities. The duty upon it is sixpence per pound, and, this included, the selling price is from one to two shillings. The Alexandrian gives from two and ninepence to three and threepence. The senna leaf imported into this country averages from one hundred and fifty thousand to two hundred thousand pounds annually.

Rhubarb.—Passing over the camphor tree, which is in a great manner peculiar to Sumatra and Borneo, we come to the *Rheum palmatum*, or rhubarb; but that also, although a valuable article of Indian import, cannot be set down as of native growth, being almost entirely obtained from the Chinese, who cultivate it most successfully in those provinces of their empire which border on Tartary. Although the finest kind of rhubarb is that which comes from Tartary proper, and which is known in Great Britain as Russian or Turkey rhubarb, yet by far the greater quantity comes from China through our East Indian commerce. The quantity from Russia in 1829 was only 10,659 lb., whereas from Hindostan it amounted to 127,443; and in the following year the difference was still greater, being from the former 3544, and from the latter 153,170 lb. The East Indian rhubarb may be set down at an average as only half the marketable price of the Turkey.

Aloes.—Although the gum-resin of the aloes is obtained both from the East and West Indies, that coming from Socotora in the Straits of Babelmandel is considered the best, and brings the highest price. Lands in the vicinity of the sea, and rather exposed to drought than otherwise, are reckoned the best for the cultivation of this plant. The soil being previously slightly ploughed and freed from stones, the young plants are put in like cabbages at about half a foot apart, the rows being kept a foot asunder. Although these will bear planting at any season of the year, the usual time is from April till June. Although the plant is generally cut within the year, yet it certainly does not come to perfection for two or three. The operation of cutting is performed by labourers, each carrying a parcel of small tubs. Having laid hold of a bunch of the blades as near as possible to the surface of the earth with one hand, he cuts it through with the other, depositing handful after handful, with as much expedition as possible, into one of the tubs till filled, and then proceeding in the same way with the other, by which time all the juice will have exuded from the blades in that first filled. These are then lightly taken out, and thrown over the ground by way of manure, and the juice then emptied into a large jar, holding from four to five gallons. The labourer goes on with this process until his jar is filled, which takes from six to seven hours, and forms his day's work.

The juice thus obtained is put aside until a sufficient quantity for boiling accumulates; and it will keep in this state for two or three weeks without injury. It is then boiled until it be sufficiently inspissated, and acquire what is termed a resin height. Sometimes a finer kind is sought to be obtained by inspissation without fire-heat, but the process is very tedious; and in some parts of the East, as well as in the West Indian islands, different modes of preparation are adopted.

"Aloes," says Mr Porter, "of the best quality, is distinguished as Socotrine, because brought from Socotora: it is a glossy, semi-transparent substance, of an orange colour, with a purple cast, and, when reduced to powder, of a bright golden colour. It is hard and friable in a cold temperature, becomes pliable in warm weather, and grows soft by the application of the heat of the hand. This drug is of an intensely bitter taste, slightly aromatic, but not sufficiently so to prevent it from being extremely nauseous."*

Cinnamon.—The cinnamon-tree, according to Marshall, has very extensive limits in the east, being found on the Malabar coast, and a great number of the islands†. It is now cultivated to a large extent in Ceylon, more than sixteen thousand acres being said to be laid out in cinnamon plantations. From Mr Cordiner's account, it would appear that the tree thrives best where the surface of the soil is sandy and the substratum a deep, rich mould. In the first volume of the Transactions of the Royal Asiatic Society, we are told by Sir A. Johnston, that from twenty-five to twenty-six thousand people are employed in Ceylon in the cultivation of the cinnamon tree, or the preparation of its bark.

The bark of larger shoots or thick branches produces coarse cinnamon, the finer kinds are obtained from the smaller and more delicate shoots; but shoots of the same caliber, from the same tree, are found to produce cinnamon of very different qualities. The best Ceylon cinnamon is thin, smooth, shining, and of a light yellow colour, bends before breaking, and is splintery in its fracture.

Cassia.—The cassia of commerce, which is now so largely imported into this country, is nothing but an inferior quality

* Tropical Agriculturist, p. 409.

† Annals of Philosophy, vol. x.

of cinnamon. When brought from British possessions, the duty on both cinnamon and cassia is sixpence a pound, and one shilling from any where else. Before 1829, cassia paid one shilling duty; cinnamon from British colonies two and sixpence, and from foreign three and sixpence. The finest cinnamon brings eight or nine shillings per pound; the second sort six or seven; and the third four or five.

We must say a few words regarding the pepper vine, which grows abundantly on the coast of Malabar, as well as in Java, Sumatra, and Borneo.

Pepper.—The berries of the *Piper nigrum* are the black and white pepper of commerce, and are obtained from a perennial plant with a climbing stem, of a dark colour, which soon becomes ligneous. The leaves are heart-shaped, with a glossy surface, and have little smell or pungency. Small white flowers grow abundantly on all the branches, and these are succeeded by the berries, which are green when young, and become of a bright red when approaching maturity. They hang in large clusters, like bunches of grapes; but the berries grow distinct, more in the manner of currants.

The pepper thrives luxuriantly on almost all soils, and requires little culture; but the level grounds along the banks of rivers are preferred, both from the rich vegetable mould found there, and for the advantage of water carriage. In order to give the vines the support they require, it is usual to plant other trees along with them; or, if this is not done, they are supported by poles, in the same manner as hops are in England. By the second year the shoots have generally attained the height of twelve or fifteen feet, and this being the best for fructification, they are then topped. At the commencement of the rainy season in November, the branches are regularly lopped, and little more left than the stem. The pepper-plant is propagated by cuttings, which spring from the foot of the old vines. To promote their growth the ground is always kept well weeded; but, during the warmer months, the finer kinds of grass are permitted to remain on the ground as a protection from the sun, and as a means of attracting the dews.

The pepper plantations are divided into gardens, containing each from 500 to 1000 plants; and these are separated from each other by hedges of shrubs. The principal crop is gathered in September and October; but a smaller one is also obtained in March and April.

The white pepper, which is sold at a high price, was long supposed to be the produce of another plant; but is now ascertained to be merely the black pepper decorticated.

The quantity of pepper imported into this country averages from six to eight millions of pounds, and yields a revenue of above a hundred thousand pounds sterling. Black pepper is sold at from threepence to sixpence a pound; white from sixpence to a shilling.

Ginger.—Ginger is found growing in great plenty on the coast of Malabar, and is native to the south-east of Asia and the adjacent isles. At one time Jamaica was the principal source of the import trade in this article, and, in 1738, 20,933 bags, of one hundredweight each, as well as 8864 lb. in casks, were exported from the island. But this branch of commerce with the west has gradually declined, and for the last two or three years, while there has been only 2453 cwt. imported from the West, there has been 7064 cwt. imported from the East Indies.

The narrow-leaved ginger is the best known and esteemed, and has a perennial root, with annual stems. The roots creep and extend under-ground in joints, from each of which a slender stem shoots forth in spring, and attains a height of two or three feet. On the top of the stalk is a scaly spike, from each of which scales a blue flower appears. When arrived at maturity, the root is taken up, and forms the ginger of commerce.

The cultivation of ginger is exceedingly simple. After the ground is cleared and trenched, the planting commences in March or April. Holes are made about six inches apart, into which a small piece of the root is inserted, and the earth then covered over it, exactly in the same way as potatoes are planted in this country. In a few months the plants are in luxuriance and do not begin to wither till the January or February succeeding, when the roots are dug up.

The black and white gingers of commerce are, in fact, the same root, and only differ in their mode of preparation. The white ginger is superior to the black, the best parts of the roots being selected. The coarse external parts of the root are scraped off, and it is then dried; but, in preparing the dark ginger, the process of scalding is gone through. Good ginger is hard, and not easily broken; and its fracture is more yellow than brown.

The rate of duty on ginger from British plantations is eleven shillings and sixpence, with the drawback of ten shillings. On foreign ginger the duty is fifty-three shillings per hundredweight.

Cardamom.—The cardamom seeds of the best quality are brought from the Malabar coast, but the *Elettari cardamomum* is a native also of Cochin-China, China, and Ceylon. In some parts of the Malabar coast, the growth of the plant is spontaneous, and, when cultivated, it is by cuttings from the root. The seeds have a powerful aromatic quality, and, on that account, are used in medicine. About 60,000 lb. avoirdupois are collected on the Malabar coast annually. The best seeds are hard, plump, of a bright yellow colour, and have an acrid but not unpleasant taste.

The trade in cardamoms is a monopoly of the East India Company, to whose agents the growers are obliged to sell their produce. The seeds are sold in England at from three shillings to three and fourpence per lb., to which one shilling of duty is added. The Ceylon cardamoms are much cheaper, being only from one and sixpence to one and tenpence per lb.

Castor-oil.—The *Ricinus communis*, or plant from which the castor-oil is obtained, grows in great abundance in every part of India, and its cultivation might be extended with great profit to the grower. The oil is obtained from the seeds of the plant, either by expression or decoction; the former kind being much the best, and less liable to rancidity. The shipment of castor-oil from the East Indies is nearly limited to Great Britain, but the trade is capable of the most advantageous extension. The price of East India castor-oil is from sixpence to one shilling per lb. exclusive of duty; that from the West is one shilling per lb. duty inclusive.

The last articles to which we shall now advert are the mace and nutmeg, both of which, like the ginger and the peppers, are the produce of the same plant.

Nutmeg and Mace.—The *Myristica moschata*, or nutmeg-tree, is, like the clove, a native of the Moluccas. Forrest ascertained that it also grew in New Guinea, and thence transplanted it to the Philippine isles. It was cultivated by the French in the Isle of France, and thence conveyed by them to Cayenne. Sir T. Raffles informs us that, in 1820, there was a plantation of one hundred thousand nutmeg trees at Bencoolen, one-fourth of which were in full bearing. It has also been cultivated with great success in Sumatra; and, during the peace of Amiens, it was introduced into the West Indies.

The nutmeg-tree is a diæcious plant; that is, it has male or barren flowers upon one tree, and female or fertile flowers upon another. These are bell-shaped, white, and without a calyx, and grow at the extremities of the branches, two or three together, on slender footstalks. The embryo fruit lies at the bottom of the female flower, like a little red knob.

After fecundation, the female flower drops off, and the little knob expands, until, at about the end of nine or ten months, it has the appearance of a small peach. The outer coat is fibrous and hard, about half an inch thick, and when arrived at maturity, this bursts, and a membranous covering of a fine red colour is seen, enveloping the thin black shell which encloses the kernel or nutmeg. This covering is the *mace* of commerce.

The nutmeg-tree is propagated both by seeds and layers. The trees are placed from twenty to thirty feet apart, and a rich loam is the most favourable to their growth. Nine years are required to bring the tree to a productive stage.

The mace resembles a verdant network; and, when collected, it is left in the shade to dry. This process requires some nicety and care. It is then pressed closely into bags, and exported.

The shell of the nutmeg being very hard, is subjected to the action of heat before being broken. The kernel thus shrivels up, as may be ascertained by rattling the shell, which is then broken. It is then subjected to the action of lime and sea-water, in order to destroy the process of vegetation.

" It is reckoned," says Mr Porter, " that the present average monthly home consumption of nutmegs is fifty casks, or about 10,000 pounds."

THE AGRICULTURIST'S NOTE-BOOK.—NO. VII.

To our Readers.—The commencement of a new volume presents us with a favourable opportunity of saying a few words to our readers, in regard to some changes that have lately been made in this Journal. It will have been observed, that its price per number has been lowered from six to five shillings, or annually from twenty-four to twenty shillings. This reduction has been made by the Publishers, partly as a sort of requital for the increasing and more decidedly good opinion, which the agricultural community have been pleased to express of this Journal; and partly from deference to the opinion of friends, who conceived that the enlargement of its circulation amongst farmers, would benefit both them and the agriculture of the country. Besides reduction in price, a good deal more matter is now afforded within the same space, by the use of small type in the quotations, and in the geological portion of the work. A short time ago, moreover, the Highland and Agricultural Society's Transactions were increased from three to four sheets, in order to overtake the matter accumulating in the Society's hands; and, just now, an uniformity of appearance, betwixt the Transactions and Journal, has been adopted, by enlarging the pages of the former to the size of those of the latter; and to leave nothing undone that can enhance the value of the work, the present volume is printed with a fount of new types, and on paper of finer quality. Putting all these things together, it will be found, that a very considerable quantity of matter has been added to each number; and coupling this addition with the reduction in price, and increase in the embellishments by plates and figures in every number, we have no hesitation in hazarding the opinion, that this Journal is now the *cheapest* work of its class in the literature of the country.

Comparisons are said to be odious, but that does not preclude comparisons being constantly made. To confine the odium, however, within as narrow a compass as possible, we shall only compare this Journal with the other *agricultural* periodicals of the day. It was determined, at its institution, by the English Agricultural Society,—at least so was it reported in the newspapers—to distribute the information they should have to communicate, in a very cheap form. The first part of their Transactions in a quarterly form has appeared, and any one who will take the trouble of comparing them will find, that the present number of this Journal contains fully twice the quantity of matter which is in the English Journal, at only double the price, besides being much more amply illustrated with figures. In regard to the condition of the other two Agricultural periodicals which regularly appear, a large proportion of the one, and almost the entire of the other, is made up of pre-existent matter; whereas all articles in this Journal, exclusive of the Miscellaneous Notices, are original, and, as such, are almost all paid for. And as to the quality of the articles contained in the respective periodicals, agricultural readers being the best judges of that, we shall willingly leave the choice of comparative merits to *their* decision.

In conclusion, no farmer, we conceive, can now reasonably object to the yearly cost of this Journal. How often do many of them throw away as much on trifles that "perish in the using," and afford no real satisfaction; whereas *it* can scarcely fail to prove a substantial equivalent for the money expended in its purchase. Besides this, its renewed appearance every quarter tends to impart a freshness to, and create a growing interest in, its contents. To the considerate farmer, it may be a silent friend,—an agreeable companion—and a welcome instructor; for, let his fame be ever so high—and farmers generally display much acuteness in their profession,—his personal experience cannot be so extensive or so varied, as to preclude the possibility of always learning something from the experience of others, that will correct his views and amend his practice; and for the conveyance of the mutual interchange of rising thought and confirmed experience, no vehicle seems so well adapted for the purpose, as the pages of a periodical.—Editor.

Red Giant Goliah Rhubarb.—In the market gardens around London, a large species of rhubarb is extensively cultivated, with which the various excellent markets of the metropolis are well supplied; but beyond the range of a few miles, the particular kind to which we would direct the attention of our farming friends, is comparatively little known,—the generality of country gardens being disgraced with a root or two of dock-like plants, with stalks no thicker than a finger, fibres like whip-cord, and a flavour!—Uh! No wonder so few persons, *thus possessed*, should like rhubarb-tarts! No wonder they disguise the taste with shrivelled apples just going out of season, or gooseberries just coming in! The noble plant which we would recommend to every living being who owns a patch of garden-ground, is as superior to the old-fashioned nauseous plant just mentioned, as our cultivated celery is superior to the rank wild weed of the same name growing by muddy ditches. One would be led to suppose, that, from the rarity of the giant rhubarb, it was difficult of cultivation, tender, and troublesome to manage; whereas it is as easily propagated as any other perennial vegetable; is so hardy that no degree of frost which we have ever experienced, will injure it; and of all esculents for pies and puddings, it is the most readily prepared. It is so prolific that half a dozen roots would keep a small family constantly supplied, during four months of the year; that is, from the beginning or middle of April (according to the forwardness or backwardness of the season), until the beginning or middle of August. We have known instances of this, *fruit* must we style it? being preferred to all others for the purpose of pastry, throughout the summer, even where fruits of every kind abound. We have known stalks of the Red Goliah Rhubarb to measure six inches in circumference and nearly two feet in length, so that only one of them has been required for a pudding: so delicate and soft, too, is its texture, that as soon as it arrives at the boiling point, it becomes a fine pulp, and is already sufficiently cooked. As a garden production for culinary purposes, it is certainly invaluable; being in perfection precisely at that season when apples become tough and scarce, and before gooseberries have made their appearance. Its flavour is so delicate, that it ought not to be mixed with any other ingredient than sugar; and on no account should it ever be peeled.

The Red Goliah Rhubarb may be propagated either by sowing the seeds or purchasing young roots of one year's growth, and planting them during the spring months in a good rich soil. In the former case, that is, if the seeds be sown, they are to be transplanted in a few weeks, and in the following year their stalks will be large enough to pull. If roots be obtained and planted in March, the plot will be available in a month or six weeks. No further care is requisite than to manure the bed in the autumn after the leaves have decayed. To those who are unaccustomed to the plant which is the subject of our eulogium, it may be as well to mention, that the stalks should never be cut from the bed, but wrenched sideways with a sudden twist, when the whole stalk comes away at its junction with the root,—round, flat, clear, and white as milk.

As soon as the growth becomes vigorous, each root sends up a flower-stalk, which will readily be distinguished from the leaf-stalks; these must be pulled away, and only one left (if it be intended to procure seed), and this plant should be less used than the others, if at all, during the season. The leaves are enormous; we have measured many that have been 4 feet long and 3½ wide. The roots, too, are gigantic,—so large, that, in the course of three or four years, a single root when digged up, would fill a wheelbarrow: hence the plants require a wide space,—say five feet apart every way.

Couch-grass as Food for Horses. By Mr James Kirsopp.—If English farmers will condescend to receive any information from Italy, where, alas! there is little for them to covet except the climate, I may be allowed to observe, that the common couch-grass, which, in the north of England, is burnt in very large quantities, is used in Rome and Naples very extensively as food for horses. It is first well washed and then given to the horses, sometimes mixed with carrots.

New Machine for Stirring the Subsoil. Messrs Lawson and Son have communicated to us the following notice of such a machine from George Burnett, Esq. of Ovington, Newcastle-upon-Tyne.

"I take this opportunity of naming to you (as one being interested in agriculture), that a shoemaker in this neighbourhood has invented an instrument, which promises to do effectually the work of a subsoil plough, taking only *half* the draught, and stones being little or no objection to it. It is simply a heavy metal-wheel of about five feet diameter, with slightly curved iron spikes or teeth inserted in its broad rim. It is drawn by a pair of horses, while a man steadies it from behind with a pair of stilts, similar to those of a common plough, the which is fixed in a frame similar to that of a roller, but without any support on either side. I think a pair of light wheels might be added with advantage as tending to relieve the man considerably."

It is not stated whether the implement has ever been practically tested, or whether it is intended it should operate in the bottom of the furrow opened up by the plough preceding it. Its mode of operation must be that of picking the subsoil loose, as it proceeds onwards; and the depth of the picking must depend on the distance the spikes or teeth are permitted to enter the subsoil. It must move unsteadily without wheels.

Subsoil-Ploughing.—The remarks which have appeared in this Journal on subsoil-ploughing, have, as we conceive, tended to good—tended to place that operation in its proper light, before our English and Irish readers. That operation was chiefly made known to English agriculturists by Mr Shaw Lefevre, in a letter addressed to his constituents, and which was put forth as a substitute for the report of the Agricultural Committee of 1836, of the House of Commons; but which laid far greater stress on the sole efficacy of subsoil-ploughing, than the evidence regarding that operation given to the Committee at all warranted. Mr Smith, in fact, was the only person who gave, and could give, any satisfactory evidence, *at that time*, regarding subsoil-ploughing, but his opinion was then and is decidedly yet against practising it prior to thorough-draining. Extraordinary exertions were made to distribute Mr Lefevre's letter throughout England, containing, as it did, not Mr Smith's evidence, but his own opinion, of that operation; and the consequence has since been, that every *agricultural writer* in the provincial press of England has adopted, and striven to disseminate, that opinion amongst the farmers of England. To what extent the farmers have adopted Mr Lefevre's opinion, it is impossible for us to say; but, judging from the very confident expressions used at public meetings, of the great importance of subsoil-ploughing alone, it is feared the opinion is much more generally believed in than the practice consequent on such a belief, injudicious as it must be, will redound to the profit of the farmers.

It was solely with the view of counteracting Mr Lefevre's opinion that we took up the subject in this Journal. We wished to warn the English farmer of the inevitable, though unexpected, evils attendant on the use of the subsoil-plough in land that had not been drained, because the operation would materially enlarge its sphere as a receptacle for water, the ill effects of which water would occasion much loss, before they could be obviated. Our object was to encourage farmers to drain the land thoroughly in the first place, and then they might do with it afterwards whatever they pleased with impunity. No doubt small patches of land may be found here and there, that apparently do not require draining, but where such are met with, refrenation from draining should be considered the exception to the general rule of draining. The general rule should be, that *all* land would be the *better for draining*; but if, on investigation, land were found as beneficially dry as if it had been drained, its possessor should congratulate himself on being exempted from so large an outlay as draining necessarily incurs. If we can impress our English readers with a conviction of this opinion of the general condition of land, as a truth, we shall accomplish all that was intended by remarking on subsoil-ploughing. Our Scotch friends have already embraced this opinion; and they would now as soon irrigate their land with an hydrate of iron, or dose it with calcined magnesia, as subsoil-plough it without previous thorough-draining. Whether Mr Lefevre has yet modified his opinion in regard to the universal application of subsoil-ploughing, we know not, but with his individual opinion we have nothing to do, when it is not promulgated with a view of inducing others to adopt it. Our subsoil critic in the British Farmers' Magazine, who avers we make "attacks," and such frightful things, has dwindled his thousands of dry acres in England that require no draining, to an instance of profitable subsoil-ploughing, which he knew of in hard dry chalk, without being previously drained. We are quite willing to take the solitary fact at his word, but if he means us thereby to infer, that *all* hard chalk subsoils *must* be dry, our knowledge of the chalk-formation of the north of Ireland is too accurate to be made a proselyte of by him.

But what constitutes a *dry* soil or subsoil? aye, that is the question; and, until its definition is definitively settled, exemption from the general rule to drain should be granted within very narrow limits. We have given it as the result of extensive observation of the condition of land, that *we have never seen one hundred contiguous acres*, that would *not be the better for draining.* This, it seems, is a startling assertion. It is so only to those who have somehow adopted the notion, that most of the land in the kingdom, situated as it is in a humid climate, may be subsoil-ploughed without being drained. We are perfectly sure we are right, in so expressing ourselves of the land we have *trodden upon;* and of that which we have only *seen*, symptoms were too manifest and manifold for us to escape the same conviction, whether during the drought of summer, or the rain of winter. But, in order to understand an Englishman's notion of a *dry* soil, when we see it, let us for a moment listen to Mr Shaw Lefevre's description of one. In the first number of the Journal of the English Agricultural Society, p. 38, is a paper entitled "An account of the application of the subsoil plough to a *dry* soil at Heckfield, Hants," in which Mr Lefevre intimates, that he has a small field which "consists of a light sandy soil, from five to seven inches in depth, *covering a stratum of hard gravel.* This stratum varies in depth from eight to twelve inches, and below it there is a yellow sand, with a very slight admixture of loam. There are *no springs* in the field; but in *wet seasons*, on those spots where the surface of the field is uneven, the *water is retained in pools until it has evaporated.* In other parts of the field, *the same passes off immediately without being retained or absorbed by the subsoil;* and consequently, in *dry seasons*, the crop is invariably parched up and burnt." In our estimation, these are just the characteristics of a *wet* soil. To our ears, it sounds very strange to characterize that a *dry* soil, whose subsoil, where it is uneven, retains water until it has evaporated; and where otherwise, the water passes off immediately, but how, or whether by evaporation, is not stated; and yet this soil, though on a subsoil of hard impervious gravel, constitutes, it seems, "*a dry burning gravel.*" If "a light sandy soil" is, under these circumstances, to be considered a *dry* one, because it is naturally dry; then, according to the same rule, a clay soil should always be considered *wet*, because of its humid nature, although it should have been rendered quite dry in consequence of draining. If such a condition of land, of whatever nature, is considered *dry*, no wonder that we are told by Englishmen, there are thousands of acres in England that require no draining. No doubt, such a soil can be rendered quite dry, for we see in the account, that subsoil-ploughing made it drier and more productive, and the heat of the sun, we also see, burnt it up. But before we can admit, even in such a condition of soil, that the subsoil-plough may, with impunity, be used in it as a *substitute for draining*, it must be shewn to us that thorough-draining would *not* have rendered *that same soil* equally, more permanently, and more truly, dry. This is the true state of the argument betwixt the *comparative merits* of *subsoil-ploughing* and *thorough-draining*; and the discussion founded on this their relative bearing cannot be of long duration. We are quite sure no true farmer, *no farmer who does not intend to act treasonably towards the soil*, will ever so confide in subsoil-ploughing alone, as a *permanent* improvement, as he *can* confide, as such, in thorough-draining; and, consequently, he will far less be disposed to employ a probably temporary substitute, in the stead of a certainly permanent principal.

Furrow-Draining.—One cannot go a distance from home without observing the extent to which furrow-draining is now practised. Almost every stubble and grass field that is intended to be ploughed up, especially at the commencement of a lease, presents, by cuttings, stones, and tiles, a pleasing scene of industrious enterprise, and of determined desire of improvement. At some places drains are cut in every furrow, from 15 to 18 feet asunder, at others, in every other furrow, the distance no doubt, being regulated, at least should be regulated, by the nature of subsoil. Stones are entirely used in some places, but, in general, we should say, tiles alone are used, though in others, stones are used in conjunction with tile. This last mode is perhaps the best for filling drains, and is certainly preferable to tiles alone; but where stones are really scarce, much rather use tiles alone than neglect draining.

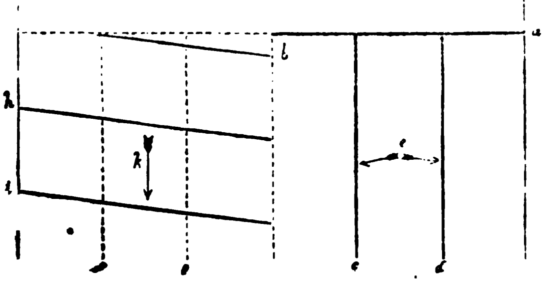
Some objections, however, occur to our minds to the *mode* of *conducting* furrow draining in many places. Great extent of drains are cut and left open for a length of time, in which rain and snow may fall to interrupt work, and bring down the earth from the sides. The spade-work is frequently roughly and slovenly executed. Instead of removing the obstacles that may occur in the line of the drains, such as boulder-stones, the drains are sharply curved round to avoid them. The impervious earth of the drain is thrown out and left nearest it. The tiles are carelessly laid down, in two long ranges at a time. Tile-soles are too frequently neglected. And, to crown the climax of negligence in the process, a long time is frequently allowed to elapse before the earth is again returned into the drain. Every one of these particulars is a fault, and should be scrupulously avoided. We scarcely need point out their defects, they being so very obvious. They entirely arise from neglecting to exercise a strict superintendence over the labourers who have undertaken the work by the piece. One state of weather is pleasanter for the spademen to cut the drain, and they continue to cut on, day after day, as if they had nothing else to do but to cut. Rain falling, they cannot bottom out the drain for the water, and there it stands souring for days together. Frost comes, and moulders down the sides of the drain into the bottom, where the accumulating earth lies ready to absorb the first rain that falls, by which it is converted into mortar. A fine dry day induces the men to go down into the drain and lay the stones or tiles, and they continue laying them down apparently certain the dry weather will continue. The cast out earth is too wet to be returned into the drain one day, and too hardened by frost in another, and so the drain remains unfilled for an indefinite period, or until the earth again becomes dry and soft.

Now, the occurrence of all these errors would be entirely prevented by a strict superintendence. The labourers will naturally work, in reference to weather, at that part of the work which is most conducive to their own interests, or pleasantest to their own feelings, regardless of the ultimate consequences of their choice to the drain; but, surely, it is worse than folly on the part of the farmer to grudge, or neglect to exercise, a proper superintendence over one of the most important, and certainly the most permanent, operation that can be performed on a farm. The time of a grieve or steward is imagined to be thrown away in superintending men who have undertaken piece-work. There is not a more fallacious opinion. No doubt it is unnecessary to superintend piece-work, in regard to the *quantity* of work to be performed in a given time; for their own interest will impel the men to work pretty constantly; but the quantity of work is not the important point to be considered in the case of draining; it is its *quality*, and the *efficiency* with which it is executed. Labourers will not willingly shift from one kind to another of piece-work in the same day, because much more work of any one kind than a variety can be performed in one day; but stipulations should be carefully made in the bargain to *finish* the work *begun*, every day; and as one day's trial will apprise the men of the extent of drain that may be begun and finished in one day, that quantity should only be attempted to be accomplished every day. When this system is begun and persevered in, it is fully more easy of accomplishment than work conducted in an irregular manner, and it has the advantage of securing every day's work against the vicissitudes of weather, and of having it executed in the most satisfactory manner to the employer.

In no case should tiles be used without soles to rest upon. The hardest soil, when cut, will be softened by water in time, and softened earth of whatever kind will permit the sinking of the sharp edge of the tile. We fear the neglect of soles will be discovered to be an evil when too late to be remedied; and in order entirely to avoid its risk, it is safer, at all events, to employ them. The additional expense incurred by them should never enter into the calculation, when so permanent an improvement as draining is in consideration. Let the tenant propose an agreement on this point with the landlord, and the latter must indeed be wretchedly blind to his own interest, if he refuse to supply either the sole and tile, or the soles alone, or accept of a per-centage on the expenditure, or remit the same per-centage in rent on the outlay of the tenant. The most common arrangement, we believe, is for the tenant to pay a per-centage on the outlay incurred by the landlord. When flat stones can be procured, they are used as soles, and in coal-districts, the bituminous shale, commonly called *blaize*, which always forms the roofs and floorings of coal-workings, makes an excellent substitute for manufactured tile-soles.

Some of our English agricultural friends, we observe, sport very imperfect opinions regarding furrow-draining. They cannot see what good it does land to put drains in the furrows, when they might as well be run across the ridges. This is mere special pleading. It is true, that it matters not in what direction the drains are placed, provided the land be thereby *thoroughly drained*, whether it be level or on a declination; but drains in the furrows have advantages which cross-drains cannot possess. In the first place, drains are formed deeper, with the same cutting, in reference to the crown of the ridge, in the furrow than in any other direction. This is self evident; and if economy should be prized in draining, those in the furrows should be preferred. Again, the subsoil, upon which the sole of the plough immediately moves, assumes the same form as the external surface of the ridges; and it is this state of the subsoil which causes the water that falls upon the ridges to run more rapidly towards the furrows than in any other direction. A drain in the furrow, therefore, will intercept more water, in reference to the ridge, than in any other position. Once more, it is requisite for the most perfect ploughing of the land, to make the ridges run along with the declination of the ground, if the declination is not too rapid. This circumstance forms the foundation of a general rule, which fixes the line of ridges in one direction in reference to the fall of the ground, and all other directions only form exceptions to it. Therefore, drains, for the foregoing reasons, should also follow this rule. Moreover, though thorough-drained land may, with impunity, lie at a less elevated ridge than undrained, yet the common plough always produces an unequal surface, and, of course, an unequal subsoil. It is impossible to turn over land with the common plough, without leaving open furrows somewhere; and hence these will always form inequality of surface, and, of course, of subsoil. Further, it seems English agriculturists cannot see, after fixing the position of the drains in the furrows, how the furrows, which are shifted about when the land is under the plough, can be replaced exactly above the drains. This is a strange remark to proceed from a practical farmer, who should take care to have a straight side of the field, such as a hedge, a wall, or other fixed objects which indicate a straight line, from which line the ridges are marked off, and made of one breadth; but, in truth, it matters little whether or not the furrows be *exactly* above the drains; water will get into them. We are too apt to argue as if the properties of thoroughly-drained land remained the same as undrained. It is difficult to find an object to compare land with; but we may compare undrained land to a sponge containing a considerable quantity of water; a small addition to which makes the sponge overflow, and it is ever ready so to do. Drained land, on the other hand, may be compared to a sponge recently squeezed out and dried on the surface, which is ever ready to receive a considerable quantity of water, without making much difference on its appearance. Thorough drains become almost dry in a few years; nevertheless, they are in constant requisition, and, but for them, water would be retained in the soil; but they are only completely tried as water-runs after heavy rains. Thorough-drained land may be laid perfectly flat, in which case water enters the drains from every quarter; but to obtain true flatness of surface, and, of course, of subsoil, a turn-wrest plough would require to be used. A common plough, as we have already said, cannot turn over land in a truly flat position. These remarks are chiefly applicable to flat land.

It has not yet been settled by experience, whether drains that run in the direction, or those that run across the line of declination, draw most water from below, and intercept most from the surface. Taking reason for our guide, until experience decide the point, our opinion is decidedly in favour of the



drains. For, let us suppose *h*, *i*, in the annexed figure, to be two drains cut across the declination of the dotted ridges *f*, *g*. In this position, it is obvious that the drain *h* has to draw the water passing through the ground from the drain *b*; and the drain *i*, the water passing through all the space between *h* and *i*, in the direction of the arrow *k*. This space may be any distance, let us suppose 15 feet. Let us suppose, on the other hand, that the drains *c*, *d*, run in the direction of the declination, in the furrows of the ridges. In this position, it is obvious that the centre of the ridge *e* is elevated fully more above the bottoms of the drains *c* and *d* than their depth, which, let us also suppose, are each 24 inches; that is, *c* is elevated fully two feet above the bottoms of the drains *c* and *d*; that is, the ridge being 15 feet, there is a fall from its crown *e* to the bottom of the drain down each of its sides of two feet in 7½ feet; so that the water on the ridge *e* falling towards the drains *c* and *d*, will only have to run 7½ feet each way, in the direction of the arrows at *e*, instead of the entire 15 feet, as in the case of the cross-drains. Therefore, the furrow-drained land should always lie in a drier state than the cross-drained.—Q. E. D.

Moorband-pan.—The talk about the subsoil-plough has brought this substance more of late into notice than, perhaps, it ever before was. One of the great advantages represented to be derived from the use of the subsoil-plough, was the riddance of that subterranean nuisance, moorband-pan, which may, it is said, be "shivered to pieces" by it. The substance that is to be so shivered by it, consists almost always of an indurated combination of clay, small stones, and iron in a particular state, situated either immediately, or at some distance, below the path of the plough, and is nearly impervious to water. All indurated incrustations, however, formed under the sole of the plough, are not *moorband-pan*. In good alluvial loam, of greater depth than the plough-furrow, and rendered adhesive by pressure, an incrustation or firming of the subsoil, that is, the bottom upon which the plough moves, is frequently formed by the sole of the plough rubbing constantly on the soil at the same depth. This result of the action of the plough is not so likely to occur now that great and unequal depths of furrows are usually practised in cultivating land, as in former times, when the plough was usually made to skim under the surface of the ground; or where ploughs are still used, whose depths in penetrating the soil are regulated by mechanical contrivance. This encrusted earth can retain water, but its effects on soil and plants are more innocuous, compared to those of moorband-pan Nevertheless, its disruption by deep-ploughing is of benefit to the soil, and we have experienced it in very fine deep mould.

Although pan is now much talked of, and its mischiefs depicted in the most gloomy colours, yet, as we conceive from what is said, its nature is generally not well understood. We are led to think this from the tenor of a letter lately addressed to the Newcastle Chronicle, by Mr John Grey, of Dilston, whose talents as a speaker at agricultural meetings are well known to the agricultural community, and whose opinions are believed to be influential among farmers. In that letter, which was intended as an answer to some observations which the Marquis of Tweeddale had made regarding the subsoil-plough, at the agricultural show at Wooler, in October last year, Mr Grey states, that the subsoil-plough had been beneficially employed on a certain part of Mylnefield Plain, without previous draining, in breaking up moorband-pan, two specimens of which he had caused to be analyzed: the first of which contained, out of 120 parts, 34 of oxide of iron, 74 of silex, and 6 of alumine or clay and loss; and the second, 43 parts of oxide of iron, 64 of silex, and 8 of alumine and loss; and, on this analysis, he immediately adds his opinion of the nature of moorband-pan, that "in general, it is unnecessary to observe, that such a combination *must* be injurious to vegetation, and, therefore, *pernicious if brought to the surface*," &c.

Now, this analysis of moorband-pan is of no value. It tells us, no doubt, the relative proportions of clay, sand, and oxide of iron, in the substance that *was* injurious moorband-pan, but it does not tell us the *state* in which the iron existed *before the pan was broken up;* and yet this is the only particular that is essential to be known to the determination of, by an analysis, whether its iron would be inoffensive or injurious to vegetation. The iron in the state in which it is represented in the analysis, would be quite innocuous, and, therefore, could injure vegetation neither under nor above ground; but it is represented in it in quite a different state from what it was under ground, when it was committing its injuries upon vegetation. The true state of the matter is this:—Iron is only injurious to vegetation in a solvable state; but oxide of iron is insoluble, and therefore inoffensive. It is present in all soils, even of the most fertile quality, in the shape of powder, and, indeed, gives the characteristic colours to all soils, whether blue, green, yellow, red, brown, or black. There are three known states of the oxides of iron,—one the black, which is composed of 73 parts of iron and 27 of oxygen; a second, the protoxide, which contains only half the quantity of oxygen in the preceding; and the third, or peroxide, which contains only 52 parts of iron and 48 of oxygen. The last is the highest state of oxidation of iron, and is called the red oxide, or vulgarly red rust, which rust, however, contains a proportion of carbonic acid. But the oxide of iron also combines with water; does not dissolve in it, as common salt in water, but combines with it, and becomes what is termed a *hydrate*, which is defined by Proust to be a compound of a solid body and water, *still retaining the solid state.* The reason that the oxide of iron combines with water, is of its great affinity for oxygen; it takes the oxygen from the water, and leaves the hydrogen to escape, or make other combinations. Thus, when oxide of iron occurs in any sensible quantity in the soil or subsoil, and meets with water, it becomes a hydrate of iron. It meets the water that is brought to it in the soil on any impervious substance, such as clay, clay and stones, or even compact gravel; and when it meets with water on any of these impervious substances, the action which is peculiar betwixt liquids and solids takes effect. Acting only at the points of contact, as far as the mass of the iron is concerned, it is quite the same thing whether it be acted upon by a large or small quantity of water, since the points of contact, and, of course, the sphere of the liquid's activity, must in both cases be the same; but the combination always takes place in determinate quantities. Hence, the more water is supplied to the hydrate, that is, the wetter the impervious subsoil is kept, the longer will the oxide of iron remain in the state of hydrate; and this consequence also arises from the foregoing circumstances, that, however small the supply of water may be, if it is just sufficient to cover the mass of iron, and be renewed as the action proceeds, the iron will be kept in that state. Mr Grey's moorband-pan was thus a *hydrate under the ground.*

But the hydrate of iron is a delicate hydrate, it easily parts with its water, when other substances, capable of affording it oxygen more readily, come within the sphere of its action. Hence it is easily affected by acid solutions, some of which may be placed in its way by the processes of cultivation, and all such combinations are injurious to vegetation. The water impregnated with the oxide of iron is injurious; a weak solution of sulphuric acid with iron, that is, sulphate of iron, or green vitriol, is injurious to vegetation. Animal manures supply sulphur to the soil, which, coming in contact with the hydrate, forms the sulphuret of iron, leaving the impregnated water of the hydrate to escape, and to do mischief; and though the sulphuret of iron is itself insoluble, and therefore inoffensive, yet oxygen decomposes it, and frees the sulphate of iron, which again becomes injurious to vegetation.

Since, then, the oxide of iron, when it exists in the earth, is liable to be acted on by water, and rendered injurious to vegetation, the obvious remedy by higher oxidation is the entire and permanent removal of the water. This may be effected by draining or subsoil-ploughing. Draining, there cannot be a doubt, will remove the water effectually and permanently; and since this is the case, there can be, by no possibility, after draining, any *hydrate* of iron in the soil or subsoil. Subsoil-ploughing alone may, no doubt, remove the water for a time; but no man can give the assurance that it will remove it permanently. It is not enough to say that the moorband-pan is "shivered to pieces" by the subsoil-plough, and that the open subsoil *under* where it was, will preclude accumulation of water in future; for we would ask, How came the impervious crust to be at all formed *above* the said *open* subsoil? The open subsoil should have been as ready then as now to convey away water; at least there is nothing that can be produced for the opposite opinion that rests on experience or analogy in the matter. On the contrary, analogy would lead us to conclude that land subsides, and becomes more compact by the agency of water; and hence, if water is allowed to pass freely through the subsoil-ploughed subsoil, and directed to no channel by which it can obviously make its permanent exit, analogy assures us, and experience confirms the assurance, that the earth must subside, must become more compact, may again retain water; and hence, the injuries of the moorband-pan may again be experienced.

Since iron has so strong affinity for oxygen, and since all its oxides, as such, are inoffensive, it is clear that the more completely it can be placed in a position to receive oxygen most easily, it will be the more easily oxidised or rendered inoffensive to vegetation. Now, there can be no two opinions that it will receive oxygen most freely in contact with atmospheric air, and no where so freely as on the surface of the ground, certainly much more freely there than under ground. Above ground, the hydrate of iron freely combines with oxygen, and becomes an oxide, most commonly a peroxide. Mr Grey's moorband pan was thus a *peroxide of iron, above ground.* His analysis, therefore, was not applied to *moorband pan*, properly speaking, for the true composition of that substance is alumine, silex, and *hydrate* of iron, that is, a combination of the oxide of iron with water, which is soluble, and therefore injurious to vegetation; but to a combination of alumine, silex, and *oxide* of iron, which is insoluble, and therefore inoffensive to vegetation. This distinction in the state of the iron may appear to constitute a trifling difference in the eyes of a subsoil-plougher, but to vegetation they constitute the important difference betwixt poison and inoffensive matter.

How, then, should these facts direct us to free land, and keep it free, from the injuries of *moorband-pan?* Decidedly to drain the land to free it of *moisture*, and deprive the *hydrate* of its *water*, and then to bring up the hydrate in contact with the atmospheric air, and thereby render it for ever innocuous. A somewhat analogous change may be mentioned with regard to lime. Limestone when burnt is deprived of its carbonic acid, in which state it has a strong affinity for water, and becomes a hydrate, and which is the state of quick lime; but no sooner is it in that state than it possesses a strong affinity for carbonic acid, which it receives from the atmosphere, and again becomes a carbonate of lime. In the quick state it is *directly* injurious to vegetation, in the state of carbonate it is inoffensive. With regard to the moorband-pan, the above is just the theory and consequent practice of the Marquis of Tweeddale, on which Mr Grey comments; but we think that we have made it plain that both are invulnerable, and that both are founded on truly scientific principles. His Lordship brings up the pan, and gives it all the advantages of the atmospheric air that is practicable, by comminuting it with rollers, and making it fit to mix intimately with the active soil, which, when it has undergone proper treatment with lime, manure, and green crops, there is no danger of injuring young stock or any thing else. Indeed such injury is physically impossible. Any instances that Mr Grey may have seen to the contrary must have been somehow ill-managed; for if *too much poor clay* devoid of organic matter, in proportion to the active soil, is hurriedly mixed with it, and then laid down to grass, and without previous thorough-draining, it would prove injurious from physical, independently of chemical causes; because the mollifying influence of the air had not had time to take effect on it. But if land has been thorough-drained, deep ploughed, the pan brought up, broken, land well dunged, limed, green cropped with turnips, eaten off by sheep, followed by a crop of barley, and then laid down to grass,—when land has been so treated, we will stake our existence that no injury can then possibly befal either plants or animals.

Sago as Food for Domesticated Animals.—Sago, as our readers are no doubt well aware, has, for some time past, been given as food to the animals usually reared on a farm, particularly horses and calves. We have hitherto refrained noticing the use of sago at all, until it shall have been ascertained by experiment, that it constituted an economical as well as a wholesome food for domesticated animals. In such a work as this we think it more consonant with the interests of good husbandry, to retain a prudent silence on untried though recommended practices, than excite hopes in regard to them which may never be realised. The wholesomeness of sago as food was never doubted, for it has long been administered to the human subject in infancy and sickness, but its economy in any instance, in feeding live-stock, was very problematical. Experience, however, has decided in its favour, in reference to animals in both respects; and henceforward it will, no doubt, constitute a staple article of food on all farms that rear young stock. From its emollient and nutritive properties, we should consider it admirably adapted for calves while on milk; for cows, sometime before and after calving; for young horses in winter, instead of much dry corn, or none at all, as is too frequently practised; and for young pet lambs, whose mothers have either died or forsaken them, in which events, a serious encroachment is apt to be made on the milk intended for the calves. We entertain doubts of its economy in supporting draught horses and fattening cattle, seeing that a very large quantity must be required for those purposes. We should like to see a set of well conducted experiments undertaken in these respects by some intelligent farmers. Sago seems peculiarly well adapted to horses for fast work, and for sporting dogs, since it is found to leave the wind unaffected; and with regard to fowls, the whole class of them might be rendered by it, much more white in flesh and delicate for the table, than the food usually allowed them on farms.

Sago is most commonly used in a gelatinous state, and it is easily reduced to that state by boiling water. There is a proper method, however, of making it into a jelly, not by pouring water on it, but by sprinkling it amongst water. The method is simply this; To two imperial gallons of *boiling* water in any vessel, take $4\frac{1}{2}$ pounds of sago, and add it by degrees to the water; let one person sprinkle the sago, and another keep the mass constantly astir; add an ounce of salt, and let the jelly stand till cold, when it is fit for use, and any proportion can be taken of it for the purpose required. It has been found, however, that the jellied state is too soft food for horses on fast work; and the nearer, it seems, it can be administered in its ordinary state the better for them. For this purpose it is given in lumps made up with water, or given in the dry state; but, of course, water is offered for drink, as in the case of feeding on oats. As the horse is the most important animal, we shall take his treatment first into consideration, and, in shewing the effects of sago on his constitution when employed at fast work, we cannot do better than communicate to our readers, an account of some interesting experiments made on this subject by Mr Thomas Ritchie, veterinary surgeon in this city, with which he is kind enough to furnish us. These experiments certainly tend to inspire confidence in sago as a wholesome and hard food for horses urged to high speeds.

"Being of opinion," says Mr Ritchie, "that few or none of those whom I have frequently heard speaking of sago, for and against it, as a food for horses, had ever adopted a proper method of ascertaining the real value of the article, I purchased, about two months ago, a horse for the express purpose of experimenting on that species of food. He is eight years old, between fourteen and fifteen hands high, stoutly formed, of sound constitution, and chestnut colour. His pulse, when I got him, averaged thirty-five in a minute, during rest; and his respiration eight; and these have never varied much, except when the animal has been put to exertion. Previous to his coming into my possession, he had been kept on corn and hay, and was in good condition. He was several times trotted five miles within half an hour, at as uniform a pace as possible. His pulse, at the end of that distance, averaged sixty-seven, and his respirations forty-two; and there was slight perspiration about the breast, and the fore part of the thighs. The perspiration could not, of course, be numbered, weighed, or measured; but it was so very carefully attended to, that any difference afterwards might be easily ascertained.

"The pony was then put upon sago feeding, which consisted of jelly made of three pounds of sago, stirred into about two gallons of boiling water, and given in equal parts at morning, noon, and night. When he had been a few days on this feeding, with regular exercise, he was again trotted, and carefully attended to, as before. There was little difference on the pulse, or respiration; but the perspiration was sensibly more profuse; and the trials were repeated frequently with the same effects.

"I then, as I had from the first intended, gave him the sago in an almost dry state, having only moistened it with about four ounces of warm water to each pound of sago, that it might be the more easily masticated; and after a few days he was again subjected to trial-trotting, when he was found to have completely regained his former fine condition, and even to have improved upon it. He trotted with great spirit; the respiration was comparatively tranquil, and the perspiration scarcely sensible. I then gave him alternately moistened sago and sago jelly, for several successive days, and the effects were always the same as before; that is, the spirit and endurance *increasing* with the moistened sago, and *decreasing* with the jelly.

"In corroboration of this very important fact, which I think I have ascertained with great certainty, I now directed my attention to the circumstance, that the stomach of the horse does not seem to be intended *to retain* water at all. In evidence of this, I shall state a case, which I believe I gave to the Highland and Agricultural Society, in a prize essay, some time ago, and which is peculiarly applicable to the present subject. I was called to attend a horse, some years ago, which had an opening through the lower part of the belly, and into the small gut, within about twelve inches of the large gut, and more than twenty yards from the stomach, by the course of the intestinal canal. Whenever a pailful of water was given, the greater part of it could be received into the pail again from the hole in the belly, within a few minutes after it had been taken in by the mouth; thus shewing how quickly water passes to a great distance from the stomach to where it is lodged in the great intestines.*

"Besides this evidence of the quickness with which water passes through the stomach, may be mentioned the fact, that the healthy stomach of the horse is never found to contain any flow of water, when opened; the contents are moist, but that is all. Within ten minutes after a draught of water, it would be impossible to tell, by opening the stomach, whether or not the horse had recently taken water; the food there would be just as moist as without it. I have frequently made the experiment, and found no difference. All food, before it is swallowed, is sufficiently moistened by the fluid of the mouth. After that, it receives the natural fluids of the stomach, and these seem to be sufficient for all the purposes of digestion. It is evident that water, in the healthy state of the stomach, has merely a passage from the recipient to the expellent orifice, but no lodgment there; nor does it pass through the contents of the stomach, but past them. It seems, then, that the healthy stomach of the horse does not retain water in the sensible form, and that when it is compelled to retain it, in union with food, the effect is to debilitate the animal. In proof of this, let us consider green grass, which contains a large quantity of watery fluid, as is evinced by the great quantity of urine which the horse stales when using it, although he drinks but little. We find that it tends greatly to produce perspiration, and is not compatible with strength and endurance. But if the moisture be evaporated out of the grass, as when given in the form of hay, the animal can endure double the exertion, even though the original weight of it be

* By the way, I may tell veterinary practitioners, that an aperture of this kind, which they will readily know from any other, and which is produced by suppuration, in the case of umbilical hernia, may be shut up at once with perfect safety, first, by mechanical means, and then by adhesive inflammation, as there is no danger of fluid, or other matter, escaping from the bowel into the cavity of the abdomen; a fact with which I was not acquainted, till after the death of the horse, because I had never before heard of such a case. The bowel adheres to the skin, so as to prevent all danger that might be supposed to arise from the sudden shutting of the aperture.

fully made up by giving water by itself. Water passes quickly through the stomach, and does not remain there, either to dilute the gastric fluid, or otherwise interfere with the process of digestion or respiration. Every experienced man knows this, and the case is quite analogous to that of soft sago-jelly. But sago in a dry, or nearly in a dry state, is far from being soft. It is the hardest food I know of. I use the terms *hard* and *soft* as applied by stablemen. By hard food, I mean that food which tends to promote high condition, that is, muscular strength and endurance. Sago then, I affirm, to be the hardest food that we have, and, at its present price, it is cheaper than corn. I have only farther to add, that sago seems to be so very free from all tendency to fermentation, that it may be given in large quantities, when high condition is wanted. I have given it to nearly the entire exclusion of hay; and never could observe the slightest symptoms of flatulency or indigestion. It consists, too, almost entirely of nutritive matter, without any refuse, as shewn by chemical analysis; and is, therefore, peculiarly adapted to hunters and racers; and, by its use, a great addition may be made to their strength and powers of endurance, without danger of producing that over excitement of the system which frequently arises from an inordinate quantity of oats. I mean, however, that the sago should be added to an ordinary quantity of corn, perhaps two, three, or four pounds of sago a-day; but the experience of each particular case will speedily suggest the proper quantity to be used. I have tried this mode of feeding on my little horse, and find that he has acquired a very unusual degree of strength and spirit."

As a drink for a horse, after a severe run or burst in the field, sago-gruel, consisting of about a pound of jelly, completely dissolved in two or three gallons of warm water, is found to be superior to any other kind of drink.

For cows, as we conceive, the jelly should be given dissolved in water, in the shape of drink. We suppose that it has not yet been ascertained, whether sago is more conducive to the fattening or milking property; we conceive to the former. It is probable, that the flavour of milk will be improved by sago, imparting to it most probably a kernelly taste; though it is not correct to state that turnips *always* impart an unpleasant flavour to milk; as turnips, deprived of the rind, are quite inoffensive to milk, and particularly, if a small quantity of the solution of saltpetre is poured into the milk on being brought into the dairy.

Sago-jelly, mixed with new milk, in the proportion which inseed porridge, or *lythax*, as it is termed in Berwickshire, is used, must form an excellent food for calves. The astringency of the fecula being more favourable to the healthy action of the bowels than the lythax.

For dogs it is said to constitute a desirable food. Oatmeal, of itself, is a costive and heating food for dogs; and when dogs are in either state, their nose is liable to be in fault. The quantity and method of administering sago to dogs is found to be this:—Take half a pound boiled to a jelly, and pour it over biscuit, bread, or potatoes, previously soaked, in milk so much the better, to form a broth or jelly to these substances. This quantity is enough for one greyhound, and upon it he stands his work better than when fed on meat, and he will have neither mange, humours, nor smell. All dogs, whether in kennel or at large, should have, at will, an ample supply of pure water.

To pigs sago should be administered in the shape of drink, from two to three pounds being given to each pig once a-day; and the jelly given to fowls should be in warm balls, mixed up with barleymeal.

Sago is a grateful food to the human stomach. It is of easy digestion, as evinced by the remarkable experiments of Dr Beaumont on Alexis Martin, a French Canadian, the operations of whose stomach was permanently laid open to view through an orifice occasioned by a gunshot wound.

Sago is the starch obtained from the spongy medullary matter contained in the young shoots of several species of palm, which flourish to greatest perfection in some of the spice islands of the Indian Archipelago, rapidly attaining a height of 30 feet, and 18 to 22 inches in diameter.

"The palm is cut into pieces of five or six feet in length, the woody part is cut off on one side, exposing the pith lying, as it were, in the bottom of a canoe. Cold water is poured in, and the pith well stirred, by which means the starch is separated from the fibrous part, and passes through with the water, when the whole is thrown on a searce. The sago, thus separated, is allowed to settle, the water is poured off, and when it is half dry, it is granulated, by being forced through a kind of funnel. It is *said* to acquire its grey colour, while *dried in an artificial heat*."* "Within these few years, however, a process has been invented by the Chinese for refining sago, so as to give it a fine pearly lustre; and

* Thomson's Chemistry, vol. iv. p. 708.

the sago so cured, is in the highest estimation in all the European markets. * * * It is sent from the island where it is grown to Singapore, where it is granulated and bleached by the Chinese. The export trade to Europe and India is now principally confined to that settlement." *

In subjecting pellets of sago to microscopic observations, after having been immersed in water for some hours, M. Raspail arrived at the conclusion, from the phenomena developed, that they must have been subjected to heat in the preparation. The grains of fecula are burst by the water, and their surface much torn.

"Under this superficial layer," adds M. Raspail, "the grains that have not been burnt, exhibit either within them, or on a point of their surface, a granulation or excrescence, which is remarked on all the varieties of fecula, when they have been submitted for an instant to the *action of heat, after being moistened in water*. In the centre of the pellets, on the other hand, the grains are all entire and unaltered. * * * By treating the fecula of the potato in the same way, we may obtain sago so much resembling that which is imported, that I am led to believe that much of the sago of commerce is mostly of this kind. The adulteration of drugs is so frequent, that I cannot suppose that one so easy as this would be neglected."†

The consumption of sago increased from 1339 cwt. in 1822, to 3859 cwt. in 1832. The price of common sago varies in bond from 12s. to L.1; while pearl sago fetches from 15s. to 35s. a cwt.; the price being liable to much fluctuation.‡ The price which Mr Baildon, the chemist of this city, at present asks for sago, suited to the feeding of stock, in quantities not less than one cwt., is 22s. per. cwt.

Pearl sago has lately been used as an ingredient in household bread, in the proportion of one of sago to three of wheaten flour. The bread is palatable, wholesome, and keepable, but not more so than good wheaten bread. The reduction of price it effects is only a halfpenny per pound. At the present time, during the high price of wheat, sago bread may find customers; but whenever the price of wheat again falls, which will most likely be the case after harvest, it will no more be thought of. Soda bread had a name for a time, and so will sago; because "novelty is pleasing."

* MacCulloch's Commercial Dict. † Organic Chemistry, p. 118.
‡ MacCulloch's Commercial Dict.

MISCELLANEOUS NOTICES.

I. *A Landlord.*—We cannot resist inserting the following speech of the Duke of Buckingham, delivered at a tenantry dinner at Stowe, his Grace's residence, as containing sentiments which do honour to the landlord. "Gentlemen, and, I may add, my very kind and much respected friends and tenantry, let me hasten to thank you for your enthusiastic reception of this toast, and my old friend and tenant, Bennett, for giving it. I take the earliest opportunity afforded me, of marking the respect I entertain for my tenants by meeting them, and of expressing the pleasure and gratification I experience in seeing so many present. It is the first audit since I became your landlord, and I am therefore happy in being able to attend it, and of thanking you for your kindness towards me, and him who preceded me. It was his pride (whose loss I must ever deplore) to witness the prosperity of his tenantry, as it must be mine, and as, I hope, it is the case also of every country gentleman who delights in the welfare of those renting under him, and who wishes to see his country prosper and flourish. It is my delight, and it is my intention, to meet you often,—always to be accessible to your application,—and ready to listen with attention to your statements, wishes, and opinions. I now appear before you as your landlord. For many long and happy years we have been well acquainted with each other; and I trust to Providence to allow us many more of mutual confidence and esteem. To you I owe it to express the debt of gratitude due from me to the farmers of this county; and to express also, not only in my name, but in that of my family, our acknowledgments for the kind, friendly, and liberal conduct of the tenantry to this house. He who has preceded me, and whose loss I so greatly lament, and the recollection of whom so constantly fills my mind, esteemed it a source of pride to know of the comfort of his tenantry; and in his last hours, his thoughts were directed to them and his labourers, and his parting directions to me were, to watch over and protect their interests. This instruction on his part, combined with the dictates of my own feelings, have induced me to seek this opportunity of meeting you and telling you that the honest and upright tenant will find in me a kind, anxious, and friendly landlord. For many years I have experienced the greatest attention on all occasions from you and the farmers; and I have taken a warm interest in your comforts, and the farms you occupy. The possessions which I hold are extensive and important, and I am anxious that my tenantry, who have laid out their capital on their farms, shall have every encouragement and assistance they deserve. In some instances farmers may hesitate to lay out their money in improvements in draining, fearing that a rise in rent might follow such a course on their part; but that is not my intention; and as I have often expressed myself, so I repeat, that "Live and let live" ought to be the motto of farmer and landlord; and the more the tenant improves his land, the more he must benefit himself, and the happier I shall be to see it. I depend on your labour for my subsistence, and my residence here. You will meet with every liberal feeling from me—every assistance I will give you; and you may be assured that it is not my intention to make any alteration in your holdings—certainly not to alter your rents, considering that you hold your farms on easy terms, and wishing to see you reap every benefit which times and seasons may give you, leaving it to you, to your honour, and your friendship, to assist me should I ever require it at your hands; and I feel that you would do it with the same pleasure that my predecessor and myself assisted you when in distress. With this intention, I consider my tenantry are bound to cultivate their lands in the most farming-like way; and, with *few exceptions*, I acknowledge they are so cultivated. I shall certainly make a difference between the tenant who uses his land fairly, and him who merely occupies it for his own benefit alone, working out the very heart of it, and then, when he finds it no longer profitable, throws it back on his landlord. I have but very few allusions to make of such conduct, or of over-cropping. I have an eye to a neat farm and a good farmer; and my health and activity enable me to see much more of my property than most people. It affords me the highest satisfaction to know that the arrears are very trifling; and my steward has directions to remit those; and I thank you most heartily for your punctuality and liberality. I rely on your honour and character as English farmers—I rely on you as neighbours and friends; and the confidence we repose mutually in each other, will, I know, never be abused. As regards leases, it was the rule of the late Duke, and one which I shall pursue, not to grant them; it will be the tenant's fault if he quits my farm, for if he treats me properly, and uses his farm as he ought to do, his holding is as good as a lease of twenty-one years. Let me recommend draining, and that under-draining; much of your land requires it, and I prefer the system of under-draining to that which I know is done on some farms, I allude to superficial draining, by merely opening furrows; such a system will do no good permanently. As to the repairs of your farms, directions have been given to put your buildings, when they require it, into a proper state; and I hope every tenant will have that accommodation which he ought to have for his comfort and convenience. I have seen with much satisfaction the alterations and repairs on my estate at Aston Clinton, where my agent Mr Bull, whom I have the pleasure of seeing here, has done everything in a most satisfactory way, and I thank him for his attention to my wishes, and to the property as well. Gentlemen, my time and property are yours: here in this county I shall reside, spending my means amongst you; I cannot leave my old friends at Wotton, where for so many years I have resided with delight and happiness; but the distance between it and this is not great, and upon these two properties you will find me a resident landlord. Let me repeat that your farms are yours, so long as you like to hold them, it is your fault if you leave them; on your own care, conduct, and management, depend your comfort and prosperity, but if I find my farm improperly treated, or myself deceived, then the occupier of that farm must not be surprised in finding another tenant proposed to him, for confidence must be mutual, and good intentions towards each other reciprocal. You now hold possession, with half a year's rent in hand; I make no alteration in this to the present holders, and you continue your holdings as you did under him who has been taken away fom me—whose name will ever live in my fondest, and most grateful, and affectionate remembrance. Gentlemen, I will detain you no longer, I live in the hope of being of use to you and my county—I heartily wish you all every happiness in this world, and I now drink with a full glass and a full heart (assuring you of my regard and attachment) to your healths, and long may you live to enjoy and increase your prosperty, as my kind, friendly, happy, and independent tenantry."

II. *Railways.*—It is impossible to observe the changes produced by the opening of the railways connected with London without feelings of considerable apprehension. The streets of the metropolis are already deprived of a considerable portion of their traffic. The coach-offices, instead of displaying the busy activity by which they used to be distinguished, are now nearly deserted. An omnibus to a railway station supplies the place of the gallant teams of high-bred horses which formerly were seen issuing forth at all hours of the day and night, with well-appointed coaches, to all parts of the empire. Our advertising columns daily exhibit the announcements of the sales of horses, in consequence of the opening of different lines of railway. In the country, the alterations visible in every direction are even more alarming. The high-roads are forsaken by nearly all the conveyances which have for years diffused wealth and convenience throughout the districts in which they worked. The inns are deprived of their wonted custom, and are either shut or about to be so. The post-horses are sold, or their numbers greatly reduced, and the various towns and villages not immediately contiguous to a railway station, are either left without means of access or communication, or the circuitous route now forced upon them occasions great delay and inconvenience.

It would be useless now to enter into a discussion on the propriety of creating the monopoly which the directors of the different railroads have contrived to acquire. Time alone can shew whether it will operate beneficially for the public or not. We entertain no hostile feeling to the establishment of railways, but we contend, that however useful they may be as a means of communication between two distant points, or along a particular line, they cannot, from their peculiar construction, and from the rules by which they must be governed, afford that varied accommodation which the general necessities of an extensive population require.

To promote, therefore, the continuance of coaches and post-horses on the main roads, it is necessary to relieve that mode of travelling from the taxation which has so long pressed heavily upon it. The revenue derived from post-horses has for some time past been considerably diminished by the conveyance of passengers in steam-boats, and the mileage duties on coaches must now sustain a reduction still more extensive, by the general adoption of railway travelling. In fairness, both these duties ought to be wholly repealed, as the act under which they are at present levied confers on the conveyance of passengers by railway an undue preference. The stage-coaches and mails are charged with a duty of a penny per mile for every four passengers that they are licensed to carry. The duty must be paid, although the coach performs the whole journey without a passenger. The railway carriages are liable to a duty of only a halfpenny per mile for every four passengers actually conveyed in them. Thus the stage-coach, whether full or empty, is chargeable with a duty double in amount to that which is paid on the passengers conveyed in a railway carriage. As regards post-horses, the loss to the revenue is still greater. Assessing the duty as above on four passengers, it appears that for every carriage forwarded by railway that would have been conveyed by a pair of horses, the loss is 2¼d. per mile; and for those that would have travelled with four horses, the loss is 5¼d. per mile.

Under a taxation so unequal, it is scarcely possible that either coaches or post-horses can be maintained on the different roads, now that the bulk of traffic has been absorbed by the railways; yet without their agency the communication through the country cannot be preserved.

There is this farther and still more important point to be considered. There is no apparent mode of protecting the public from the insults and inconveniences they are daily experiencing from the railroad monopolists —especially the persons employed on the Birmingham railway—but keeping coaches and post-horses on the road. This would be effected by the abolition of the post-horse and mileage duties; and we hope to see those duties removed immediately by the Parliament.—*Times.*

QUARTERLY AGRICULTURAL REPORT.

May 1839.

A press of matter last quarter, at the winding up of a volume, deprived us of the space usually allotted to the quarterly report, and another press of matter, at the commencement of another volume, threatens to place us again in the same predicament. To avoid the dilemma, we have been under the necessity of postponing several articles of value, from our kind correspondents, until the next opportunity. Whilst alluding to correspondents, we may announce generally, that communications, particularly of any length, sent within the month of the period of publication, have little chance of appearing in the ensuing Number.

The last was an open winter, with occasional falls of snow, and days of severe frost, but no storm of any endurance. It may be characterized as a windy winter, some of the severest gales blowing from the SW., and occasioning much damage amongst shipping, and loss of life at sea. The spring has been cold, with prevailing east winds, which were peculiarly severe to the feelings, much more so than could be anticipated from the indications of the thermometer. The air was never free of frost, and the hoar-frost at times was very heavy, but still dry. April has been very cold, and May, as yet, assumes the garb of vegetation with due caution.

Though the land was occasionally well drenched in winter, field-work went on without any lengthened interruption; and during the spring, it has been so dry and mellow, that the seed has not received a more auspicious bed for many a year. This remark is applicable to all seed, from that of the spring wheat in January, to the turnip seed at the present moment. In whatever state the land may be placed, a dry seed-time is the first and grandest desideratum, in the earlier portion of the year. In this respect, the year contrasts favourably with the last.

The young wheat, though not far advanced, looks well, and a considerable increased breadth of it has been sown this year. The braird of all the spring sowings, especially on good land, look remarkably healthy and strong. In passing, we may remark on this subject, that unripened seed, such as that from last year's crop, may excite no alarm for a healthy braird in a dry seed-bed. Indeed, plump potato-oats are very apt to burst in a wet season before vegetating. The young and old grass are both late, but the turnip bearing more eating than the appearance indicated in the early part of winter, stock has not suffered so much from want as was at one time apprehended. Hay has fetched a high price all spring. Those who bought it largely and early last summer may now realize about 100 per cent. for it. Potatoes having paid well this year, an unusual breadth has been planted this spring, so that we may look for cheap potatoes next winter.

Fat stock of all kinds are not plentiful, and fetch high prices. Butcher-meat has not attained the present prices for many years. Lean stock, also, are in much demand, and prices advancing, notwithstanding the lateness of the pastures. Grass parks, in consequence, have risen in rent fully 10 per cent. The lambing season has been very successful, both in hill and dale. The hill lambing having been a week later than last year, has passed over with fewer losses than for four years past. Early lambing is attended with great risk on hill farms, unless there is a certainty of plenty of spring keep, which can only be the case in a very few localities among the mountains. Much rather secure a numerical strength of strong lambs, and rapid growth in later weather, than attempt to force forward an early crop, under unfavourable circumstances. Earliness is a desirable object to attain where there is plenty of food and shelter; but where these are awanting, or are insufficient, early lambs will perish by thousands, and incur immense loss.

This is the first season that has fairly tried the working of the corn law. By its restrictive clauses falling into abeyance on the advance of price, a large quantity of foreign corn has been brought from European ports, particularly from those of the Baltic and the Black Sea. Notwithstanding that Belgium, the northern ports of France, Naples and Sicily, and the Papal States, prohibited the exportation of wheat to this country, at the time of its necessity, about 4,000,000 quarters of wheat will have been entered for home consumption, and paid the low duties, before the realization of the next crop. The prices of wheat gradually fell from 81/6 on the 11th January to 70/1 on the 26th April, after which there has been a slight fluctuation, but the duty remains at 10/8; though the backwardness of vegetation in England give rise to the belief that the duty will yet recede 4/. From 7th December 1838 to 15th March 1839, the duty continued stationary at the nominal value of 1/.

We conceive there is yet a good deal of wheat in the farmers' hands. This may be accounted for, notwithstanding the temptation of high prices held out so long, from two circumstances. One is, during the great and constant importation and expectation of the arrival of foreign wheat, which was certain would be of better quality than the home grown, our farmers could not enter into competition. The other circumstance is, that farmers seldom wish to thrash out wheat until after March, when it only becomes fully won, hardened, and equalized in appearance in the stack, by the piercing wind of March; and this year, especially, the wheat being very soft when stacked, and of suspicious quality in general estimation, there was no inducement to make, through it, a premature exposure of the nakedness of the land in the open markets. Notwithstanding these well grounded apprehensions of its quality, there is much better wheat shewn every week in the Edinburgh market, than we ever expected to see of last year's crop. Taking all these circumstances together, we think there is no great chance of the prices of wheat rising much above their present range. The wheat market, as we conceive, will essentially and entirely be for the remainder of the season, a "*weather market,*" rising and falling with sunshine and cloud. As to the prospect of future prices, we may state, that we have heard of a farmer in Lincolnshire who has agreed to take 60/ a-quarter for all his wheat of the ensuing crop.

The fiars must this year necessarily be struck at a high figure, much to the advantage of the clergy, and as much to the disadvantage of corn-paying renters, a bad crop with high prices enhancing rent in a prodigious ratio. The difference in the price of oatmeal, which constitutes the staple stipend of the clergy of this country, in the county of Edinburgh, betwixt this and last year's fiars, is 5/ per boll of 112 lb.; and the county which shews the greatest disparity of price is Ayrshire, being 7/;—the average of the whole counties being about 6/ per boll. It is worth while pointing out an anomaly in the fiars of Lanarkshire, as given in the annexed table. It may there be seen, that the value of the second quality of barley is 2/4 per quarter higher than that of the first quality, and this anomalous circumstance is accounted for in this way. One witness deponed to having paid a price per quarter for barley of *second* quality, *above* that deponed by others to have been paid for *first* quality; and this result probably arose from the purchases having been made at different periods of the season. The quantity of the first-rate barley was, besides, small, whereas that of the second quality was great, which circumstance has always a considerable influence on the *average* price.

TABLES OF PRICES, &c.

...e Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
77 10	44 5	27 7	49 10	42 4	40 3
75 1	43 1	27 3	50 6	38 10	38 9
73 0	40 7	25 11	49 6	39 4	37 1
71 3	40 8	25 1	48 7	39 9	37 6
73 3	39 2	25 0	47 2	38 6	36 10
74 10	42 3	24 7	44 6	38 2	36 5
76 0	41 4	24 7	43 4	37 4	35 0
72 5	39 8	24 3	42 6	37 6	35 11
70 0	40 3	23 4	41 5	38 8	35 4
69 8	39 5	25 0	40 8	37 5	34 5
68 2	39 8	24 10	40 2	36 6	35 6
73 8	41 10	25 1	39 8	37 4	35 6
74 2	40 9	25 4	38 10	37 9	36 2

DUBLIN.

Date.	Wheat per Bar. 20 St.	Barley per Bar. 16 St.	Bear per Bar. 17 St.	Oats per Bar. 14 St.	Flour per Bar 9 St.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 1.	40 0	24 0	19 6	14 6	23 6
8.	38 5	24 4	19 10	14 4	24 8½
15.	38 7	22 5	18 8	15 5	23 10½
22.	42 0	23 0	18 11	15 10	23 7½
Mar. 1.	39 6	23 9	19 2	15 8	23 2
8.	37 9	23 0	19 1	15 6	23 9
15.	39 3	23 5	18 4	15 8	23 11
22.	39 8	23 8	18 6	15 10	23 7½
29.	40 10	24 0	18 10	15 8	22 5½
April 5.	39 1	23 2	18 4	15 3	22 6½
12.	40 0	23 6	18 8	15 6	22 8½
19.	40 2	23 2	18 2	15 8	22 4
26.	41 4	24 0	19 4	15 6	21 8½

LIVERPOOL.

	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1.	72 0	39 10	27 5	48 10	44 6	47 3
8.	65 8	40 0	27 3	48 6	46 7	54 6
15.	65 10	39 2	25 10	48 9	44 2	42 0
22.	66 2	40 2	25 1	46 7	45 5	44 10
1.	67 5	40 10	26 2	45 10	44 6	45 0
8.	64 10	37 6	24 7	45 4	42 8	41 9
15.	66 0	36 11	26 2	42 6	41 4	42 0
22.	60 10	38 2	25 5	41 4	42 6	42 4
29.	61 5	40 0	24 9	40 5	40 4	40 6
5.	64 4	40 3	23 9	39 6	39 2	42 6
12.	61 6	40 2	25 2	38 4	38 7	39 10
19.	65 6	40 0	25 10	39 9	40 2	41 0
26.	63 0	42 5	25 8	40 6	41 6	43 3

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 6.	69 8	40 7	29 10	42 0	42 9
13.	67 10	38 0	29 4	42 4	42 8
20.	67 4	38 2	29 6	42 6	43 0
27.	69 4	40 9	30 8	42 0	42 6
Mar. 6.	69 6	41 2	31 8	44 0	44 6
13.	67 4	39 0	30 9	44 0	44 4
20.	67 10	38 0	31 6	44 6	44 10
27.	67 8	38 2	30 6	43 0	43 8
April 3.	67 4	38 10	30 9	43 0	43 2
10.	71 1	39 2	32 1	42 6	43 0
17.	71 5	40 6	33 2	42 4	42 9
24.	70 0	39 6	32 2	41 4	42 0
May 1.	68 2	38 3	31 4	41 6	42 3

...E shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th ...o. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN ...ORN; the Duties payable thereon, from February to May 1839.

Wheat.			Barley.			Oats.			Rye.			Pease.			Beans.		
Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d	s. d.	s. d.	s. d.	s. d.	s. d.
77 0	79 7	1 0	41 2	40 4	1 10	26 3	26 7	7 9	48 11	51 2	1 0	42 2	42 11	6 6	40 8	41 6	8 0
74 1	78 11	1 0	40 4	40 10	1 10	25 8	26 6	7 9	48 5	50 6	1 0	41 0	42 6	6 6	39 9	41 4	8 0
71 6	77 5	1 0	38 6	40 10	1 10	25 2	26 3	7 9	44 6	49 3	1 0	39 7	41 9	8 0	38 8	40 9	9 6
71 10	75 10	1 0	37 10	40 5	1 10	24 5	25 10	9 3	41 10	47 7	1 0	39 2	41 2	8 0	38 7	40 3	9 6
72 10	74 5	1 0	37 8	39 8	3 4	24 7	25 6	9 3	42 3	45 10	2 0	39 1	40 6	9 6	38 0	39 7	11 0
73 8	73 6	1 0	38 9	39 1	3 4	24 3	25 1	9 3	41 2	44 6	3 6	39 2	40 9	9 6	37 10	39 11	11 0
74 1	73 0	1 0	39 3	38 9	4 10	24 4	24 9	10 9	42 6	43 5	5 0	38 10	39 6	11 0	37 4	38 4	12 6
71 3	72 6	2 8	38 1	38 4	4 10	24 2	24 6	10 9	37 9	41 8	8 0	37 11	38 11	12 6	37 2	37 11	14 0
68 11	72 1	2 8	37 8	38 2	4 10	23 8	24 3	10 9	39 10	40 11	9 6	37 7	38 7	12 6	36 9	37 7	14 0
68 8	71 7	6 8	37 9	38 2	4 10	24 4	24 3	10 9	40 7	40 8	9 6	36 8	38 2	12 6	36 6	37 3	14 0
68 3	70 10	10 8	38 3	38 3	4 10	24 6	24 3	10 9	40 6	40 0	9 6	37 7	37 11	14 0	37 2	37 1	14 0
71 0	70 4	10 8	39 2	38 4	4 10	24 10	24 4	10 9	39 7	40 2	9 6	38 1	37 9	14 0	37 11	37 1	14 0
72 7	70 1	10 8	40 1	38 6	4 10	25 2	24 5	10 9	39 7	39 8	11 0	38 9	37 9	14 0	38 9	37 4	14 0

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantit upon which duties have been paid for home-consumption, during the same Month; and the Qua tities remaining in Warehouse at the close thereof, from 5th February to 5th May 1839.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOUS From Foreign Countries.	REMAINING IN WAREHOUS From British Possessions.	REMAINING IN WAREHOUS Tot
Feb. 5. 1839.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu	Qrs.
Wheat, . .	147,937 3	2 0	147,939 3	150,010 1	2 0	150,012 1	9,318 0	173 4	9,491
Barley, . .	505 0	. .	505 0	8 2	. .	8 2	11,787 2	. .	11,78
Oats, . . .	181 3	. .	181 3	305 0	. .	305 0	240,514 6	. .	240,51
Rye, ...	6,658 6	. .	6,658 6	12,110 7	. .	12,110 7	6 5	. .	6
Pease, . . .	8,997 4	. .	8,997 4	40,068 6	. .	40,068 6	4,190 5	. .	4,19
Beans, . .	626 6	. .	626 6	404 5	. .	404 5	18,680 4	. .	13,6
Totals,	164,906 6	2 0	164,908 6	202,907 5	2 0	202,909 5	279,447 6	173 4	279,6
March 5.									
Wheat, . .	210,419 2	. .	210,419 2	211,637 4	. .	211,637 4	12,696 4	173 4	12,87
Barley, . .	10,808 1	. .	10,808 1	20,032 4	. .	20,032 4	2,661 1	. .	2,66
Oats, . . .	15,711 1	. .	15,711 1	31,365 2	. .	31,365 2	222,495 2	. .	222,49
Rye, ...	8,165 4	. .	8,165 4	8,276 0	. .	8,276 0	6 1	. .	6
Pease, . . .	3,650 6	. .	3,550 6	4,436 5	. .	4,436 5	3,524 0	0 7	3,52
Beans, . . .	2,899 7	. .	2,899 7	12,848 6	. .	12,848 6	2,581 5	. .	2,581
Totals,	231,554 5	. .	231,554 5	288,596 5	. .	288,596 5	243,964 5	174 3	244,13
April 5.									
Wheat, . .	450,854 1	. .	450,854 1	466,399 1	. .	466,399 1	4,660 2	173 5	4,83
Barley, . .	28,665 5	. .	28,665 5	31,011 3	. .	31,011 3	490 7	. .	490
Oats, . . .	23,379 4	. .	23,379 4	4,254 4	. .	4,254 4	238,211 7	. .	238,211
Rye, ...	12,107 0	. .	12,107 0	12,107 0	. .	12,107 0	6 1	. .	6
Pease, . . .	6,166 0	. .	6,166 0	5,647 3	. .	5,647 3	4,103 4	0 7	4,104
Beans, . .	7,944 2	. .	7,944 2	3,925 0	. .	3,925 0	8,504 7	. .	8,504
Totals,	529,116 4	. .	529,116 4	523,344 3	. .	523,344 3	256,067 4	174 4	256,242
Feb. 5.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. q
Flour, . . .	56,263 1 2	329 2 18	56,592 3 20	63,084 2 12	329 2 18	63,414 1 2	25,172 0 0	4,599 1 0	29,771
Oatmeal, .	60 0 12	. .	60 0 12	66 0 5	. .	66 0 5	275 0 13	. .	275
Totals,	56,323 1 14	329 2 18	56,653 0 4	63,150 2 17	329 2 18	63,480 1 7	25,447 0 13	4,599 1 0	30,046
March. 5.									
Flour, . . .	80,826 3 18	1,200 0 0	82,028 3 18	78,357 0 1	1,200 0 0	79,557 0 1	27,345 3 15	4,594 3 17	31,940
Oatmeal, .	. .	. .	. .	. .	. .	. .	274 0 26	. .	274
Totals,	80,826 3 18	1,200 0 0	82,028 3 18	78,357 0 1	1,200 0 0	79,557 0 1	27,620 0 13	4,594 3 17	32,215
April 5.									
Flour, . . .	164,780 1 25	1,588 0 13	166,368 2 10	178,486 2 9	1,588 0 18	180,074 2 22	9,605 2 26	4,646 3 9	14,252
Oatmeal, .	1 2 3	. .	1 2 3	1 2 3	. .	1 2 3	274 0 26	. .	274
Totals,	164,782 0 0	1,588 0 13	166,370 0 13	178,488 0 12	1,588 0 18	180,076 0 25	9,879 3 24	4,646 3 9	14,526

PRICES of BUTCHER-MEAT.

Date.	SMITHFIELD, *Per Stone of* 14 lb. Beef.	SMITHFIELD, *Per Stone of* 14 lb. Mutton.	MORPETH, *Per Stone of* 14 lb. Beef.	MORPETH, *Per Stone of* 14 lb. Mutton.	EDINBURGH, *Per Stone of* 14 lb. Beef.	EDINBURGH, *Per Stone of* 14 lb. Mutton.	GLASGOW, *Per Stone of* 14 lb. Beef.	GLASGOW, *Per Stone of* 14 lb. Mutton.
1839.								
Feb.	6/9 to 8/	7/ to 8/	6/9 to 7/9	6/6 to 7/6	6/6 to 7/6	6/6 to 7/6	6/9 to 7/6	6/6 to 7/6
Mar.	7/3 8/3	7/6 8/3	7/ 7/9	6/9 7/9	6/9 7/6	6/9 7/9	6/9 7/9	6/9 7/9
April	7/6 8/6	7/6 8/6	7/3 8/	7/6 8/6	7/ 7/9	7/ 8/	7/3 8/	7/3 8/

PRICES of English and Scotch WOOL.

English, per 14 lb.

Merino, ...	25/	to 27/
In Grease, ...	26/6	30/6
South Down, ...	23/6	25/6
Leicester, Hogg, ...	18/	21/
Ewe and Hogg, . . .	15/6	16/6
Locks, ...	10/	12/
Moor .	7/6	11

Scotch, per 14 lb.

Leicester, Hogg, . .	16/	to 19/6
Ewe and Wether, . . .	14/6	16/
Ewe, ...	12/	14/6
Cheviot, white, ...	20/6	24/6
Laid, washed, . . .	12/6	16/6
Unwashed, . . .	9/6	12/
Moor, white, ...	6/6	8/6
Laid, washed, . . .	5/	7/6
Unwashed, .. .	4/6	6/

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of April 1838, and 5th of April 1839,—shewing the Increase and Decrease on each head thereof.

	Quarters ended April 5.		Increase.	Decrease.	Years ended April 5.		Increase.	Decrease.
	1838.	1839.			1838.	1839.		
	£	£	£	£	£	£	£	£
Customs, ...	4,061,670	4,411,569	349,899	. .	18,451,449	19,504,628	1,053,179	. .
Excise, ...	1,705,853	1,841,511	135,658	. .	11,665,748	11,999,772	334,024	. .
Stamps, ...	1,648,194	1,640,253	. .	7,941	6,461,885	6,604,986	143,101	. .
Post-Office, . .	369,000	392,000	23,000	. .	1,519,743	1,548,000	28,257	. .
Taxes, ...	130,576	176,440	45,864	. .	3,627,105	3,700,682	73,577	. .
Miscellaneous,	90,841	75,545	. .	15,296	99,443	235,408	135,965	. .
	8,006,184	8,537,318	554,421	23,237	41,825,378	43,593,476		. .
	Deduct Decrease,		23,237		Increase on Year,		1,768,103	
	Increase on the Qr.		531,184					

FIAR PRICES *of the different* COUNTIES *of* SCOTLAND, *for Crop and Year* 1838, *by the Imperial Measure.*

ABERDEENSHIRE.

	Imp. Qr
Wheat, no evidence.	
Barley, with fodder, . .	33/
——— without fodder, .	39/6
Bear, with fodder, . . .	31/
——— without fodder, . .	37/6
Oats, First, with fodder, .	25/3
——— without fodder,	33/6
——— Second, with fodder,	24/3
——— without fod.	32/6
Meal, 140 lb.	21/6

ARGYLE.

Bear, ...	32/8
Oats, without fodder, . .	24/
Beans, ...	40/
Oatmeal, 140 lb.	21/1

AYR.

Wheat, ...	59/1½
Barley, ...	33/4½
Bear, ...	29/6½
Oats, ...	20/11
Pease and Beans, ...	44/1½
Oatmeal, 140 lb.	20/3

BANFF.

Wheat, ...	67/5
Barley, with fodder, . .	40/3
——— without fodder, .	35/3
Bear, First, with fodder, .	37/6
——— without fodder,	32/6
——— Second, with fodder,	32/5
——— without fod.	27/5
Oats, Potato, with fodder,	31/3
——— without fod.	24/9
——— Common, with fod.	31/1
——— without do.	24/7
Pease and Beans, no evidence.	
Rye, ...	
Oatmeal, 140 lb.	21/8

BERWICKSHIRE.

	Imp. Qr.
Wheat, ...	69/4½
Barley, Merse, ...	34/10½
——— Lammermuir, . .	31/5½
Bear.	
Oats, Merse, ...	27/11
——— Lammermuir, . .	25/9½
Pease, ...	48/11¼
Oatmeal, per 140 lb. . . .	21/8

BUTE.

Wheat, ...	55/7½
Barley, ...	33/11½
Bear, ...	31/
Oats, ...	23/4½
Pease, ...	37/
Beans, ...	37
Oatmeal, 140 lb.	19/8½

CAITHNESS.

Bear, ...	30/2
Oats, Early Angus, . . .	23/9
——— Potato, ...	22/3
——— Hopeton, ...	21/3
——— Dun, ...	18/
——— Black, ...	12/
Oatmeal, per 140 lb. . . .	21/3

CLACKMANNAN.

Wheat, ...	63/7½
Barley, Kerse, ...	39/0½
——— Dryfield, ...	37/1½
——— Muirland, ...	
Oats, Kerse, ...	30/4½
——— Dryfield, ...	27/3½
——— Black, ...	
Pease and Beans, ...	44/1½
Malt, ...	60/10½
Oatmeal, 140 lb.	22/10½

DUMBARTONSHIRE.

	Imp. Qr.
Wheat, ...	68/11
Barley, ...	38/
Bear, ...	31/10
Oats, ...	25/11
Pease and Beans, ...	48/4
Oatmeal, 140 lb.	20/9

DUMFRIES.

Wheat, ...	61/6
Barley, ...	32/2
Bear, ...	32/2
Barley, Malt, ...	67/
Oats, White, ...	24/10
——— Potato, ...	26/10
Pease, Grey, ...	36/
Rye, ...	48/3
Beans, ...	41/
Oatmeal, per 140 lb. . . .	21/0½

EDINBURGH.

Wheat, First, ...	63/
——— Second, ...	60/
Barley, First, ...	36/6
——— Second, ...	33/
——— Third, ...	30/
Oats, First, ...	28/
——— Second, ...	24/
Pease and Beans, ...	36/8
Oatmeal, 112 lb.	18/

ELGIN & MORAY.

Wheat, ...	66/1
Barley, ...	35/7
Oats, ...	27/9
Pease, ...	42/8
Rye, ...	40/
Oatmeal, 112 lb.	18/

FIFESHIRE.

	Imp. Qr.
Wheat, White,	64/8
——— Red,	62/8
Barley,	33/10¾
Bear,	31/10¾
Oats,	26/4½
Pease and Beans,	41/1¾
Rye,	36/6½
Malt,	57/6¾
Oatmeal, 280 lb.	44/0½

FORFAR.

Wheat,	70/10
Barley,	35/3
Bear,	33/10
Oats, Potato,	27/4
—— Common,	25/9
Pease and Beans,	38/6
Rye,	36/6
Oatmeal, 140 lb.	22/

HADDINGTON.

Wheat, First,	78/4½
——— Second,	73/1¾
——— Third,	65/10¾
Barley, First,	43/3¼
——— Second,	40/0¾
——— Third,	36/10
Oats, First,	33/0½
—— Second,	30/4
—— Third,	26/8¾

INVERNESS.

Wheat, without fodder,	64/8
——— with fodder,	
Barley, without fodder,	36/8
——— with fodder,	
Bear, without fodder,	30/
—— with fodder,	
Oats, Pot. & Hop. without fodder,	26/5
——— with fodder,	
—— Common, without fod.	25/9
——— with fod.	
Oatmeal, 112 lb.	18/

KINCARDINE.

Wheat, without fodder,	70/
——— with fodder,	80/
Barley, without fodder,	32/10
——— with fodder,	39/10
Bear, without fodder,	30/10
—— with fodder,	37/10
Oats, White, without fod.	26/1
——— with fodder,	34/7
—— Potato, without fod.	29/0
——— with fodder,	37/6
Pease, without fodder,	38/
—— with fodder,	50/
Beans, without fodder,	38/
—— with fodder,	50/
Oatmeal, 140 lb.	22/1

KINROSS.

Wheat,	60/
Barley, First,	35/4½
—— Second,	30/4½
Bear,	
Oats, White, First,	26/8
——— Second,	20/8
—— Black,	
Pease and Beans,	
Oatmeal, per 140 lb.	21/4½

KIRKCUDBRIGHT.

	Imp. Qr.
Wheat,	66/
Barley,	38/4
Bear,	28/
Oats, Pot. and Hop.	25/2
——— Common,	22/6
Beans,	44/
Oatmeal, per 140 lb.	19/2

LANARK.

Wheat, First,	59/8
——— Second,	49/5½
——— Third,	36/1½
Barley, First,	35/
——— Second,	37/4
Bear, First,	31/5¾
——— Second,	24/2½
Oats, First,	24/0¼
——— Second,	20/7½
——— Third,	19/3¾
Pease,	51/4
Beans,	45/2
Malt,	46/
Oatmeal, First, 140 lb.	20/11
——— Second,	19/5¼

ARCHBISHOPRIC OF GLASGOW.

Barley,	37/4
Oats,	28/
Malt, per Boll,	46/8
Meal, 140 lb.	22/7

LINLITHGOW.

Wheat,	66/8
Barley,	38/4
Oats,	27/1
Pease,	43/1
Oatmeal, 140 lb.	22/9
Malt,	59/

NAIRN.

Wheat,	65/
Barley, without fodder,	35/
——— with fodder,	40/
Oats, without fodder,	25/6
——— with fodder,	32/
Oatmeal, 112 lb.	17/

ORKNEY.

Beans,	
Malt,	
Oatmeal,	

PEEBLES.

Wheat, First,	55/2¾
——— Second,	48/3
——— Third,	41/3½
Barley, First,	38/0¼
——— Second,	33/10¼
——— Third,	28/9¼
Oats, First,	25/8¾
——— Second,	22/0½
——— Third,	18/7
Pease, First,	50/
——— Second,	48/9
——— Third,	48/
Oatmeal, First, 112 lb.	17/9½
——— Second,	17/2¾
——— Third,	16/5¼

PERTHSHIRE.

	Imp Qr.
Wheat, First,	67/6
——— Second,	57/7
Barley, First,	37/5
——— Second,	31/4
Oats, First,	28/5
——— Second,	25/2
Pease,	39/7
Oatmeal, 140 lb.	21/2

RENFREW.

Wheat, First,	53/2¼
——— Second,	52/7¾
Barley, First,	34/2¾
——— Second,	32/8½
Bear, First,	29/6
——— Second,	29/2
Oats, First,	24/5
——— Second,	23/0¼
Beans,	44/
Oatmeal, 140 lb.	20/7¼

ROSS AND CROMARTY.

Wheat,	54/7¾
Barley,	35/1
Bear,	30/
Oats, First,	28/5
——— Second,	27/0¾
Pease,	38/
Oatmeal, 280 lb.	44/
Barley Meal, 280 lb.	36/

ROXBURGH.

Wheat,	60/9¾
Barley,	35/3¾
Oats,	26/8½
Rye,	
Pease,	49/10
Beans,	46/10
Oatmeal, 140 lb.	20/5

SELKIRK.

Wheat,	65/4
Barley,	34/11
Oats, Potato,	27/
——— Common,	23/9
Pease,	50/8
Oatmeal, 280 lb.	42/9

STIRLING.

Wheat,	64/8
Barley, Kerse,	39/6
——— Dryfield,	39/11
Oats, Kerse,	29/2¾
——— Dryfield,	28/4
——— Muirland,	23/4
Pease and Beans,	46/
Malt,	60/8
Oatmeal, 140 lb.	22/

SUTHERLAND.

Wheat, no evidence.

Barley,	33/
Bear,	32/
Oats, Potato,	33/6
——— Common,	26/6
Pease,	40/
Rye,	
Oatmeal, 140 lb.	23/

WIGTON.

Wheat,	58/4
Barley,	32/
Bear,	28/8
Oats, Potato,	24/
——— Common,	20/8
Malt,	68/
Rye,	24/
Beans,	40/
Oatmeal, 280 lb.	38/8

We may inform our English readers, that the Fiar Prices are the average prices of grain, as ascertaine every year by the verdict of Juries in every county of Scotland. These Juries are summoned in spring and ascertain, from the evidence produced to them, the average prices of the preceding crop. By thes prices, rents payable in grain, and similar contracts, are generally determined; but the main object is t convert into money the stipends (for the most part fixed at a certain quantity grain) of the Scottis clergy.

THE

QUARTERLY

JOURNAL OF AGRICULTURE.

ON THE AGRICULTURE OF THE COUNTY OF CORK.

PART I.

This district, which comprehends, for the most part, the south coast of Ireland, is of great extent, stretching 110 British miles from east to west, and about 55 in its widest point. If its culture and fertility did but correspond with its dimensions, it would indeed be the most important county of the island; but, though partially exhibiting high degrees of culture, the general features of its husbandry are of the coarsest character, while the natural surface of some of the most bleak and barren districts exhibits wildly magnificent scenery, especially on the south-western limits, where schistose rocks, with fissures and caverns innumerable, of vast elevation, form the barrier against the tremendous power of the Atlantic, which, lashing the cliffs with its raging waves in awful majesty, would apparently threaten to engulf the land.

The proximity of this ocean, though it causes more than ordinary dampness of climate, tempers the severity of the winter, as the sea-breezes from the south-west operate in preventing the continuance of frost and snow, while in summer they cool the temperature of the air. Thus, the extremes of heat and cold, which prevail in land-locked countries of the same latitude, are unknown here. There is no doubt, however, that the climate of this county, as throughout the entire island, has undergone material alteration within sixty years, if we are to judge from the traditions that have reached us regarding nectarines and other delicate fruits, which, in the olden time, were known to ripen in the open air, as now in the southern parts of Great Britain.

The late Rev. H. Townsend, the author of the elegantly written statistical survey of this county, and a valued contributor to our pages, as well as to works of higher pretension, stated thirty years ago, that peaches and nectarines had been, in his early years, little less plentiful in the old gardens, than plums or cherries.

Diversity of scenery, climate, soil, culture, and popular habits, is strikingly remarkable in this great county; and these peculiarities we shall endeavour to describe, as we detail *more solito* the local circumstances of each barony.*

We shall, however, commence with a sketch of the statistics of the city of *Cork*, which is also a county in itself, and of such rank as to demand a particular notice.

This city, which has been considered the second in Ireland, stands on very low land—what was once a marsh on the banks of the river Lee—and owes its foundation to the Danes. The English invaders, in the reign of Henry II., who made such conquests and effected such establishments on the Wexford coast, found great difficulty in keeping their footing here, and were often repulsed and harassed by the natives.

* When giving the description of the county of Kilkenny, which appeared in Number 44 of this Journal, the writer unfortunately laboured under an attack of *chirogra*, which more than ordinarily cramped his *chirography*. It is hardly worth his while to notice any typographical errors, except those regarding the mistakes in proper names. The celebrated barony of *Iverk* is barbarously transmuted into *Toerk*. Sir Richard *Langrishe* is softened into *Languishe*. Major *Izod* is called *Tyod*, and the name of *Bushe*—a name associated with all that is great in the judicial character, or in the most refined circles of private life—is, in one place, converted into Barker, and in another actually *Burked*. Every one knows, that the Right Hon. Charles Kendal Bushe combines in himself the different attributes of forensic eloquence of the purest order, of the most playful wit, with all those fascinating attainments that constitute the character of the scholar and the gentleman, and, in no less degree, the more dignified and nobler intellectual qualifications of the *judge*. In short, imitating Widow Blower (in St Ronan's Well), who changed Doctor Quackleben's name six times in five minutes, the printer has miscalled the name in question, "beating the *Bush*" perpetually for fresh game, until he could start no more.

Until the reign of William III. little improvement took place. From that period, alterations, at first slow and gradual, and eventually rapid and almost magical, have taken place in the streets, public buildings, &c. in consequence of the unrivalled excellence of the harbour, and the river being navigable to the heart of the town.

The district included for purposes of taxation, under the 53d Geo. III. comprises (according to Lewis) 2379 statute acres, and 10,262 houses, of which 205 are weigh-houses, stores, and public buildings; and has 84,000 inhabitants in the town and suburbs alone.

The superior advantage of its magnificent and commodious harbour, and its local position in other respects, rendered Cork, during the late war, a place of vast importance for furnishing naval supplies, and it flourished accordingly. Its facilities of internal communication also rendered it then, as now, the market for agricultural produce, not only of the county of which it is the heart, but of the neighbouring counties of Tipperary and Kerry. During the war, the brisk demand for every article in the provision-line—beef, pork, and butter for the West Indies, as well as for home consumption—gave a remarkable stimulus to trade, and, while it rendered many of the government contractors and city merchants wealthy, gave the means of living comfortably to numerous subordinate agents, and to the agriculturists through the remotest parts of the county. When the war ceased, and the consequent bustle of supplying soldiers and sailors with food was checked, Cork especially felt the transition to peace; but at length she has recovered her energies, and the mercantile and agricultural interests (intimately blended and mutually dependent as they obviously are) find ample sources of profitable occupation, in the new channels of industry which have opened to them.

Nor is Cork deprived altogether of those peculiar branches of the provision trade, which were so conducive to her prosperity during the war. The government contracts for the navy, in a considerable measure,—if the expression can be justly applied to an establishment of such limited extent—are supplied by the Cork merchants. Some shipments are also made for the East Indies; but the supply for the West Indies, which formerly constituted her principal source of commercial traffic, has been transferred to those all-absorbing ports of Liverpool and Glasgow; and to make matters worse, the trade to Newfoundland, which used to consume 30,000 barrels of pork annually, besides flour, bacon, oatmeal, &c. the produce of Cork and Waterford, is now in the hands of the United States and of the Danes and Hollanders, who have the advantage of the return-commerce in fish and oil. Cork, however, still enjoys some important foreign commerce with the Mediterranean ports, which supply dried fruits, sweet oil, bark, liquorice, and other articles of foreign production. Wine, of course, is an article of traffic; but inconsiderable, compared with what it was, from the prevailing taste for whisky. About 6000 tons of salt are annually imported from St Ubes, and there is a considerable importation from Russia of tallow, hemp, flax, and other principal productions of the north of Europe. Canada contributes large quantities of timber, staves, and pot-ashes, and the duty on foreign tobacco imported pays about L.6000, annually. Though sugar and other articles of West Indian produce are generally imported indirectly (through Liverpool), there is some direct intercourse with those important colonies.

About 18,000 barrels of herrings annually find their way into Cork; for though there used to be a vast quantity brought here from Scotland in order to be repacked for the West Indies, the shrewdness and industry of the Scotch has put a stop to this quondam monopoly, by sending for the Cork curers, and learning from them their superior mode of packing.* The coal and slate trade with England and Wales is considerable, and improvement in the description and tonnage of all the vessels employed in commerce is very considerable.

The tonnage of the registered vessels, including two small contiguous ports, is 21,514 tons, employing 1684 men; and the amount of duties paid at the custom-house may be rated at L.200,000, that to the excise department at L.250,000.†

If Cork suffered for a season, in an extreme degree, from

* Lewis' Topographical Dictionary.

† See Lewis.

the transition from war to peace, she has now recovered from her state of temporary mercantile paralysis, and holds a high rank among those ports from which the busy hum of peaceful and useful industry proceeds. Her steamers are of a superior class: a spirited company employs seven vessels, of 250-horse power, in constant intercourse with London, Liverpool, Bristol, and Dublin; and four small ones ply between Cork and Cove, which is situated nine miles distant, on the beach of the harbour, and which will be referred to again in the notice of its barony.

Great and almost exclusive as was the provision trade for the navy during the protracted war, the present demand for black cattle, pigs, fish, poultry, and eggs, from the manufacturing population in England, is much greater than it was at any former period, and these vast supplies are weekly conveyed to the English markets.

The quantity of corn, too, now raised and exported, both in the raw and manufactured state, is much greater than it was in the most stirring period of the war. In short, as to internal activity and commercial enterprise, Cork must now be in a more really thriving and healthy state than while under the unnatural stimulus of war. Houses and streets are rising every day, in evidence of prosperity and peace, and there is deposited in the Savings Bank about a quarter of a million sterling.

There is a good deal of domestic manufacture also within the precincts of Cork. There are no fewer than forty-six tan-yards employing 600 tanners and curriers, and causing a proportional demand for bark, and for valonia from the Levant. There are several breweries, of which that of Messrs Beamish and Crawford is the most famous for porter, which is exported to almost all parts of the world. Nor is there any want of distilleries—we were going to add something not altogether benedictory: seven of these manufacture two millions of gallons, for the increasing demoralization and ruin of the great bulk of the consumers. There are seven iron-foundries, which, with the smiths and all others employed in the iron-work, give occupation to 1000 men. There are also several large paper-mills, and two flint-glass manufactories; various mills for the making of cloth, the spinning of yarn for camlet, and many minor establishments. Patrick Street and the Parade are wide and noble streets, but extremely irregular as to the construction of the stone-built houses, which have been erected without the slightest regard to uniformity of design or symmetry of parts. A new street at right angles to the Parade, of brick-houses, is, however, perfectly uniform, and presents a noble and city-like appearance. There was a botanic garden, but it has been converted into a Roman Catholic cemetery, in the Père-la-Chaise style. There existed, during many years, a scientific establishment, incorporated by charter, called the Cork Institution, and principally supported by a grant of L.2000 a-year from Parliament, until 1830, when it was withdrawn. While the grant lasted public lectures were given in chemistry, botany, mineralogy, and agriculture, which formed a leading subject of consideration. The books (5000 volumes) and all the *materiel* have been removed to a house presented to the Society by the Government at a small rent.

A county Agricultural Society was formed in 1836, and a Horticultural in the preceding year, and both, it is hoped, will zealously promote the purposes for which they have been incorporated.

"The scenery around the city is exceedingly beautiful, particularly on the east, where two lines of road, called Upper and Lower Glanmore Roads, have been formed along the north bank of the river, one on the elevated ground, and the other close to the strand; and a variety of new streets, terraces, crescents, and detached villas, have been erected on the sides and summits of the gentle acclivities, commanding magnificent views of the river Lee, the city, Blackrock, and the beautiful and fertile district bounded by the hills of Carrigaline. The scenery on the south side of the river, from Anglesey bridge to Blackrock and Passage, is pleasantly undulating and diversified; elegant houses, with lawns, gardens, and plantations, sloping to the water's edge, and commanding delightful views over the noble expanse of water to the lofty and verdant hills of Rathcoony, have been built throughout the entire space. The beauty of the scenery, the mildness and salubrity of the water, the fertility of the soil, and the excellence of the markets, have induced many wealthy families from distant parts to settle here, who have erected very elegant villas and cottages, in fanciful situations, and in every variety of architectural style."

Let the reader's imagination now transport him to the mouth of Bantry Bay, which is twenty-five miles in length, with a breadth of eight miles in its broadest part, the south-western limit, and consent to accompany us regularly thence by *land* through the twenty baronies into which the county of Cork is divided,* commencing with *Bere* and *Bantry*, which are so interwoven, and so similar in their circumstances, that they shall be considered under one and the same head.

The sublime impressions which the view of expansive waters here excites is greatly increased by the height and boldness of the surrounding mountains, especially on the west side. Among these, Hungry Hill, rising abruptly to the height of more than 2000 feet above the level of the sea, from whose summit a stupendous cataract is sometimes visible at the distance of several miles, is the most conspicuous object of grandeur. Not far from the mouth of the capacious Bay, Bere Island (a portion of the barony of the same denomination), of clay-slate formation, stretches obliquely across, leaving the principal channel on the east side of sufficient depth for vessels of any tonnage. At the western side of this island (which contains 2849 acres, and nearly 2000 inhabitants), is the harbour of Berehaven, deep, and completely sheltered from the west and from the south, except in the point where the narrow channel flows. On the western side, between the island and the mainland, the town of Castletown, the only town in this wild and rocky barony, stands at the head of an estuary running in a westerly direction, and exposed only to the east.

The island itself, which is the property of Robert Hedges Eyre, Esq., one of the most extensive land-proprietors in Ireland, contains 2850 acres, of which a fourth is rudely cultivated : of the remainder a good deal affords sweet pasturage and peat in abundance. The southern side is gently inclined to the water's edge, though the northern side, which opposes itself to the ocean, is more bold and precipitous. The five Martello towers and barracks, and other public works which Government erected after the surprise which the French fleet occasioned, form conspicuous features of the interesting scene.

* There has lately been effected a grand division into the East and West Ridings, for judicial and other civil purposes.

Fishing-boats or hookers, of sixteen tons, have the advantage of a pier on the island, and these, with a considerable portion of the population, are employed whenever the weather permits. Between this island and the main on the north and north-west is the harbour of Berehaven.

The character of the scenery in the Bay of Bantry is vast, and in many particulars resembles some of the finest coast and mountain scenery in the west of Scotland, but yet within the range of immediate vision. This peculiarity is thus eloquently expressed by Mr Townsend.

"Large as the ground of this great picture is, it comes within the scope of human sight, a circumstance upon which the powerfulness of its impression materially depends. A greater extension of the parts, by throwing them far from view, would diminish their effect, and a reduction of their scale would lessen their grandeur.

"Much and justly as Killarney is celebrated for the varied beauty of its scenes, no single view it affords can vie with this in sublimity of character and greatness of effect."

Whiddy Island, at the upper end of the bay, is an object of considerable interest, contrasting with the ruggedness of the neighbouring heights on either side. This is a fertile spot, presenting a variety of soils, comprising 1200 acres, well tilled, well inhabited, many of which are sufficiently productive to fatten bullocks of heavy size. It is the estate of Lord Bantry, who has an excellent farm on it. It has a salt and fresh water lake, and the barracks and batteries, of which the fear of hostile invasion at the close of the last century occasioned the erection, are still remaining, but under the wardenship of a solitary *militaire.*

On the east quarter of this interesting district there are many islets, between which and the main the town of Bantry stands. There is admirable land-locked anchorage in five or six fathoms water. The town itself, which is on the eastern side of the Bay, is far from imposing in appearance. It can boast of only two parallel streets leading in the direction of the sea, and a connecting transverse one, and these are sadly disfigured by cabins of the poorest description; yet it was once a place of some trading importance.

Great numbers used to be employed in the manufacture of coarse linens, but now, except a little employment in a flour-mill, a small porter-brewery, and in the store-houses for butter and corn, designed for the English markets, there is little active or remunerative occupation in Bantry.

The chief employment for the labouring poor is in fishing for hake during the season, which lasts from July to November, and periodically for herrings and sprats, all which have a ready sale through the agency of hawkers and jolters, who retail the fish through a very extended district of the interior.

A century and a half ago, the curing of pilchards gave very considerable occupation to the inhabitants, but, from inscrutable causes, they have long since disappeared from the coast. Herrings, however, have not seceded, and these are cured in what was formerly called *fish-palaces*, and yield a revenue of L.2000 a-year to the persons engaged in taking and curing.

Sea Court, the residence of Lord Bantry, is close to the town, which adds some importance to this part of his Lordship's property, which it otherwise would not possess. Detached fragments of limestone are found on the neighbouring shore, and in the gravelly hills on the north side, but though rock-limestone has not been, we believe, discovered there, a calcareous substance, which answers for the purpose of cement, is abundant. As the coralline suffices for the purposes of agriculture, the want of rock-limestone is not inconveniently felt.

A new line of road connects Bantry with Skibbereen, and one is in progress to Kenmare through Glengariff, which will render the tourist's route over a very extensive and picturesque line of coast scenery a matter of comparatively very easy accomplishment.

The principal point of attraction in this region of varied beauty is Glengariff, at the northern termination of the Bay. This beautiful glen, so rich in sylvan splendour, is part of the property of Lord Bantry, and very much resembles some of the scenery in Scotland. This glen is unrivalled in the south of Ireland; the combination of woods, precipitous mountains, rocks, and waterfalls, and the expanse of the lake-like waters of Glengariff bay, evergreens and flowering shrubs, and verdant turf, renders it a spot of extreme interest.

There is a delightful residence here, Glengariff Castle, belonging to Mr White, a relative of Lord Bantry, sheltered by a mountain which slopes to the water's edge, and well timbered to the summit. This gentleman's demesne is the paradise of the sportsman. As may be supposed in such an attractive place, an inn, "for the more grace called an hotel," has been among the more modern adjuncts of comfort, to the extinction of the old and miserable *shebeen*-house, which formerly was the only place of refuge to the traveller who chanced to stray, and which certainly did not boast of a Meg Dods as its mistress.

Large tracts of this lovely region are, however, of little value to the farmer; but if they constitute a waste, they form one of exceeding interest, from the covering of copsewood in which so much of the glen is clothed, contrasting with the bleak and denuded state of the adjacent mountains, capes, and headlands. In such a locality, on the verge of the ocean, the appearance even of a stunted tree forms an object of pleasureable surprise: but compared with this glen on the Atlantic, the glens and hollows which are so frequent on the surface of the interior of the county, and far distant from the influence of the south-west wind, suffer much in the contrast, being for the most part without a tree, although the oak, the ash, the hazel, the birch, the fir, and the holly, once flourished in numerous spots, and have left sufficient evidence that, if their stoles had been protected with any degree of care, coppices of value to the proprietor, and of ornament to the country, would, in due time, have sprung up again.

Castletown-Berehaven, on the north side of the harbour of Berehaven, is the only town in the barony of Bere, and not within thirty miles of its nearest neighbour, Bantry. Here, the only division of General Hoche's army that landed was captured. It is encircled by hills except on the water side, and was originally only a collection of fishermen's huts, but now it is a respectable street of slated houses for the accommodation of the persons occupied in the works of the neighbouring Allihais copper mines, which were discovered in 1812. The village boasts of a pier and several fishing-boats, and some small coasters.

On the extreme western limit of the barony of Bere, is the little island of Dursey, at the extremity of a peninsula of coarse and rocky land, and containing, notwithstanding its isolated and lonely locality near a tempestuous ocean, a population of about 200 human beings, who find the means of subsistence on 700 acres—the area of their miniature and sequestered world. Their soils yield potatoes, oats, wild pasturage for sheep, goats, and stunted cows. If nature supplies these essentials, the inhabitants of Dursey, at least, set small store upon the knowledge of those mighty concerns with which their fellow mortals are concerned in Dublin Castle and Downing Street.

The noble river Kenmare, forms the western limit of the county, as also of the barony of Bere, and on its shores, at this side, and at the southern extremity of the peninsular portion, are some considerable bays, Ballydonagan, Killcatceran, and Kilcumhine, the last of which is awfully exposed to the south. There is a vast deal of *bog* intermixed with the mountains of this barony, so that, at least, the necessary comfort of fuel is enjoyed. Potatoes and oats are cultivated here, principally with the spade.

West Carberry.—The district which goes under the general denomination of Carberry, is not less than four miles from east to west, but it is subdivided for civil purposes into four baronies. The western portion, to which we shall first refer, is the mountainous, and, for the most part, steril portion, similar in many respects to Bere and Bantry. The peninsula,* in the western verge of Dunmanus Bay (which is sixteen miles in length, and deep enough for any vessels), which it separates from the parallel bay of Bantry, is rude, and, in every respect, similar to that of Bere; hilly, and abounding in rock, with some sheep pastures, a good deal of herbage, and some acres of bog, with a sufficient portion of arable land for the support of the population, which is very considerable, there being not fewer than 10,000 in the peninsular area, and within this barony. There are some small lakes here, and indications of copper-ore which is so abundant on the western side of Bantry bay. Towards Bantry, the land improves in value, and here, as

* The upper part of this peninsula merges in the barony of Bantry.

elsewhere, it is estimated highly, from the abundance of sea-sand which is brought up the bay and landed at the different creeks. At Four-Mile Water, which is at the upper end of the bay, there are several respectable houses of resident gentry; the marks of civilized life are apparent, and there is a good deal of arable and fertile land lying intermixed with the barren tracts. Its southern boundary is the ocean, and here nature has been prodigal in the production of marine wonders,

> "Wherein of antres vast and deserts idle
> It was my bent to speak."

In this, as in the more western parts (and this observation is applicable to the entire of the county south and west of Cork), the spade is more in use than the plough, partly from the stony nature of the soil, which, in many places, precludes the entrance of an ordinary plough, and partly from the natural influence of long prevailing usage. The small holders, whose means are too limited to maintain horses or oxen, *must* substitute the spade; and even, if they could afford to provide teams suited to the task of penetrating land encumbered with stones, they act more prudently in using the manual implement. Many of these small farmers do, however, keep a horse each, and plough by combination of these little animals alternately borrowed; and in the vicinity of the coast, or within a moderate distance of the coralline or calcareous sand so bountifully spread upon the shores, they are indispensable for drawing it. While the peasant, however, can supply labourers from his own cabin,—that is, as long as his sons remain unmarried and assist him, he acts with the best economy in avoiding the maintenance of a horse.

If we wanted proof of this, we have only to look to Flanders, where there are the best models of husbandry on a small scale. Instances there, are not unfrequent, of farms of six or eight acres being cultivated entirely with the spade and shovel, with the assistance of only one labourer in addition to the occupier's family, aye, and *trenched*, too, three feet deep in the course of rotations. The manure is carried on the land in wheelbarrows. But if the Belgian small holder is without the encumbrances of horses, he takes care to have three or four cows on his holding, kept the greater part of the year in their stalls and well fed. These, with the never-failing urine tank, supply the necessary manure, and render long journeys for extraneous manures unnecessary.

The Irish cottier is unjustly ridiculed for the use of spade and shovel, and narrow ridge and wide furrow. By covering his seed from the furrow, deeply dug with a long narrow spade, he contrives, at farthest, in the course of three years, in some measure to trench his field (each furrow being the third part in breadth of the ridge), and he adds to the depth of the soil at the same time. He covers his seed from the intervals between his ridges with great evenness, and is not, in this process, so much mistaken as some would represent him to be. When the Irishman, in the secluded and semibarbarous districts under consideration, fully learns that good deep digging and minute pulverization are as essential to the prosperity of his crop as the manure itself, which he too often imagines to be the sole agent in the process of fertilization,—he will find a material change in his circumstances, *provided* that he abstains from whisky, and prefers a tank for the collection of liquid manures, to the smell and taste of the contents of a cask of alcohol.

The Carberry peasant plants his potatoes in beds, and with a sleight, jerks the seed from a little apron or *plaskeen* tied round his waist into the fissures which he makes about a foot apart. With his sharp narrow spade as he moves backwards, he covers the sets, as is so general through the kingdom with the same class of people, from the undug or unploughed rib which he left between the ridges. This he digs to the utmost depth, and inverting it, lays it over the surface of the bed, chopping the sods or clods as he proceeds in his work, the manure being previously laid over the ridge.

In very rough or moory places, a peculiar hoe, called, in the native language, a *graffone*, as more powerful than a spade, is used to prepare the surface, and it is surprising with what dexterity this is used. With the labourers of this county, it is the ordinary implement, and very efficacious in taking off the surface in small sods, and in grubbing the stumps of furze, and such other obstacles as would render the free passage of a plough impracticable. Apple potatoes used to be great favourites with the husbandmen of this part of the county, but cups and lumpers now seem to have superseded them.

If the coralline of Bantry Bay raised with expense and labour be an invaluable fertilizer to the adjacent farms of Bere and Bantry, the sand from most parts of the coast, which is more or less calcareous, is also a valuable boon of Providence. Some of this contains 60 per cent. of carbonate of lime, and is the principal manure.* Land bears a high value throughout this region, and is let in the wilder parts, not in the usual way by the acre, but by what is termed the *gneeve*, which is the twelfth part of a townland, and therefore of very undefined acreage, and is held by leases of three lives, one life or thirty-one years (whichever lasts longer), or twenty-one years and a life; the last is becoming a favourite limit with landlords, and sufficiently permanent for the tenant, unless there is to be much outlay in building and other expensive and durable improvements, which, by the way, are rarely contemplated either by landlord or tenant.

Any person viewing the extent of tillage here, the clumsy ill constructed tools with which it is conducted, and considering the disadvantages under which the cultivators labour, too poor and thrifty to consume even a portion of the corn which they raise, and often with very scanty clothing, as well as insufficient food, must appreciate the industry of these poor people, who labour principally for their landlords. Notwithstanding the difficulty which they (the peasantry) have to encounter from indigence and ignorance, better management would effect a good deal more; but the accomplishment of so much is at least highly creditable to the industry of a people, who, if idle, are often so from necessity, and not from choice.

The entire western portion of Carberry has a sameness of general character, headlands and islands, slaty hills, heath,

* The analysis of the sands on the western shores, as given by the late Dr William Reade of Cork, may be interesting to some of our readers, and will be presented in a succeeding article, when those parts of the coast where they abound shall be particularly noticed.

furze, pasturage, and patches of tillage, with occasionally a small lake, and here and there spots of sylvan loveliness.

Roaring Water Bay with its numerous rocky islands is one of the marine objects of admiration. At the head of this bay stands Whitehall, the estate of the oldest branch of the Townsend family, from which the view is sublime, Mizen Head forming the extreme point of land scenery on the south.

Baltimore Bay, which is a fine harbour of refuge, presents features of great and varying interest. There is some lovely scenery within, and excellent land in the vicinity, on the east side, though not well cultivated by any of the few gentry in that secluded locality. The islands are innumerable,—many within the harbour, which terminates at Skibbereen, where the river Ilen mixes its streams with the waters of the ocean. The island of Inisherkin, near the thriving village of Baltimore, once a borough and a port of much more importance than Skibbereen, is inhabited by very industrious peasants. The property here belongs to Lord Carberry, of whom mention will be made, when his lordship's place of residence comes under notice.

Outside the harbour is the considerable island of Cape Clear, the property of Sir William Beecher, in the eastern division of West Carberry, and the most southern point of Ireland, which contains 1400 acres, some of which is very elevated. The soil is shallow and unproductive, even of furze, except of a stunted quality, and consequently very limited in fuel, which is principally brought from the mainland. Fishing and rude husbandry occupy a numerous and half wild population (more than 1000 in number) who are remarkably attached to their own little world, which they fondly and naturally consider "the first gem of the sea," especially as it now has a good artificial harbour and pier for the security of their boats in bad weather, if it was freed from the surveillance of coast-guards and revenue officials, who neither allow them to traffic with homeward bound vessels, as in the days of their forefathers, nor to hold intercourse with contraband traders from the coasts of France and Holland, nor even to manufacture their own whisky. The women are industrious and spin flax for domestic use, and assist the men in every branch of rural labour. The few cows on the island are extremely diminutive, the sheep are on a corresponding scale, and there are only four little horses on the island, for drawing sea-weed, or trying to scratch the ground with a plough, which indicates the inferior state of the tillage, and of natural pasture. But what vegetation could be expected, except of the most dwarfish character, on a spot so frequently assailed by the most tremendous gales, and so constantly exposed to saline aspersions from the Atlantic? The men are generally good pilots; and, from their habits and seclusion and little intercourse with the people of the mainland, except occasionally for the purchase of clothing or the sale of their fish, or it may be for a short time in the season for digging out potatoes, when they emigrate in quest of stipendiary employment, are very hardy and of primitive simplicity. There are some lakes in this sequestered land, and one not inconsiderable on the south-west quarter. The whole coast is remarkable for fine dark coloured flags, and excellent—but here useless—quarries of building-stone. The ruins of an old castle are still to be seen on this island, built on a spot approachable at one point, and by a passage of terrific aspect.

The following whimsical practice related by Mr Townsend, is not a little characteristic of the natives.

"Frieze is here manufactured, as in other places, for domestic use. The want of a tucking mill, the island possessing no stream capable of turning a wheel, has obliged the inhabitants to have recourse to a singular expedient. The business of the field or the fishing engrossing the attention of the men, the operation of tucking has devolved to their fair associates, who perform it in the following manner. Upon a square hurdle, to keep the cloth from the dirt of the ground, eight women take their seats, four opposite to four, at such a distance as that the extended legs of one set just reach the drawn up feet of the other. The frieze placed between, is pushed alternately by each party with as much force as they can exert, against the feet of the other, until, by frequent repetition of this laborious process, the piece is sufficiently tucked. Partly from the necessity of keeping the frieze wet, and partly from the convenience of having their limbs at liberty in this laborious exercise, the fair operators find it necessary to disencumber themselves of superfluous clothing. The work is, therefore, always performed in a state of half nudity, nor does the approach of a curious stranger suspend their labours. Unconscious of anything extraordinary in a situation too common to excite any surprise among their own tribes, their simplicity very naturally supposes that it will be viewed with equal indifference by others."

Proceeding up the Bay of Baltimore we reach Skibbereen, the only town in the west division of West Carberry, and it contains only 4500 inhabitants. It deserves some notice from the manifest improvement which has taken place in its appearance and economy, principally in consequence of the new and excellent roads which connect it with the interior. The river there is navigable for vessels of 200 tons, and a brisk trade is carried on here. The connection of Skibbereen with the interior has alone occasioned its prosperity, and until trade was invigorated here it was a miserable place, disfigured by filth and cabins. An infantry barrack—that general appendage to Irish towns,—adds to its importance.

But instead of going directly to Skibbereen by water, by steering across the bay of Baltimore to the westward, after passing the island of Inisherkin, there is a delightful sail through Roaring Water Bay, to the populous parish of Skull, which is a wild and uncultivated parish, containing 84,000 acres, and more than 15,000 inhabitants.

From its numerous rocks and strongholds, it was, in the annals of Irish history, a tract of defensive importance, and the remains of a sod-built fort attest, according to antiquarian researches, the contests between the aborigines and the Danes. It contains within its boundaries the numerous inhabited islands of Roaring Bay and those of Dunmanus. The largest of these is Long Island, but the most valuable is Horse Island, which abounds with copper-ore of very good quality. Copper-mines have been opened on Cappagh Hill, the estate of Lord Audley, and are now rented by the West Cork Mining Company, which has also opened and worked slate-quarries with great spirit. These slates are of prime quality, and great quantities are sent to London and other British markets. The mines and quarries now in work are on the verge of a small creek called Audley's Cove, whence they are readily shipped in vessels of great tonnage. The harbour of Skull is well situated and finely sheltered.

In the interior of this barony, paring and burning the moor land for potatoes is a very common practice, though generally forbidden by the proprietors. The sod is always cut by the implement already noticed,—the *graffone*, instead of the plough, even though the surface should be even and free from stones; and if sea-sand be within reach it is added to the ashes; indeed, its value is so well understood, that no man thinks he has done justice to his land without it. Those who were familiar with the state of this district half a century ago, and who have visited it lately, must have experienced great surprise at the increase and industry of the inhabitants, who, from occupying only a few scattered cabins near the coast, and leaving the more distant parts in their natural clothing of peat, or furze, or woodland, have gradually spread over every portion of surface fit for the residence of men, and caused the heath and furze, and, alas! the coppices, to disappear altogether.

Though the original breeds of cattle here are remarkably diminutive, and in many places adapted especially to the quality of the soil and climate, many of the gentry have introduced good crosses, and even the Durham and Ayrshire are sometimes to be met, as well as the Leicester sheep, but very rarely in the western division of the barony, and never in its wilds, where they would soon starve or degenerate most rapidly. The poor farmers half starve their lambs from the necessity of abstracting part of the milk of nursing ewes for their own use. These poor animals are generally seen *fettered* by the road-side or in bare fields, where the country is called enclosed, lest they should stray into some neighbour's land, where a patch of clover would be an irresistible temptation to transgress. As it is not the custom to drink mare's milk, foals fare better than lambs, but their dams have seldom enough of food to support their offspring.

Black oats used to be very generally sown throughout the west of this barony, and still it is preferred in the exposed and sheltered soils; but in the deeper and richer soils and more favoured situations, the potato oat and the common white oat are generally sown. Whatever wheat is sown is of the red Lammas kind.

Flax which bears a very inconsiderable proportion to other crops, is always sown after potatoes, and on the best portion of the field, and very carefully dug and raked for the seed. Spinning, however, is far less an object of solicitude and importance than it was formerly, before the manufactory and use of calicoes became so universal. Weavers who used to alternate or combine their occupations at the loom with those of the field, have now comparatively but little to do at their sedentary work, and find the spade far more profitable than the shuttle.

The rents all through this barony are, considering its general quality and remoteness from any great town, very high. The peasantry are of the poorest and most wretched class, frequently without shoes and stockings, and working at labour-rates sadly disproportioned to their services. They are decidedly among the most servile and degraded of God's creatures; yet, if they had more intelligence in the mode of managing their land, and more energy, they could easily pay the high rents to which they render themselves liable. From the facilities of manure, and of grazing cattle on their bog or rocky pastures, and, by good management, they might always have a supply of fresh or salt fish, as well as of milk, for family consumption; but mere labourers and very small farmers can only, at the utmost, meet the pressure of constant and *immediate* wants—they seldom or never can anticipate them.

Castle Townsend is a small and very picturesque village, and of a totally different character from that of any other in the south-west of the county. It is surrounded by fine trees, and adjacent to the beautiful demesne of Townsend. Built on the margin of a tranquil bay, of depth for vessels drawing ten feet, and without any of the coarse features of petty trade, it invites, by its air of tranquillity, quiet, and retirement. It has the custom-house for the port of Baltimore, and is a coast-guard station.

Two-thirds of the adjoining lands are cultivated, but as in the more western parts with the spade or old fashioned wooden plough, which can only turn a furrow of *broken* land with any tolerable efficiency. For ploughing lea it is almost usel and, besides the difficulty of traction to the horses, it impos severe labour on the ploughman, who is obliged to exert every muscle of his system to keep it in the land and in something approaching straight lines. His right leg being especially exercised in kicking the furrow-slice, in order to assist the mould-board, which, of itself, cannot throw the slice over, and which would consequently relapse into its original position without the helping leg. The practised ploughman therefore is expected to hop almost continually upon the near leg, and if this happens to be a wooden one, the embarrassment of his position may be easily imagined!

The whole range of the western part of the county of Cork is remarkable for the hospitality of the few resident gentry and farmers. The abundance of fish and poultry, and the trifling cost of rearing small sheep, with the opportunities of purchasing home-made whisky from the mountaineers in exchange for barley, render housekeeping comparatively cheap; and as show and pretension are here unknown, a disposition of hospitality—which can never coexist with a love of display and assumed importance—prevails in its genuine spirit. May it long continue unadulterated with the selfishness, and the coldness, and the heartless formalities of modern refinements!

D.

ON THE HISTORY OF FERTILIZERS.

By Cuthbert William Johnson, Esq., Corresponding Member of the Maryland Horticultural Society.

In the present article, I shall limit myself to a brief historical sketch of the application of manures, which became one of the sustaining arts of life, as soon as man was ordained to earn his bread by the sweat of his brow. In the Garden of Eden, whose fertile soil and genial clime appear to have combined in maturing a continued variety and unfailing succession of vegetable substances, agricultural operations were unknown, for that which came spontaneously to perfection, required no assistance from human ingenuity; and where there is no deficiency, there can be no inducement to strive for improvement. That period of perfection was but transitory, and the Deity that had placed man in the garden, "to dress and keep it," eventually drove him thence "to till the earth from whence he was taken." From that time to the present, the art of manuring the soil has been steadily improving, and there is no doubt but that it will go on advancing, as long as mankind continue to increase.

Man, in his greatest state of ignorance, is always found dependent for subsistence upon the produce of the chase, but, as population increases, recourse must be had to other sources of food; and we find in the shepherd's life of the early ages, the very first step of the agricultural art in the domestication of animals which it was found more convenient to have constantly at hand, rather than to have to seek them at the very time they were required. As the increase of population still went on, and the flocks and herds had to be proportionately enlarged, one favourite spot would be found too small for the subsistence of the whole, and, as in the case of Abraham and Lot, they would have to separate and find pasturage in different districts. This separation into tribes could not proceed beyond a certain extent, and when the land was fully occupied recourse would of necessity be had to means of increasing the produce of given surfaces of soil, instead of enlarging their extent; and hence originated the first employment of manures. With Abraham and Isaac, it is very evident that wheat and the other fruits of the earth were the rare and choice things of their country; but when such nations once learned, as they might from the example of Egypt, the resource such products were in periods of famine, arising from mortalities among their cattle, they would soon pursue their interests by cultivating them. This completed, the acquirement of property in land for the space not only long occupied, but upon which the occupier had bestowed his labour, built his habitation, and had enclosed from injury by vagrant animals, would be acknowledged to be his without any one stopping to inquire what right he had to make the enclosure.

When once thus located, experience and observation would soon teach the employment of manures, irrigation, times of sowing, and other necessary operations; and every generation would be wiser in the art, than that which preceded it. This especially has occurred in these more northern climes, where art and industry have to compensate for a deficiency or natural advantages. "Enlarging numbers," observes Mr Sharon Turner, "only magnify the effect, for mankind seem to thrive and civilize in proportion as they multiply, and, by a recurrent action, to multiply again in proportion as they civilize and prosper." In this manner, improved modes of cultivation, the introduction of new species, and of more fruitful varieties of agricultural produce, have universally kept pace with an increasing population. This, resting upon a basis of facts, vindicates the wisdom of Providence, and refutes Mr Malthus' superficial theory of over-production. The agricultural produce of this country has gradually increased, from the insignificant amount that was its value in the time of the Roman invasion, to the enormous annual return of L. 200,000,000; and it is very certain that in this country, and much more in other parts of the world, the produce is a mere fraction of what the soil is capable of returning.

Agriculture is the art of obtaining from the earth food for the sustenance of man and his domestic animals; and the perfection of the art is to obtain the greatest possible produce, at the smallest possible expense. Upon the importance of the art, it is needless, therefore, to insist, for by it every country is enabled to support in comfort an abundant population. On this its strength as a nation depends; and by it its independence is secured. An agricultural country has within itself the necessaries and comforts of life; and to defend these there will never be wanting a host of patriot soldiers.

Of the pleasure attending the judicious cultivation of the soil, we have the evidence of facts. The villa farms, sprinkled throughout our happy land, the establishments of Holkham, Woburn, &c. would never have been formed if the occupation connected with them was not delightful. We have an unexceptionable witness to the same fact in Mr Roscoe, the elegant, talented author of the lives of Lorenzo de Medici, and of Leo the Tenth. Mr Roscoe was the son of an extensive potato-grower near Liverpool. In the cultivation of that and other farm produce, he had been an active labourer, and he who thus had enjoyed the delights that spring from literary pursuits, and from the cultivation of the soil, has left this recorded opinion, " If I was asked whom I consider to be the happiest of the human race, I should answer, those who cultivate the earth by their own hands."

Amongst the Egyptians and Israelites, whose climates were hot, a plentiful supply of moisture was necessary for a healthful vegetation, and the simile of desolation, employed by Isaiah (c. i. 30.) is, " a garden that hath no water." In Egypt they irrigated their lands, and the water thus supplied was by an hydraulic machine, worked by men, in the same manner as the modern tread-wheel. To this practice Moses alludes, when he reminds the Israelites of their sowing their seed in Egypt, and watering it with their feet, a practice still pursued in Arabia. (Deut. xi. 10; Niebuhr's Voyage en Arabie, i. 121.)

Of their knowledge of manures we know little. Wood was so scarce that they consumed the dung of their animals for fuel (Parkhurst, 764). Perhaps it was this deficiency of carbonaceous matters for their lands that makes an attention to fallowing so strictly enjoined. (Levit. xix. 23; xxv. 3; Hosea x. 12.)

Agriculture was too important and beneficial an art not to demand, and the Greeks and Romans were nations too polished and discerning not to afford to it, a very plentiful series of presiding deities. They attributed to Ceres, as their progenitors the Egyptians did to Isis, the invention of the art of tilling the soil. Ceres is said to have imparted these to Triptolemus of Eleusis, and to have sent him as her missionary round the world, to teach mankind the best modes of ploughing, sowing, and reaping. In gratitude for this, the Greeks, about 1356 years before the Christian era, established, in honour of Ceres, the Eleusinian mysteries, by far the most celebrated and enduring of all their religious ceremonies; they were not established at Rome till the close of the fourth century, B. C. Superstition is a prolific weakness, and consequently, by degrees, every operation of agriculture, and every period of the growth of crops, obtained its presiding tutelary deity. The goddess *Terra* was the guardian of the soil. *Stercutius* presided over manures; *Volutia* guarded the crops whilst evolving their leaves; *Flora* received the still more watchful duty of sheltering their blossom; they passed to the guardianship of *Lactantia* while swelling with milky juices; *Rubigo* protected them from blight, and they successively became the care of *Hostilina* as they shot into ears; of *Matura* as they ripened; and of *Tutelina* when they were reaped. Such creations of Polytheism are fables, but they are errors which should even now give rise to feelings of gratification rather than of contempt. They must please by their elegance, and much more when we reflect that it is the concurrent testimony of anterior nations, through thousands of years, that they detected and acknowledged a Great First Cause.

Theophrastus evidently thought that the soil could not be ploughed and stirred about too much, or unseasonably; for the object is to let the earth feel the cold of winter and the sun of summer, to invert the soil, and render it free, light, and clear of all weeds, so that it can most easily afford nourishment. (De Causis Plant. lib. iii. c. 2, 6.)

Xenophon recommends green plants to be ploughed in, and green plants to be raised for the purpose; "for such," he says, "enrich the soil as much as dung." He also recommends earth that has been long under water to be put upon land to enrich it. Theophrastus, who flourished in the fourth century B. C., is still more particular upon the subject of manures. He states his conviction that a proper mixture of soils, as clay with sand, and the contrary, would produce crops as luxuriant as could be effected by the agency of manures. He describes the properties that render dungs beneficial to vegetation, and dwells upon composts (Hist. Plant. ii. c. 8). He also recommends the stubble at reaping time to be left long, if the straw is abundant; "and this, if burned, will enrich the soil very much, or it may be cut and mixed with dung."

From the outline which we can draw from ancient authorities, of the agriculture of the Romans, we shall be surprised to find how little they differed from the methods we now employ. We are superior to them in our implements, and consequently in the facility of performing the operations of tillage; but of the fundamental practices of the art they were as fully aware as ourselves. No modern writer could lay down more correct and comprehensive axioms than Cato did, in the following words, and whoever strictly obeys them will never be ranked among the ignorant of the art. "What is good tillage?" says this oldest of the Roman teachers of agriculture, "to plough—what is the second? to plough—the third is to manure; the other part of tillage is to sow plentifully, to choose your seed cautiously, and to remove as many weeds as possible in the season" (Cato, 61.). In his 4th chapter he thus expresses his conviction of the utility of manure, "Study to have a large dunghill, keep your compost carefully; when you carry it out, scatter it and pulverize it; carry it out in the autumn. Lay dung round the roots of your olives in autumn." And in his 29th chapter, "Divide your manure, carry half of it to the field when you sow your provender, and if there are olive-trees, put some dung to their roots." In his 37th chapter he advises the use of pigeons' dung for gardens, meadows, and corn-lands, as well as *amurca, or dregs of oil*, and recommends the farmer to preserve carefully the dung of all descriptions of animals. This was advice given 150 years before the Christian era, and now, after the lapse of 2000 years, the direction must be still the same. We learn from Columella (i. 6), and Pliny (xvii, 9; xxiv, 19), that they collected their manure and stored it in covered pits, so as to check the escape of the drainage, and sowed pulverized pigeons' dung and the like over their crops, and mixed it with the surface-soil by means of the sarcle or hoe; (Colum. i. 16; Cato, 36.) They were aware of the benefit of mixing together earths of opposite qualities, and sowing lupines and ploughing them in while green. (Varro, i. 23.)

Virgil is very particular in describing fertilizers. With common manure he mentions ashes (Georg. lib. i. 80); pumice stone and shells (lib. ii. v. 346. 50, and in v. 350. 8). He advises the seeds of corn to be mixed with saltpetre and the dregs of olive-oil, to make the grain swell; (lib. i. 195.) Irrigation was employed in his days; (lib. i. 106. 9.) The Italian farmers also fed down over luxuriant crops; (lib. i. 3.) And burnt the stubble; (lib. i. v. 84. 8.)

Varro, (c. 38, lib. i.), mentions many kinds of animal manure, and is particularly minute in his enumeration of the dung of birds, and includes even that of blackbirds and thrushes kept in aviaries.

Columella (lib. ii. c. 5) advises the cultivator not to carry out to the field more dung than the labourers can cover with the soil the same day, as the exposure to the sun does it considerable injury; and he enumerates (lib. ii. c. 15) as well known fertilizers, night-soil, the excrements of birds and sheep, urine (especially for apple-trees and vines), dregs of oil, the excrements of cattle, the ass, the goat, of pigs; ashes, chopped stalks of the lupine (or hop), leaves of trees, brambles, &c., and mud from sewers or ditches. Pliny also mentions that lime was employed as a fertilizer in Gaul, and marl in the same country and Britain, but we can only surmise thence that they were also probably employed by the Romans; (Pliny, xvii. 5.)

Liquid manure is not a mode of fertilizing the land altogether of modern origin. For a fermented mixture of water and night-soil has, from a very early period, been employed by the Chinese farmers. Those of Italy certainly practised irrigation in the days of Virgil (Georgic. lib. i., v. 106. 9), and Cato adds, they employed a mixture of grape-stones and water to fertilize their olive-trees (lib. xxxvii). Columella praises very highly the use of stale putrid urine for vines and apple-trees (lib. ii. c. xv); commending also the lees of oil for the same purpose. More modern agricultural authors have united in praising various liquid preparations; thus Evelyn (whose ingredient most of these authors recommend) in his Treatise on Earth (p. 123, 160) gives several recipes, some of which have served as the basis for recent modes of preparing liquid manure,—such as the dung of cattle, urine, *salt* and *lime*, nitre. Of these artificial mixtures, salt one part, and lime two parts mixed together dry, and allowed to remain in a heap for two or three months (Mr Bennet turns it over three or four times in this period), is fully equal, if not superior to any thus recommended, most of which I have tried. When mixed with water and spread over land intended for wheat, at the rate of 25 to 35 bushels of the salt and lime, to 10 or 15 tons of water per acre (and it answers very nearly as well when carried on to the land dry), excellent results are produced. The wheat which I have thus grown on clover leys, has been superior in height and strength of straw to any I have seen produced under different modes of treatment, and the seed very bright and heavy.

All substances, whether organic, earthy, or saline, which are employed to fertilize the soil or become the food of plants, can only be rendered thus serviceable to vegetation when they are presented to the roots of the plants in solution or in a fluid state; and although this may appear at first rather a sweeping position, yet such is the real fact. The compost of the farm yard, the crushed bones of the turnip cultivator, the oil and bones of fish, the gypsum of the graziers, the earth, lime, chalk, and even silica; all the saline manures are dissolved by some process or other before they can be absorbed by vegetables. Every attempt which has hitherto been made to force plants to imbibe the most minutely divided powders which chemistry can produce have been entirely fruitless. Davy ineffectually tried the finest impalpable powder of charcoal, and, with much perseverance, I have fruitlessly employed the earth, saline substances, and organic matters. This absolute necessity for every substance which is the food of plants being of a soluble nature, did not escape the sagacity of the early Greek and Egyptian philosophers. They carried, it is true, their conclusions, with regard to subjects of natural philosophy, generally too far, as in this instance, when they asserted that water is the only food of plants; yet they must have patiently noticed many facts in vegetable economy, unaided as they were by the light of modern vegetable chemistry, before they could have arrived at a conclusion so nearly approaching the truth. The idea was probably of Egyptian origin, for the early cultivators of that country could not fail to notice the magic fertilizing powers of the waters of the Nile, whose annual overflow is, perhaps, the most extensive natural irrigation, of any taken advantage of by the cultivators of the earth. The same wild dream of water being the sole food of vegetables, was again revived so lately as 1610, by M. Van Helmont, a celebrated Dutch chemist, who made some very plausible deceptive experiments on a willow tree, which he watered only with rain-water,—

researches, however, whose inaccuracy (owing principally to rain-water, as usually collected, not being quite pure) was shewn in 1691 by Mr Woodward.

Although, therefore, it is now well ascertained, that water is not the only food of plants, yet it certainly contributes universally and largely, to their support; and, as it has been well observed by Davy, no manure can be taken up by the roots of plants unless water is present, and water or its elements exist in all the products of vegetation.

The employment of *crushed bones* as a manure is but a very modern improvement; it is not one of the fertilizers even, mentioned by the early agricultural writers, and for this neglect of bones several causes contributed. The necessary machinery for crushing them was, in the early ages of agricultural efforts, totally unknown, and bones when unbroken dissolve in the soil much too slowly to be of any apparent value as a fertilizer. The use of bones is an improvement, for which agriculture is entirely indebted to the enterprize of the English farmers. The refuse matters produced by the ivory and bone turners, and cutlers of Sheffield, which speedily accumulated in very considerable heaps around their manufactories, first drew the Yorkshire farmers' attention to bone-manure. The cultivators of the poor soils in the neighbourhood of that town, towards the conclusion of the last century, began to carry away these refuse matters with some readiness, and the turners were at first too glad to be relieved from this bone-rubbish, to think of charging them anything for the valuable manure they had been the first to employ. As, however, the Yorkshire farmers soon began to scramble for these bone-turnings, the manufacturers of Sheffield speedily made a small charge for them, which has since gradually increased in amount. It required, however, some time to bring about this great and successful improvement. Mr T. Ellin (late master cutler, of Sheffield) well remembers, some fifty years since, the bone refuse carted into Sheffield Moor, and buried in pits as worthless rubbish,—these old deposites now often found in digging foundations, are carried off with much alacrity to the bone-crushing mills. The farmers at first gave 6d. a bushel for these parings and turnings, which are now scarce at L.4 or L.5 per ton, and of these about 600 tons are annually sold in Sheffield. By the sole use of this fertilizer, great breadths of very poor land have been successfully brought into cultivation, and maintained in a state of the greatest fertility in the north and east of England and Scotland. Their effect upon the wolds of Lincolnshire has been magical. "Their use," says Mr Brailsford of Barkwith, in a recent communication to me, "crushed small enough to pass the drill, began in Lincolnshire about twenty or twenty-five years since, and may now be considered as *general* over the greatest part of the county; and *universal* over those great natural divisions,—the heath and the cliff (the corn-brash and upper oolite) and the wolds (the chalk and green sand) the effect produced has been wonderful; it has converted large tracts of thin-skinned and weak lands into the most fertile districts. It is used almost exclusively for turnips, and it may be right to add, that the feeding quality of turnips raised by bones exceeds that of turnips produced by dung." The demand for bones had long since rendered their importation a matter of profitable speculation. An import, too, which has been continually on the increase: thus, in 1833, 17,500 tons were imported into Hull; this had amounted to 23,900 tons in 1834; and to 25,700 tons in 1835. In 1821, the declared value of all the bones imported into England was L.15,898; but in 1835, this had increased to L.127,131. In Scotland, the declared value, which was L.69 in 1821, was L.28,215 in 1835. By the 3d and 4th Will. IV. c. 56, a duty of 1 per cent. on the declared value is payable on all imported bones.

Manuring with *calcareous sand* was practised very early in the middle ages by the English farmers. This they obtained not only from inland pits, but from the sea-shore, especially in Norfolk and Cornwall. The privilege of freely taking it from the sea-shore, the West of England farmers enjoyed under a grant from Richard Duke of Cornwall, confirmed by another of 45th of Henry III. A.D. 1261.* This is expressed in the preamble of the act of the 6th James II. c. 18, A. D. 1609, which says, "Whereas the sea-sand by *long trial and experience*, hath been found to be very profitable for the bettering of land, and especially for the increase of corn and tillage within the counties of Cornwall and Devon, where the most part of the inhabitants have not commonly used any other *worth* for the bettering of their arable grounds and pastures." This act, which empowers the farmers to take this

* Camden, Britt.

sand free from any toll, was, after being several times renewed, made perpetual by the 16th Charles I., c. 4.

This wise encouragement of the use of manures by the legislature of England, has not been confined to the sea-sand of Padstow harbour. Thus, uncrushed bones, passing through a turnpike to be crushed for manure, are exempt from toll, under the 3d G. IV. c. 126, § 32, and 5th and 6th W. IV c. 18, § 1, *Pratt* v. *Brown*, 8 C. and P. 244; and carts loaded with common manure are equally free, *Rex* v. *Adams*, 6 M. and S. 52; or even when going empty to fetch it *Harrison* v. *James*, 2 Chitty 547; but this exemption does not extend to lime, *King* v. *Gough*, 2 Chitty 655. And in authorizing the construction of railways, Parliament has carefully provided, that the tolls levied upon the manures conveyed by them, shall be much smaller than those demandable for any other description of goods: thus, in the Birmingham and Gloucester Railway Act, the authorized toll is, for manure of all kinds, only one penny per ton per mile, while coals &c., are to pay three halfpence, sugar twopence, cottons and other manufactured goods, threepence per mile. The same proportionate rate of tolls are authorized to be taken on several other railways,—such as the Birmingham and Derby, the Midland Counties, and on the Eastern the difference in favour of the farmer is still greater; for while limestone, sand, and clay, are to pay a penny, and all other manures three halfpence, coals are to pay twopence, sugar, &c. fourpence, and manufactured goods, sixpence per mile.

Saltpetre is perhaps the most ancient of all the saline manures, and its introduction is not, as is commonly believed, a modern improvement. It is commended by Virgil as a steep with olive oil, to make the seed grain swell. To this knowledge of the fertilizing powers of saltpetre, the early cultivators of the earth were probably assisted from noticing that those soils which naturally produce saltpetre are ever found to be of the most fertile description, and that all those rich eastern fields which are so celebrated in Palestine for their prolificness, abound in this salt. Three centuries since, according to Googe, it was employed by the German farmers, 'some saie coleworts prospereth best in salt grounde, and, therefore they use to cast upon the grounde saltpetre or [illegible] in 167[illegible] Evelyn, in his Discourses on Earth, tells us, "rains and dews, cold and dry winters with store of snow, which I reckon equal to the richest manures, impregnated as they are with celestial nitre." "I firmly believe," he adds, "that were saltpetre, I mean fictitious nitre, to be obtained in plenty, we should need but little other composts to meliorate our grounds." Evelyn recommends saltpetre to be used in solution, three pounds of this salt to fifteen gallons of water mixed with earth. And in this way Sir Kenelm Digby made some barley grow very luxuriantly by watering it with a very weak solution.

It would be, perhaps, difficult to name any other substance in the catalogue of modern fertilizers whose powers have been so often disputed as *common salt.* For this controversy many reasons may be assigned. It has been generally employed with little scientific accuracy, has been tried in a manner far too careless for any reliance to be placed upon the majority of the reports which have been furnished to us, and for many years a prohibitory duty rendered it inaccessible to the farmer, an impost which has not very long been removed, and which yet was the occasion of a great variety of blundering trials, miscalled experiments. The duty on salt was indeed one of long continuance. It originated as a war tax, in the ninth year of the reign of William the Third, and was not removed until after an arduous debate at the end of that of George the Third. The price of salt thus raised to more than 20s. a bushel, was, in consequence, too expensive a fertilizer to be employed by the English farmers. During that long period it was known only in their traditions. Through these they were told that it was formerly used to kill worms and to destroy weeds, that it cleansed fallows, increased the produce of light arable soils, and sweetened grass. These reported advantages were rendered more probable by certain facts that had been forced as it were upon their attention. Every gardener was aware that the brine of the pickling tubs when poured over his heaps of weeds, not only killed those weeds and their attendant seeds and grubs, but that these heaps were then converted into so many parcels of the most fertilizing manure, whose good effects, especially upon potatoes and carrots, were very decided It was well known too that a single grain of salt, placed upon an earth-worm, speedily destroyed it, that if brine was poured upon a lawn, that from that spot all the earth-worms were immediately ejected, and that if it was sprinkled over a portion of the grass, on this salted portion all the deer, or sheep, or horses of the park constantly repaired in preference to any other part of the field. Salt, evidently, therefore, destroyed weeds and worms, and rendered grass more palatable to live stock; and, upon consulting the old agricultural writers, it was found that the notices of salt as a manure were many and important, and that salt had been employed in various agricultural operations from a very early period. Thus it is referred to by St Luke, ch. xiv. v. 34; Virgil reprobates a salt soil; Cato recommends it for cattle, hay, straw, &c., as does Virgil, (lib. iii. v. 394.) The early German farmers knew of its value for sheep, and for the same purpose, in Spain, it has been employed from the earliest ages. In 1570, Conrad Herebaschius commends it as a certain prevention of the "murrain or rotte." In 1653, Sir Hugh Platt speaks of salt as a fertilizer, in his usual visionary manner, and details the result of a very successful experiment on a "*patch of ground*" at Clapham, from which some late writers upon the uses of salt, have led their readers into great blunders, by stating this experiment to have been performed upon an *acre* land.

The use of salt by the cultivator, since the repeal of the duties in 1823, has been considerable, however, in many districts of England, in spite of these blundering instructions, ill contrived experiments, and ignorant conclusions. If to this be added the natural difficulty of obtaining correct results in any experiments in which vegetable life is concerned, we need no longer be surprised that many contradictory statements have been made with regard not only to salt, but to all other fertilizers.

These difficulties, with regard to vegetable chemistry, and the phenomena with which it abounds, are, in fact, not few in number; they meet us in every investigation, from the period when a seed first begins to germinate, through its growth, its ripening, its decay; and, finally, when the putrefactive fermentation, by reducing the whole mass of vegetable matter to its constituent earths and gases, puts an end to every trace of a vegetable substance, we are still obliged often to content ourselves with examining and noting the phenomena we cannot chemically explain. These mysteries were observed at the very dawn of modern chemistry, that the same mass of earth, the same water, the same atmosphere, could, at the same time, produce the flour of the wheat, the opium of the poppy, the oxalic acid of the sorrel, the vegetable poisons of the hemlock and the night-shade, the sugar of the beet-root, and the timber of the forest, none of which are contained in either the soil, the water, or the atmosphere, were matters of serious and undivided attention ; and although the ablest chemical philosophers have investigated these vegetable mysteries, the harvest they have reaped, though highly important, has hardly been worthy of the labourers.

The use of *ashes* as manure may be traced to a very early age. The Roman farmers were well acquainted with paring and burning. Cato recommends the burning of the twigs and branches of trees, and spreading them on the land. Palladius says, that soils thus treated would not require any other manure for five years. They also burnt their stubbles, a practice common amongst the Jews in Palestine. The ancient Britons, according to Pliny, were used to burn their wheat-straw and stubble, and spread the ashes over the soil ; and Conradus Heresbaschius, a German counsellor, in his Treatise on Husbandry, published in 1575, which was translated by Googe, tells us, p. 20, " In Lombardie, they like so well the use of ashes, as they esteem it far above doung, thinking doung not meete to be used for the unwholsomness thereof."

Gypsum, or sulphate of lime, when employed as it exists in an impure state in ashes, which owe all their virtues to the gypsum they contain, were used by the early Italian farmers. Virgil, Geor. i. l. 80, gives the following injunction :—

> ———————" Neve
> " Effœtos cinerem immundum jactare per agros."
> " —— nor hesitate to scatter the dirty ashes over the
> Exhausted soils."

And he also recommends, in addition to ashes, two other remedies for sterility of soil, viz. *stercoratio*, (or manuring), and glebarum cum stipulis incensio (the turning up and burning the stubble). Robert Ainslie, steward to the celebrated John, Earl of Stair, at Culhorn in Wigtownshire, had very nearly discovered the agricultural advantages of gypsum in 1728, for in that year the Earl sent from London several hogsheads of peat-ashes, which abound in sulphate of lime, with directions for their use, describing them to Ainslie as being much employed in the south of England, as an admirable top-dressing for grass and even tillage lands. These ashes were used, according to his Lordship's directions, with great success, on both barley and grass lands. Ainslie, convinced of their fertilizing properties, immediately began to burn turf, moss, and peat, for the use of the farm under his care, in considerable quantities; he, moreover, submitted these ashes to what he very ludicrously calls an analysis, and gravely tells us that "with a great proportion of earthy substances, they contained many particles of lime or shelly matter;" this was most probably the gypsum.

The use of the mineral gypsum, as a manure, was discovered in 1768, according to Kirwan, by M. Meyer, a German clergyman of great talents, but as in those days the chemical composition of gypsum was totally unknown, he naturally confounded it with other calcareous earths which it resembled in appearance. His merit consisted in discovering the use of a certain mineral substance existing in his own neighbourhood, which was long afterwards shewn to be sulphate of lime, but of which fact Meyer was entirely ignorant. Even as early as 1792, gypsum was tried very successfully by Mr H. Smith of Highstead, near Sittinbourne, who first noticed, what has since been confirmed by numerous observations, that clover manured with gypsum is always preferred by horses and cattle to all other clover.

Sir Joseph Banks recommended this substance as a fertilizer to Lord Leicester, and, at his suggestion, it was tried at Holkham, many years since, but, owing to mismanagement in its application, it did not then appear to answer the intended purpose. Some years afterwards, owing to the warm recommendation of Mr Grisenthwaite, it was again employed pretty extensively by the same nobleman, and with great success; and so satisfied was this great friend of agriculture with the result, that he presented Mr Grisenwaithe with a piece of plate for his exertions in its introduction. In a letter with which I was favoured from the Rev. R. Collyer, dated Holkham, October 17. 1837, that gentleman tells me, "Lord Leicester wishes me to say, in regard to gypsum, that its effects, when applied to clover and saintfoin, have been invariably such as to induce him to speak from his own experience in favourable terms of that fertilizer." It has since been gradually creeping into use in the east and south of England. Mills have been erected for grinding it, and considerable quantities have been brought from the northern counties; but still not one-thousandth part of the quantity is employed in agriculture that would be used if its correct mode of application were more generally known, since, from the small quantity used per acre, and small value of the article, it constitutes one of the cheapest of the artificial manures. It is only when in its native state that sulphate of lime is called gypsum; when burnt, its water of crystallization is driven off, and it falls to powder, which powder has the property, when moistened with water, of becoming solid, and forms an excellent stucco for internal purposes in buildings, images, &c., and it is in this state called plaster of Paris. The farmer will find no difficulty in burning the gypsum; he need merely pile it in a heap, mixing it with wood faggots, or other combustibles, much after the style in which limestone is burnt by the Yorkshire farmers, or clay by those of the south; and he need not apply a very violent heat; in fact, gypsum is burned with much more readiness than limestone. It appears that in the Russian empire, especially on the banks of the Wolga, the burning of gypsum constitutes one of the chief sources of employment for the peasantry; they afterwards form it into cakes, with water, and dispose of them at the rate of a ruble per thousand.

From this sketch of the history of manures, and of the steady improvement in the mode of applying them, we may safely conclude, that, as regards the cultivation of even the most barren soils, the drifting lands of Norfolk, the heath lands of the north of England, and Scotland, and even the shingle of its sea-coast, much will yet be effected by improved modes of applying manures. Let such improvements proceed; let science go hand in hand with the farmer; let the naturalist find new cultivatable vegetables, or new varieties of those already known; let the chemist yield his magic aid to demonstrate the best mode of promoting their growth, and increasing the fertility of the soil; and then I fearlessly assert that many more than the present inhabitants of Britain may be amply supported by the produce of the land of our birth.

ON EXTRAVASATION OF SAP AND HONEY-DEW.

By Mr Main, Chelsea.

I beg to offer a few words, by way of comment, on some of the opinions of our friend G. W. Johnson, Esq., as stated in his paper "On the diseases incidental to plants," page 456 of No. 44 of this Journal; and this I presume to do, more for the purpose of recalling Mr Johnson's attention to some of the particulars, than for adding any thing of consequence, save what a practical man is enabled to adduce as the gleanings of his experience.

Extravasated Sap.—This disease is described as caused by the sap escaping from the proper vessels, and appearing either in the interior, or on the bark in the shape of resin, gum, or as sanious water. Such extravasations are often seen in old wounds, or round dead knots in fir-timber when sawn up for use; and stone-fruit trees which are wounded, or receive a *wind-shake,* discharge sap into, or out of, such wounds, and which, thickening in the air, is called gum. Old elms discharge great quantities of the sap from wounds where live or dead boughs have been broken off; but this never takes the consistence of either gum or resin.

These unnatural discharges or appearances of the sap are attributed either to a vitiated state of the sap—to its excessive abundance—to contraction of the vessels—from hurtful atmospheric influence—or from wounds. With respect to the sap being contaminated by noxious fluids, taken in by the roots, is an idea which is more than probable; for the disease certainly originates beneath the cuticle; and as it is most prevalent among fruit-trees whose roots have descended into a substratum of ferruginous clay, gravel, or other deleterious soil, the nourishment thence extracted is vitiated in some way or other, so that when risen into the young wood, either prevents its ripening, or causes ruptures and exfoliations of the bark, and consequent destruction and death of the parts.

The next cause of extravasation is said to arise from a superabundance of sap in the system, causing a plethoric habit. This may be seen among rank growing culinary vegetables, planted on rich ground immoderately dunged. Monstrous shoots, or *gourmands* as the French gardeners call them, are seen on many different plants, and which appear to be excited into extraordinary vigour, either by the accidental protrusion of one division of the roots into a richer bed of soil, or to some local check inflicted by the pruner on the shoots situated immediately above, or round the place of the glutton. Deformed swellings or nodosities on the buds, leaves, shoots, or stems of plants, are the results of wounds chiefly given by parasitic fungi, or by insects or other animals. Of this description are the mildew on peach-trees, and the galls on the oak and other trees by which the healthy organization is deranged. These irregular developments, however, are not caused by juices impelled into the enlarged parts. Indeed, the very term *propulsion* is a doubtful one, when employed to describe the ascent of the sap in plants. In speaking of the motion of fluids through a syphon, or up the lower pipe of a pump, the term may be properly used ; because, in both cases, gravitation is the impelling power. But I am inclined to doubt whether the same pressure can act in like manner on the sap of plants, unless we can maintain that the lower or lowest membranes of the stem of a plant *are susceptible* of atmospheric pressure, while the membranes of bark and wood at the top *are not.* No, we must look to the simple attractive power of a vacuum on rarified fluids to account for the ascent of vegetable sap. We are well aware of the rapid flow especially in spring when the buds begin to open, and how copiously it is discharged from an amputated stem or limb of a tree at that season. An empty bladder tied over a fresh cut stump is quickly inflated and even burst by the rising sap and gas invited into it. But these fluids rise because there is an outlet, as in Mr Hale's experiments; for, assuredly, were the stump hermetically sealed, the motion upwards would instantly cease.

This is very evident, if we compare the rapidity of the rising current of a full-leaved tree with that of one which is leafless, and which, by the bye, is a circumstance shewing the perspiratory function of the leaves, and their attractive powers in increasing the current of the sap, and thereby assisting the development of all the other members of the plant. But however rapidly or slowly the sap is attracted along the vascular apparatus, depends entirely on the number and capacity of the outlets at top. The motion, as is well known, must first commence at the top,—a vacuum must first exist above, before the next drop below can flow upward: but whether flowing or stagnant, I never observed, nor can I conceive that any cell, tube, or vessel, can possibly be ruptured by any surcharge of healthy sap; and, therefore, I think that nothing like plethora can happen, unless by some external excitement or injury.

Another circumstance to which Mr Johnson attributes the extravasation of sap is the local contraction of the sap-vessels, and that such contraction sometimes happens, he gives an instance of one of his own cherry-trees, on which the graft has very much outgrown, in diameter, the stock on which it is worked. This appearance is not uncommon among trees that are either budded or grafted. But it is no sign of disease, nor can the swelling be considered as a receptacle of extravasated sap. If it were separated by the saw, it would be found composed of the same number of ligneous layers as the stock, only the former would be found of a grosser texture, and the latter more diminutive, owing to the specific difference of the two plants thus united. As a proof, were their positions reversed, the stock would certainly outgrow the graft. Of this fact many instances might be adduced, as occurring among grafted trees, when the stock and graft are dissimilar in constitution. That gum is often seen oozing from the swollen part is quite true, but this is from bruises, which this projecting part is more liable to than any other part of the trunk.

A fourth cause of extravasation brought forward by Mr Johnson is wounds, and which, he truly remarks, are most exhausting of all others. I cordially agree with what is stated on this point, as wounds, whether made in pruning or by accident, are sure to be attended more or less by a waste or extravasation of the juices. Wind-shakes are incurable by art, but the curative art may be effectual in cases of accidental contusions.

The quantities of sap yielded by some trees by tapping is certainly considerable, as instanced in the birch-trees of this country, and the sugar-maple of America. The flow of *toddy* from the cocoa-nut tree, as well as *pulque* from the American aloe (*Agave Americana*), is obtained in a very different manner than by tapping; for in both these cases the fructification is sacrificed,—the sap flowing and caught from the naked stump or base of the flower-stem.

Honey-dew.—From what Mr Johnson has stated concerning honey-dew, it appears that the cause of this phenomenon is still unexplained, or at least not universally agreed upon. Mr Johnson is one of those who believe that this dew is sometimes an exudation from the stomata or pores of the upper surfaces of the leaves. In this idea he is borne out by the testimony of many intelligent natural philosophers. A Mr Murray, a very clever writer in the Magazine of Natural History, some years ago paid much attention to honey-dew, and felt convinced that it was exuded from the leaves on which it appeared. As a proof, he had repeatedly washed and dried the same leaf, but which was shortly afterwards again covered with dew. Unluckily his account was defective, as he omitted to state positively, that there were no insects on the topmost leaves of the tree on which he was experimenting. For it is often seen on the lower leaves of a tree, and on the leaves of every herb immediately under it, when no insects are visible unless *sought* for on the under side of the highest leaves. The idea that it falls from the air is certainly erroneous, as it is never seen on the highest leaves, but on those only which have others above them.

I have seen honey-dew in all seasons, and in all situations, but never saw it in the absence of either stationary or fugitive insects. In cold weather it is somewhat candied, and in that state is collected by the ants in morsels, to be carried home. In warm weather it is perfectly fluid, and appears in blotches, or diffused over the whole surface of the lower leaves, hanging in drops from the points, and actually falling in showers, as was witnessed by the Abbé Boissier de Savauges, and which I have also observed repeatedly, and even in such quantity as to saturate the dust of a road under a large lime-tree. Bees sip it when fluid much more than at other times; and it being scarce or plentiful, makes a great difference in the profits of the apiarian.

In gardens, honey-dew always accompanies the colonies of aphides; on plum and cherry trees it not only disfigures the foliage, but also the fruit, by attracting dust, which is not easily washed off. In such cases the ants are serviceable to gardeners, as they assist to cleanse the trees.

The common aphides, in my humble opinion, are the chief producers of honey-dew; but if I am not greatly mistaken, there is another small fly, perhaps a species of the genus Thrips, which also emits a sweet clammy liquor on the leaves of the trees it lives on. I am led to believe this, because, on many of the trees, as oak, birch, sycamore, and lime, when infested with honey-dew, there was also a great concourse of those thripses as well as aphides.

That salt prevents the formation of honey-dew, is a circumstance quite new to me, never having used it for this purpose, nor noticed by accident that it had such effects, and therefore cannot doubt what Mr Johnson affirms of it. On the contrary, I consider it a discovery of the utmost importance to gardeners; because if salt be a preventive—whether honey-dew be an exudation or an emission from insects, the remedy banishes both; and in this point of view, I say, the discovery is invaluable.

That salt neutralizes the effects of frost, and is the most active solvent of ice, I am well aware of, having used it on a large scale for both purposes.

I have only to repeat, that I offer the foregoing observations for the sole purpose of re-engaging Mr Johnson's attention to some of the particulars, especially to honey-dew, which, as its real history is as interesting to the cultivator as to the vegetable physiologist, is a subject well worthy of investigation; and no one is better qualified to give a rational account of the phenomenon than Mr Johnson himself. No doubt this present summer will afford many opportunities for studying its appearances on different plants. If the summer be warm, it will probably be seen on the common currant as soon as on any other.*

ON THE PAUPERISM OF THE NORTHERN COUNTIES OF ENGLAND.

By Mr John Chrisp, Rugley.

As a sequel to the candid and able review of Mr Turnbull's Report of the state of Pauperism in Berwickshire, I hope that my endeavour to supply a few facts, and to remark on the working of what is generally called the *New Poor-Law*, on the southern side of the Tweed, will not be altogether irrelevant; and though I am personally concerned in the working of the present system, as guardian and rate-payer in an extensive and not slightly-burdened parish, I shall carefully endeavour to do so with candour and impartiality. My experience will, therefore, I expect, be considered as adding weight to my opinions, though these should be a little more strongly confirmatory of the soundness of the views of the reporter, than may be apparent to the reviewer.

It must be admitted that there has been, and still is, considerable prejudice against the English Poor-Law Amendment Act; but as this has been chiefly upheld by noise and misrepresentation, it has subsided not a little during the last twelve months, as the spirit of the law is better understood, and its practical working gets a fair trial. As rate-payers are now generally satisfied, that, notwithstanding the unavoidable expenses incurred by building, altering, and fitting-up work-houses at the

* This communication was too late of reaching us for the June number. —Editor.

commencement, the saving to parishes has been considerable, even during the first year of the new law, and are now convinced that it will be a sure protection against imposition, and squandering of those funds which are designed and ought to be kept sacred for the sole use of the poor and destitute,—one great source of opposition is thus overcome; and the only other source remaining is from those whose sympathies are so strongly expressed in favour of the poor and needy, that, were their views acted upon, the hard-working man would be put on a level with the pauper. It is they chiefly who, consequently, raise an outcry against the work-house and the dietary, as constituting imprisonment and starvation, and out-door relief as being totally insufficient for the support of life.

First, then, as to *in-door* relief, it will be sufficient to compare the present with the late system. It was only in some of the more extensive parishes that poor-houses were previously established, and in them the pauper was mostly *farmed*, that is, provided by a contractor with food and clothing for a certain sum per head per week, to be paid by the overseer for the year agreed upon, and generally let by tender. Under this system, the paupers were crowded together in rooms, where they ate, drank, and slept, in many cases without regard to decency, and always without order. The contractor, finding it difficult to procure work, allowed all those who could to stroll about the town or neighbourhood, running errands, putting in coals, or even begging, because the money they picked up was left at their own disposal, and spent in victuals or beer, and thus it saved the stores of the house. Some praiseworthy exceptions might be found to this account, but, generally, the poor-house was nothing but a filthy, ill-regulated lodging-house, where no overseer or select vestry durst send an idle or vicious character, as, by doing so, his bad habits would only be confirmed at the cost of the rate-payers. The smaller parishes or townships often had a deserted cottage of the very worst description for those poor creatures whom misery had thrown upon them; and in these, ill lodged and worse clothed, they all, or one of them, supplied themselves with food from a miserable pittance paid by the overseer. But, in the north of England, several of the larger parishes have been broken up into townships, many of them not including above a farm or two, and scarcely ever having a poorhouse. Such had to pay exorbitantly on an emergency for their neglect, as they had then to make what bargain they could with a servant in the homestead or adjoining village; and as birth always constituted a settlement, a single woman with child was hunted out of every parish, till she came to that one in which she could claim relief by settlement. Much difficulty was found in providing suitable accommodation for a girl in such circumstances; and farmers have been known to be obliged to take them into their own houses, when all other means of providing lodgings had failed.

The present system provides a work-house for a whole district, under the name of an union, at the common cost of all, regulated according to the sums paid to the poor for the three years previous to the formation of the unions, so that there is not a place but what has a right to send a pauper to an asylum on an emergency, where the old and infirm are properly looked to, and where the indolent and pretending can be tested as to their claim upon charity. In the work-house, everything is under the immediate superintendence of the guardians, of whom a visiting committee is annually appointed, acting in accordance with a set of well-devised rules laid down by the poor-law commissioners, and occasionally visited by the assistant-commissioner of the district, and arranged in a very superior and satisfactory manner by a master and matron. The work-house has at least two wards for men and women, with roomy yards attached for air and exercise, a work-shed for the men and a day-room for each sex. By these arrangements, every person capable of moving out of their bed-rooms does so during the day, by which their sleeping apartments are kept in a state of ventilation and cleanliness, equal to any of the best regulated public institutions in cities, and by which the comfort of the old and infirm is increased to a degree that strangers would rejoice to find, on looking through our work-houses, and which is an improvement that was thought impossible to be attained in the olden time. There is also a fever and sick ward in every one, where regular attention and medical aid are given to the ailing. As regards the dietary, it is certainly regulated with due regard to economy; and though every union selects its own, it is fully sufficient for any moderate person; the boys and girls being evidently well fed and healthy, as well as educated under the charge of schoolmasters, or sent to school in the nearest town. As the strict discipline of the work-house is found to prevent the able-bodied who can work, from taking up their permanent residence within its walls, the hardship of separating man and wife is never mentioned or complained of in practice; and though, to remove clamour, the poor-law commissioners have made it a rule to allow old couples to inhabit the same apartment, when recommended by the Board, I am not aware that the necessary permission has once been applied for; and every man of common sense will at once admit, that it would be both expensive and absurd to compel parishes to build and furnish cottages for every able-bodied pauper who may choose to claim relief. The bastardy clauses may properly be mentioned under this head, as the mothers are now generally relieved in the work-house; and really, after all the objections against them, they do not appear capable of much amendment. Instead of driving a poor erring girl from parish to parish, or carting her for miles across a county, that she may declare her shame before a magistrate, and saddle a parish with the penalty of her folly, the parish being always the first to furnish the support, and taking its chance of getting it again from the father, by which very large sums have been lost to parishes, and bastardy been generally complained of as no slight item in the overseer's expenditure, the law now merely says, you have inconsiderately placed yourself in the situation of a widow, and the rule is, if you are so destitute as not to be able to support your offspring, or get the father to do so, you may have relief in the work-house; but out-relief only encourages vice, and we are determined to refuse it. The attempt to grant affiliations at quarter-sessions is generally admitted to be a failure, and only outrages decency without checking vice.

I must, in the second place, consider *out-relief*. It must be admitted by all who have in the least turned their attention to the working of the old law, and the evidence given before the Commission of Inquiry is most conclusive on this head, that out-relief is liable to gross imposition and abuse. I can confidently refer to the experience of every person on the south side of the Tweed, particularly to those who were members of select vestries, with respect to the methods resorted to by would-be paupers, who had either relations or means to support themselves to obtain a weekly allowance from the parish funds. I have known persons up in years give up any little property they may have been possessed of to their children, that they might make their "*claim on their parish*," which they considered as much their right as the landlord does his rent, or the clergyman his tithes. Many of the "gangrel bodies" called muggers, though in the prime of life, and possessed of cart and horse with stock in trade, were regular claimants, and generally succeeded, by teazing the overseer, to secure a weekly allowance, or at least payment of house-rent, rather than allow them to reside in the ill-regulated poor's houses. This nuisance has been abated since the strict adoption of in-door relief to the able-bodied; and the only question now is in many of the Boards of Guardians, whether it might not be adopted in almost every case. It is certainly a feeling amongst the benevolent, that to be sent to the work-house is equivalent to suffering punishment; but when it is certain, that it can only be so to those who are capable of earning their livelihood by industry, if they choose, or to those who wish to impose upon the parish, though their relatives are able to support them, and that the old and infirm are much more comfortable, and receive more attentive nursing and medical advice than they can at their own domiciles, this feeling must speedily subside. And as the children are healthy, their education duly attended to, and will still more be so if the recommendation of the fourth report is carried out, much misconception of this particular will be rectified, notwithstanding the efforts of popular writers to keep it alive, by appealing to the sensitive feelings of our nature. But as facts should allay the imagination, let any person who has been misled by the descriptions in "Oliver Twist" look into even the imperfectly regulated work-houses of the north of England, and, after examining their inmates and regulations, say if such cruelties and abuses as are there represented can happen now, though they might have occurred in those known by the name of Gilbert's Unions, which the legislature was expected to be called upon this session to abolish.

To sum up my experience, which is, that abuses and impositions are inseparable from out-relief, and that the check of the work-house is inseparable from a compulsory poor-rate. These conditions are not alone acknowledged in England; they are found to prevail on the continent of Europe, and in the democratic States of North America *(see Senior's Report on Foreign Poor-Laws)*, and there practised with a strictness and even harshness that would be impossible in England. The legislature has now sanctioned the principle of *in-door* relief only in Ireland, and it cannot be long before the same is demanded for the infected parts of Scotland. Berwickshire will soon find that England surpasses her in economy; at present it is nearer than could be suspected, without official documents to refer to; and the following table, extracted from a local newspaper, the *Gateshead Observer*, is given, both as a standard for reference and a beacon to warn.

DURHAM.	Population in 1831.	Expenditure for year ending Lady-day 1838.	Decrease from the average of the three previous years before the Union.	Rate per head on the population of 1831.
Auckland Union,....	14,632	L.3,225	29 per cent.	4s. 4½d.
Chester-le-street do.	17,178	5,094	29 —	5s. 11d.
Darlington do........	18,883	5,278	22 —	6s. 8d.
Durham do............	15,550	3,836	24 —	5s. 0d.
Gateshead do.........	31,017	7,078	21 —	4s. 6d.
South Shields do......	24,427	6,166	32 —	5s. 0d.
Sunderland do.......	42,664	9,380	14 —	4s. 4½d.
Weardale do.........	12,775	3,353	1 —	5s. 0d.
NORTHUMBERLAND.				
Alnwick Union,......	17,263	6,001	13 —	6s. 10d.
Belford do............	6,422	1,869	20 —	5s. 9½d.
Bellingham do.......	6,530	2,562	21 —	7s. 10d.
Berwick do...........	28,782	6,837	19 —	4s. 8¼d.
Castle-Ward do......	15,539	4,475	22 —	5s. 9d.
Glendale-Ward do...	13,856	4,439	22 —	6s. 0½d.
Haltwhistle do.......	5,634	1,464	26 —	5s. 2½d.
Hexham do...........	27,271	7,826	13 —	5s. 8½d.
Morpeth do...........	14,340	4,506	15 —	6s. 3d.
Newcastle do.........	54,991	13,422	11 —	4s. 10d.
Rothbury do.........	7,715	3,275	12 —	8s. 6d.
Tynemouth do.......	47,715	10,509	20 —	4s. 4½d.
Berwickshire, as per Mr Turnbull's Report,.......................				4s. 1d.

This table being principally extracted from the Report of the Poor-Law Commissioners, may be relied on as authentic. Some surprise will, no doubt, be excited at the difference of the comparative pressure on the unions of the same county. Those, however, which are least, are those in which the work-house system is most efficient, or where it has been most promptly introduced: those which appear the highest had not an union work-house, and scarcely a parish poor's house, to fall back upon.

ON SHELTER, AS A MEAN OF IMPROVEMENT.

By Mr DONALD BAIN, Edinburgh.

This is a mean of improvement that has not perhaps received all the attention it is entitled to; but as an accompaniment of other improvements, it is almost invaluable.

When we consider the cause of barrenness deliberately, we are surprised to find, against our general pre-conception, that it is not *height* that leads to it, but *cold;* for in the highest hills we find occasionally sheltered valleys, and as often as we do so, we find those valleys fertile.

Again, in plains as low as the general level of the country, we often find approaches to sterility, or sterility itself, if they happen to lie open to any blighting wind.

Few travellers can go over Scotland, without finding, in situations exposed, and apparently naturally barren, evident marks of cultivation at some remote period, sometimes far up the hills; and fewer still, it is fortunate, can now go over it, without finding rich land, and bearing heavy crops, where it is easy to see that cultivation has been but lately introduced. This last is often to be traced to draining, trenching, and other expensive operations of an agricultural nature merely; but it may often be remarked also, by a person familiar with certain localities, that the growth of belts of wood, has, by sheltering the land, and enabling heavier crops to rise, wholly altered the nature of extensive districts, as well as their climate and appearance.

On the very top of Corryarick, (a hill in the pass from Fort-

Augustus to Badenoch), the root of an oak may still be seen, the very prongs of which are eighteen inches across. Nothing of the kind could now rise in this spot; but history tells us, that though there is now not a tree visible, in a walk of eighteen miles over those moors, the district was once the site of an extensive forest; and this magnificent oak, therefore, though on the very summit of the ridge, found the shelter necessary to its luxuriant growth. It is equally certain, that at that time, this extensive range of heath must have been warm, and covered with grass, and sustaining in comfort extensive herds of cattle and deer, as well as those who fed upon them. It is at present comparatively barren,—there is not a hut but the shepherd's, and that only in a range of many miles, and without an effort at raising a single plant,—this is wholly unnecessary.

Let any one look at a moor where plantations have been raised, and he will find as follows: *First*, If the wood has been properly planted, and fenced, and thinned, that is, if proper care has been taken to make the plant reach the subsoil, to shelter it while growing, and in due time to provide room for its growth, the wood is thriving; and instead of *heath*, as was the original covering of the soil, it is now covered between the trees by a rich, and if they are close, an exceedingly *silky grass*. Even the heath at the outskirts, if any remains, has a softer and more luxuriant character than the stunted article of the same description without the enclosure. It may be said this is produced by the manure annually furnished by the falling leaves, and this *may* promote the richness and luxuriance of the grass. But the efficacy of shelter is evident from this, that the grass is often finest and richest, where there is shelter only, and no manure from the falling leaves, that is, in casual openings of the plantation.

Next, If corn-fields have been created under shelter of the woods, they will generally be found luxuriant, while beyond this, there is first coldness, and a light crop; and beyond this perhaps heath: or even one side of the wood is thin and stunted, and the other, which has been sheltered by this stunted part, is thriving and vigorous.

A more remarkable evidence of the benefits of shelter, and of the consequences of the want of it, may be stated as follows; namely, where a dyke has been raised of a certain height, and trees planted within it, the trees are *cut* by the blast *as if by a hedge-knife, exactly in the direction the blast has received from the coping of the wall;* that is, if the wall is flat at top, the wood has suffered far in; if the angle of the top is small, the cut of the trees is exactly of the same angle, and extends far in, in proportion to the flatness of the angle; but if the angle is very acute, and sends the blast almost *directly upwards, the wood almost escapes;* the tree by the wall is slightly cut, and no more. These facts may not have been noticed in any scientific publication, but they are open to every observer; and they suggest many ideas of the utmost importance, as regards this division of the empire.

They suggest, *first*, the great utility of shelter as a general principle; but if we reflect for a moment, that every gentleman's residence is sheltered, and that much of its beauty is held to depend upon that circumstance, we shall be satisfied that the utility of shelter is not only recognised, but so completely established in the public mind, as to form one of the elements in our ideas of beauty. Again, by means of shelter, in gardens, we can raise the fruits of entirely different climates. These observations suggest, *next*, that where woods are planted, the wall opposed to the most prevalent or most destructive wind, should be of considerable height; and *third*, that even *the form of the coping of dykes*, for woods or fields, is of consequence; and that it should always be of such an angle, as to send the blast (which in all cases will obey it more or less), *almost directly upwards.*

By proper shelter, almost every part of this kingdom might be brought into a state of warmth and productiveness. Ranges of moor, apparently the most barren, might be rendered warm and kindly to every species of vegetation,—even *hills*, were it worth while to contend with them, might be conquered by successive belts of wood; and if not cultivated (as they evidently have in many instances been), at least made of double or triple value for pasture. But our common moors and moorland require nothing so much as shelter; and even where the lands are not moorish, but much exposed, shelter is necessary both to the fields and flocks, and nothing can so much enhance their value. And it is not continued ring-fences, clapped down any where, or any how, that should be recommended in this matter. When an engineer wishes to oppose the tide, he does not put down a long dead wall. He puts down in the strength of the current, a point of great power, and as the strength of the current, thus broken, diminishes, he diminishes his defences, and finally leaves the matter to the tide itself, when fully broken to the desired direction. In like manner, the person dealing with the winds, should consider where they bear hardest, and where they may be made to trend away with advantage, and suit his defences to the exigency, whether in height or strength. A very slight defence, for example, placed on a height exposed to the east, may not only protect that height, but shelter a long reach of lower land. The whole east coast of Scotland is bold, and it is bare. A belt of wood behind a wall of proper height, and presenting proper angles to the blast, might shelter whole districts inland; and so, of any other exposure, art is in this case, as in most others, greatly more than strength. An hundred yards of wall or of wood, rightly placed, may do more than a thousand placed without skill. Put down without judgment, indeed, intended defences may do manifest injury, for they may *shut out the most kindly influences, and expose the crop to a cataract of included winds.* But, as a general position, shelter is, in Scotland, of the greatest value. It is nearly a national object. It might reclaim many thousand acres, that without it can never be reclaimed; and almost incalculably improve many thousands more. A survey of the kingdom, with this particular object in view, would not be out of place.* On the contrary, it is exceedingly wanted. The larger features of other improvements might be combined, such as leading occasional lines of deep drains or canals, or taking advantage of the gullies that occasionally wind between the hills, for making them,—a natural canal, for example, extends, for nearly eighteen miles, from Corryarrick to Fort-Augustus; it is at present the bed of a trifling stream; but by occasional stop-

* This is a good hint, and the attention of the gentlemen connected with the great trigonometrical survey, should be irected to it.—EDITOR.

pings of very limited extent, might be made of any depth, and open Badenoch to the great canal, and *vice versa;* and this is only one instance. But the object of shelter alone would justify the survey I have suggested, and if it should lead to directing many hundred miles of sheltering walls, much more expensive walls have been led for worse purposes. The labour would fall upon many, and so would be light; and, above all, it would be profitable to the present and to all future ages.

Holland is, for the most part, protected from *water* by dykes. It would not be so arduous to protect Scotland from wind, nor would a breach in the dykes be so dangerous.

These reasonings may seem very proper for a castle-builder; but I have very lately had the satisfaction of seeing, that not only is my theory correct, but that it has been, perhaps for ages, extensively in practice. In a recent history of Devonshire, it is said, that "in this part of the country the fences are chiefly *high mounds,* surmounted by coppice-woods, which not only afford a *sufficient supply of fuel,* but also a surplus of poles, cordwood, faggots, and oak-bark for sale." (Let landowners mark that.) "This kind of product is considered a crop of some value, in addition to its utility as a fence; as it affords to the pasturing animals excellent protection from wind and sun, with but moderate care and expense in repairing. These hedges are better adapted to the hilly surface of Devon, than to more level countries, commonly forming altogether a barrier thirty feet high, which *so softens the rigour of the unfriendly blasts, that many of the inferior hills are cultivated to the very summits.* A stranger unaware of the practice, considers himself as travelling in deep hollow ways, for miles, till arriving at some elevated opening, he is charmed with the delightful scenery of the fertile country he has passed."

This places the principle of shelter on a large scale, so completely on the footing of *an approved practice,* in one of the counties of England, apparently made "*the finest*" by this very practice, that there seems to be no necessity for giving the idea out with fear. The whole of the east coast of Scotland should be sheltered by high mounds, either carrying or protecting wood; and in every situation where the plains or valleys are swept by scourging blasts, similar impediments should be put down. This acted upon as a general principle, for a few years, would entirely change the climate and aspect, and even the soil of many parts of Scotland; for as money makes money, so heavy crops lead to heavier crops; by enriching at once the soil and the cultivator, from making more manure, and sheltering and fining the soil. There is no part of *Scotland*, or *England*, or *Ireland*, that may not be sheltered at less expense than the wilds of America may be cleared, and with more certainty of a market for the proceeds. "Sheltering leases," therefore, should be granted, as "improving leases" have been; and speedily we should see shelters rise, as profitable to the raisers, as pleasing and profitable to the country.

In Ireland, particularly in the northern parts, shelter is much wanted, and, so far as it exists, produces the most marked effects.

It may be essential to consider the *figure* of the dykes. Perhaps there is little doubt that they should, on the side exposed to the blast, be perpendicular, rather than merely sloping mounds; as the perpendicular face completely breaks the current of the stratum of air rushing against it, while an obstacle of a sloping description would merely change the direction of the blast, but not decrease the force.

For their *structure* they need not be expensive, being intended for use not ornament; and their beauty would consist in their utility. Besides the scenery to which they would give rise, in belts of wood, sheltered corn-fields and cattle, these would constitute the beauties of the spots so benefited, and render the other accessories of no moment. In time, too, they would become like natural objects, and covered with verdure and foliage of some description. They would in this way be as beautiful as useful; and both, it is believed, in a very high degree.

ON THE RELATIONS BETWEEN THE TEMPERATURES AND THE PRODUCTIVENESS OF DIFFERENT YEARS.

By Mr G. Dickie, Aberdeen.

The relations of the Gramineæ to different climates must always be considered of importance, and the study of this subject would undoubtedly tend to increase among agriculturists a knowledge of the necessity of accommodating them as well as other plants, to the climates peculiar to different parts of the country. Without doubt, the importance of this is, to a certain extent, understood by most agriculturists, and, indeed, is so far compulsory, because an error in this respect very soon affects the interest of the cultivator. It must, at the same time, be admitted that other circumstances ought to be taken into account; the nature of the soil for example, whether poor or rich, moist or dry. The influence of heat (as well as other agents) seems, however, worthy of more attention than is generally paid to it. The disputes which have arisen regarding the merits of different cultivated grasses, have partly arisen from forgetting that a grass, valuable on account of its produce in one part of Britain, may, in another part, and consequently under a different climate, be found less profitable; and further, the power of becoming acclimated may be different in different species or varieties.

"The distribution of the cultivated grasses," says Schouw, "is determined not merely by climate, but depends on the civilization, industry, and traffic of the people, and often on historical events." The truth of these remarks cannot be denied, but the first (climate, viz.) places impassable boundaries to the influence of the others. The same author remarks, "The grains which extend furthest north in Europe, are barley and oats. These which, in the milder climates, are not used for bread, afford to the inhabitants of the northern parts of Norway and Sweden, and of a part of Siberia and Scotland, their chief vegetable nourishment."

In Norway, at Attengard, near N. Lat. 70°, barley succeeds sometimes in the valleys, the snow line there is 3600 feet; in N. Lat. 65°, oats ripen. In Sweden, early barley reaches almost to the boundaries of the pine woods in N. Lat. 69°, where the sun never sinks below the horizon from the latter part of May to the end of July. Oats, to the north of N. Lat. 66°, very seldom ripen; the snow line here is 4800 feet.* "In the course of the month of May," remarks Dr Richardson,

* On the Snow Regions of Norway and Sweden, by Lieut. Pol. Hagelstam

"ground was prepared at Cumberland House, and, toward the end of it, barley sown, to be reaped again in August, after an interval of about ninety days, whose mean temperature may be stated at 67°.8 Fahr.* This place borders on the isothermal line of 32° F. According to Humboldt, barley, to be cultivated to advantage, requires, during ninety days, a temperature of from 47°.3 F. to 48°.2 F. Although the mean annual temperature of any place may be far below that at which seeds can germinate, still grain will come to maturity if the mean of the vegetating season reach a certain degree. Oats seldom ripen farther north than Lat. 66°, the annual mean temperature being 33° F., that of the summer being 57°.8 F., while barley reaches to N. Lat. 69°, where the annual mean is only 27° F., that of the summer being 54°.8.

The following table, and brief remarks on the relation between the crops of different years, and the temperatures of these years, are presented, not on the supposition that they are of any great value, but rather from a desire to direct attention to a subject not less interesting than important. Professor Playfair proposed to date the vegetating season from 20th March to 20th October, and supposed that it is on the nature of that season that the quantity of the crop principally depends.† He assumed 40° F. to be the lowest temperature at which corn will vegetate, and considered 56° F. as the mean temperature of a good vegetating season. The limit at which corn will not ripen he stated to be about 48° F. In the following table Professor Playfair's method has been adopted, and by the vegetating season is meant the period from 20th March to 20th October in each year. The fiars prices are assumed as fair criteria of the productiveness of the seasons, and are placed in comparison with the mean temperature of each year, the mean temperature of the vegetating season, and the total fall of rain. The fiars are those of Aberdeenshire as given in the Aberdeen almanack.

* On the Botany of Hudson's Bay.

† Trans. Royal Society, Edinburgh, 1800.

Years.	Mean of veg. season.	Annual mean temperature.	Excess of veg. season above 40°.	Rain in inches.	Oatmeal per boll.
					s. d.
1829	50°.94	46°.62	10°.94	28°.66	13 6
1830	51 .24	46 .81	11 .24	30 .60	16 8
1831	53 .49	48 .14	13 .49	29 .16	14 10
1832	51 .98	47 .83	11 .98	21 .07	12 0
1833	52 .05	47 .13	12 .05	22 .04	11 16
1834	53 .22	49 .18	13 .22	12 .28	14 6
1835	51 .50	46 .96	11 .50	14 .94	13 6
1836	50 .92	46 .14	10 .92	24 .69	18 0
1837	48 .67	45 .35	8 .67	20 .29	15 6
1838	48 .58	44 .25	8 .58	34 .40	21 6

Annual mean temperature at Aberdeen, from observations during the last sixteen years, = 47°.22.

The temperatures are from records kept at Aberdeen by Mr Innes; they therefore cannot be considered as strictly applicable to the whole county, but can only be regarded as an approximation; for this reason we cannot venture to draw any certain inferences from the comparisons.

Professor Playfair says, "whether the quantity of the crop may be expected to be proportional to the excess of the mean temperature of the vegetating season, above 40° F., may deserve to be more accurately considered. There is every reason, however, to think that the variations of the crop, at least corn, will be greater than in proportion to the variations of temperature. By doubling the deficiency of the heat, we do a great deal more than double the deficiency of the crop, so that the latter varies in a higher ratio than the former. The limit at which corn will not ripen may perhaps be stated at 48°." A writer in the Aberdeen Journal of January 18th 1837 remarks, "I have observed that if May, June, and July had an average of 54°.5 per diem, grain would fill and ripen notwithstanding an autumn as wet as that of 1829. In that year grain did ripen, while in the present year (1836) the average heat for the three months being 43°.29 F. only, the staple crops (barley and oats) in this district (Huntly) have ripened so imperfectly as in most cases to be unfit for seed, and deficient in weight compared with any crop since 1821." In making such comparisons, it would be necessary to take into account the comparative temperatures of shorter periods of time. It is of importance to note the *daily* range of temperature, as this forms a prominent feature in the nature of the seasons.

At the beginning of these remarks, it was stated that grain comes to maturity in high latitudes where the sun never sinks below the horizon for several weeks; the temperature at this time is favourable to vegetation, but it is a question if the long-continued presence of the sun's rays is equally so, for alternations of light and darkness seem to be essential to the proper performance of the functions of respiration and digestion in plants. Probably, however, all vegetables, cultivated as well as uncultivated, have a power of adapting themselves, to a certain extent, to the different circumstances in which they are placed.

The study of the relation between climate and the productiveness of the different crops, is deserving of much attention. The difference between the nature of any two seasons may be such as to be worthy of being considered equal to a difference of several degrees of latitude; hence the importance of selecting early or hardy kinds of grain, by which means the consequences of an unfavourable vegetating season may be much modified. The same care is applicable to situations whose average temperatures do not rank very high; "great advantage has been derived in this part of the country from the introduction of early varieties of oats."*

The distribution of rain throughout the vegetating season constitutes also a very important feature of its character. Frequent rain, although not very copious, will be less favourable to vegetation than a greater quantity falling at longer intervals, provided it is not so overpowering as to cause lodging of the crops. Other circumstances might be mentioned as worthy of notice; the number of clear and of cloudy days, and the state of the atmosphere in respect to the vapour contained in it,—the lowness or highness of the dew point.

ON PORT PHILLIP, IN AUSTRALIA FELIX.

By Mr G. MACKILLOP, Hobart Town.

I sent a paper on the subject of the new colony at Port Phillip in August last, to this Journal;† and as I still consider

* Dr Farquharson in Northern Flora.

† We had not the good fortune to receive the paper alluded to.—EDITOR.

that place well deserving the attention of persons emigrating to these colonies, I now send your readers excerpts, from its commencement in October last, of the *Port Phillip Gazette*, the only newspaper yet published at Melbourne.

Perhaps your readers will consider the articles in these newspapers which I am now about to bring to their notice, of sufficient importance for perusal. In that case I should wish them to be accompanied by the following remarks, in order to prevent proposing emigrants forming the exaggerated expectations which some of these articles may be calculated to produce.

The first article I would bring to their notice is from the introductory remarks of the editor, in his first number, dated 27th October 1838, as follows:—

"That we have chosen a highly flourishing district for the scene of our literary exertions, we are well assured, not only from personal observation, but from the unanimous consent of all experienced settlers in the elder colonies, from the opinion of those whose knowledge of the subject and strength of mind enable them at one view to take in, comprehend, and systematize the great questions of colonial immigration and statistics, and from the strong and general testimony of the press both of Van Diemen's Land and Sidney.

"It was by one of the second class that we were apprised of the information contained in the following summary of statistical facts:—

"Sir George Gipps, in laying the Estimates for 1839 before the Legislative Council, stated that 'the land revenue during the first six months of this year (1838) amounted to only L.31,662 : 10 : 9, and estimating the revenue for the last six months at the same rate, we shall have only the sum of L.63,325 : 1 : 6 to meet the expenditure in immigration for the year 1838.

"Now, from this it appears that the total amount of the land revenue realised during the first six months of the year from the entire territory of New South Wales, was L.31,662 : 10 : 9, whereas the Melbourne district alone realized in two days, the 12th and 13th September, the sum of L.35,359 : 3 : 0 ! being positively L.3696 : 12 : 3 more than the probable revenue estimated by Sir George Gipps in his financial minute from the land sales of the entire territory of New South Wales for the last six months of the year.

"Again, we may contrast in a way the most favourable for ourselves, the state of this district with the colony of Van Diemen's Land, possessing a population of 41,512 souls, living on a soil which, from its capabilities, has constituted it the granary of Australasia, enjoying an extended and wealthy commerce, a well acting if not popular government, and a support from the labour of its convict population, the want of which has almost made our infant community quail before its oppressive character.

"Sir John Franklin, in his financial minute, stated the land revenue for twenty-two months, namely from the 1st July 1836 to 30th April 1838, at L.52,850 : 8 : 7, against which the expense of gaols and police for the same period, was set at L.51,146 : 9 : 0, leaving a balance of only L.1,705 : 7 : 10, available for immigration.

"The argument, then, in support of the unparalleled success of our district is founded on undeniable facts illustrated by numerical figures. But, indeed, we have only to look round at our favoured territory to see what nature has done for us, our beautiful country, our rich soil, our admirable port, our central position, and above all the enterprising character of our population, to be at once satisfied of its present and future prosperity; this has been a country owing its success chiefly to the last cause—the first arrivals on its shores were men of old colonial experience from Van Diemen's Land, they were met by persons of decision, activity, and energy of character, from Sydney—flocks and herds rapidly increased—the land was on every side fast and thickly located—the soil was made subservient to the production of their wants, and favoured by a genial climate with sufficient moisture, their expected crops will be abundant—the sheep have increased in health, strength, and growth—the pasturage is most luxuriant, and the land around Melbourne no art could improve. Two years have scarcely elapsed since the site of Melbourne was a wilderness, the echo of its woods answering only to the shrill cooee of the savage, or the long wild howl of its native dogs; now the sounds of a busy population, the noise of the hammer and saw knows scarce a moment's cessation, the ground has been cleared and houses like mushrooms are every day springing up; we have noticed, not once, buildings run up during the night, where the day previous was a void: this speaks for the industry of its labouring classes, we mean those usually classed under the denomination of artizans, who borrow from the hours of rest to effect that which others look to in the day. That the district is every day increasing in the estimation of the richer and elder colonies, is evident from the constant and rapid influx of immigrants of all classes both from Van Diemen's Land and Sydney; and that they value the country where their enterprize has suddenly called up around them the fruits of society and civilization, may be learned from the trivial and almost laughable fact of the extreme jealousy with which the motions of the rival parties have been on either side and on every occasion watched, but we are glad to see this petty motive of apparent distrust sinking into a cordial co-operation, whenever required for the public benefit of the country they have settled, or the town they have built. We look upon this mixture of agriculturists and stockbreeders as one of the most fortunate circumstances which could have taken place with regard to the population of the district. We have on every side a most luxuriant pasturage, though we believe, from the opinion of good judges, in general better adapted to cattle than sheep; and we have undoubtedly a greater proportion of good land and that naturally cleared and drained ready for the plough on first occupation than has ever yet occurred in the sale of Crown lands in any other part of the colony; this advantage might probably have been lost or disregarded by the settlers from the 'Sydney side,' who are men accustomed to the possession of large herds 'running on a thousand hills,' the number of which they seldom or never accurately know, and these dispersed through stations in the interior where only a bare sufficiency of wheat is grown to supply their own immediate necessities; but in the sister colony, where want of space obliges the landholders to turn their attention to farming, a triumph, we may say a noble one, has been gained over the soil in opposition to the blighting effects of the hot wind, the simoom of Australasia, whose devastating powers are instantaneous and distressing beyond comparison with any evil of the kind in England. We trust, therefore, to see this an agricultural country; everything ought to be done, every inducement held out, every facility afforded to the class of small farmers who can and will turn every foot of land to account, every acre to the production of 'corn.' The plan of frequent villages which has been adopted in the survey is a favourable feature, it forms at once a central depot to a number of the contiguous farmers, it prevents the waste of time which they would occupy in journeys to the port, the distracting the attention from the chief end of their labour, and holds a bond of union between them which is highly necessary in a country where the form of society is so broken, cold, and unnatural, so different from that of their native land, and so unfavourable to the increase and growth of the better and more kindly feelings of their natures."

The next article is from the paper of 10th November :—

"Incredible as it may appear to people in England, it is no less true, that men-servants, at present, demand and obtain fifty-two pounds per annum with board and lodging, and female servants from twenty-five to thirty pounds a-year. We hope the time is nigh at hand when we shall have the pleasure of seeing vessels direct from England, entering our port with emigrants."

In reference to the above I remark, the present rate of wages for house-servants is, for men L.30, and for women, L.16 to L.20 per annum; but that it is nearly impossible to get or to keep such servants as persons in the middle rank of life at home would be content with. Few house-servants have gone from this to Port Phillip. Many of them wish to go, but they are too improvident to save enough (L.4) to pay for their passage.

In the paper of 17th November, it is unhesitatingly stated that Colonel Snodgrass is likely to be appointed Commandant (chief civil and military authority) at Port Phillip, and that courts of request and quarter-sessions are to be established there ; but in the late newspapers, direct from Sydney, a report of such courts being in contemplation was not even bruited ; and Colonel Snodgrass, instead of going to Port Phillip, is about to return to England. The courts just referred to are much wanted at Port Phillip, for the reasons stated in my last communication. It is also stated in the same paper that, by the custom-house books, the clip of wool of 1837, exported from Port Phillip in the beginning of 1838, amounted to 260,000 lb. ; and that it is expected the clip of 1838 will amount to 900,000 lb. In my opinion, the clip of 1838 will not probably amount to more than 600,000 lb. value say L.40,000 ; and even this is not a small beginning for a place where, only about three years ago, there was not a single sheep ! It is possible that some of the New South Wales sheep-farmers on the river Hume, and even on the Murrimbidgee, may this summer bring their wool to Port Phillip for shipment, in place of taking it to Sydney, as heretofore, (the expense of the transport of wool on the roads in the settled parts of New South Wales being great, as explained in my former communication), and in that case the exports from Port Phillip may amount to 900,000 lb. ; but as 100 miles of the road between Melbourne and the Murrimbidgee is yet nearly without settlers, the farmers on that river will not probably find it convenient to send a sufficient escort with their wool, to protect it and their drays from the natives, there numerous, and sometimes mischievous ; and I do not, therefore, think they will send their wool to Port Phillip this year, though they will probably do so the next, as the New South Wales government have lately sent four "Protectors of the Aborigines" to Port Phillip, and it will be part of their duty to open a friendly intercourse with the natives on the road in question.

In the same paper is an article on the subject of the necessity of a court of requests, and also of quarter-sessions for Port Phillip. That place has been neglected by the authorities in Downing-Street and at Sydney, or it would have had both ere now.

"Wanted immediately, for the town of Melbourne and district of Port Phillip, a court of requests. We have been told over and over again, that we may expect a court of requests as also of quarter sessions at Melbourne, but it would seem that, like Christmas, they are always coming. That we are serious when adding our voice to the general cry, we are confident no one will for an instant doubt. We see too clearly the absolute necessity of such a measure in a populous settlement so far removed from the seat of justice, as to render the time wasted and the expenses incurred far more vexatious than the loss it is intended to recover on the part of a defrauded creditor. We see too clearly that nothing but a present, immediate, and active legal power can give satisfaction to the hard-working and industrious tradesman, and suppress the cheating and shirking of those who, having no credit elsewhere, come hither to 'let us in.' We see these things too clearly, we repeat, ever to make a jest of a subject alone calculated to restore that confidence which reciprocal industry and labour has heretofore induced us, to our mutual benefit, to repose in each other; and we can see too clearly the consequence of distrust, the paralyzation of our energies, and the general bankruptcy that will follow, ever to cease demanding a court whose presence will shield us from a crisis the most distant approach of which is seriously to be dreaded."

I now ask attention of your readers to an article in the paper of 1st December, and which, it will be observed, coincides exactly with what is said in my former communication on the subject of the sale of the Port Phillip land. In proof that the editor is not singular in his opinion on this subject, I quote the following from a letter which I have received within the last few days, from a wealthy farmer at Port Phillip:—

"After much reflection, I have determined not to send funds to Sydney for the purchase of Port Phillip land at the next sale. When the powers that be condescend to sell the land at Melbourne I will purchase; but I cannot leave my affairs here to go all the way to Sydney, and it is impossible to give the instructions necessary in all contingencies to an agent."

The paragraph in the Gazette is as follows:—

"We have been given to understand that an application from the settlers at Geelong to the Governor, requesting his Excellency's interference in the proposed sale of land in that district, has failed to meet with that success which we would unassumingly, yet firmly, assert it truly merited, not only because a favourable answer would have made the sale of land on the spot, which was the sought-for intent of the memorial, an advantage to those men whose fearless enterprise, regardless of all the labour, anxiety, distress, deprivations, and difficulties innumerable encountered and overcome, has thrown open a vast tract of hitherto unlocated land, to the spread of traffic and civilization, industry and wealth, colonial aggrandizement and national grandeur, but also because a cession of the point submitted to his Excellency's influential judgment would have been in favour of that party he is supposed to represent, and whose injunctions to him as an agent are, 'Bear in mind, that in disposing of the Crown lands you do so to our uttermost advantage; that if either in particular or general sales our property should pass to the purchaser at a sum, which it is evident to us might, by judicious management, have been greatly increased, you will be held responsible for such loss.'* It is when looking at the subject in this view that we feel surprised the enlightened, active, and decisive mind of Sir George Gipps should have for an instant been overclouded; for we consider, and are prepared to support, by various arguments, our views of the case, that the local and immediate disposal or sale of the lands at the townships of Melbourne and Geelong, will be productive of much greater wealth in the return of money to the public treasury, than it has proved even by the enormous account of the recent sale in Sydney; for although the town allotments went at an average increase of 100 per cent. on the previous sale at Melbourne, yet be it recollected that the same proportion was the relative result between the second and first sales of allotments at the same place, when sold on the spot. The country sections were, by all good judges of land in these parts, and none more likely to be acquainted with its real worth than those so long located on the soil, expected to average one pound per acre, they actually brought only twelve shillings: mark, reader, the loss herein accruing to Government. What, then, may one well ask, or wherein are we to be benefited, if, by the attainment of the measure proposed, that of the land being sold here, we are not to obtain it cheaper than when disposed of in Sydney? This is an interrogation which naturally arises, and we, as far as our limits allow, will endeavour to answer it. When a sale takes place at so great a distance, and the journey to which would be attended with so great and so heavy an expense, it will, as it has already done, deter, in many instances, the present tenants of the ground from going up to Sydney, to continue to themselves the possession of their several locations; the land then falls into the hands of speculators, jobbers, usurers, mortgage-contractors, prosecution-drivers, and ultimate-fraudulent regainers of the property as well as money, which has before been invested at an extortionate rate of interest on the same. The beggared owner, or rather believer in this miserable delusion of ownership, disheartened at the closing meshes of his wily adversary, neglects his crops, his farming, his household affairs, the payment of his debts, and is broken, not only in fortune, but alas, too often in character. But here

* Vide private instructions to ——— from the Secretary of State's Office.

the owner is not the only sufferer; the narrow-minded and avaricious mortgager sees not, until it is too late, the decreasing value of the land, arising from the injurious neglect to which he has driven the poor occupant. Then he is caught at last—says the reader quickly. By no means; you must be some silly fresh arrival, who could put so foolish a finish to the picture we have drawn—he will take good care not to be a loser at any rate, he will contrive to rid himself of it by taking in some 'new chum,' while the country, or rather the public, whose united energies and enterprise reciprocate the benefit derivable from the soil remain the really injured. How contrary, then, would be the chain of current and recurrent advantages to the purchaser, the property, the soil, the public, the colonial government, and the pockets of the home administrators, were this bar we complained of removed; the sale of land being held at Melbourne or its vicinity, where the squatter, to secure and continue to himself the improvements of his position, would go to even a higher price than ordinary, or than could ever be expected by its sale in Sydney; the buyer of a necessity would become the *bona fide* settler, would farm and till his land with zest and industry; from motives of a sure gain, the harvests would be abundant, exports increase, commerce be enriched, and the Governor, who advocated the measure, be proud of his timely interference in a cause so important to the local interests of a community now rapidly increasing in numbers, wealth, and political importance. We would call, therefore, earnestly upon the residents of Melbourne, the stockholders of the country, the merchants, tradesmen, capitalists, and labourers, to meet in memorializing the Governor upon a subject so intimately connected with our future weal, respectfully pointing out that the probable result would not in any way be likely to cause the land to deteriorate in value, and would only be a just acquisition of advantage and gain to us, inasmuch as it would clear away the expenditure and loss attendant upon so long an absence from our individual business and affairs, in which (to us real advantage) we humbly suppose we have a priority of right over the inhabitants of Sydney, who have remained on their part quietly at home, while we explored the country for their speculation and gain."

I now refer your readers to a long article on the subject of the prospects held out by Port Phillip to emigrants generally.

"To endeavour to draw the general attention to our beautiful district; to lead men of business and energy of character to settle amongst us; to point out the superior qualifications which Port Phillip possesses over all the hitherto discovered tracts of country in Australia; to sway the tide of British and Colonial talent and wealth to our port, by a fair and open representation of its indisputable advantages, has been and ever will be the chief object and aim of our labour, and if, in one single instance, such a line of duty should prove of beneficial result, it will be a point upon which the memory for years after may return to dwell with secret satisfaction.

"It is a pleasure we cannot deny, to speak of a settlement which has grown with our growth, and to the prosperity of which we have all in some measure, been conducive; the interest it everywhere begins to create ought to prove a fresh impulse to our exertions in its cause, the more so that there are some of the leading journals, whose power over public opinion should be first exercised in support of our infant community, perversely using that strength to turn the stream of interest excited in our favour into their own choked up channel. To enter into detail, one journal in an article which displays a decent share of talent for mechanical writing, sneers at the idea, which he designates as, 'by-the-by, a favorite one with the people of Melbourne,' of severing Port Phillip from the colony of New South Wales. 'As well,' doth he most luminously proceed to observe, 'might the settlers at Bathurst wish to raise their district into an independent colony;' a remark displaying the most deplorable ignorance on the part of the writer. For his better information we will point out a few slight differences between the townships—Bathurst is one hundred and twenty miles, and Melbourne nearly seven hundred, from the present seat of government; the one is an inland the other a seaport town; the former twenty years after its formation claims only four hundred inhabitants, the latter in two years possesses eighteen hundren, with a population of seven thousand in the district; the first, like the other inland towns of New South Wales, is a place scarce worthy of note except as the site for a bench of magistrates necessary to the maintenance of good order in a disorderly district; the last forms a commercial depot for thousands of settlers, and, on reference to the eight numbers published of the Port Phillip Gazette, will be found amongst the 'shipping reports' the arrivals and departures of fifty-three vessels, exclusive of those trading to Geelong, and at a time of the year when trade is by no means brisk. Stockholders from the Murray and the Murrumbidgee, a distance of three hundred and fifty miles, have already given the preference to Melbourne for the attainment of their annual supplies, and crowds of immigrants deserting both Van Diemen's Land and Sydney are daily confirming our superiority. Need we waste more time upon this argument?

"Public journals depending upon a faction of grasping and selfish landholders, the proprietors themselves being perhaps some of the number, cannot but wish to cast a barrier in the way of immigration and purchase here, because the more valuable land becomes at Port Phillip the more will fresh arrivals bend their way thither, and this may cause *their* lands to decrease in value; but 'comparisons are'——; our friends know the rest, so now the secret is out, we'll pursue the even tenor of our way.

"This settlement and district hold out the finest prospects to capitalists, mechanics, and labourers, that are likely to be realised in any of the British colonies. We shall confine our remarks in this number to labourers, of whom single, perhaps, would be acceptable, in preference to married, because, unless man and wife would consent to sever, there are but few parties who could afford to give employment to such at the rate of wages likely to be demanded, sufficient to support a large or even a small family. Single female servants of reputable characters, would be certain of situations at twenty pounds a-year, with board, &c. and dairy-women from thirty to thirty-five. Young married couples, where the females can wash (a lucrative employment here at six shillings a-dozen), and where the husband can manage the rough part of garden-work (an improvement which all town-inhabitants are anxious to forward), besides the getting in a daily supply of wood for firing and water, are sure to do well. House-servants, perhaps, at this present time do not obtain work upon such terms as daily labourers or workmen in the stores of merchants, though the former procure generally from fifteen shillings to one pound, and the latter from one guinea to twenty-five shillings per week, with ample board rations. As shepherds in the country, hut or stock-keepers, shearers in the season, rough carpenters, or splitters and fencers, wages in proportion to the quality of the duties enumerated, from forty to sixty pounds per annum, can easily be had with seldom any limitation as to provisioning. Married men desirous to work for wages alone, having a home and family to go to at night, will be able to purchase their meat at 2½d. or 3d. if corned, or 3d. and 3½d. per pound, when fresh; the famed Derwent potatoes, to say nothing of our own growth, which are considered even superior, though of course somewhat more expensive, can at any time be bought here cheaper than in Sydney, flour and bread are in proportion; the two latter articles, with every description of vegetables, will, by the return of the season, be equalized in price, because all the farmers adjacent to the town will have an abundance, which, no doubt, they would rather sell at a fair and immediate remunerating value in Melbourne, than store for months previous to exportation, with the hopes of realising a higher figure elsewhere; in short, any commonly sober and industrious man might, from the wages of two or three years' labour, save sufficient to purchase a cart and horse, or even a dray with team of bullocks, which could be very profitably employed in conveying wood and water to the inhabitants in town, or drawing building materials, &c. which, at the busy seasons, would return to the amount of fifteen or twenty shillings per diem. Shops and household utensils, with tobacco, will be found to require the greatest expenditure, but even these are to be obtained at this moment at but a small advance on Sydney, Hobart Town, or Launceston prices. Wine, spirits, and malt liquors, from the quantity consumed, maintain almost entire their first exorbitant value, but this will be a wholesome check on the hard-working man's thirsty and profitless desire of casting away his money on such pernicious subjects; there are two breweries in the settlement which furnish very palatable table-beer at two shillings per gallon. We believe there are many labouring masons and bricklayers who have earned in this town sufficient to buy a small section of ground for the sum of ten or fifteen pounds, upon which they have built their little wooden or brick tenements, and could now dispose of the same at from thirty-five to forty pounds; or, a very decent brick-house containing two rooms with garden-ground attached, may be rented at twelve shillings per week, and we have heard of houses with four apartments being leased for a period of two or three years at the same rate.

"There is but little doubt, that if two or three ships with emigrants were to come to this port, they could all readily find employment. When we think of the numbers of fine able-bodied men constantly thrown out of work in England, or barely earning a hard-wrought subsistence, and females from the tenderest age worn, pale, and haggard with the midnight labours of the loom, we feel surprised, that when they hear of the advantages the colonies, especially Australia, hold out, they do not seize with avidity the slightest prospect of bettering their wretched condition. Thousands, we are aware, flock over to America and the Canadas, but they are now overstocked; the supply being greater than the demand, work cannot be obtained, and if to be had, giving no prospects of anything beyond a decent maintenance.

"Vessels have arrived in Sydney, laden with emigrants of the lower classes, from whose labour the colony throughout expected some benefit to be derived; but in many instances they were with wives and large families, for whose support they preferred to remain at Sydney at less wages, than to proceed in the interior for higher. At other times, the importations have consisted of single females of low, profligate habits, drawn from Liverpool and other seaport towns, with men of probably similar characters. If the emigration agents would use their valuable services in drawing their forces from the inland parts of the kingdom, where vice and depravity are not so prevalent, they would confer a greater benefit upon us, and remove the stigma which attaches itself to their present operations, of engaging their hands where easiest to be procured, thinking only of the positive gain to themselves on the arrival of their cargoes in Sydney. We believe these agents would be glad to secure emigrants of the country class, were the men to present themselves at the several counting-houses of the seaport towns; the only difficulty then to be encountered would be the bar which ignorance and distance effectually place to their removal from the boundaries of their respective villages. It is a fact, that the simple labourers and farmer lads of the midland provinces, dread more the ideal dangers they have to face from the little village of Piddleton, or what not, to "Lunnun," than all the unknown horrors of a sea-voyage, of which, not having the slightest conception, they cannot form an idea either of good or evil."

In reference to the above, I may say briefly, that, ever since buildings began to be erected in Melbourne, mechanics of all descriptions have been earning 10s. per day. In the above, it is said that shepherds earn from L.40 to L.60 per annum. Some certainly do so; and it might perhaps be better to give L 40 or L.50 to steady men from home, even though they have no knowledge of sheep, than L.35 per annum to the men we now generally have as shepherds, viz. men who have formerly been convicts in this colony. For a full account, however, of how Port Phillip is at present actually situated as to shepherds, I refer your readers to the accompanying copy of a letter, which was intended to have been signed by a number of gentlemen here, who have large flocks at Port Phillip, and to have been sent to Mr Elliot, the agent-general for emigration in London, through the governor of New South Wales; but was not afterwards forwarded, as it was ascertained that the governor had already recommended emigrants to be sent to Port Phillip; and it was, in consequence, feared that the letter in question would receive no attention from him. The facts of the case, however, still remain as stated in that letter.

"To F. H. Elliot, Esq. Agent-general for Emigration.

"Sir,—You probably know, that, in the course of the last three years, a new colony has been commenced at Port Phillip in Bass' Straits; but you are not perhaps aware, there are already nearly 300,000 sheep there (which is upwards of a fourth of the number as yet in all the old-settled colonies of Van Diemen's Land), chiefly ewes imported from this island in 1836 and 1837, and their progeny; but also including some considerable flocks latterly brought there from Yass, in the settled territory of New South Wales.

"Though the settlement at Port Phillip is now so well provided with sheep, which, we may remark, afford the only commodity of value produced by these colonies suited to the English markets, and though it must be evident to you, from what we have stated, that the amount of capital productively invested there is already very great; still, from these operations being carried on nearly entirely by persons residing in the colonies, and from the importance of the new colony not being fully understood in England, no ships have yet arrived at Port Phillip from Britain with immigrants. Hence we and the other sheep-farmers there now find great difficulty in procuring shepherds for our rapidly increasing flocks.

"The farmers at Port Phillip have hitherto generally been in the habit of engaging servants in Van Diemen's Land; but they find this course very expensive and inconvenient; for, as they generally reside at Port Phillip with their flocks, they have not the means of inquiring personally as to the character of the men about to be engaged for them here; and it is not to be supposed, that an agent can enter so fully into matters of this kind, as the principal would himself do, if present. They cannot either secure the services of servants when required on an emergency,—for from the time the order of the farmer at Port Phillip to his agent here for servants can reach this, till the servants can be engaged and sent from this to that settlement, five or six weeks must necessarily elapse. Moreover, the expense of sending men from this to Port Phillip is great, the passage-money alone having been, for the last two years, L.4 to L.5 for each shepherd.

"In the other parts of the New South Wales' territory, as well as in this island, convicts are nearly invariably employed as shepherds; but Port Phillip being so far from the seat of government at Sydney, convicts have not been allowed to be sent to the farmers there, who have imported sheep from this island.

"From all these causes, we think we may say with safety, that the farmers at Port Phillip labour under more disadvantages in procuring servants, than those in any other part of the Australian colonies. We therefore beg respectfully to suggest, that if you were to send out to Port Phillip 500 to 600 working men, chiefly shepherds, in parties of 150 or 200 at a time, you would confer a very great benefit on the colony generally, and on the sheep-farmers in particular. The rates of wages now usually given to shepherds may not be considered high,—L.30 to L.40 per annum besides provisions,—but then, the only description of shepherds we can generally get here are convicts, the term of whose servitude has expired. It would be much more to our advantage to pay L.5 or even L.10 higher wages to steady free men, well acquainted with their business. About 600 or 700 persons (three-fourths of them shepherds, we believe) have left this island for Port Phillip in the course of the last six months, and 200 or 300 have gone there from Sydney, in the same period. Hence, we may remark, that the importation there of 400 or even 800 shepherds from England, in the course of twelve months, would have no perceptible effect in reducing the rates of wages.

"It must be evident to you, that a new colony in all cases stands much more in want of the boon we ask for, than places which have been long settled; and Port Phillip, though under the control of the Sydney Government, is, in point of fact, a totally new, and we may say distinct colony. No person from the colonized parts of New South Wales had visited Port Phillip even casually from 1826 to 1835, when it was taken possession of by a few settlers from Van Diemen's Land, and in the following year, though 90 vessels went there, not one came from any port in New South Wales, with either goods, passengers, or live-stock. In short, the colony was entirely set on foot by importations of sheep from this island. No ship arrived there from New South Wales with goods or stock till after the place had been formally taken possession of by the New South Wales' Government, twelve months after 35,000 sheep had been sent to it from Van Diemen's Land.

"The land and town allotments at Port Phillip, already sold, have brought L.35,000 into the Sydney Treasury, and we do not therefore expect that any objection will be made to what we propose on account of the expense, because, in our opinion, a part of the funds just referred to cannot possibly be better employed than in furnishing the means of carrying on effectually the only extensive branch of industry, for which the colony has yet been found to be fitted, viz. the production of wool for the English market."

"HOBART TOWN, *November* 1838."

I now call your readers' attention to a letter in the paper of 29th December, though it is written in rather a flippant style, and shews an evident bias in favour of Port Phillip, and against South Australia.

"*Port Phillip in* 1838, *by a Visitor.*—I promised a long and full account of this place, but the limited period of my visit prevents the fulfilment of such promise. I have, however, to mention, that I approached the Heads with feelings of an unpleasant nature, for reports were unfavourable as to its entrance. The clear channel is about a mile and a half; the rate of tide with its violent ripplings, is not near so bad as places I have visited; such, for instance, as Calcutta, Dardanelles, Bosphorus, Pentland Frith, Queen Charlotte's Sound, and many other places; it is nevertheless an awkward place for a ship to be becalmed, and it requires a high and low light to render it serviceable to vessels in the night. The sands within the Heads also want buoys, which should be firmly built of pine or cedar, and be well sheathed and coppered. There are many parts within the Heads that require either buoys or beacons, and to render Melbourne River more accessible, buoys and beacons would be found beneficial. A pilot stationed within Point Nepean would be of much service, and another at Gellibrand's Point is also necessary. The passage to Geelong River and harbour, also requires beacons.

"Melbourne, the present capital, is a remarkably fine place for a township, and is surrounded with a truly delightful country; its climate and soil are far superior to Adelaide, and its natural sources hold out many more advantages to the capitalist as well as to the labourer. This place has been colonized by a few wealthy and spirited members of the sister colonies, chiefly from Van Diemen's Land, and is as yet without a governor, being almost unknown in England; it has never been puffed off in a collection of long speeches by practised orators at Exeter Hall. The bubbles blown at that place in favour of Adelaide, are extremely absurd and injurious to society. The founders of Melbourne are experienced colonists, whose knowledge of colonization is too well known to need publication in handbills and newspapers, with a long show of M. P.'s and a dinner at the Albion in Aldersgate Street. The pencil of the artist cannot add beauty to the surrounding scenery of Melbourne or Geelong, which will eventually shew itself in colours equal to any in New South Wales, or its dependences. How reports could ever be made that this place was destitute of fresh water, I cannot imagine; there is a beautiful little river of excellent water flowing through Melbourne, which contains more water by nine-tenths than the creek at Adelaide which is honoured by the name of the 'River Torrens.'

"The township of Geelong is also a very pretty place, with excellent soil, but its fresh water is not convenient for shipping. I have little doubt but coals are to be found in the vicinity of Geelong, and if so, they will be of excellent quality.

"Society in Melbourne is much better than that of Adelaide, being entirely destitute of swells, loungers, &c., so prevalent in Adelaide; nor is there any nonsensical party-spirit, with cavilling for office by a few individuals sent out under the patronage of titled men, and whose salaries will neither find them in shoes to tramp their barren wastes, nor turn their pretty-bright button threadbare coats into new ones.

"When the word hotel was announced to me on my way to Melbourne, I pictured to myself a little weather-boarded house, or a bark hut, or some such as I have seen in Adelaide; but judge of my surprise when I looked at a building something like the Bush Hotel, Piccadilly—the fittings up are certainly less costly, but, upon the whole, there are two or three houses in Melbourne capable of entertaining noblemen. Buildings generally are very much superior in Melbourne than in Adelaide; in the former place there are neither canvass tents nor wigwams,—in a few words, I beg to say that Melbourne is to Adelaide what gold is to dross.

"This little epistle is far short of what I intended, and is, perhaps, somewhat unconnected in its arrangement; however be pleased to consider that it is such as my short stay would allow me to give."

About 150 or 200 vessels have visited Port Phillip annually for the last two years, and no one of them has been lost either at "the Heads," described in the above letter as dangerous, nor in the Lake. To say more in favour of the harbour would be waste of time; it only requires buoys in many places, and these it will, no doubt, get ere long.

I have never been at South Australia, but, notwithstanding what is said in the above letter, there is plenty of good land there for the depasturage, of sheep, and for grain-farming.

In comparing Port Phillip and Adelaide together, it appears that Adelaide has the fortuitous advantage of being known in England, and the tide of emigration to that colony will perhaps therefore flow, for a short time, chiefly in that direction. This is a great advantage, for labouring emigrants form the chief wealth of a new and thriving colony. Another advantage Adelaide has is, it has a court of justice, which Port Phillip has not, for it would be nearly absurd to say that the court at Sydney is of any use to the Phillipians. Port Phillip will, no doubt, soon be put on the same footing, in this respect, as the sister colony. Adelaide has no convicts, nor has Port Phillip, except a few men in the Government employ at Melbourne. Port Phillip is a "step-bairn," in this respect; it has the name of a convict-colony without the benefit of convict-labour; nor have the Phillipians a better prospect for the future, for the Governor of New South Wales, in lately advertising part of the land at Port Phillip for sale, intimated to the intending purchasers, that no convicts would be assigned to them if they bought the land, though the landholders in New South Wales have usually had this favour conferred on them. The Governor's grand object in all such sales, is to get *as much as he possibly can for the land;* and as he was aware that all the individuals intending to purchase the Port Phillip land were desirous to have convicts assigned to them, it is clear he would not have checked the bidding for the land, by the above intimation, if he had not fully determined that no convicts were to be assigned to the Phillipians. Persons, therefore, coming to these colonies may take it for granted there will be no convicts at Port Phillip. Most of the settlers who have gone there from this island are men of education and large capital, as the extent of their flocks shews. The first free emigrants (150) have just arrived there from Sydney, and, from the account of the land sales last year, many more emigrants must now be on their way out; hence, I expect, that, in a very few years, the labouring classes at Adelaide and Port Phillip, so far as regards morality, will be very nearly on a par.

But what should determine emigrants, coming out with the intention of turning sheep farmers, to give Port Phillip a preference over Adelaide, is this:—At Port Phillip there are now 300,000 sheep; and young ewes could be purchased at about 23s. per head. At Adelaide, I believe, there are only about 20,000 sheep, and young ewes could not, I suspect, be purchased there for less than 45s. or 50s. It is true that meat is at present 1s. per lb. at Adelaide, and only 4d. per lb. at Port Phillip; but before any one now going to Adelaide could have young wethers fit for the butcher, the place may, and probably will, be inundated with cattle from Sydney. Several herds have arrived from thence, and some thousands are expected almost immediately. I refer to what I said in my former communication as to the difficulty of bringing sheep from Sydney to Adelaide.

Port Phillip has also this great advantage over Adelaide, in that its port is a much safer one than any that has yet been found in South Australia; for, though more vessels have arrived at the former than at the latter colony, none have been lost at Port Phillip; but upwards of ten, I believe, have been lost in Gulf St Vincent, at Kangaroo Island, &c.

If, too, Port Phillip and Adelaide prove to be good grain colonies, which I have no doubt they will, Port Phillip will have the advantage in this respect also, from its being so much nearer to Sydney, the only market to which grain is almost ever shipped in these colonies.

For the particular descriptions of emigrants at present much wanted at Port Phillip, I refer your readers to the Gazette of 5th January. Little is said in that article as to the present rates of wages; but I have already given you full information on that head.

"In a previous number we adduced a few observations with regard to labourers, and the probable success they were likely to meet with in emigrating to this settlement, at the same time we proposed to apply a few remarks to the services of mechanics, and the rewards held out to them for persevering in a course of even moderate industry. It may easily be seen, when considered, that artizans of all grades are requisite to add to the comforts, furnish the wants, and even to supply the absolute necessities of a community upon its first formation; in the very commencement, houses must be built for a shelter and a dwelling to the primitive settlers; these cannot be accomplished without the aid of sawyers when built of wood, or brickmakers when formed of brick. To raise the superstructure, the labours of the bricklayer, the stone-mason, the carpenter, the plasterer, the shingler (synonymous with the English slater), are in constant demand; to finish and furnish the habitation, the glazier, the painter, and the joiner, must be called in. While building, therefore, is so rapidly and continually progressing, mechanics of the classes enumerated need not doubt the want of work, with proportionate payment, for years to come; those who have judiciously chosen Melbourne as the scene of their industry from its first formation, find their enterprise rewarded by possession of wealth and landed property; we may assert, indeed, the extension of our fast-populated town will depend, in a great measure, on the influx of men of the above denominations. To proceed,—a house being built and finished both without and within according to the cunning of the craft, or the pleasure of the proprietor, it will be necessary, particularly if he be married (a rare occurrence, from the great scarcity of the female sex), to purchase various articles of furniture, such as tables, chairs, &c., with all the culinary paraphernalia of the kitchen; of these, particularly the last, in tin, iron, brush, and crokery ware, the greater portion is imported, neither a cabinetmaker nor a tinman nor brazier having as yet been led to settle amongst us. We earnestly hope that this cursory notice may be the means of drawing the man of pots and kettles to bestow his toil upon the district at large; three or four might come, and yet scarcely be aware of anything in the shape of competition. Neither can we yet boast of a cooper, although there are two hundred stations in the district, besides the shipping and inhabitants of the town, and two breweries, all of whom must use barrels, tubs, buckets, kegs, &c.; the number of dairy stations in the country would alone keep up the market for milk-coolers, watermen want their casks and buckets, washerwomen their tubs, families their beer kegs, and numerous other utensils are repeatedly calling for the aid of a cooper to mend or make. As we go not like the aborigines in a state of nudity, tailors are requisite; we have four supplying our necessities now, and very good tailors they are, and a very pretty sum no doubt they make of their trade; but when they are in want of assistants, journeymen's wages are very high, and many could find employment. The same reason retards the work in the shops of the gunsmith and wheelwright. We are such an industrious race of people that we do not know how time flies, and from the absence of a clock and watchmaker, a stranger would be inclined to judge that we do not wish to know, but somehow the watches of men of business will at times get out of order, and then, being obliged to send their timekeepers round to Sydney, or over to Launceston (from a sense of the deficiency being brought home to themselves), they wonder for full nine days that there should be no clock and watchmaker here. What can be a greater proof of the salubrity of the climate, than when we state it as a fact, that no undertaker has yet thought it worth his time or labour to come and watch our decrease, in expectance of a little business in his own line. With the number of drays, carts, and various other vehicles incessantly employed throughout the district, wheelwrights need not hesitate to become residents here; there are no mechanics probably so much desired for, to meet the supply of work; the only master wheelwright of which the settlement can boast, has been unable to procure men even at the highest wages, who are really versed in their trade, and, in consequence, has to make his own wheels, employing carpenters to build the bodies. Blacksmiths have every opportunity of speedily realizing an independence, as their services are always in request, for not a settler, either squatter or landholder, tradesmen, professional, official, or mercantile man, but is possessed of a horse. Shoeing is necessarily always wanted; this would keep numbers employed without considering the quantity of jobbing work. We have but four in the township who can ask, sure of no refusal, a price which would astonish our English vulcans; in this trade, as in others, a sober and steady workman, without being at all a superior hand at the craft, will be enabled to lay by the overplus of his wages, from which, if he purchase the necessary equipment to commence as a master, he possesses at once the means of becoming not onl independent, but wealthy, that is to say, according to his station in life. We have four butchers and three bakers to feed the hungry, who would all be willing to engage men acquainted with their respective trades, at good salaries. Three saddlers and harness-makers also form part of our community. There are two printing-offices, and a third (!) may be shortly expected, if reports be true; the one from which this weekly publication is issued would employ one man at liberal wages.

" As the first arrivals gradually find themselves settling down to the regular routine of their several occupations, the brunt of unusual privation and difficulty has been encountered and turned to advantage, and their business being established, money begins to return, the mind naturally gives its attention to amusement and relaxation,—foremost of these in position will stand the cultivation of its talents by reading and study; but books are few and difficult to be procured. We have a small subscription library, which Mr Fawkner, the publican, has, not a little to his credit, opened in Melbourne; the club, also, which is on the eve of regular formation, will have a reading-room and library, but neither of these will throw any obstacle in the way of a party desirous of setting up a complete establishment as a bookseller, stationer, and bookbinder.

" With the quantity of shipping visiting our harbour, as yet only between ourselves and the colonial ports, a sailmaker settled in Melbourne must be a desideratum; the voyages are short as to time, but destructive as to sails and cordage from the roughness of the winds and waves encountered in the straits; our trade is increasing with an unparalleled vigour and enterprise; vessels are already laid on for England, to transmit thither the wealthy produce of our shores, a return will be made partly in money, the rest in merchandise; our sheep multiply, other natural resources are discovered and converted to public benefit and individual success, all tending to add fresh strength and stability to the commerce of Port Phillip, while ships of various burthen crowding our noble port will be at a loss—a serious loss—in the want of persons competent to make and repair the sails. So closely are the trades of a shipwright and boat-builder connected with the foregoing, that this appears the most fit opportunity to introduce a few words relative to them. That we are in want of these artizans has been lamentably proved in more than one instance. We remember a craft lying at the Queen's wharf for upwards of two months, unable to procure masts; she had lost them in a severe gale, came into port under a jury-mast, and on her arrival had ultimately to send to Launceston, lying idle at a heavy expense to the owners till the masts were made and sent by one of the traders between the two ports to Melbourne; the vessel we allude to has since been lost. A boat-builder in like manner is urgently required, the number of cutters of from three to ten tons burthen, running for shells, &c., to Geelong, or working on the river between the site of the shipping and the wharf at Melbourne, would afford him probably more opportunities of making his fortune than he could find time to take advantage of. Of shoemakers, we have several, employing, perhaps, twelve or thirteen men; as the inhabitants increase, so do their wants in the same proportion, tradesmen therefore are required in the like ratio to furnish them. It may be, that the quantity of boots and shoes imported injures in some degree the profits of this trade, although, at present, work is sufficiently plentiful to ensure a comfortable independence. Thus, we might go on enumerating trade after trade, making similar observations on each, until we had engaged more space than our columns will admit of. What we have said, will give rise, we are led to believe, to numerous suggestions, but upon which, we are unable further to expatiate. In concluding the brief hints we have thrown out to mechanics, we will assert that health—the greatest blessing of life—being their portion, artizans, of whatever denomination, in this part of the world, must be either thoroughly idle, or irreclaimable drunkards not to prosper."

It will be observed, by reference to the Gazette of 17th January, that the imports into Melbourne in 1838 amounted to upwards of L.86,000, and nearly half this amount, perhaps, consisted of English manufactures brought there from Hobart Town and Launceston; yet no ship has been sent there from England.

About nine months ago, several persons residing here arranged to send to England for a steamer of about 350 tons, to be constructed expressly for the conveyance of sheep. This vessel they intended to have employed chiefly between Adelaide, Georgetown, and Port Phillip. Just, however, when they were about to despatch their orders to London for the vessel, they received a printed notice, containing the names of many gentlemen in London well known here, and stating that they and other persons had formed themselves into a company for the purpose of supplying the Australian colonies with steamers. The Hobart Town company were deterred by this notice from carrying their plans into effect; for they were averse to enter into competition with a company conducted with English capital. It is now much to be regretted that they were so, for nothing further has ever been heard of the English company's steamers! and a steamer of the description given above is just what is wanted to make Adelaide a place of consequence, for without sheep I do not see how it is to be made to answer the expectations formed of it; and *cheap* sheep, I suspect, can only be got by the means of a steamer. The steamer, too, would have been of great advantage to the colonists in this island and at Port Phillip, as it would have enabled those who are desirous to sell some of their flocks to dispose of them to more advantage than they now can do.

There is plenty of coal in this island; but none that is considered good for steam purposes has yet been found. About twelve "crops" of excellent coal have been seen within a short distance of Westernport harbour. None of these seams are more than forty-two inches thick at the surface; but there will be little difficulty in working them, the roofs being of indurated clay. It was from these mines that the Hobart Town company expected to have got fuel for their steamer. I sent samples of this coal, some months ago, to one of the members of the English company.

An application was made to the N. S. Wales' government, soon after a steamer was thought of in Hobart Town, for permission to purchase or to work the Westernport coal; but it was then found that this could not be granted at Sydney, owing to some arrangement said to have been entered into by the English government with a company in London! This is too bad. Sir Geo. Gipps wrote home in June last on the subject; and the embarrassment will probably be got over, *but after some years of uncertainty*, unless, indeed, some one in London will take the trouble to expedite the matter.

The greatest difficulty sheep-farmers in N. S. Wales and Port Phillip have to contend with is the want of good shepherds. Some of the farmers, chiefly half-pay officers, who have formerly been in India, have lately got shepherds and farm-servants from thence; and about L.15,000 in bills on London are now on their way to Calcutta to pay for the passage of more of these men. I observe, however, that the Directors of the East India Company have lately forbidden, in fact, strictly prohibited, Indians from leaving their own country under engagements to serve in these colonies. What are the agents in Calcutta to do with the above L.15,000 when they arrive? I do not suppose that at the time the directors issued their orders they took the least trouble to inquire whether or not Indians are likely to be well treated in these colonies. I send an extract from the Hobart Town Courier of 28th December, in which there is this paper on the subject:—

" You may have observed, that 700 or 800 men, nearly all shepherds, I presume, have left this island for Port Phillip, in the course of the last six months; and as this colony is now recovering fast from its late state of depression (owing to the improved prospects of our great staple export, wool), I fear the continued emigration of so many working men will soon be severely felt by our farmers. Being under this impression, I think the following details worthy of notice.

" No doubt you have observed that a cargo of Hill Coolies or Daughas have lately been imported into Sydney from Calcutta, as labourers and shepherds; and by a letter I have received from a friend in New South Wales, it appears that 800 to 1000 more of them have been ordered from thence. These Coolies are generally *garcon*, but some of them also have their wives and families with them. The rates of passage-money from Calcutta, paid by those who hire them, are:—a man L.13, 10s., a boy L.12, this includes six months' advance of wages. A woman L.6, 15s. no wages are included in this, the women generally accompanying their husbands without being bound to the performance of any duty.

" An agreement is entered into by the exporter with the Bengal Government, at the time the Coolies are shipped, that the unmarried men shall be returned to Bengal at the end of five years. No such agreement is required in the case of the *benedicts*, as it is supposed, that they having brought their wives and families with them, intend to become colonists.

" The Coolies shipped for each Sydney farmer are accompanied by a head man ' Sirdar,' who can speak a little English, and thus acts as the go-between for the master and servants. The wages promised for the five years are,—to the Sirdar 14s. per month; Coolies 10s.; boys 6s.; and women, if employed, 6s. Rations of rice, &c. are stipulated for in the

Bengal agreements; but on the arrival of the Coolies at Sydney, these rations are willingly commuted for 1½ lb. flour, 1½ lb. meat, and a little salt per diem. They are also entitled to an ample allowance of clothing.

'It appears certain to me that these colonies will soon be much embarrassed by the want of labouring men; for the late report of prison-discipline by a Committee of the House of Commons to Parliament will, in all probability, have the effect of diminishing the number of convicts sent here; and free emigrants will no doubt be in a great measure deterred from our shores by the mischievous and greatly exaggerated accounts which have lately been published in London, describing our settlements as "sinks of iniquity." It is, therefore, much to be regretted, that some of the philanthropists in London are now trying to put an end to our getting Coolies from Calcutta. If you have a file of the *Spectator* newspaper by you, you will find, that, at a late meeting of the proprietors of East India stock, it was stated, many cargoes of Coolies had been sent from Calcutta to the West Indies, Mauritius, &c. and as it was feared they would receive ill-treatment there, it was agreed 'a representation be made to Her Majesty's Government, that a deposite of L.25 should be lodged with the Bengal Government, for every Coolie that may hereafter be exported.'

"The L.25 is proposed to be taken nominally as a security for the farmer's proper behaviour to the Coolie, and for the latter being returned to Bengal at the end of the five years; but it is virtually intended to put an end to such transactions altogether; and you may be well assured, that it will act as an effectual 'stopper,' if it be put in practice. It does not appear that, at the meeting in question, any evidence was tendered to shew that Coolies had been ill-used in the West Indies, or at Mauritius; nor was it even hinted that it was likely they would be ill-treated in these colonies. Still I fear the representation will be attended to, and orders accordingly issued. This is the modern mode of legislating. '*Audi alteram partem*' is now no longer necessary.

"If the philanthropists had anything like common sense or humanity on their side, I would readily give up the point to them; but I maintain there is no reason to suppose the Coolies would receive ill-treatment in these colonies. They would be extremely useful; and hence the parties importing them would find it to be to their own advantage to be kind to them. If they acted otherwise, it would be easy for the Coolies, by application to a magistrate, to get out of their employ, and to receive much higher wages from other parties. I do not see either why the interests of the Coolies should not be put under the special charge of the newly appointed 'Protector-General' of the Aborigines of New South Wales. He is well known to be an active and humane man, and would do his duty towards them conscientiously.

"But I have not yet done with the philanthropists. What sort of usage do the Coolies usually get at the Indigo factories in Bengal? Is it not known to every one, who has seen these establishments, that their reward is often *bamtoo buckshies, i. e.* a good thrashing with a bamboo? What is the usage the natives of India get on board the ships sailing from its ports? I have sailed in three of them in the last few years, and in two of the three, the native sailors were often beaten most unmercifully.

"The Baronet who proposed the resolution at the India-House, is highly respectable, and a man of great wealth. Among other properties he has many vessels sailing out of Bombay. I doubt not the natives of India are beaten on board of them, the same as in other vessels, yet these men are allowed to go to sea; whereas we are to be debarred from having their services, on the possibility that we shall ill-treat them. This is too bad.

"There are parts of these colonies to which Coolies should not be brought; as to this island, and some of the high table-lands in New South Wales,—as Monera, where snow sometimes lies for days; but the climate of most of the districts of New South Wales would be congenial to Indians. Even at Port Phillip, though so far to the south, there is no snow (so Mr Buckley tells me, and he was long enough there to have seen it) and though there be rather sharp morning frosts there, the same is the case in India.

"The Sydney Government could easily devise means for the security of the Coolies being returned to India at the end of the five years, if they should then wish to go back, without putting the importers of them to the ruinous expense proposed in the India House representation."

There are now "Protectors of the Aborigines" in all parts of N. S. Wales, and they might easily see whether the Indians had any just cause of complaint against their own masters, or other persons. My letters from Sydney state they are perfectly satisfied with the rations and clothing that they get, and that they are behaving to the satisfaction of their employers.

It is reported that a small canal is about to be cut from Melbourne to Hobson's Bay, near the mouth of the Yarra-yarra, and where ships usually ride at anchor, there not being more than eight feet of water in some places from thence to Melbourne. A railroad would better answer the purpose; the distance is about two and a half or three miles, and the country a perfect flat, and still belonging to the government. Melbourne is about six miles from Hobson's Bay, and seven from Williamstown by water, owing to the windings of the Yarra-yarra. There is a very small steamer now employed in carrying goods and passengers between these places.

There has lately been a long and severe drought in N. S.

Wales, and from which the crops and flocks have suffered in many places. The crop of wheat now being reaped in Van Diemen's Land is said to be an abundant one ; but as wheat is required for Sydney, Port Phillip, and Adelaide, the farmers here are now getting 8s. to 9s. per bushel for theirs. The prices of sheep and cattle here remain as quoted in my last communication. Good bills on London, at thirty days' sight, now bear a premium here of two and a half per cent.

Owing to the number of new banks now established here with English capital, and to others, and a company for lending money on mortgages being talked of as in contemplation in London for these colonies, money is plentiful; and I suspect the returns from these companies will not be so great as the late state of affairs here would lead one to expect. The profits by wool, and all sorts of farm-stock and produce, are now so much diminished, that the farmers cannot longer afford to pay high interest.

Another sale of about 15,000 acres of Port Phillip land (in the Geelong district) is to take place at Sydney on 13th February. Some allotments in the township of Melbourne, also of Geelong (the place called Corrayio in most of the maps I have seen), are to be sold at the same time. The land will probably sell on an average for 20s. per acre. This will bring a considerable sum into the Sydney treasury ;* and I hope that Her Majesty's Government will send the Phillipians useful emigrants to compensate for this expenditure.

A letter I have lately received from a gentleman at Melbourne states, that the customs now collected at Port Phillip amount to L.10,000 per annum ; and as the place has neither as yet had a judge nor any expensive establishment, it cannot have cost the N. S. Wales' government much.

* 15,000 acres of land, say at 20s., .	L.15,000	
120 half-acre allotments in Melbourne, say at the *minimum* price of L.75, .	9000	
		L.24,000,

or with the allotments at Geelong, the particulars of which I have not seen, say L.30,000. This, with the proceeds of the former sales, upwards of L.35,000, should be more than enough to enable the government to send from England all the emigrants that are required.

Hobart Town, 31*st January* 1839.

THE AGRICULTURIST'S NOTE-BOOK.—NO. VIII.

A Defence of Tobacco.—When a "dead set" is made at any person or any thing, it appears to require no little moral courage to enter the lists in favour of the persecuted. In fact, who, but such a veteran as ourself, would undertake the cause of tobacco,—a luxury which fine lady-authoresses have vituperated in no measured terms,—which ultra "*exquisites*" have condemned as "vul-g-a-a-r,"—which scribbling apothecaries have designated "a rank and deadly poison,"—which those of her Majesty's lieges who (having weakened their digestive organs by excesses) are unable to indulge in with impunity, and being envious therefore of their more robust fellow-subjects, denounce the fragrant plant accordingly;—we repeat, who, but our hardy self, would advocate a calumniated gift of God, which has been voted "*low*" by a slender-witted few of the arrogant, ungrateful, and silly?

It rarely happens that men who write on a given subject of this nature, *can* bring to their aid feelings totally unbiassed by personal liking, or dislike: there will always be a leaning one way or the other in their method of handling the matter; hence every word should be received with caution, and freedom of opinion be rigidly guarded by the reader. Even our own observations—though we hope and believe them to be disinterested, and our motives pure—may be mistrusted, when we confess, that the scent of a cigar is the most grateful to our sense of smelling of all the exquisite and fragrant odours in the creation: at the same time, we must observe, that, to obtain the gratification of one sense, we put no other under contribution,—*we never smoke;* but, when we have no friend with us to whom the recreation of smoking is agreeable, or when our evening is solitary, we light a cigar, and place it by our side, while we write or read. This is a method of enjoying an innocent gratification, which we have in several instances recommended to, and known to be adopted by, those ladies of our acquaintance who are partial to the scent, though they dislike the taste of tobacco. We are so ungallant, that we care not for the uplifted hands and eyes of some few of our female readers at this announcement. English ladies, with rare exceptions, do not smoke; though those of Spain, South America, &c. indulge in the habit as freely as the male population of those countries. No! we are too firm and sincere to be scared by vulgar affectations. We are, moreover, tired of the stupid tirades that are put forth against this useful and admirable boon; and since no pen better able to do justice to its excellence dare lift itself up in defence of the reviled herb—we beg pardon, "*the stinking weed*,"—we will put our own in requisition, only regretting that the weapon we employ is not a fitter instrument to do justice to the feelings which the subject inspires.

We were recently in company with an intelligent gentleman, just returned from a tour of some months through France, and we were impressed with a remark he made to this purport. He said: "We at home are accustomed to think and to say, that our national flag not only floats on all seas, but that the 'Union Jack' is to be found in every harbour of the world; and we conclude that we are necessary to the comforts, the well-being, almost the existence of all other nations: but what mistaken notion is this! how calculated to foster our already overweening vanity and pride. I remarked, that, in many of the ports on the west and south coasts of France, not one of our vessels was to be seen; while those of other nations, Spanish, American, &c. every where abounded. So rich and fertile is the soil of France, so industrious and intelligent the population, that this humiliating conviction was forced upon my mind, if my native country—that precious gem set in the silver sea—were annihilated, it would not be missed by other nations."

"Think that there be livers out of Britain," is as necessary an injunction now to the natives of our isolated home, as it was in the time of Shakspeare; so much do we still deserve that national opprobrium, *exclusiveness!* Like the inhabitant of Skye, we think our sea-girt isle the only country worthy of our consideration. With the conceit of little minds, we lay down conventional rules, and expect other nobler natures to follow them.

It is our firm opinion that a larger portion of silly vituperative trash has been said and written in England on the subject of tobacco, than could be found to have emanated from the whole of the civilized world: we believe, indeed, that there is not another nation so absurd as to disdain the blessing. We have known persons of both sexes, more nice than wise, affect a horror at a casual whiff from a cigar, whom circumstances had since induced to travel, and who have returned to England " steeped to the core" in the reek of German pipes, and reconciled to the habit of smoking. As well might they have expected by their affectations to have metamorphosed the German stones into " sea-coal fires," as to have quelled the national passion for tobacco. From the prince to the peasant, the entire male population of Germany smoke incessantly: if wakeful in the night, they smoke; in the theatres, at their musical parties, at home, abroad,—always excepting during sleep,* and while eating,—they smoke. Travel enlarges the mind, enforces forbearance, and mellows the crude selfishness of man.

The shallowness of those conceited scribblers who vilify tobacco, disqualifies them from being capable to judge of the value of that which they condemn. Eager to display their little knowledge, and yet more desirous to restrict the enjoyments of their fellow-creatures, they tell us that " *the essential oil of tobacco* is a poison of a potent nature, which, if taken into the stomach, will cause death ;" *argol*, it is dangerous to smoke the leaves of this terrible plant! Prussic acid is also a poison, yet who would abstain from smelling a bunch of hawthorn, sipping the delicate *crême de noyeau*, or eating Italian macaroons? yet they all contain a portion of this latter dreadful poison. No!

" Men have died, and worms have eaten them, but not from smoking."

We do not pretend to deny that the habit of using tobacco is inimical to some few persons, and to such we would recommend total abstinence from it; as we would caution the man with whose stomach, bread, pork, beer, &c. might be found to disagree, against the use of those aliments; but fools should we be to infer, from their effects on a few individuals, that they are unwholesome to the whole community, and insist on their being abjured. We are acquainted with a lady who has subsisted for the last three years upon raw oatmeal and water;

* We have been driven by a German postilion, fast asleep on the box in a very hot day, whiffing away with the pipe between his teeth, and the reins trailing at the horses' heels.—EDITOR.

but we should be sorry to consider this restricted regimen as necessary to be adopted by ourselves.

In this age of dogmatism, nothing is so easy (and, to domineering natures, so delightful), as to convert the good gifts of the Creator into curses; to stigmatize them as possessing the properties of those fabled fruits "which are pleasant to the eye, but turn to dust and ashes on the lips." Oh that a few teachers of the people (since it seems we *must* put ourselves in trammels, and bow down to the dicta of our fellow-men, rather than exercise the powers of our minds, and learn to think for ourselves) would arise, embued with gratitude themselves, and desirous to foster it in others; *who would preach moderation rather than restriction*; who would advise the *use*, and dissuade from the *abuse*, of the blessings which a benevolent Deity has so lavishly created for our gratification and benefit.

In our defence of tobacco, we will commence with its agreeable rather than its useful properties, and propose a few simple queries, which we dare any man with one spark of philanthropy in his composition to answer (with truth) inimically to our wishes. Among the few, the very few, recreations attainable by the poor and over-worked mechanic, is there one more cheering, soothing, and devoid of evil, than the placid indulgence of a pipe, after the dreary employments of the day are ended? To the half-fed, miserable portion of our unhappy fellow-subjects, male and female, can there be pointed out, or imagined, a greater comfort, a more innocent enjoyment, a more genial consoler, or a more useful corrector of the damp and squalor of their existence? Can there be a more pleasing sight to a benevolent nature, than the contented countenance of a hard-working man, resting from his labour, surrounded with those fragrant fumes, that, like the breath of catholic [illegible], steal over the feelings, and allay the "fever [illegible] [illegible] [illegible] [illegible]sed by the "eating cares" of this "working-day world"? Then our sailors,—who would not feel his heart [illegible] within him, and his spirit rouse, at the wickedness that would seek to deprive our noble defenders—that interesting race of beings, the hardy and enduring tars—of one of the [illegible] [illegible] means of whiling away those hours of desolate monotony, when,

"Far amid the melancholy main,"

an isolated existence is necessarily consumed in cheerless abstinence from numberless comforts and enjoyments, that to the landsmen are common as the sun at noon-day, and being easily attainable, are proportionably undervalued. Debar a sailor from tobacco! Where will the puritanical ill-natured meddlers draw the line beyond which they will not interfere with the comforts of their fellow-beings? Already have they sought to abolish those necessary stimulants which great and prolonged exposure to the warfare of the elements render *absolutely necessary* to restore the wear and tear of a sailor's toilful life; they would now deprive him of that other—perhaps greater—perchance more necessary comfort—his genial pipe of tobacco. Oh ye voluptuous rich, crammed to satiety with luxuries, how much have ye to answer for, who seek to deprive the poor and destitute of the scanty consolations which hard fate has allotted to them! "Poison," forsooth! Whoever heard of a sailor being done to death with tobacco? Is it not, on the contrary, a self-evident fact, that almost all the world smokes; and that no one was ever proved to have died from the effects of oil of tobacco having been introduced into the stomach by means of smoking its leaves? So far from its use being pernicious, is it not well known, that the result of its indulgence is to cause a soothing influence on the feelings, to calm irritation, and allay the pains of hunger; when, in consequence of untoward circumstances, a terrible privation from food becomes necessary! True, it will be urged, that the use of the herb has been in the latter case extended to an injurious excess; that hunger is a natural want, and ought not to be appeased by unnatural means; that the action of tobacco has here been morbid, &c. This we admit, but, though citing an extreme case, still maintain that the situation of starving men would be alleviated by the use of tobacco, that their powers of enduring privation would be increased, and time would thus be afforded them to await the termination of their period of enforced abstinence.

"Poison!" Let Turkey, Germany, and Holland, with their endless pipes, reply to that (if they *could* for contempt!),

—let India, as well as North and South America, where, in the latter, four dozen cigars are, upon an average, smoked every day by each person!—let the Americans laugh the assertion to scorn!—let an exorbitant use, such as this, shame the maudlin scribblers, who would dare to restrict the moderate smokers of this most moderate country! But the truth is, that the love of dictating blinds our would-be monitors to facts. It is fortunate that they are few and insignificant; but, like buzzing flies, they are tiresome, and we would whisk them aside. And, moreover, though they are inconsiderable, they may do some injury, for there are always to be found in a community persons of weak intellect, who are glad to be spared the trouble of thinking, and who might be induced, because they find the folly in a "prent buke," to consider it sound sense—and, therefore, abjure the salutary habit of smoking. Yet, if these *gobmouches* would but exert the little sense that may have fallen to their share, they could with ease refute the calumny; they would say, "What smoker of my acquaintance has been proved to have died from the effects of oil of tobacco, distilled in the stomach as in an alembic?" They would reason, "If the habit of smoking be so injurious, how is it that other countries, where it has existed generally from time immemorial, have not suffered a decrease in their population *from this very custom?*—why have not *their writers, their medical men, their popular restrictors*, discovered and exposed the noxious properties of the condemned herb?" They would argue, "If tobacco be smoked *to excess* in *all* climates, and that in England it is used with greater moderation than in any other country on the globe, are we not justified in concluding, that we have been imposed upon by men who affect to have the good of their species at heart; and [illegible] no more than those they would gladly [illegible] to their spiteful *ipse dixit*, are ever at work, forging fresh shackles for poor human nature?" They would ask, "if this plant be not intended for the service of man, what becomes of the 'beneficence of the Creator,' which our hypocrites twist into cruelty, for having sent it to flourish in such profusion [illegible] globe where corn can be [illegible] cultivation as is the very grain from which our chief article of diet is made?" They would reflect—"Fumigation is advantageous in preventing the spread of contagion; insects are exterminated by myriads in our hot-houses and conservatories, by means of tobacco smoke; infection is pretty well ascertained to be *insect;* that which destroys vitality in creatures which are visible to the naked eye, it is to be inferred, has power sufficient to extinguish life in those minuter 'motes that people the sunbeam;' hence, it would be desirable to make trial of fumigation with tobacco-smoke in cases of infection and suspected contagion, rather than seek to abolish from among the nations that beautiful herb which 'the Lord hath blessed,' (for did He not create it, and did He not 'see that it was good?')—*that* herb which may be precisely the one that He intended to be made use of for the mitigation of many of the evils from which it has been seen fit humanity should suffer?" They would urge —"If this plant is indeed the blessing which it appears to be proved to be—and every thing tends to establish its excellence—then those writers who seek to destroy its influence among us, are not only displaying their ignorance of the subject, but are attacking it on false grounds, and proving themselves to be enemies to the human race, and overflowing with ingratitude to the Great Giver of all things!"

Here we laid aside our pen, and having looked down the columns of the "Gardener's Gazette," we were arrested by the following paragraph, a quotation from Fraser's Magazine for November, which bears so admirably upon the subject under discussion, that we cannot forbear to copy it. "The present age," said Mr Phillipson, "is an age pregnant with quacking. Every scheme that can charm the vulgar, is set forth as the regeneration of the race. Diseases are to be cured by homoeopathy; men are to be made immortal by animal magnetism; and morals are to expand into a millennium by dint of tee-totalism and temperance societies. I hate drunkenness and immorality; but even more do I hate that mercenary spirit which turns these to a good account, and daubing the wall with 'untempered mortar,' keeps men from solid and real panaceas. *The whole system of temperance and tee-total societies is but a new edition of monasticism. The monk retired from the world rather than 'use, as not abusing it;' and the anti-whisky man runs from blue ruin and its sister spirits, rather than resist the intemperate use of them. Both are indolent ways of overcoming evil and ruinous passions.*" * * * *

It would be foreign to our present purpose to argue upon the policy of Government in having prohibited the cultivation of tobacco in Britain and Ireland, in order to foster our Colonies; the plant is grown extensively in France, and her peasantry are enabled, consequently, to obtain a daily luxury, free from taxation. The legislative benevolence of England embraces a wider extent; it does not confine itself to the pauper wants of this over-populated country. The poor here pay exorbitantly for even the very necessaries of life; it would then indeed be incongruous that their few and scanty luxuries should be attainable duty free! Certain it is that tobacco fit for consumption, and far superior to that which is known as Guernsey tobacco, can be grown in England. It is not to be expected that the flavour or scent are equal to those of the plant which is cultivated in warmer climates and more congenial soils; but not only is English tobacco sufficiently pleasant when made into cigars, but, for the purpose of fumigation for hot-houses, conservatories, &c., is quite equal to that which is imported.

To the gardener, the herb, for this use, is inestimable; and as it is an expensive article to purchase, the easiest method of growing it and preparing it, as well as forming home-made cigars, may not be unacceptable to our readers. These we shall extract from the "Gardener's Gazette," of May 12. and July 14. 1838; at the same time we must mention, that we know the directions may be relied on, as we have grown our own tobacco, and have made cigars, according to the above method.

The writer says:—"We know by experience that a very efficient article may be produced in the garden; * * * but simple as most gardeners would deem the culture of the large-leaved Virginian tobacco [illegible]be, we are not acquainted with any herb which is more subject to casualtics, nor one which at times more speedily disappoints the expectations of the grower. It is not that the plant is tender or miffy, for we have known it to bear six or eight degrees of frost. But the great destroyer of the seedling in its first stage of existence is the wood-louse, formerly called [illegible] though erroneously. This insect abounds beyond belief in [illegible] the second enemy, and by far the most fatal, is the small [illegible] garden. The critical period is that wherein the plant is apparently to[illegible] removal from the pot to the open [illegible]nd [illegible] the juices [illegible] become thickened [illegible] perhaps sweet; and the vital energy of the foliage is exerted to establish new roots in a soil which differs more or less from that within the pot, every injury sustained by it becomes of serious consequence to the establishment of those roots. Thus the wounds inflicted by the slug (whose rapacity is tempted by the condition of the inspissated sap) become rapidly fatal; and weeks of watchful nursing may have been spent in vain, at a period when it is too late to think of raising other seedlings. We saved thirty or forty plants in 1836, and these supplied us sufficiently; but we were beaten in 1837, and were unable to bring more than five to perfection.

"Experience then has shewn, that, if plants are to be raised and brought to flower in one season, the seed should be sown (if wood-lice abound) in pans of light sandy soil, supported over a trough or other vessel containing water; through this the insects cannot pass. When the plants become large enough, one or two must be transplanted into a pot turner, a 'sixty' of rich sandy earth; and kept shaded, in heat, till the roots play about the pot. If the plants attain the height of five or six inches, either in these small pots, or in others a size larger, so much the safer will they be. * * * The latter end of March is time enough for the sowing; but the plants should never be suffered to flag, and they may be hardened off in a cool frame prior to their removal to the open ground about the first week in June.

"When in the ground, each must be covered with a small pot or hand-glass, round which powdered lime, with one-fourth of soot, should be sprinkled; if slugs infest the mould within the cover, a little dry lime, without soot, must be scattered over the plant and the earth. Shade for a time is essential, and, therefore, the pots or glass must be retained till the objects of protection and shelter be effected, and growth be evidently established.

"Sometimes an early flowering plant will shed ripe seeds on the surface, and, from these, good seedlings will rise in the following spring; whenever this occurs, it is a fortunate circumstance. Another plan might be tried, and that is, to sow in August or September under glass, to nurse the seedlings as before recommended, and to preserve pots of the best plants under gentle temperature throughout the winter. In the garden, the most open situation and exposure, remote from trees, fences, or hedges, should be adopted; and we have proved that manured trenches promote the growth of the plants very materially."

We now proceed to give the method of making cigars, first describing the process of preparing the leaves for the purpose:—

"The leaves of the large Virginian tobacco, with pink flowers, grow from about eighteen to twenty inches in length, and more than six inches broad. They should be gathered just as the flower-buds begin to separate, prior to the blossom expanding. The midribs of each being pared off level with the leaf through its whole length, the leaves are suspended across a line in a warm stove or vinery, or even an open shed, if well exposed to the sun. When they become flaccid, and their colour changes to a dingy yellow, they are placed on a board, one on another, as flat and level as possible, till the pile be several inches deep. Another board is then laid on the pile, and pressed by weights. If the bulk be considerable, a degree of fermentation takes place, and a slight heat is developed. These induce a rapid change; the raw odour goes off, and that of tobacco is formed. When this becomes perceptible, the mass is divided into several portions, which are slowly dried in a half cooled brick bread-oven.

"There are certain salts, one of which is nitre, revealed during the curing of tobacco, which attract moisture. When, therefore, the dry and brittle leaves are taken from the oven, and placed in the atmosphere of a moist stove, they speedily again become flaccid; and in this state the leaves are separated, and laid in a long narrow box, and sprinkled, one by one, with the least possible quantity of saltpetre (nitre), and salt of steel (refined copperas, that is, sulphate of iron), rubbed till intimately united in a stoneware mortar. By this application, which may be given with a soft brush, and thus made to extend over the whole of the leaf, colour is given, and the smouldering quality of tinder imparted. The flavour and odour are also much assisted, by scattering between every dozen of leaves a few shreds of the superior foreign leaf tobacco, or of the best Dutch canaster. The whole stock of leaves being thus placed in the box, a weighted board is laid over them. If the crop be gathered in fine sunny weather during September, and carefully prepared, the leaves will be in prime condition in the following March.

"In manufacturing home-made cigars, the process of rolling and adapting the smaller fragments, so that nothing be lost, can be most effectually learned by taking two or three soft foreign cigars to pieces, and carefully observing the order in which the different parts are arranged. A flat rolling board may be of use, and a little gum water, to cause the outermost coiled edges to adhere, but they are not indispensable. For fumigation, a sprinkling of the strongest shag between the leaves will answer every purpose, and one ounce will suffice for two pounds."

We repeat, that the above instructions are so good, that, by attending to them, we have succeeded in manufacturing cigars [illegible] pleasant flavour; and although growing tobacco for sale [illegible] prohibited, private individuals are not restricted in raising it for their own consumption: hence to the poor [illegible] information must be of great use; for this favourite luxury [illegible] heavily taxed, and consequently a considerable item in their expenditure; but every cottage garden or piece of land (where such an advantage is possessed) might be made to yield annually a portion [illegible] Nor need a failure be apprehended for want of artificial heat on which to raise the seedlings; for the writer of the foregoing directions for the home-cultivation of tobacco expressly says, that " sometimes an early flowering plânt will shed ripe seeds on the surface, and from these good seedlings will rise in the following spring;" adding, " whenever this occurs it is a fortunate circumstance." This observation, moreover, tends to simplify the raising of this invaluable herb materially; and seems to prove, that the only advantage to be derived from protecting the young plants is to guard them from the depredations of slugs and woodlice.

This might, then, assuredly be effected, by watching for the egress of the naturally sown seedlings in the following spring, and securing them in the way recommended by the writer for the protection of the seedlings, that is, by sprinkling dry lime frequently over the leaves, and thickly on the adjacent earth.

We *know* that frost (to a certain degree, and if of short continuance) will not destroy this plant; but rather than risk a loss, if there be a threat of a sharp fit of weather while the nursery is young and tender, nothing will be more easy than to cover the whole with a mat during the continuance of the severe weather, or on suspicious nights, removing the protection during the day; the circumstance of the seeds being self-sown, and consequently comprised in a very small space, will render this precaution easy of adaptation. When the plants shall have arrived at the height of five or six inches, they should be transplanted, as before directed; and if in rows, at least six feet apart, and about four from plant to plant.

We repeat, that, for all purposes, we also have found the pink-flowered Virginian tobacco the best hitherto tried; but we hope to make experiment with the superior Havannah seed during this year. Should we succeed, we will report to our readers the result of our attempts.

We close the article with a sincere wish that we could witness the cultivation of this highly ornamental, delightful, and very useful herb, in every cottage and other garden within our ken; and could believe that it would be as generally cultivated by the poor, as is the flaring, troublesome, useless—worse than useless—dahlia.

Effects of Food on Milk.—Messrs Boussingault and Le Bel instituted experiments, with the view of ascertaining if the food consumed by cows affects, in any appreciable degree, the quality and chemical composition of milk. They found the opinions of agriculturists, in regard to the effects of food on milk, to be very diversified, and in discussing the matter with some of them, soon perceived that those opinions were frequently founded on imperfect observation. For example, in researches of this kind, the object almost always is confined to measuring the milk, without seeking to note the changes that take place in its composition. Since this is true, it may be said that we do not yet possess a complete analysis of the milk of the cow. The researches of Messrs Boussingault and Le Bel having been purely directed to a practical end, especially on the farm on which they experimented, they limited their experiments to only ascertaining the effects of food, which is usually given to cows.

" In the observations," says Messrs Boussingault and Le Bel, " of which the following table presents the abstract, it will be seen that the quantity of milk given by the cows progressively diminished. This diminution cannot be attributed to the regimen to which the cows were subjected, since, in again putting them on the food on which they had previously fed, the same quantity of milk was not obtained as at first,—the diminution continued.

" The distance from the period at which the cow has calved, seems to be the principal cause of the decrease of the milk. This cause is so strongly marked, that it may even prevent the influence that the nature of the food exercises over it from being seen. . . . . . Indeed, this result permits us to state, that the nature of the food consumed does not exert so very sensible an influence on the quantity and chemical composition of milk (we do not say, on its quality), if the cows receive equal nutrition from the different kinds of food. It is very evident, that if the [illegible]eight of the feeds were not calculated according to that of the equi[illegible]lents, great variations would be observed in the products of milk; but [illegible]en those variations would be principally caused by the augmentation [illegible]iminution of the nutritive matter. We know, for example, that [illegible]vhich, during winter, are reduced to simple feeding on chopped [illegible], cease almost entirely to produce milk, and with difficulty recover [illegible] ordinary rate of production: in cognizance of such a fact, we are [illegible]t to ascribe the return and abundance of milk, exclusively to the pro[illegible]erties of the green food in spring, whilst that effect is in a great part [illegible] by a rea[illegible] [illegible]ease in the feeds.

[illegible]

[illegible] he

difference, if any exist, betwixt the feeding in winter and summer, being in all cases much less considerable. These are the results of experiments made during a year on eight cows constantly fed together on a great variety of food."

Number of Days since Calving.	Milk given in 24 hours.	Solid Matters in 100 lb. of Milk.	Food given equivalent to 15 kilogrammes, or about 30 lb. of Hay.	Composition of Milk.					Remarks.
				Cheese.	Butter.	Sugar of Milk.	Salts.	Water.	
1st Series of Experiments,—COUNTRY COW.									
	Litres.*								
1	5.0†	21.6	Potatoes, hay . .	15.1	2.6	3.6	0.3	78.4	Milk drawn immediately after calving. The cow had not been milked for 43 days.
13	7.5	...	Ditto	...	...	...	...	...	
24	10.6	11.2	Hay, green clover .	3.0	3.5	4.5	0.2	88.8	
35	12.0	13.1	Green clover . .	3.1	5.6	4.2	0.3	88.9	
200	5.6	12.3	Hay.	3.0	4.5	4.7	0.1	87.7	
207	6.0	12.4	Turnips	3.0	4.2	5.0	0.2	87.6	
215	5.6	12.9	Red beet	3.4	4.0	5.3	0.2	87.1	
229	5.0	13.5	Potatoes	3.4	4.0	5.9	0.2	86.5	
240	3.6	...	Hay	...	...	...	...	...	
270	3.4	...	Potatoes	...	...	...	...	...	
290	3.5	12.5	Jerusalem artichokes	3.3	3.5	5.5	0.2	87.5	
302	2.8	13.2	Hay and oil-cake .	3.4	3.6	6.0	0.2	86.8	The feed being $1\frac{1}{2}$ equivalent.
2d Series of Experiments,—SWISS COW.									
176	9.3	13.5	Potatoes, hay . .	3.3	4.8	5.1	0.3	86.5	
182	8.9	12.8	Hay, green clover .	4.0	4.5	4.0	0.3	87.2	
193	9.8	11.2	Green clover . .	4.0	2.2	4.7	0.3	88.8	
204	7.8	12.6	Clover in flower .	3.7	3.5	5.2	0.2	87.4	

The analyses were made according to the processes followed by M. Peligot in the examination of asses' milk.

Comptes Rendus, 10*th December* 1838.

Crossing the Musmon with the Sheep.—It is known that many naturalists, amongst others Cuvier, have presumed that the Musmon of Corsica (*Ovis musmon*)‡ may be the stock

* A litre is nearly $1\frac{3}{4}$ pint imperial.

† This milk coagulated like albumen; nevertheless the cheese obtained from it differed in nothing from that obtained from other portions of milk.

‡ " This sheep, now, we may say, so comparatively little known, inhabits the mountainous wilds of Corsica and Sardinia, and has there only to contend against man as its enemy, no large carnivorous animals existing which would carry destruction among its herds; and it is to this circumstance probably that these islands are indebted to the remnants of the flocks

from whence our domesticated sheep have sprung. On this supposition, it would be a curious thing to ascertain if a reconcilement could be made between the wild and domesticated races of so useful an animal as the sheep.

"To attain this object, M. Durieu, receiver-general of the finances at Carcassonne," says M. Marcel de Serres, "has imported musmons from Corsica, and when a female of them has been in season, she has been put to a merino ram. These two animals, deprived of their liberty, and coupled, have produced a female cross, which was much more like the sire than the dam (that is the merino than the musmon). Indeed, this hybrid was no longer covered over with coarse reddish hairs, such as those which characterize the musmon; but only whitish wool scattered singly and at intervals among the coarse hairs.

"This female cross was then put to a pure musmon ram, and the produce obtained resembled, this time, much more the sire than the dam, (that is, the musmon than the merino). It was reddish coloured like the musmon, and bore only some woolly patches mixed among the reddish hairs, principally upon the neck. This produce was a male.

"This new cross was put to a female merino, and from that union resulted this time an individual of the male sex, which retained all the characters of its dam. Like her, he was covered with thick enough wool, through which were scattered here and there, reddish hairs, that reminded of its origin.

"In all these crosses, obtained as we have stated, the limbs remained always naked, without wool as without hair, and it was the same with the under part of the body. The limbs were remarkable for strength, thickness, and vigour. Their habits also retained those of the musmons; at least those wild, savage crosses do not walk with a proper step, but almost always bound or leap. They also climb with as much ease as dexterity, and, when pursued, dart forward with nimbleness, and readily and quickly fall again upon their four feet.

"Such attempts at crossing are continued in order to ascertain the certainty of the crosses being prolific, and if they can be led back to a fixed type, whether to that of the musmon or the sheep. Those researches have another object, and that is, to ascertain, by means of crossings, [illegible]ether th[illegible] [illegible]iddling size of the merino can be enlarged, and a [illegible] [illegible]antit[illegible] [illegible] wool [illegible]btained

[illegible] [illegible]xisted among the mountains of Spain, and [illegible]ne neigh[illegible] [illegible]arts of the continent of Europe.

[illegible]he flocks consist sometimes of a hundred and more, placed under the [illegible]uidance of [illegible] [illegible]ourageous male. In a domestic state, the young [illegible]ales and [illegible] [illegible] and gentle; but the old males became subject [illegible] [illegible]ll-na[illegible] [illegible] [illegible]imes assail children, women, and even men, [illegible]ttempt[illegible] [illegible] by [illegible]" *The [illegible] Library*, vol. iv. [illegible] [illegible]DITOR

"We may mention, that every attempt has been made to cross the he-goat in season, deprived of its liberty, with the female musmon in the same state, but every such attempt to overcome the aversion which they shew for each other has failed.

"It seems to result from these facts, that it is not always possible to triumph over the repugnance which different species feel against mutual crossing; and since the musmon and sheep do cross with one another, it is probable that both belong to one and the same species."

Comptes Rendus, 15*th October* 1838.

Artesian Wells of Ancient Egypt.—In a letter in the *Comptes Rendus* of 10th September 1838, from M. Lefebvre, relative to a journey of his into Sennaar, is described the localities, and the method of boring used by the ancient Egyptians in forming their famed artesian wells. Those wells are situate in the two great oases of Thebes and Garbe. The oasis of Thebes is twenty-five leagues in length, and from two to three or four in breadth: that of Garbe, about twenty leagues in length, and of an oval shape. The two together contain about 25,000 arpents of land (an arpent and a half being about an imperial acre), of very good quality, and capable of growing sugar, indigo, madder, and cotton. Those two oases had been, as it were, holed like a sieve with artesian wells, but which wells are now in a very dilapidated state, being, in a great measure, filled up with the falling in of the wooden lining, as also of the fragments of rocks which constituted partition walls between them. Aided by the advice of M. Lefebvre after the establishment, in 1836, of an apparatus for boring, M. Ayme was able with a rod (tige) of 500 feet, to clear and clean out several of those wells, and which have supplied him with water ascending as high as the surface of the ground.

The particulars of the formation of those wells were communicated to M. Lefebvre by M. Ayme, a chemist, who resides in the oasis of Thebes, and who has an alum-work in that of Garbe; and who, from his reputation, has been made civil and military governor of all the oases, by the Viceroy of Egypt. His researches have led to these discoveries regarding the structure of those artesian wells.

"This is what was done by the ancient inhabitants of these countries. They sunk square wells of about sizes varying from 2 to 3.33 metres a side (a metre being 3 feet 11¼ lines). They sunk them thus to a bed of calcareous rock, distant from the surface of the soil from 20 to 25 metres, a space consisting of beds composed, from the top to the bottom, of vegetable earth, clay, marl, and marly clay. This last rock rests upon a calcareous rock, under the mass of which is found the sheet of water that feeds all the wells of the oases. At one time, the wells, dug to the calcareous rock, had furnished from it the partition walls even to the surface, with a triple lining of palm-wood to prevent them falling down. This work was finished dry, then bored (it is unknown whether by the method of rods, or by the Chinese method), the calcareous mass, which the Arabs call *agar el moya* (water-stone), and which was from 100 to a 133 metres in thickness, before reaching the course of subterranean water that traverses the sands corresponding to those of the Nile, if we judge of them at least by the specimens afforded by the auger. After being thus cleared and cleaned out, one of those wells presented a fact, somewhat analogous to that of the wells of Elbeuf: that is, from the depth of 108.33 metres, the water brought up fish through the bone, with which M. Ayme, then and since, has supplied his table.

"These are the precautions which the borers of antiquity took. After coming upon the *agar el moya*, they bored holes of four, five, or even eight inches diameter, called by the Arabs *algue;* then, in case the country should be inundated by the great quantity of ascending water up the bores when reaching the aqueferous bed, they prepared the orifice by covering or surrounding it with a kind of safety-valve, made of very hard free-stone (probably siliceous), and to which was given the form of a pear. This valve was furnished with a ring of iron, which permitted the orifice to be more or less open or shut. They also contrived an easy method of economizing the quantity of water necessary to their wants. This said pyriform valve was substituted in some wells by a tube of wood sunk in the *algue*, and its end projecting above.

"The multitude of those wells, and their different situations, lead to the belief, that at whatever place artesian wells are found in these oases, ascending water was sure to be found in quantity proportioned to the diameter of the bore.

"The motives which have made them abandon those wells, are, that, the lining of wood having become rotten, a great part of the wood which composed them is detached, and has obstructed the flowing of water in the bore. The marls and other rocks which the wood supported, wanting support, are detached and have been allowed to accumulate in the spaces between the fragments [illegible], thus has it become necessary to employ divers to clear them [illegible], practising on the credulity of the people, [illegible] a day (an exorbitant price for the country), [illegible] and as they only have their hands to [illegible] silting, they are never able entirely to [illegible]

"M. Ayme, notwithstanding all he means at his disposal, has been obliged to abandon the operations of clearing and cleaning these wells, because of the enormous expense of removing the lining of wood. He proposes to bore new ones, which will make him acquainted with the nature of the calcareous rock they may traverse; and his operations will, no doubt, present us with many remarkable facts regarding the enormous subterranean current which flows under the soil of the oases, and which seems to come from Darfour."

Do Plants take Azote from the Air?—M. Boussingault has paid great attention to this department of chemical botany, and as his experiments during the examination of the question, whether plants take azote from the air, appear to have been conducted in a satisfactory manner, their results may prove not uninteresting to those of our readers who delight in such studies. The preparations made by M. Boussingault for conducting his experiments are thus alluded to by him.

"In this memoir," he says, "I shew the new researches which I have made with the view of verifying the results obtained in the former part of my operations; I now examine, if developed plants, endowed with perfect organization, take azote, when they are transplanted and cultivated in a soil absolutely deprived of organic matter? The experiments made in the course of last year, 1837, have established, that clover grown and cultivated in sand previously calcined to a red heat, admits into its organization a certain quantity of azote obtained most probably from the atmosphere."

He then proceeds to relate experiments with pease, clover, and oats, in order to ascertain the particular object he had in view.

"In cultivating, this year, 1838, *pease* in exactly the same conditions as the clover of last year, I observed the same results, and more, I had occasion to prove a fact little enough attended to; which is, that pease, under the influence of a similar regimen, having for their whole food nothing but water and air, have flowered and produced seeds to perfect maturity.

Result of the Experiment.

	Grains.		Carbon.	Hydrogen.	Oxygen.	Azote.
Peas sown,	1.072,	containing grains of	0.515	0.069	0.443	0.046
Crop,	4.441,	. .	2.376	0.284	1.680	0.110
		Gain on culture	1.861	0.215	1.237	0.055

"It results from this experiment that 1.072 grain of pea-seed gained

3.369 grains of organic matter in 99 days of complete vegetation during the hottest months of the year. The weight of azote primarily contained in the seed was more than doubled in the culture. Besides, in the harvested peas, the proportion of azote was less than in the sown peas, of 3.6 per cent. of azote instead of 4.3. The elementary matter which had been taken up during the growth of the plant, is not exactly represented by the water and the carbon; the hydrogen is in excess, and this excess is such that it can scarcely be attributed to an error in the analysis."

"The plants of *clover* were chosen from a field sown down the last year, 1837. The clover was transplanted in sand on the 28th May, and sheltered forthwith from dust floating in the atmosphere. In the first days vegetation languished, but soon after shewed remarkable vigour. Towards the 8th July the flowers began to shew themselves; on the 15th their colour was of a beautiful flesh-red. The experiment ceased on the 1st August: it was then obvious that the roots had not grown any.

Result of the Experiment.

	Grains.
The transplanted clover weighed, when dry, and cleared of ashes, ...	0.884
After 63 days of culture, the harvested clover weighed . .	2.264
Gain on culture, . .	1.380

Before the culture the plant contained	Carbon.	Hydrogen.	Oxygen.	Azote.
grains of, . . .	0.384	0.048	0.419	0.033
After it, ...	1.200	0.145	0.863	0.056
Differences of gain,	0.816	0.097	0.444	0.023

"Thus, in two months of vegetation, at the cost of the air and water, the clover may be said to have tripled its elementary matter, and the azote to have been almost doubled.

"On the 20th June were disposed several plants of *oats* in shelter from dust; the roots were plunged in distilled water. On the 10th of August the plant bore perfectly ripe seeds.

Result of the Experiment.

	Grains.
Before the experiment the [illegible] of oats weighed, dry and clear [illegible]m ashes, ...	0.1560
[illegible] . .	3.118
Gain on culture,	1.558

[illegible] plan[illegible] [illegible]	[illegible]bon.	Hydrogen.	Oxygen.	Azote.
[illegible]xperiment, g[illegible] of,	0.827	0.106	0.568	0.059
[illegible] 4 [illegible]tatio[illegible]	[illegible].500	0.193	1.372	0.053
[illegible]	[illegible]	[illegible]087	[illegible]	— 0.006

"In this experiment, the analysis, far from indicating a gain of azote, is, on the contrary, remarkable for a small loss of this principle.

"The researches which I have undertaken seem to establish that, in many conditions, certain plants are apt to draw from the azote in the air; but in what circumstances and in what state this element fixes itself in vegetables, is as yet unknown to us. Indeed, azote can enter directly into plants, if their green parts are fit to fix it. Azote, too, can be conveyed into vegetables by water, which is always aerated, and which is always taken up by the roots. In short, it is possible, as many physicians think, that it exists in the air in very small quantities of ammoniacal vapour. In a work on rotations, which I shall publish soon, I have proved, by numerous analyses, that, in cultivation on a large scale, the azote contained in a succession of crops always exceeds, and often in a very great proportion, the azote, which is originally to be found in the manure applied to raise them."*

The Relative Value of Rotations.—In another memoir,† M. Boussingault enters into a discussion on the relative values of rotations, which he endeavours to ascertain by analyses of the comparative proportions of the elements yielded by each crop subjected to rotation. These elements he endeavours to prove are not derived from one source only, but from several, particularly from the earth, the air and water.

"The relation," he observes, "in which the air and earth concur in developing vegetable life, is not only worthy of fixing our attention to the interest of physiology, it is moreover an important fact, a knowledge of which would enable us to investigate those two vital questions of agricultural science,—the theory of the exhaustion of the soil by culture, and the study of rotations.

"Thaër, who, better than any other person, comprehends the extent of the question of the exhaustion of the soil, has sought to resolve it principally by culture. I have no need to shew here the method which he followed, since it may be perused in his admirable work, I shall only observe that his method is founded on a disputable principle, which is, that the exhaustion of the soil is proportional to the quantity of nutritive matter contained in the crops. In admitting this principle laid down by this illustrious agriculturist, we would tacitly acknowledge that all the organic matter of plants originates in the soil. The soil, no doubt, contributes a certain proportion to the development of vegetables, but it is also known that the air gives an equal part."

There can be no doubt that M. Boussingault is quite correct in combating the opinion of M. Thaër, that the exhaus-

* Comptes Rendus, 19th November 1839.

Ibid, 31st December 1838.

tion of soils is proportioned to the quantity of nutritive matter contained in the crops; for if, at the end of the rotation, it is found necessary to renovate the exhaustion of the soil by a fresh supply of manure, it is obvious to the common sense of every farmer, that, did the crops receive no nourishment whatever but from the manure furnished at the beginning of the rotation, the quantity, however great it may be in some instances, could never supply all the nutritive matter derived from the whole crops during the whole rotation. Could a few tons per acre of farm-yard manure applied to green crops on the fallow-break be sufficient of themselves to cope with the weight of valuable matter derived from the soil during a rotation? No, either the extra matter must exist in the soil previous to the application of the manure, as the theory of M. Thaër seems to suggest, or it must be derived from some other source, from the air, as asserted by M. Boussingault; and the experiments of the latter, which we have related in the preceding paper, do tend to shew that plants are enabled to draw much nourishment from the air, and thereby afford much valuable matter to the husbandman. But if M. Boussingault is correct in his strictures on M. Thaër, he is himself in error in regard to the nature and necessity of a rotation in crops, when he assumes in the following paragraph, that, could manure be procured in unlimited quantities, there would be no absolute necessity for the adoption of a system of rotation; for a system of rotation is not only useful in affording regular intervals of time for the application of manure, without which the energy of vegetation could no longer be maintained, but it is as useful in establishing the annual proportion of the crops, whereby the supply every year of each kind of crop is uniformly maintained. Without a uniformity in the supply of crops, no farmer could depend on the kind and quantity of produce he would take to market, nor could the farm support a stated number of breeding stock. We perceive that almost all writers on agriculture out of Scotland are apt to overlook these latter advantages attending the adoption of a system of rotation. Let us now hear M. Boussingault's remarks on M. Thaër's principle.

"Where an unlimited quantity of manure can be procured, there is felt no absolute necessity for adopting a system of rotation; but in most agricultural operations, where extraneous manure cannot be obtained, the matter is quite different. A system is then obliged to be followed, and the quantity of produce which it is possible to dispose of every year, must be comprised within certain limits, which can never be passed with impunity. In order to preserve to the earth its healthy fertility, we must give it periodically, after each succession of crops, equal quantities of manure. In viewing this matter, in a point of view purely chemical, we would say that the produce which we can dispose of, without injury to the fertility of the land, is represented by the organic matter contained in the crops, deduction being made of the organic matter to be found in the manure. Indeed this last substance, under one form or another, ought to be returned into the soil to fertilize it anew; it is a capital intrusted to the soil, the interest of which is represented by the produce sold off by labour. I undertake to prove that the most profitable rotation is that which deduces the greatest quantity of elementary matter from the atmosphere, and it is precisely this quantity which it is important to appreciate, in order to judge comparatively of the value of different rotations of culture. In a word, I propose to compare, by a particular case of soil and climate, the relation which exists betwixt the elementary matter contained in a succession of crops, and the same matter comprised in the manure consumed by the produce. In other terms, I seek to value, by analysis, the quantity of organic substance deduced from the atmosphere by such and such a rotation. In a well-conducted farm on which a good system of culture has been followed for a long time, we can, no doubt, collect data necessary to estimate this valuation. It suffices, indeed, to have with sufficient exactness, the produce of the soil and the manure expended. This manure comprehends the organic matter which should be consumed, in assimilating part of it to cultivated vegetable products. I say part of it, because I am far from thinking that the whole of the manure necessarily enters into the constitution of the plants that are raised in the duration of the rotation. No doubt, a part of the manure may be lost to vegetation, in decomposing itself spontaneously, or in being drained away by water. It is also certain that another part remains a long time in the soil in an inert state, only to exert its fertilizing action at a period more or less remote; and even it may happen that, in the actual rotation, a part of the manure previously introduced acts in concert with the new addition. But what is well established is, that the proportions of manure indicated by use are indispensable to attaining the mere rate of our crops. In short, we know that, after the rotation, the crops have consumed the manure, and that the land will no longer present a productive culture, if it is desired to prolong it, without restoring to it a new dose."

The author details the results of a few of his experiments. He takes the hectare, which is to the acre as 2 : 1½, as the unit of surface. The produce is almost always deduced from a mean of six years. The dung employed was farm-yard dung half fermented; the unit of its bulk is a measure of which the weight had been found after numerous weighings to be 1818 kilogrammes of 2 lb. 3 oz. each. The grains, the straw, the roots, the tubers, were analyzed with the greatest care, each of those substances having been subjected to at least four analyses. Before being analyzed, all those substances were dried at a temperature of 110° of the centigrade or 230° of Fahr. thermometer for a sufficient time, and this is the five years' rotation which the author followed:—

"Potatoes or red beet, dunged, wheat, clover, wheat, oats. It was found that, in the dung consumed on the hectare, there were 2793 kilogrammes of carbon; in the suite of crops produced by this dung, the carbon was raised to 8383 kilogrammes. The weight of the carbon furnished in culture by the carbonic acid of the air was thus raised at least 5400 kilogrammes. In the same rotation the azote primarily included in the dung weighed 157 kilogrammes. In culture, the weight of this principle attained 251 kilogrammes; the atmosphere had thus furnished on its part 94 kilogrammes of azote. In another very productive rotation . . . . . the carbon of the crops surpassed the carbon of the dung by 7600 kilogrammes; the azote in excess was as high as 163 kilogrammes.

"The three years' rotation with bare fallow dunged, such as is followed elsewhere, but which has almost entirely disappeared from Alsace, is far from offering, as to azote, results so satisfactory; the carbon taken from the air was only 4358 kilogrammes, the azote acquired did not exceed 17 kilogrammes. I may remark generally that every time a rotation includes only the cereal crops, the azote becomes less considerable. Thus in seeking the aid of analytical data, and of the agricultural tokens which precede them,—the relation which exists betwixt organic matter entered into the earth with the dung, and the same matter exhumed by the crops,—we arrive at results which are not without interest.

[illegible] Jerusalem artichoke is, of all the plants of which I can discuss [illegible], that which [illegible] largely from the atmosphere. It is [illegible]ly alternat[illegible] that gives the most nutritive mat[illegible] with [illegible] doubt, to this circumstance must be [illegible] has taken place in the culture of this [illegible] year. It may be seen in the following tables, [illegible] taken from the air, from the surface of a hectare, rose to 13,237 kilogrammes, and the weight of azote contained in the dung is almost doubled.

"The principal results of my operations plainly shew that the rotations which are judged in practice as the most productive, are precisely those which abstract the greatest quantity of elements from the atmosphere; elementary analysis can certainly serve to determine the value of this quantity, for a particular case of soil and climate.

"In comparing the composition of cultivated substances, a remarkable fact is nearly overlooked, and which I do not pretend to explain; which s, that many articles of food, when analyzed, afford exactly the same composition, let their properties or flavour be ever so different.

"The composition of most of those substances are not represented exactly by carbon and water, there is almost always found a slight excess of hydrogen, which raises the proportion to nearly a half centime, in some cases, the excess attaining to one or two centimes. The precaution which I have taken to protect myself from the hygrometrical influences of the air, authorize me in considering this result as not entirely an error of analysis. Nevertheless, I am very far from finding, in the fact of hydrogen in excess, a new proof of the fixation of the hydrogen of water, under the influence of the vegetable life. Indeed, if this fact were sufficient to prove the assimilation, it might not be disputed by any person, because, for a long time, a great number of vegetable substances have been known, in which hydrogen is in excess, in relation to oxygen; such, for example, as resin in resinous trees, fatty matter in oleaginous plants. It is quite natural to draw a positive conclusion from this circumstance, because the same substances are the origin of vegetables, which are believed to be under the influence of the organic matters deposited in the soil. To resolve this question in a decisive manner, plants should be raised and cultivated apart from the influence of every organized matter, and only water and air given them, for food. This is what I have done. Several analyses have proved that, in the vegetables developed under these conditions, hydrogen was in excess in the amount of the organic matter acquired in the duration of the experiment.

"These two facts, if I mistake not, have a certain physiological interest. The one which establishes that *azote can be assimilated from the atmosphere during vegetable existence;* the other which proves that, *water is decomposed during vegetation.* This decomposition of water has been quite recently proved by Messrs Edwards and Colin, by the assistance of a method quite different from that which I employed."

The following tables serve to illustrate the foregoing observations of M. Bousingault. We may here observe, that we do not well understand the use of the third division of the first table, under the title of "Ashes deduced" (Cendres deduites).

Composition of cultivated substances dried in a temperature of 110° Centigrade, or 230° Fahr.

Substances.	Their Ashes comprised of							Ashes deduced.			
	Dry Matter.	Water.	Carbon.	Hydrogen.	Oxygen.	Azote.	Ashes.	Carbon.	Hydrogen.	Oxygen.	Azote.
Wheat	0.855	0.145	46.1	05.8	43.4	02.3	02.4	47.2	06.0	44.4	02.4
Rye	0.834	0.166	46.2	05.6	44.2	01.7	02.3	47.3	06.7	45.3	01.7
Oats	0.792	0.208	50.7	06.4	36.7	02.2	04.0	52.9	06.6	38.2	02.3
Wheat-Straw	0.740	0.260	48.4	05.3	38.9	00.4	07.0	52.1	05.7	41.8	00.4
Rye-Straw	0.813	0.187	49.9	05.6	40.6	00.3	03.6	51.8	05.8	42.1	00.3
Oat-Straw	0.713	0.287	50.1	05.4	39.0	00.4	05.1	52.8	05.7	41.1	00.4
Potatoes	0.241	0.759	44.0	05.8	44.7	01.5	04.0	45.9	06.1	46.4	01.6
Field Beet	0.122	0.878	42.8	05.8	43.4	01.7	06.3	45.7	06.2	46.3	01.8
Turnips	0.075	0.925	42.9	05.5	42.3	01.7	07.6	46.3	06.0	45.9	01.8
Jerusalem artichokes	0.208	0.792	43.3	05.8	43.3	01.6	06.0	46.0	06.2	46.1	01.7
Yellow Pea	0.914	0.086	46.5	06.2	40.0	04.2	03.1	48.0	06.4	41.3	04.3
Pea-Straw	0.882	0.118	45.8	05.2	35.6	02.3	11.3	51.5	05.6	40.3	02.6
Red Clover Hay	0.792	0.210	47.4	05.0	37.8	02.1	07.7	51.3	05.4	41.1	02.2
Stems of Jerusalem artichoke	0.871	0.129	45.7	05.4	45.7	00.4	02.8	47.0	05.6	47.0	00.4
Manure (mean)	0.204	0.796	38.8	04.0	23.6	01.9	36.7				

The mean of cultivated crops in a hectare.

Cultivated Substances.	In weight of kilogrammes of 2 lb. 3 oz.	In measure of hectolitres of 77 Paris bushels.
Potatoes (dunged)	12,800	......
Wheat after Potatoes	......	17
Wheat after Red Beet	......	15
Wheat upon Clover broken up	......	21
The Grain is to the Straw : : 44 : 100	......	......
Red Clover, dry	5,100	......
Turnips (stripped crop)	18,000	......
Oats (end of the rotation)	......	32
Oat-Straw (end of the rotation)	1,800	......
Field Red Beet (dunged)	26,300	......
Rye (given with some certainty)	......	23
Rye to rye-straw : : 45 : 100	......	......
Yellow Pea	......	14.2
Pea-Straw	2,790	......
Jerusalem artichoke	26,440	......
Dry stems of do.	1,410	......

Water-Irrigation near Edinburgh.—No question of public polity, whether civil, ecclesiastical, or political, is now-a-days discussed without an agitation being, in the first instance, [illegible] and the agitation is always attempted to be instigated by an appeal to some ignoble feeling of our nature, especially that of fear. This is done with the view of intimidating the unthinking, of whom the largest portion of society consists, into the belief that if the object desired to be attained is not immediately granted, the most awful consequences will be sure to befall them or the nation. In imitation, in a small way, of this now established method of discussing public questions, an impression has lately been attempted to be made on the public mind against the system of irrigation, which has, for so long a time, been practised in the neighbourhood of Edinburgh, as a public nuisance; and, in order to ensure an agitation of the public mind on so trivial a matter as a nuisance in a large town, an alarm has been sounded from high places and industriously circulated amongst the inhabitants, that the miasm arising from the irrigated meadows surrounding the city, has been the cause of the increase of fever which has been experienced within it during the last twelvemonth. This assertion has unhesitatingly been made by the municipal corporation of the city, and with what truth it is our present purpose to inquire.

That a disagreeable odour does at times arise from the irrigating water of those meadows, no one is disposed to deny. Any other effect could hardly have been looked for when the nature of the irrigating water is considered. But the odour is not at all seasons perceptible. In winter, when irrigation is little practised, and the water mostly allowed to flow directly to the sea, no odour is perceptible. In summer, on the contrary, it is prosecuted with vigour, and the odour is perceptible; but even then not always, and certainly not always in the same degree. In dry weather in summer, when the sun's heat is great, and evaporation active, accompanied with a keen east wind, the odour is sensibly perceived; in rainy weather, in the same season, when the discharge from the drains is greatly increased, it is scarcely perceptible. As a disagreeable nuisance, at times, the irrigation may therefore be reasonably complained of. It may with truth be alleged, that the neighbourhood of the irrigated meadows is disagreeable at certain times of the year, and in certain circumstances; and that property in their vicinity has been thereby deteriorated in value. These are valid objections against the continuance of the irrigation, and were they based on such grounds alone, the complaint would be listened to with patience, and a remedy endeavoured to be applied.

But, after all the outcry, what harm can accrue from an odour, a smell—"the power of affecting by the nose?" Who ever heard of any one being killed by a scent? Poets, indeed, speak of bees being drowned in their own sweets, but no such calamity ever happened to one of the human race, for no one, as we suppose, would venture to bathe in the foul-water drains. Instead of being killed outright, who ever knew of any one being even nearly suffocated by those drains? We hear of people in India falling asleep amongst the poppies that supply that powerful narcotic—opium; but the effluvia from the irrigating drains produce no such soporific effects, for we never heard of any one dropping asleep beside them, except when under the more potent influence of the barley-corn. To come nearer home, we have known field-workers nearly overcome with sleep in fields of beans when in bloom, but for all that, we never heard a complaint in the country against bean blossoms being a nuisance. In fact, good or bad odours are comparative terms; like good or bad of any thing else, they are merely matters of taste. Some people, for example, are very fond of the odour of musk, whilst others cannot endure it. We have often thought, when inhaling that perfume, that if ladies knew from what part of the body of the animal musk is extracted, they would not be so doatingly fond of applying it to their olfactory organs. For ourselves, such is the disagreeable association of ideas which the smell of musk creates in our minds, that it never greets our olfactory nerves from the person of any one, without leaving the impression that some strong odour is intended to be overcome by it. We know those who are delighted with the fumes of a newly extinguished tallow candle, whilst to us they are exceedingly nauseating. Some cannot endure the fermenting odour of a farm-yard midden, whilst to us it is the prince of scents, because with it is associated in our minds the idea of fine crops of potatoes, turnips and fallow wheat. When such diversity of feeling exists among people in regard to odours, we need not wonder at the dislike which some have expressed against the effluvia at times evolved from the foul-water irrigation in the neighbourhood of the city, whilst others are careless about them; especially if, with that dislike of the particular odour, is associated the idea of an epidemic, which, if extending to disgust, may be the cause of actual disease in the person entertaining it.

But when those effluvia are alleged to be closely connected with the origin of disease, the allegation assumes quite a different and a more serious aspect, and in the attempt to connect those meadows with disease, they have been branded with many opprobrious epithets, such as *stagnant* pools, putrid *marshes*, generators of *malaria*, hatchers of *fever*, promoters of *infection;* all which, as we conceive, are wholly inapplicable to them. However disagreeable they may be, they are really innocuous; "The tender lamb that never nipt the grass is not more innocent than they of murder:" and these are our proofs;—They are, in the *first* place, *not stagnant* pools. It is chiefly in summer that the water from the drains of the town is employed in irrigation, in winter it being permitted to flow directly into the sea. Now irrigation cannot be successfully practised with stagnant water of any kind, for the moment water is allowed to stagnate on plants, whose nature is ungenial to that state, they become sickly and die, and their places are soon occupied by others whose nature is congenial to that state. The plants produced in stagnant water are coarse, and quite unfit for the support of live-stock, for whose maintenance these meadows are purposely irrigated. To insure, then, the existence of the proper plants, and to promote their forced growth, the water of irrigation is made to flow over the plants in a continuous stream, and only for a certain number of days; and when the water has run for that certain number of days over the same piece of ground, it is directed for a definite time over another piece of ground, off which the crop of grass has been previously mown and carried away. Different pieces of ground are thus irrigated in succession, and the same piece of ground is irrigated at intervals of time, measured by the progress of vegetation; but upon one and all of them, under whatever varying circumstances they may be, the water, at **no time, is allowed to stand** still **one instant.**

To insure the constant and uniform currency of the water, the ground is previously carefully prepared for the purpose by a practised irrigator, and the cost of so preparing it is, under the most favourable circumstances, not less than from L.20 to L.25 per acre. It is, therefore, the *interest* of the irrigator to ascertain that no *stagnant* water is permitted to rest on his meadows; and for this purpose, at the time when there is a cessation from irrigation every year, all the main channels through which the water flows, and the subsidiary ones which convey the water uniformly over the declivity of the ground, are cleared out. This operation is attended with the considerable yearly cost to the irrigator of from 10s. to 15s. an acre, which, of course, he would not voluntarily incur, unless it were necessary for removing the obstructions to the continued flow of the water in the season of irrigation.

Since the water of irrigation would be injurious to the plants irrigated, were it stagnant, the ground over which it passes cannot, in truth, be denominated *marshy*; that term being used by lexicographers synonymously with *bog*, *fen*, the condition of which implies stillness of existence. All marshy grounds are covered with what botanists call semi-aquatic plants, a class quite unsuited to the irrigated meadows of this neighbourhood, and not to be found in them. Indeed, the plants which compose them are rather indigenous and conformable to a *dry* soil, and this statement in connection with *water*-meadows need not excite surprise, when it is considered that irrigation cannot be successfully prosecuted but on soil either naturally dry enough to absorb and carry off superfluous water, or rendered so by draining. Stagnant water *in* the soil is injurious to cultivated vegetables at all times, and it is more obviously so when irrigating water is made to flow over it; because the ground, which covers the stagnant water below, receiving an excess of water by irrigation, throws out the useful plants, and promotes the growth of the semi-aquatic ones. Wherever semi-aquatic plants are therefore seen growing on water-meadows, there, under them, will assuredly be found stagnant water, which cannot be removed but by draining. The cognomen of *marsh* applied to an *irrigated* meadow is, therefore, a [illegible] misnomer.

Without stagna[illegible] ground, *malaria* cannot *be generated.* What is malaria? It is an Italian word signifying "ill air," recognised most probably from the ill consequences experienced by inhaling the exhalations in summer from such marshes as those of the Pontine near Rome. It is supposed to arise from evaporation by the sun's heat in summer, of the elements of diseased vegetables in water, and that diseased state is superinduced by the water being suddenly rendered nearly dry. It may, perhaps truly, be expressed in Shaksperian language, "as reek of the rotten fens." Malaria thus forms a local atmosphere, which, if inhaled, produces disease; but how its inhalation into the lungs superinduces disease in the human system, pathologists have yet been unable to explain. There is, however, no doubt of the fact, as those who have been affected by intermittent fever, caught, by incautious exposure, in a certain season of the year in the Campagna di Roma and marshes in other parts of the world, can testify. In like manner, ague and St Vitus's dance were every year contracted in the Carse of Gowrie, when its moist surface in summer was undergoing evaporation nearly to dryness, and rendering its vegetation diseased. The mires were very flat and wet, as the prefix inch or island, attached to many names of places in that now fertile region, was no doubt given to them on account of their standing up or out of the generally wet, flat surface of the country. In many other parts of this country similar diseases prevailed annually,—such as in the neighbourhood of Edinburgh forty years ago, when the land from Easter Dalry to Ratho was one swamp; but now, when it is drained, and channels are formed for the rapid riddance of the surface-water into the rivers, those diseases are there unknown. So, the dank exhalations and rapid evaporation, by the power of the tropical sun, rendering the vegetables on the banks of the sluggish rivers, and on the low shores of the west coast of Africa, diseased, have made Sierra Leone and other settlements on that repellent coast, the graves of thousands of Europeans. Nor are the same causes at the mouth of the Mississippi less potent in sacrificing the inhabitants of New Orleans. But the water-meadows in this neighbourhood bear no affinity whatever to those localities which undoubtedly produce malaria. Here is no *stagnant* water, no *marsh* to be suddenly half dried up in summer, overburdened with vegetables in a diseased state of growth, no agues to shiver the bodies of men, no black vomit, no yellow fever. Indeed, it is physically impossible that those diseases, which are all characteristic of a swampy condition of country, can have existence here, for this good and sufficient reason, that the water which promotes the healthy growth of the plants growing on them being always in a current state, preserves the air over them in quite the opposite state from what the air is where malaria is known to be generated.

No doubt, the feculence in the water, which is too heavy to be borne down to the sea after irrigation, is deposited in the hollowest places; but, when there deposited, it is out of the decomposing influence of the air or the heat of the sun, as long as it is covered with *running* water. The causes which produce decomposition in animal and vegetable matter in stagnant, are not exerted in running water, but, in either case, the elements disengaged in their decomposition are innocuous to the human constitution; for, " it cannot be admitted that marsh miasms are the result of vegetable putrefaction," as is generally supposed, and far less can it be admitted, that miasms arise at all from running water, even although vegetable putrefaction should proceed in it; but it is not admitted that putrefaction proceeds at all as long as the feculence is kept afloat in the current water. *Why* decomposition should be stayed under running water, or its elements should be innocuous to the human constitution ; and how vegetables become diseased in stagnant water after it is suddenly evaporated, and produce malaria that proves injurious to the human constitution, are problems which we do not pretend to solve ; but that these terms of all the propositions are true, and that all of them admit of solution, we firmly believe, though, at present, they must continue among the arcana of nature.

Where there is no malaria—ill air,—ill in reference to the power of propagating or engendering disease,—there can be no *infection* even from marshy ground, and far less from irrigated. *Why* infection should propagate, as well as malaria engender, disease, is a principle of operation in nature not yet understood. The theory of infection was amply propounded and discussed during the occurrence of the cholera in this country; but the subject is as much involved in mystery as ever. Some suppose it to be propagated by insects, engendered in the body by disease, and if so, insects may also be engendered by malaria. Perhaps a diseased body, like half-dried marshy ground under the influence of a summer sun, gives out malaria —ill air,—which, when inhaled into the lungs by the mouth or nose, constitutes infection, and when incorporated into the system by the touch, constitutes contagion; but, before infection or contagion can be propagated, disease must pre-exist; and, perhaps, malaria is itself disease of a particular kind, an intermittent fever, which, when incorporated into the human body, exhibits through it its peculiar properties in a visible and tangible shape. Malaria, in always producing the same effects on the human body, must be a fixed principle, and this is characteristic of every disease having a fixed diagnosis. This exposition endeavours to shew how the virus of malaria may be supposed to be propagated by infection or contagion, though the exposition leaves its origin, under either condition, still incomprehensible. Now it cannot with truth be alleged, that fever is more infectious in the neighbourhood of the meadows than elsewhere; for the truth is, that infection spreads, when disease has once gained a footing, to much greater extent in localities in Edinburgh placed at a distance from those meadows, than in their immediate neighbourhood. For example, in all the closes branching off from the High Street and Canongate, all diseases, both by infection and contagion, spread in the same tenements of houses, and through the same family, to a much more fearful extent, and in a much more rapid manner, than in situations contiguous to these meadows. Out of 90 cases of fever in the eastern district of the city, 65 were traceable to contagion, and the rest, 25, to other causes; but none of the cases exhibited characters different from similar diseases in other parts of the town.

But it has been publicly proclaimed by municipal authority in this town, that miasm, arising from these water-meadows, *is* the cause of the increase of fever; and the plausible reason for the promulgation of this opinion, has been grounded on the undoubted fact of an increase of fever this year. Of the cases of fever admitted into the Royal Infirmary for the last eight years, there is an increase in 1839 over 1838 of 1017 cases; but if this fact is alone sufficient to condemn the irrigated meadows, how is the comparative exemption from fever since 1831 to be accounted for; and how is the great prevalence of fever in Dundee in 1838, (the mortality occasioned by which having been much more fatal than that by the cholera), and its comparative exemption in 1839, a case exactly the opposite to that of Edinburgh, to be also accounted for? Truly, the logical deductions on the subject of disease by our "grave, potent, and reverend seignors," may vie in astuteness with the conclusion which the old man came to regarding the Goodwin Sands, which he alleged to have been formed, to the danger of the mariner, only since the building of Tenterden Steeple.

To place the medical view of the case of these meadows in its proper light, we have only to refer to Mr Tait's observations on foul-water irrigation, which have been lately published.* The prevalence of fever in Edinburgh in 1839 may be accounted for by other causes than the miasm of the meadows. "It is possible," says Mr Tait, "that the atmospherical vicissitudes of the present winter, the continued and severe storms of 1837—8, and the poverty to which many families were reduced, in consequence of the want of work, the high prices and unwholesome nature of the food which thousands have been obliged to use, might aid, in no inconsiderable a degree, to account for the cases of fever which were not traceable to contagion." There being no extensive manufactories in Edinburgh, the labouring people are obliged to betake themselves to field-labour, such as is offered in the large gardens and nurseries, and numerous farms in the immediate neighbourhood of the town; but when such weather occurs as to put a stop to field-labour, the labourers, of course, feel, with great poignancy, the effects of want of work; for it is a melancholy truth that, whenever the poor labourer's family is subjected to idleness and hunger, they are sure to become the victims of disease also. Want of work, and its consequent privations, produced similar effects in Dundee in

* [illegible] on Foul-Water Irrigat[illegible], by William Tait, Surgeon, [illegible]burgh. 183[illegible]

1838, when the fever raged with virulence during the time so many thousands of the manufacturing population were thrown out of employment, by the depressed state of the trade peculiar to that town. This year, 1839, on the other hand, when the prices of provisions are even higher, and when their subsistence is, of course, scantier, yet having again gained employment, the career of the fever has been arrested.

To obtain a satisfactory investigation of the subject, Mr Tait views it under every possible condition. He inquires, in the *first* place, whether fever is more prevalent in the neighbourhood of the irrigated lands than in other parts of the city? which should be the case, were the latter the cause of the former; but his personal researches over the eastern, southern, and western districts of the town, in quest of the statistics of disease, lead him to form quite an opposite conclusion—not that the meadows are positively conducive to health, but that other causes operate much more actively in producing fever than they do. For example, in a population of 4820 individuals, inhabiting the immediate vicinage of the meadows, 90 cases of fever occurred, 10 of which proved fatal; whereas, during the same time, in a population of 4275 individuals, living in the remotest district from the meadows, 91 cases occurred, of which 16 proved fatal.

Hence, in the *second* place, it is contrary to experience to expect disease, caused by any miasm arising from irrigated lands, to be more prevalent at a distance than in their immediate vicinity. It is no argument against this position to state, "that the inhabitants on the banks of such meadows become proof against the deleterious influence of the miasm;" for the impunity could not extend to new comers, and they, of course, would become the victims of its virulence. "Such, however," says Mr Tait, "is not the case. At Drymills, situated in the very centre of the irrigated lands, many of the inhabitants are changed annually, and not a single fact has transpired to shew that *the strangers are more liable to disease* than the oldest inhabitants, notwithstanding that such changes take place at that period of the year when irrigation is carried on to its greatest extent, and when disease ought to be most prevalent."—(p. 6.)

The *third* view which Mr Tait takes is, that the continued form of fever which usually prevails in Edinburgh, is not the form of fever which is generally produced by marsh miasm. It is a fact, that the miasm generated in the marshes of Cambridge and Lincoln shires, in the Pontine marshes near Rome, in Holland, and in North and South America, produce intermittent fever, and when any cases of continued fever occur there, they are never imputed to the marsh miasm. Now, the form of fever occurring in the vicinity of these meadows is not intermittent, but is of the continued form; and, from this fact alone, we are warranted in concluding, that these meadows do not generate miasm. The difference in nature betwixt the two forms of fever is strongly exhibited in this other striking fact, that, when the land from Easter Dalry, westwards, was in a state of real marsh, intermittent fever prevailed; but now, when a large proportion of the same land is converted into irrigated meadows, no intermittent fever exists. Hence, if miasm does arise from irrigated land, it must be of quite a different nature from marsh miasm. What is marsh miasm? "It cannot be admitted," says Mr Tait, truly, "that marsh miasms are the *result of vegetable putrefaction*, as is generally supposed, but rather a *secretion of diseased vegetables*. If they did arise from putrefaction, they ought not to exist in salt marshes, where no putrefaction takes place, and they ought also to be produced artificially, by putting vegetables under the conditions favourable to decomposition. This idea," continues Mr Tait, "is countenanced by the fact stated by Dr Fergusson, that *paucity* of water, where it has previously and recently *abounded*, is the most favourable condition for the propagation of malaria; and nowhere could we expect sooner to find a diseased state of vegetables, than where the conditions favourable to a healthy vegetation becomes so suddenly and materially affected."—(p. 10.)

On this latter consideration Mr Tait feels inclined to inquire, "how far a hot and dry season may affect or alter the condition of the land, and conduce to a diseased vegetation, and thereby be the production of a remittent or intermittent fever?" This inquiry may be easily instituted, by considering what was the state of the meadows in 1826, the driest and hottest season within the memory of most men, and we expect it will be found, that their vegetation that year, instead of being at all diseased, was peculiarly luxuriant. Hot and dry seasons may produce injurious effects from stagnant marshes, but [illegible] produce no such effects from current or irrigating water.

But though *marsh* miasm does not produce continued fever, it may still be asked is it not produced by *animal* miasm? Some medical men assent to the probability of the truth of this opinion, among whom was Dr Southwood South; but it is unsupported by facts. "That miasm or effluvia, arising from a person *labouring under disease*, will produce disease in others, we readily admit," says Mr Tait, "but that effluvia or gases arising from the *decomposition of animal matter* will have the same effect remains to be proved. As the latter differ from the former in their nature and properties, so will they differ in their effects. The difference between animal miasm and putrefactive gases must be carefully observed; the former arise only from the body in a state of specific disease, and are never formed in the dead body. Putrefactive gases are not, *per se*, in any degree poisonous, but prove hurtful only by exciting disgust. It was the opinion of the late Dr Fletcher, 'that a person may live as well in an atmosphere containing the most putrid effluvia, as in a pure one.' 'I shall not multiply facts and illustrations,' says Dr Fergusson, 'to prove that putrefaction and the matter of disease are altogether *distinct* and *independent* elements; that the one travels beyond the other, *without producing the smallest bad effect*; and that, however frequently they may be found in company, they have no *necessary* connection.'"—(p. 9.) After repeated visits to the most filthy abodes and places in Edinburgh, Mr Tait comes to the necessary conclusion, that, since health is found there, no farther proof is required in support of the position, that odours and putrefactive gases are innocuous. And if, as we have already stated, running water retards the putrefactive process of both animal and vegetable matter placed under it, it follows that these irrigated meadows exhale less putrefactive gas than stagnant decomposing marshes, and are therefore even more innocuous than they are.

The *fourth* proposition is, that fever does not prevail to its greatest extent at that season of the year when the condition of the meadows is most favourable for generating malaria. A few facts will soon decide this proposition. It has been most satisfactorily ascertained by observation, that fever occurs in Edinburgh to the greatest extent in the months of November, December, and January, and to the least, in July and August. On an average of nine years' observation, the lowest number of cases of fever varied in July and August as low as from 631 to 676, whereas they rose as high as 1090 in November, 1176 in December, and 1166 in January. Now, the months of June, July, and August are those in which irrigation is most vigorously prosecuted. Hence, we are led to infer, that irrigation, though most copious, in no way conduces to originate fever. But an objection may be advanced against this conclusion, that marsh miasms are more frequent and severe in the autumnal than the summer months. The objection, if it can be so called, is thus satisfactorily disposed of by Mr Tait. "The effects produced by miasma are the only proof we have of their existence. If it be true, then, that miasma may be latent in the system for weeks or months together before their effects appear, and we believe it to be so far true; and if their effects only begin to appear in autumn, then it must follow, as a legitimate conclusion, that the system must have received it in summer, which is still in favour of the summer as the period when miasma are most apt to be generated. All experience, all authority, all analogy, are in favour of our proposition. In Rome, and all other countries where marshes abound and intermittents prevail, July and August are the two months of the year when they are most common. On examining the cases in M. Bailly's work, we find, that more than four-fifths occurred in these two months, and a great majority of them in July alone. Indeed, this fact is so well known, that travellers and strangers avoid visiting those parts at that season of the year. It is in warm countries and tropical climates that ague is experienced in its most severe form; and summer is the only period when there can be any analogy between the temperature of this and foreign countries, and where, of course, miasma ought to exist. But as it has been shewn, that fever, instead of being most prevalent in these months here, is least so, we are forced to conclude, that its increase is in no way referrible to the irrigation which is carried on around the city." —(p. 12.)

The *fifth* and last proposition is, that fever does not prevail so generally in the families living near the meadows as would lead us to suppose it was caused by any thing of a local nature to which all are equally exposed. If marsh miasm were the cause of fever, it is evident that it should not only [illegible] in the neighbourhood of the meadows, but also more generally among the population there than elsewhere. At Walcheren, and other places, where our troops suffered severely from the effects of malaria, all those dwelling in particular parts of the ground were almost all seized with disease. But we have [illegible] which prevails here is not so prevalent [illegible] meadows as elsewhere; and it is [illegible] prevail is not general in its attacks, but confines itself to individuals, families, or the same tenement, avoiding many intermediate houses. Since the irrigated lands extend pretty generally from the east, by the south, to the west part of the town, if the miasm from them was the cause of the fever, it ought always to be very generally extended; but when fever does occur, it is any thing but general,—it is very partial in its attacks. Hence, the fever does not arise from any miasm. But, after all, what effect could the miasm, from all the irrigated land, have in contaminating the atmosphere over the whole space of ground, which the town and its environs cover? and more especially in late years, after the system of irrigation has been so improved that the drains are confined in proper channels, and made to traverse the ground to the fields to be irrigated, with as small a surface of exposure as is practicable. Those who do not derive immediate benefit from irrigation, endeavour to confine the foul water past their land into as narrow a channel as possible, the land being very valuable through which those channels do pass. The whole extent of ground irrigated around Edinburgh does not amount to 400 acres, and it extends over a space of about six miles from Colt Bridge to the sea at Portobello. A circle of six miles in diameter contains 17,920 acres, so that the meadows only cover one forty-fifth part of the space occupied by the town, and they are, moreover, situate in its outskirts.

It is proposed to carry the irrigating water by drains to the sea. It may be perfectly practicable to carry such a drain down to Portobello, and lay all the lands dry in this quarter, where is the most extensive system of irrigation; but we conceive it would be injudicious to drain the lands towards Corstorphin, for if a drain were carried under ground in that direction it must empty itself entirely into the Water of Leith, which would inevitably carry down the filth into Leith harbour,—a large enough puddle already. True, the irrigating water already finds its way into the Water of Leith at Coltbridge, but at present much of it is absorbed and evaporated, and the grosser portions retained before it reaches the river. If it were carried to the sea in a drain towards the north, to avoid the river, the expense of the whole drainage would amount to many thousands of pounds. Besides this direct, unnecessary outlay of money for the drain, the irrigated lands would be reduced in annual value not less than from L.14 to L.20 an acre; because their produce would be proportionally diminished. The food which is thus annually raised from April to November for the support of probably not fewer than 3300 milch cows in Edinburgh, and 600 in Leith, would, in a great measure, be made to disappear; and the consequences would either be a diminution of the number of cows for want of provender to support them, or an increase in the price of milk, for the additional cost that would be incurred in bringing in provisions for them from a distance. Thus to allay an unfounded fear against imaginary danger, or to gratify a prejudice against a harmless nuisance, which has been endured for a hundred years, the inhabitants of Edinburgh are called upon to expend thousands of pounds directly out of their pockets to form drains, in order to destroy a most useful improvement; and annually to incur a serious loss by paying a greater price for a commodity, which forms an essential article of consumption in the families of every grade of society.

We have endeavoured to shew by reason and facts, in contradiction to the inconsiderate statements of the Town-Council, that, in the irrigated meadows in the neighbourhood of this city, no miasm or malaria is originated; and as malaria produces a specific form of fever, an intermittent, it cannot be mistaken for the form of fever that has infected Edinburgh so extensively during the last twelve months. But even should the Town-Council give up the allegations against those meadows of generating miasm and causing fever; if it nevertheless persevere in draining them as a public nuisance, other public nuisances ought, in justice, to be destroyed at the same time. Gas-works, chemical-works, soap-works, tan-works, the fermentation of all dunghills, ought also to be prohibited. They are one and all of them great and public nuisances, and the most of them situated in localities more likely to injure the health of the inhabitants than the irrigated meadows. But we believe none of them to be injurious to health. The composition of the air over towns is always chemically the same, and all the petty operations of man will never be able to effect a change in its composition. The narrow-minded attempt of the Corporation of London to prohibit the use of coal-fires in that city, from a supposed contamination of the air by the smoke, is on a par with the attempts of our own corporation against the water-meadows, and their efforts, we hope, will prove as futile as those of their great antitype. Let man be content and "drink the air before him" as he finds it. In expressing these our sentiments, we have no personal interest in the prolonged existence of those meadows, but we do feel a very strong interest in the improvement of the soil—in the increase of the value of land—in the increase of its produce —in the increase and proper treatment of live-stock—and in the increase of the necessaries of life for the whole community, from the wealthy who have no need to work, to the poor who must work hard for their subsistence. And when we perceive these interesting objects in danger of being deteriorated, our indignation is roused against the intermeddlers, and no deference to an opinion expressed on agricultural matters, if prejudiced, though expressed ever so publicly, will induce us to refrain from counteracting that opinion.

Profit from Thorough-draining.—A farmer in Lanarkshire, whose name we are not at liberty to use, tried the effects of thorough-draining on a small field of four acres. Two acres of this field were drained in every furrow, the subsoil being retentive, but the upper soil was favourable to the growth of green crops. The other half was allowed to remain undrained, as the whole had been until the winter of 1837. In spring 1838, the whole field was worked for, and planted with, potatoes. The potatoes were sold, and the result was, that the thorough-drained half yielded L.45 an acre, whilst the undrained only realized L.13 an acre. The drained land thus yielded about three and one-half times the undrained; and, supposing that the draining cost, at the utmost stretch, L.10 an acre, the first crop, notwithstanding, not only repaid that cost, but left L.22 an acre more than the whole crop per acre of the undrained land. What an encouragement does this simple fact and single instance of profit hold out to farmers to spare no expense and indulge in no hesitation in thorough-draining retentive-bottomed land! Although L.45 an acre is a very large sum to obtain for an acre of potatoes, yet the crop was generally very deficient last year, and *good* potatoes were very scarce; but it must not be supposed that that amount was all profit, for the expenses of raising and driving the crop to market fall to be deducted from the value of the gross produce; still, L.45 and L.13 give the relative values of produce obtained from drained and undrained land. It is worthy of remark, that draining renders strong soil capable of raising a large green crop even in a wet season, whilst soil, in want of draining, is comparatively materially injured in a wet season. It is obvious that the soil here spoken of only required draining, to render it eminently qualified to raise green crops; and there is abundance of such soil in the country.

Moorband-pan.—The Mark-Lane Express of the 17th June last, asks a very needless question, when commenting on a short article on moorband pan, which appeared in the last number (45. p. 131) of this Journal. We thought we had made it "as plain as a pike-staff," that moorband-pan was not an oxide, but a hydrate of iron, and that because it was in this condition that caused it to be injurious to vegetation. It seems, however, that the Express has not understoo dus, and as he should be well acquainted with the subject, we are apprehensive that many of our readers may also have misunderstood us. And yet, we do not see how our sentiments should have been misunderstood, if fairly construed.

After giving our definition of moorband-pan, as consisting of alumine, silex, and *hydrate* of iron, a composition which is injurious to vegetation, the Express asks, what we have characterized as a needless question, "Where is the benefit of bringing it to the surface?" No one, on seeing this question, indeed no one, on perusing the whole article of the Express, could know—that we had striven with all our might to shew, that the oxide of iron is innocuous to vegetation, though the hydrate is known to be the contrary, and that, therefore, the only way of rendering the hydrate innocuous, is that of [illegible]ing it into an oxide, and that the most permanent way [illegible] tha[illegible] drain and plough the land; in order, [illegible] the one [illegible] a supply of water, and on the other, to bring the hydrate to the surface of the ground, where the air will convert it into an oxide as fast as possible. This is the sum and substance of what we said of the nature of *true* moorband-pan. It is a very simple statement, incapable, we should think, of being misunderstood; and, what is more, it is incontrovertible, try who may to overturn it. The benefit, therefore, of bringing up the pan to the air, is its conversion from an hydrate to an oxide,—from a state of active mischief, to a state of passive good,—verifying the policy of Lord Kames, when he deprecated the then usual practice of burning couch grass, instead of converting it into a compost, and then asked, "What better policy than to convert a foe into a friend?" We presume, moreover, it will not be denied that any substance will be sooner oxidated in the air than under the ground.*

But it seems, the Express can "assert that hundreds of instances can be adduced, in which the bringing two or three inches of the subsoil to the surface, and mixing it with the top-soil would injure the land for years." And further on, the Express is of opinion that, "if the subsoil be of a fertile character, it may be advantageously brought to the surface, and will not require additional quantities of dung and lime, but will rather supply the want of these adjuncts; but if the surface be a made soil of a few inches depth only, to bring the subsoil to the surface is to destroy the labour and expense of many past years." These sentiments may all be very true, and they may also truly describe the usual experience of farmers; but what reference have such instances to moorband-pan? the subject chosen to be commented on by the Express. None whatever. Cold, wet, or hard unvegetative clay, if injudiciously brought up, and largely and hastily mixed with a thin upper soil, may do harm for as long time as farmers may choose to permit it; but that kind of clayey subsoil is not moorband-pan; it is promoting confusion of ideas to confound the two together. Moorband-pan always has iron to excess in its composition,

* Chemical and practical results may not always display a common origin, but in the case of pan, practice could never have discovered that iron may exist in two states in the soil, the one in a state of hydrate, the other in a state of oxide; nor could practice teach us to distinguish which was the hydrate, and which the oxide. Chemistry alone has afforded us this facility, and vegetable physiologists have rendered the facility the greater, by demonstrating, by the best of experiment, that the hydrate of iron is injurious, and that all the oxides are innoxious to vegetatior.

and the state of the iron is always the hydrate. Clay does not usually contain iron to excess; and, therefore, its injurious effects on vegetation operate in a very different manner from those of pan. The two kinds of subsoil should never be confounded together, if clear ideas are desired to be entertained on the subject of subsoils, and without clear ideas there can be no clear practice. But in those numerous instances in which the bringing up of clayey subsoil has injured the top-soil, the Express does not inform us whether the land had been, in all the cases, thorough-drained. It is of great importance to ascertain this particular, for as draining is known to impose a very different condition on both soils and subsoils, the bringing up of the latter, in the altered condition, may produce very different effects on the upper soil from undrained subsoil. We suppose the land had not been thorough-drained, because the Express having alluded specifically to "hundreds of instances," he could hardly have been cognizant of so many instances in the short time that thorough-draining has been practised, particularly in England. If we are right in this conjecture, then his remarks against our treatment of pan go for nothing; for the permanent benefits derived from bringing up pan to the surface, and the permanent prevention of its formation in future, can only be ensured through the instrumentality of thorough-draining. If, on the other hand, we are wrong in our conjecture, in supposing that his instances of injuriously bringing up the subsoil was unaccompanied with thorough-draining, then we must say the experience of the Express is directly opposed to our own. We know successful instances of bringing up poor unvegetative clay to the surface, after the land had been thorough-drained; but we do not know one successful instance without previous draining. As thorough-draining is but a recent practice in this country, and cannot afford us "hundreds of instances" to adduce in support of our position, we shall confine ourselves for the present to one instance, but that one shall be of the most eminent description, and particularly corroborative of the view we have taken of the benefits of deep ploughing.

The farm of Yester, in East-Lothian, belonging to the Marquis of Tweeddale, and in his own hand, in great part, rests upon as poor, tough, retentive, hungry, many-coloured clay as can be found in any other part of the country. In a field of grass we could not discover a single useful plant, and the surface appeared to have been poached with the feet of stock. Some of the fields have been thorough-tile-drained in every furrow, and in working the land for green crops, the subsoil has been brought up with one plough following another in the same furrow, and the clay thus brought up broken with Crosskill's clod-crushing roller, and harrowed and intimately mixed with the upper soil, such as it was, poor and thin—the land now presents quite a changed and renovated aspect, capable and in the act of growing excellent crops of all descriptions, from wheat to turnips. A more complete change for the better cannot be conceived than what has been effected on the farm of Yester, and only by means which are in the power of every farmer to employ; for his Lordship is no mere amateur farmer who likes to see a nice looking field, without troubling himself about the way by which the effect has been produced, or reckless proprietor, who is regardless of the cost if he accomplish the object of his ambition, but a truly practical farmer throughout, who will do a thing because it is right, and who is ready to give a satisfactory reason for every thing that he causes to be done on his farm. So far, therefore, is the statement of the Express correct, in reference to Yester, that "there is much land, nay most of the land, which will be benefited by draining and subsoil-ploughing, upon which, at all events in the first instance, turnips cannot be grown and eaten off with sheep, and followed by a crop of barley," that we have seen not only excellent turnips immediately after the draining, but the land drilled across the face of the declivity, and the sheep lying as comfortably dry on the land in winter or early spring as any one could desire, and the land so thoroughly dried that the marks of the cart-wheels on the new grass were scarcely visible in leading off the barley after turnips. That very field which could not afford a single specimen of useful grass is in turnips this season, 1839, after being drained. What has thus been accomplished by one person on inauspicious land, may be effected by any other person on land of as bad quality. If, after perusing this statement, the Express will still ask, "What course, then, is to be pursued in such cases?" alluding to the impossibility of raising turnips, at all events, in the first instance, after draining most land,—"cannot be grown" is his expression—he must make us better acquainted with the particulars of that land which cannot grow turnips after draining, before a satisfactory answer can be given to his question. The Express should advise his readers, who possess poor clay land, to go to Yester, and witness the turnips after draining, and witness the bringing up of the poor clay and without the use of the subsoil-plough, and witness the sheep lying dry, and feeding on the turnips in winter, and witness the barley after the turnips, and after witnessing all these supposed impossibilities, advise them to "*Go and do likewise.*"

When such instances as this, of cultivating poor clays, occur, and they are patent to the observation of every one, and consistent with our own observation elsewhere, we cannot hesitate to encourage farmers to thorough-drain their land, and bring up the most obdurate and unpromising subsoil to the air, to be there ameliorated into useful soil. Mind, we do not say, first bring up the clay or pan, and then do other things, but first drain, and then bring up the obdurate stuff to be subdued and rendered useful. Do this, and, as we said on another occasion, "we will stake our existence that no injury can then possibly befal either plants or animals." What is there to create fear in pursuing such a course? Nothing. Has not every improving farmer experienced the good effects produced on the strongest clay that had been brought up and spread on the surface, from the bottom of the deepest drain, n bearing the strongest stems of corn, and especially the most luxuriant clover of any other parts of the field, when, if the same substance had been brought up and spread upon the undrained soil, loss would have been incurred for some time to come? Since this is the usual and invariable expe-[illegible] drain their land, why hesitate to ex-[illegible] ice and drain more land, in order to [illegible] stems of corn and more luxuriant clover? [illegible] ance, to bring up the injurious [illegible] nature to mix with the surface soil, before either has been thoroughly drained? Does the expense of thorough-draining frighten you? We have given above at p. 179, an instance of only one small experiment of thorough-draining performed last year by a farmer in Lanarkshire, and you see his success; and since he was more than repaid the whole expense of it by the first crop, and it was a green crop too, do you doubt that he will now drain his farm with vigour and in confidence? No; you cannot doubt it. Try, therefore, such a small experiment at first, if your faith in it is naturally weak; if you succeed, you will no longer hesitate to go on; if you fail, you cannot suffer a *great* loss from a small experiment. If you wish personally to witness a successful instance before commencing yourself, you cannot turn your eyes now in almost any direction, without witnessing the operations of many farmers on a large scale; and you will universally learn from them, that thorough-draining is the only certain source of success. You will subsoil-plough, or bring up clay to the surface, all to no good purpose, without the land, in the first instance, be drained. Drain thoroughly, and you may then subsoil-plough your land, or bring up the worst subsoil, and in any quantity, with perfect impunity. Some farmers in this country were led to believe that they could drain their land with the subsoil-plough, but they have been sadly bitten in the attempt, and you may depend upon it they will not play the same game over again. They are still advocates for the subsoil-plough, but they are now stronger advocates for thorough-draining, as the first necessary operation. It is thus, by experience, that the progress of improvement is secured, and when secured by it, there is no danger of retrogradation into erroneous practice.

But it seems thorough-draining, liming, and other operations, by which soils are usually ameliorated, are considered extra and too expensive operations merely to get rid of pan, which, since it is injurious to vegetation in its site, is advised to be let alone, rather than brought to the surface and rendered innocuous. This is the doctrine of expediency, not of correct principle, and being so, it is as objectionable in farming as in morals. If there is any substance in or under the soil—be it water, pan, or clay—known to be injurious to the growing crops, it should be quickly and effectually destroyed, or rendered harmless by a change of its condition, effected by all the means in the farmer's power, if less will not suffice. What is there in any operation on a farm that can be characterized as so extraordinarily expensive as to deter any farmer undertaking it? In pursuing his ordinary rotation of crops, does not every farmer fallow his land to clean it, raise turnips thereon for the support of his live stock, eat those turnips off with sheep, when the land is either naturally dry enough, or artificially so made, to bear them in winter, and afterwards take barley or wheat as the season may best suit the kind of crop? What is there of extra labour or expense in all this? The land may or may not require liming; but when pan exists in the land to an injurious degree, draining will be found to be absolutely necessary, for the sake of the land itself, independently of the motive of employing it to get rid of the pan. Expedients may be attempted, more or less, of shorter or longer duration, to avoid incurring the expense of draining; and many farmers, it must be owned, are great adepts at expedients in the management of their farms, on the principle of economy as they term it, who slip either carelessly or niggardly through a lease, and such farmers are always found the first to complain of the hardness of the times, when the crop happens partially to fail, or prices descend to a low pitch. This is not the principle on which a farm should be conducted in any condition of the times; and far less at a time when profits are small, under the best management, and when desperate attempts are making by the enemies of the agriculturists to debase them to the level of a struggle for existence with the serfs of the Continent. In such circumstances the best form of management should prevail in every department of the farm.

But as long as farmers are buoyed up with the assurance that their land either does not require draining, or that it can be made dry enough with a little stirring under the furrow usually operated on by the common plough, with an instrument called the subsoil-plough; and as long as either advice is given them, not that either may be followed at a time, in particular circumstances, but usually and generally, so long will niggardly and profitless farming prevail, and complaints of hard times be frequently heard. The disciples of the Lefevre school are striving hard to assure the English farmer that his land may be made sufficiently dry with the subsoil-plough, or that it is dry enough as it is.

We regret to observe the British Farmers' Magazine, professedly a standard work, lending itself to propagate the delusion. It should have left it to the newspapers who first took it up. In its last number for July 1839, it enumerates a few parishes in Norfolk and Suffolk, the soil of which, it alleges, requires no draining. This enumeration it makes with the view of counteracting a resolution which we wished the farmers of Great Britain and Ireland to adopt as a general rule or maxim, that the soil of this kingdom would be the better for thorough-draining; but, where any land is found so naturally dry as not to require draining, it should be regarded as an exception to the rule. Were the farmer's mind impressed with this maxim with the force of truth, it would be furnished with a principle by which every improvement of the land might be judged. Its adoption would not oblige those to drain who really occupied dry land, it would rather be a source of gratulation to them that they possessed land that required little outlay in its improvement. But, instead of inculcating the wholesome maxim, the Magazine endeavours to make the impression that most land requires no draining; and for this purpose, it talks of 100,000 acres in one county, and 50,000 acres in another—the drifting sands and burning gravels of Norfolk and Suffolk—that require no draining. Taking the fact as he states it, we ask, What of that? The condition of those few acres, or ten times their extent, cannot deface the general impression that the soil of this kingdom would be much improved by draining; and that it would thereby raise a vast deal more produce than it does. These are truths, and no attempts need be made to deny them. Of what utility, therefore, is it in dwelling upon a particular exception, when it is generally known that the soil of the kingdom is neither a drifting sand nor a burning gravel? If there are thousands of acres, nay, whole parishes, whose soil requires no draining, such an instance, or any argument founded on it, cannot invalidate the indubitable truth, that the soil of the kingdom is generally improvable by draining and other means, draining forming the fundamental operation of all farming improvements. This truth every agricultural writer should adopt as his text, and inculcate it at all times, in season and out of season, until the farmers are induced to practise it, which, if they would but do, farming would produce most extraordinary results compared to what it does at present.

But are sands when they drift, and gravels when they burn, sure indications of requiring no draining? We trow not. Fortunately for our guidance we have an instance which shews what English agricultural writers consider a burning gravel, in the account which Mr Shaw Lefevre gives of one, in the first number of the Journal of the English Agricultural Society, where he states it retained water in the hollows until the water was evaporated! Retaining water in the hollows until it is evaporated is, no doubt, a strong characteristic of a burning gravel—dry as an Egyptian mummy! Has the writer in the Magazine ever seen the drifting sands of Barry? If he has, we request him to have the goodness to describe to us their condition in winter; but should he not have seen them, we can inform him that, in winter, a cart will sink half way to the naves in them, and that, in the same season, a well may be formed in them any where at a very few feet under the surface. Deep ruts and wells in sands are no doubt strong characteristics of their drifting quality! No, no, the Magazine need not talk of drifting sands and burning gravels in the height of drought in summer; let us know the state of the land in the depth of winter, and then we shall be able to judge whether or not it requires draining.

The splash at wit of the Magazine regarding something about the existence of this journal as being unseen, is rather *mal à propos* to the state of a work which has found its way into Europe and America, and all our colonies; and is just a bit of balaam. The concluding paragraph of its attempted strictures upon us is pure nonsense, and, knowing how difficult it is to write nonsense, we leave it without remark. Not so, however, the sneer regarding the papers on the herring-fishery and foreign agriculture. The Magazine evidently does not know that the promotion of the herring-fishery of Scotland was one of the first cares of the Highland Society, and continued to receive the support of that influential body until the permanent establishment of the public Board of the Herring Fishery. It seems not to be aware that the Society was prompted to take a deep interest in the fishery, because of the employment it afforded, and still affords, to many thousands of men and women of the poor rural population near the coasts of the mainland, and its numerous islands, at a season when field-labour requires less assiduous attention. Besides, writers on political economy have always associated the fisheries with rural economy. As to the valuable articles of spiceries and drugs, treated of in the papers on the agriculture of Hindostan, we very much question whether the editor of the Magazine knew the culture of the plants that supply those articles of profitable commerce, or ever heard of such a place as Gurloo Purbut being upon the face of the globe, until he was made acquainted with them by this Journal.

The Magazine cannot admit the inseparability of thorough-draining and subsoil-ploughing. We never bound them together. Our implied and expressed sentiments on these two subjects have always been these:—With respect to their condition generally, we hold that all soils are improvable by thorough-draining; that it in due time is solely sufficient for drying land; that subsoil-ploughing is inimical to retentive land previous to draining; that it may be practised with impunity in drained land, or in land naturally dry; that it is unnecessary to practise it in either case; that the best method of ameliorating an injurious subsoil is to bring it up to the surface, after thorough-draining the land. Facts are not awanting to demonstrate every one of these theorems.

The Rohan Potato.—Some time ago we directed the attention of our readers to a potato which the Prince of Rohan had introduced into culture in the neighbourhood of Geneva, and which promised to yield very great returns. Since then it has received the attention of the agriculturists of Germany and France, who are not so much farmers as proprietors and scientific experimentalists, of whom there are many more of the latter class on the Continent than in this country, where scientific men will scarcely condescend to make experiments in the open fields. This potato has as yet attracted little or no attention in this country amongst farmers, and therefore we can give no account of any trials that may have been made of it here; but as it appears to yield large returns compared with many of the sorts in common cultivation, and though it seems a rather coarse potato for the table, it may prove useful in some districts for fattening live-stock. We shall communicate the latest intelligence in regard to the mode of its culture abroad on a small scale, no trials having yet been made in the open field.

The first experiments we shall relate are those of Viscount de Saint-Geniez, whose experience enables him to state that the Rohan potato is of a kind which has a strong tendency to grow above the ground, and, on that account, requires great earthing up all round about it, and, of course, it should only be set in ground deep enough to admit of earthing up.

"Towards the end of March of this year, 1837," says the Viscount, "I chose a large square bed in my kitchen-garden, equal to a good quarter of an arpent (1½ arpent = 1 acre), which was made fine without dung. I formed lines of holes, east and west, at 3 feet apart every way, of 6 inches in depth. I divided the ground into three portions, north and south, and, of course, all having the same exposure. I then placed the sets of potato cut diamond-shaped, having each from one to three eyes, (dried for thirty-six hours on the side of the trench) into the holes, and covered them up with three inches of earth. Four weeks after, the stems began to appear, and, in a few days, they were above ground, which obliged me to fill up the holes. The stems growing tall, I tried this experiment with them: The first division was well-earthed up all round, and a stout support placed at each mound of earth. The second was earthed up to the south according to the advice of the Count de Turrenne, but had no supports. The third was cultivated as a kind of potato is cultivated at Roville, by that eminent agriculturist M. Dombasle, simply by letting the earth alone without earthing up and supports.

"I tool [illegible] up the potatoes on the 25th November, and obtained these results: [illegible] irst division, with the plants earthed up all round, and with supp[illegible] [illegible]ms, which grew to the height of 6 feet, and the [illegible] [illegible] lb. 4 lb. 3 lb. and 2 lb. each, the crop [illegible]gned . . . . . 548 lb.

[illegible] [illegible] arthed up on the south and [illegible] weighing [illegible] lb. and 1 lb. [illegible] . . 364½ —

[illegible] [illegible]ning up, and the ground [illegible] that of weeding, the potatoes [illegible] smaller tha[illegible] the above, the crop was, . 318 —

[illegible]tal produce, 1,230½ lb.

"These 1230½ lb. raised on a quarter of an arpent, were produced from 30 lb. of sets, which gives an increase of 40-fold, which might have been raised to 60-fold if I had not made experiments contrary to the nature of this new kind of potato."

The Viscount comes to the conclusion, from the experience of the culture of the Rohan potato for two years, that earthing up largely is indispensable; that supports are necessary in a cold country, as a facility to the heat to penetrate to the tubers; but that supports are less necessary in a warm climate, as the creep ing stems preserve the tubers from the great heat, and prevent, by their coolness, the mounds from cracking. It remains to be seen whether the same success will attend the culture of this potato in the open field, and earthed up with the plough, which the Viscount proposes to put to the proof.*

The next experiments which we shall relate are those made by M. Pergot, at Rupt near Port-sur-Soane. They are also on a small scale, but M. Pergot proposes to try the field-culture in the ensuing year.

"On the 20th April 1837," says M. Pergot, "I planted, in holes 6 inches in depth and 2 feet asunder every way, 37 lb. of tubers, divided into sets having one or two eyes, and covered over with three inches of earth. The soil was sandy, and the space covered was 4.032 *ares* (an are being a square of 22 feet). Three modes of culture were adopted; the first was just to fill the holes with earth, the two others suitably earthed up. On the same day I planted, in the same manner, 187 lb. in a light soil of medium quality, covering a surface of 16.050 ares. They received the same culture as the preceding, but only there were no props to the stems which being 5 or 6 feet in length, covered the ground. They all flowered, what I had not seen since I began their culture three years ago. Yielding to the requests of several cultivators who adhere to erroneous practice, I planted 12 tubers entire, of the thickness of a turkey egg, and they have given me the worst produce, the largest not weighing 2 lb. The fear of frost determined me on taking up the crop on the 10th October, and I obtained from the first field, . . . 1,080 lb.

from the second, ... 12,810 —

In all, . . 13,890 lb.

or 62 fold. Most of the tubers weighed from 2 lb. to 5 lb. It is highly probable that they would have attained greater bulk, if I had not taken them up so soon, and if the stems had not been damaged by the hail which fell in the month of August."†

The peculiar result of these experiments seem to be, that

* Le Cultivateur for January 1838. † Id. for April 1838.

the produce of 1080 lb. from 37 lb. of sets is only 29-fold, whereas the 12,810 lb. after 187 lb. of sets give 68½-fold, the average of the two being 48½-fold. The largest produce in these experiments was derived without support to the stems, whereas the results of Viscount de Saint-Geniez's experiments, given above, are quite the contrary.

The experiments of Vis. Morel-Vindé in some respects confirm those of M. Pergot, in reference to the largest produce being obtained without props to the stems, in the ratio of 58 bushels to 63 bushels per 2⅙ perches of 22 feet square. Vis. Morel-Vindé, in the end of March 1837, put into a good and light soil, not recently dunged, laboured with the spade, containing 26 perches, divided into 12 equal parts of 2⅙ perches, sets of two eyes at two feet apart each way; and each division was cultivated in a somewhat different manner, varying in the matter of props, and the number of hoeings and earthings up. The result from the whole was 666 bushels of potatoes from 26 perches of 22 feet square each; and, as the sets filled 20 bushels, the produce was 33-fold. A common kind of potato, yellow and round, and of less size, though more productive than others in its neighbourhood, was planted at the same time with the Rohan; and its produce, in the best circumstances, was only 250 bushels from the 26 perches, or 12½-fold.

The remarks of Vis. Morel-Vindé on the nature of the Rohan are valuable, and, in perusing them, the best method of cultivating it may also be learned.

"1. The Rohan potato," he says, "keeps together its tubers round the foot of its stem, and this property permits its being earthed up as much as desired.

"2. It produces its tubers so near the surface of the earth, that, without earthing up, many of them would shew themselves above ground, assume a green colour, and exhibit a great want of maturity. This property shews the absolute necessity of a large earthing up.

[illegible]his potato has need of moisture being preserved around the foot [illegible]em, the elevated position of the tubers exposing them the more [illegible]ught. It is this property which renders it indispensable to allow [illegible] eaves to remain on the ground for the sake of the shade afforded [illegible]hem.

[illegible]t carries flowers on almost all the stems, but it bears no apples, [illegible]ay be explained from the circumstance of the large size of the [illegible] absorbs the elements necessary to the formation of apples, and deprives the plant of this mode of propagation.

"5. To form and ripen the large tubers, it requires to be a long time in the earth. It ought thus to be the first planted and the last taken up.

"6. I shall not speak of the quality of this potato, that varying according to the nature of the ground, and as often from different tastes; but at Celle Saint-Cloud I have subjected it to various cookings and culinary processes. I have had it tasted by great amateurs of the potato; and, if its quality is not superior to several fine and more succulent kinds, it is found at least to be of a good taste, sufficiently mealy, and superior to most of the kinds employed in feeding cattle or making starch."*

Poudrette and Farm-yard Manure.—M. Hermbstädt gives, in the monthly journal of the Economical Society of Potsdam, these as the results of his experiments instituted with the view of ascertaining the comparative fertilizing powers of farm-yard manure and poudrette, one of the new compound manures, made in France, it is supposed, principally of night-soil.

"1. Poudrette is a perfect substitute for common dung, whether with respect to price or quality. 2. Its favourable effects essentially depend on the moisture of the season. 3. In dry years it is less efficacious upon sandy soils than upon very greasy or medium clays. 4. It is particularly suitable to very greasy clays. 5. By virtue of the lime and ammonia which it contains it quickens and developes the inert humus, and the humic acid which often accumulates in the soil. 6. The poudrette combined with organic matter, or in the state it is actually made, is a powerful means of rendering clay land friable."†

Fattening of Swine.—M. Bengtrapp mentions, in his work on the fattening of swine, several experiments which serve to shew the fattening powers of boiled carrots, potatoes, and some others. He brought up separately five couples of pigs, and obtained, after a certain length of time, the following results:—

Couples.	Food.		Increase of weight.	
1st	got 55 decalitres‡	of peas, . . .	22 st.	7 lb.
2d	... 283	... ... balls of wheat, .	24	3
3d	... 96	... ... buckwheat, . .	26	10
4th	... 98	... ... boiled potatoes, .	20	4
5th	... 175	... ... carrots, .	28	[illegible]

These results of the experiment are unsatisfactory; because it is not mentioned whether the pigs were all of the same age and weight, nor is it stated whether the quantity of food

* Le Cultivateur for March 1838. † Id. for August 1838.

‡ A decalitre is equal to 15 pints.

marked in the table was as much as the pigs could consume. We have always believed that peas were the most nutritious food that could be given to pigs, and this experiment confirms the belief, as may be seen on comparing the relative increase of weight obtained from the various kinds of food: viz. 55 decalitres of peas gave an increase of 22 stones 7 lb., or nearly 6 lb. of increase of pork from 1 decalitre of peas; whereas, from boiled carrots, 28 stones 2 lb. of increase were only obtained from 175 decalitres, or about $2\frac{1}{3}$ lb. from 1 decalitre, giving the advantage over the peas in the ratio of $2\frac{1}{2} : 1$. The next most nourishing food is buckwheat, which nearly gives 4 lb. of pork from 1 decalitre. Boiled potatoes are next, giving nearly 3 lb. of pork from 1 decalitre. And the lowest quantity of pork obtained was from the balls of wheat, which is as low as 1_{7} lb. from 1 decalitre. Flour would, no doubt, fatten better than wheat, especially if the feeds were made into small dry balls of dough and frequently administered, but better still, if made into bread of flour ground overhead.

How to preserve Green Vegetables.—M. Braconnot has discovered a new method of preserving fresh vegetables. The happy results which he has obtained by his trials attest their efficacy. Provide a cask furnished with an opening, which fill three-quarters with the vegetables which it is desired to preserve. At the opening, fix an iron wire, to which suspend a match of sulphur, which set on fire. After burning for some time, shake the cask, and put on the vegetable, sheets of paper which have absorbed sulphuric acid for a time. Fumigate the cask with burning brimstone at two different times, taking care to preserve the vegetables and sheets of paper from the embers of the match when burning. The vegetables, after parting with the water of vegetation, appear boiled. After this process, they are put into stoneware pots, and placed in a cellar, without any other precaution than a covering of parchment. When you wish to use the vegetables, all that is necessary is to let them steep some hours in water, their cooking taking no more time than that given to vegetables recently gathered, and their taste is as agreeable. M. Braconnet has extended his [illegible] to many sorts of vegetables, among others to sorrel, Ro-[illegible] lettuce, [illegible] asparagus; and they have all afforded him satisfactory results. He has, however, found that the sulphuric acid was only usefully employed when it was applied to tender vegetable substances, susceptible of prompt cookery.*

Period of Gestation of different Animals.—The true causes which abridge or prolong more or less the period of gestation in the females of quadrupeds, and of the incubation of birds, are yet unknown to us. Many persons are also unacquainted with the proper age for reproduction, the duration of the power of reproduction, and other conditions even of the domesticated animals. It cannot, therefore, but be interesting to our readers to find in the following table the results of observations made on this subject by the best ancient and modern naturalists.†

KINDS OF ANIMALS.	Proper age for reproduction.	Period of the power of reproduction.	Number of Females for one Male.	The most favourable season for copulation.	Period of gestation and incubation. Shortest period.	Mean period.	Longest period.
		Years.			Days.	Days.	Days.
Mare	4 years	10 to 12	...	May	322	347	419
Stallion	5 ...	12 to 15	20 to 30	...	...	...	...
Cow	3 ...	10	...	July	240	283	321
Bull	3 ...	5	30 to 40	...	...	...	...
Ewe	2 ...	6	...	Nov.	146	154	161
Tup	2 ...	7	40 to 50	...	...	...	...
Sow	1 ...	6	...	March	109	115	143
Boar	1 ...	6	6 to 10	...	...	...	...
She-Goat	2 ...	6	...	Nov.	150	156	163
He-Goat	2 ...	5	20 to 40	...	...	...	...
She-Ass	4 ...	10 to 12	...	May	365	380	391
He-Ass	5 ...	12 to 15	...	...	...	...	...
She-Buffalo	.. ...	...	...	...	281	308	335
Bitch	2 ...	8 to 9	...	Feb.	55	60	63
Dog	2 ...	8 to 9	...	...	...	...	...
She-Cat	1 ...	5 to 6	...	...	48	50	56
He-Cat	1 ...	9 to 10	5 to 6	...	...	...	...
Doe-Rabbit	6 months	5 to 6	...	Nov.	20	28	35
Buck-Rabbit	6 ...	5 to 6	30	...	...	...	...
Cock	6 ...	5 to 6	12 to 15	...	...	...	...
Turkey sitting on the eggs of the Hen	.. ...	...	...	...	17	24	28
Turkey sitting on the eggs of the Duck	.. ...	...	...	...	24	27	30
Turkey sitting on the eggs of the Turkey	.. ...	...	...	...	24	26	30
Hen sitting on the eggs of the Duck	.. ...	...	...	...	26	30	34
Hen sitting on the eggs of the Hen	.. ...	3 to 5	...	...	19	21	24
Duck	.. ...	...	...	...	28	30	32
Goose	.. ...	...	...	...	27	30	33
Pigeon	.. ...	...	...	...	16	18	20

* Le Cultivateur for June 1838.

† Æconomische neugik und verhandl.

Some of these results do not altogether coincide with the practice of this country. For the season of copulation for the cow, for instance, July is considered too late. That period would produce late calves in the following year. November is stated to be the best season for the ewe; for the black-faced ewe it is, but for the Leicester, and in many situations for the Cheviot ewe, it is a month too late. The duration of the power of reproduction accords with our experience as respects the mare and stallion; but thirteen years of age for the cow, and eight years for the bull, is too young a period for old age in them, fine animals of both sexes, of a valuable breed, having been kept in a useful state to a much greater age. We have seen a short-horn bull in use at thirteen years, and a cow of the same breed bearing calves at eighteen; but, if the ages of eight and thirteen respectively refer to the usual time bulls and cows are kept for use, the statement is not far from the truth. The period of gestation of the sow is represented to occur from the shortest period of 109, to the longest period of 143 days, making a difference of 34 days. Now we have always understood, and certainly have always found, the sow to farrow with great exactness to her reckoning, that is, 112 days, neither more nor less.

Frozen Potatoes.—To the number of the many damages caused by great frosts, we must add that of thef reezing of several vegetable productions, and amongst those is a remarkable alteration, which affects one of the most important crops. It has been said, that frozen potatoes frequently give, after being thawed, scarcely a fourth part of the starch which might have been obtained from them before. The cause of this great depreciation is unknown, but, from analogy, it has been attributed to a transformation to the nature of those plants which give their starch in a state of solution.

M. Payen has made numerous researches on this subject; and he has established that frozen tubers contain as much dry substance as in a healthy state; that the proportion of the soluble matter is not lessened; that the starch itself is in the [illegible] nothing is changed in these respects [illegible] The actual composition not being able to explain the foregoing phenomena, the author has searched into physiological modifications for the solution of the problem, and has ascertained that they arise from a general derangement of the cellular tissue. This effect, produced, without doubt, by a change in the state of the bulk of all the fluid parts, separates the utricles from one another. Freed from all the pressure which they supported, the utricles assume the surrounding forms, and when the teeth of the rasp break them, they are detached one by one, or by little groups, but not with such resistance as to be broken to pieces. It results from this that the greatest number of the cells, though filled with starch, do not pass through fine sieves, and remaining in the pulp, diminish so much the proportion of the produce.

He repeats, as M. d'Orbigny did, a simple method, by means of which the natives of Peru dry the entire tubers of frozen potatoes, rendering them as easy of preservation, and fit for daily food, analogous to what is found in bread. The experiments of Messrs Girardin and Callias confirm the statements of M. Payen.*

A Method of Making Coffee. By Dr Ratier.—Take four ounces of good coffee, properly roasted and ground. Dilute it in two glasses of cold water with a spoon. Let it steep all night, covering the vessel which contains it. Next day pour this pap with care on fine linen placed in a glass funnel in a bottle. You have an extremely strong infusion, of which a single spoonful, poured in a cup of boiling milk, is sufficient to give the whole a delightful perfume. One part of this infusion, and two parts of pure water, put on the fire until it comes to boil, gives a water coffee of a superb colour and perfect taste.

It may indeed be conceived that coffee, treated cold, may not have parted with every portion of its aromatic principle. Now, can cold water draw from coffee all that can be obtained from it? I answer, Yes! approved by experience. Indeed I have tried the process related above with boiling and with cold water, and I have assured myself by comparison, that the pow-

* Le Cultivateur, for May 1838.

der, drained by the cold water, and treated then with boiling water, gave nothing but a water slightly tinted with yellow, and devoid of odour and flavour. It is, besides, proper to pass an equal quantity of water to the first, over the grounds, in order that the second water may serve for new powder.

There is thus both economy of fuel and time, since the operation is done at once, and constantly succeeds if done in the same manner. This process is not spoilt in the boiling, nor can it frequently overflow, as in the apparatus called *Morize*, and others, which answer the purpose well, but are expensive to purchase, and require repairs. As for myself, two small decanters of glass and a funnel of the same material, compose all my apparatus. One of the decanters contains the prepared coffee, and has a ground stopper. The other, in which the funnel is placed, receives the second water, and in its turn, contains the coffee, and thus both are used in succession, all the care required is in passing a little water through them at times.

Every person who has tasted my coffee, whether made with water or with milk, have found it of a superior quality. I am astonished that so simple a process has not been adopted. For the coffee-houses it would have the great advantage of always having coffee ready made, not by adding water to the milk, which contains enough already, or making the coffee from hand to mouth, but in a manner by which none of the qualities sought for by true amateurs are lost.

I may here mention that the process was suggested to me in reading a memoir of M. Boullay, apothecary in Paris, upon the preparation of tinctures and extracts, by a method which he calls of *déplacement*. It is a good thing, that in borrowing from science, some little means can be used to make our living more comfortable.*

Mode of ascertaining the Milking Properties of Cows.—The [illegible] Agricultural Societies have been lately occupied in investigating the pretensions of a M. Guénon, who asserts that he can [illegible] certain outward marks common to every

* [illegible] for July 1838.

cow, at once declare what quantity of milk she gives, of what quality it may be, and how long it will last after calving. In a late number of the *Annales de l'Agriculture Francaise*, we find the particulars of a report made to the Society of Agriculture at Rosoy, on an examination which took place of M. Guénon's system. The application of his plan was tried in the dairy of one of the chief proprietors of the place. It appears by the report, that out of 30 cows submitted to his examination, 25 were perfectly well described as to their milking qualities, and in the other 5, the differences from the truth were of such a nature, as to leave room for doubting whether they were not apparent rather than real differences. In two cases only was M. Guénon altogether in error. Afterwards, 20 milking cows were brought under his notice, and, in thirteen cases, his declarations agreed perfectly with those of the steward of the farm; three of the others to which he had attributed a greater quantity of milk than they really produced, were declared to have diminished from age, for which he, having made the examination with great rapidity, had not made any allowance. With respect to two others, the steward was not able to declare positively as to the produce which they gave; for the other two, there were several quarts difference from the quantity named by M. Guénon.

In making his examination, M. Guénon more than once declared, that when he was required to name the quantity of milk exactly in measure, it might occur that his declaration was less than that which the animal produced, but that if the whole of the judgments which he gave were compared, it would be found that the relative proportions held good throughout the whole dairy. Besides, he does not maintain that he may not sometimes be in error; he thinks that it arises from the imperfect mode of applying the system, and not from the system itself. A circumstance occurred on this occasion, which serves to confirm the certainty of M. Guénon's judgment. He had to examine in a stable apart two heifers, of whose mothers he knew nothing; he declared that they ought to give certain quantities of milk, differing altogether from each other, but agreeing perfectly with the nature of their mothers. An individual, not belonging to the farm, asked permission to bring in a cow whose produce he knew perfectly well, and of which he named beforehand, the quantity of milk, its continuance, and its quality. M. Guénon's account agreed in all parts with the person's statement. M. Guénon was afterwards taken to the farm of M. Gibert, and five cows were submitted to his examination. He was perfectly correct as to the quantity of milk they gave, and its duration; as to its quality, the servant who was in charge of the place, could not declare any thing with certainty. Amongst these cows was one which was an exceedingly bad milker; on her appearing M. Guénon uttered some exclamations on her beauty. The persons present thought he was on the point of making some mistake. On examining her nearer, he at once declared her not equal by half in produce to the rest, and retaining her milk for five months only. In both respects he was perfectly correct.

The following article appeared in the *Gardener's Gazette* of 4th May last, which gives an account of the discovery of M. Guénon's, as far as it has been made known.

Mode of judging of the Milking Qualities of Cows.—The Minister of Public Works and Agriculture in France was lately applied to by a M. Guénon, a land-owner at Libourne, respecting a new method which he had discovered for classing the cows of every description, according to the quantity of milk which they can give per day, the quality of their produce, and the time they can keep it. The minister requested the Society of Agriculture to take charge of the necessary experiments to test the value of the discovery; and, in consequence, certain members were appointed to investigate the matter. M. Guénon, previous to his arrival in Paris, tried to obtain a remunerating number of subscribers to a pamphlet of his, containing full particulars of his discovery. When the total of the subscribed sums would amount to what he thought a sufficient rev[illegible] his secret, he proposed to send each subscri[illegible] cop[illegible] vork he shewed at once to the gentlemen [illegible] society. In their report, they allude to the [illegible] abstain from disclosing the mode of [illegible] procedure. They presented lately a report of [illegible] gain the following information

M. Guénon's declaration goes so far as to assert that he can decide respecting the quality as well as the quantity of the milk. He asserts, besides, that his system applies to calves, no matter how young; so that, from examining one of the bovine race, he can predict with certainty the qualities which the animal, whether male or female, must be marked by. This part of his plan could not be tested, as it demands an examination extending to several years. M. Guénon gave an opinion before the gentlemen appointed by the Society to act as a committee, on 149 cows giving milk, on 17 bulls and male calves, and 30 females. The whole experiments lasted four days. It would appear, from the terms of the report, that M. Guénon, in deciding on the quantity of milk in those cases, only approximated, but did not often hit on the exact number of quarts. Out of the 149 cases, only 21 were exactly corresponding with the declarations of the owners of the cows. Also, in speaking of the time during which the cow holds her milk before calving, M. Guénon was seldom exact; the most he did was to come near the mark. On 2573 quarts of milk given in three dairies, he was wrong in 514, or a fifth of the whole. The committee declare that the characters which serve as the foundation of the system are easy to be understood. The only fault they find is in the number of divisions and subdivisions which his system includes. First of all, he makes eight classes, and to each of these, the mark which serves as a guiding-star may be varied frequently, according to the age and form of the animal. This gives eight subdivisions to each, which at once gives sixty-four different orders. Again, in each of these there are three degrees, according to the age of the cows; so that we have thus 192 different kinds. But, omitting this drawback, it must be acknowledged that the character which directs him, and which is common to the whole of the race, must be considered of some value. He was incorrect in several instances, no doubt; but his method of deciding is new, and may be carried much farther. The sign by which he judges has been altogether unperceived up to the present time. In theory, it is such as may be admitted; and the presumption is, that it is of some value.

M. Guénon's discovery is applicable to every country, and the publication of his pamphlet is the only means of ascertaining (by a number of persons observing closely at the same time in different places) whether the method is as valuable as he asserts. One thing is certain, that he appears convinced that the principle upon which he judges is unerring. He acted most fairly and openly before the commission, and secured the approbation of each and all by his straightforward conduct. Their report may be thus summed up:—That the discoverer did not prove all he asserted, but the subject was worthy of further investigation. In pointing out bad milkers, M. Guénon was mistaken only in one instance, and then by omission rather than false declaration. At Rambouillet, there was one bad milker in the number, and that he pointed out at once; and at Alfort one which gave infinitely less milk than the rest was instantly discovered. The commission also declare that the mark by which he judges can be used approximately, in every form and every age.*

The English Agricultural Society at Oxford—The first great show of the English Agricultural Society was held at Oxford on Wednesday the 16th July 1839. The show was accommodated in a field immediately adjoining the town, belonging to Mr Pinfold of Oxford. The space allotted for the show contained five acres of ground, and was enclosed with broad deals of wood, some set up on end, some on edge, and some diagonally, to the height of twelve feet. The pens, appropriated to the accommodation and security of the stock, were placed all round the internal circumference, but at a little distance from the enclosure; and they were protected from rain or heat by a roof of wooden rafters covered with canvass. A covered roof over the stock was rendered necessary from the circumstance of the stock being obliged to be placed in their respective places, on the Monday and Tuesday preceding the day of the show. For the same reason, food was obliged to be given to the stock in the pens, and large tubs of water were placed on the ground to supply water for them. The pens were arranged in double form under the roof, the inside

* Agricultural Journal for July 1839.

ones, being the largest, were appropriated principally to the cattle and horses, and the outside, as far as was requisite, to the sheep and swine. Sheds of the same materials were erected on the ground for some of the implements ; and marquees were also pitched for the display of seeds and roots, and the competition of different varieties of grain. The stock were finally placed and judged on the Tuesday. Tickets explanatory of each lot, and the awards of the premiums, were attached to each lot. The company were admitted by tickets only, obtained in Oxford, at half-past seven in the morning, at half a crown, and at twelve, at one shilling each ticket. Three-fourths, we should say, of the company entered at the half-crown, thereby making up the larger portion of the money received for tickets, which we understand was not less than L.1100. The day was very fine, and the company seemed to enjoy the show with great satisfaction. Had the day been as stormy as the succeeding one, when the sale of some of the stock took place, it is more than probable that the shaking of the canvass on the roof would have produced serious consequences to some of the stock.

Upon the whole, the show was not so great, nor the stock so generally good, as might have been expected. With the exception of a few animals in each kind of stock, the quality was in no way remarkable. Mr Bates of Kirklivington, Yorkshire, shewed the only short-horns worth looking at. There was an excellent long-horned bull shewn by Mr Horton, Warwickshire, as also some excellent Devon queys, and a bull-calf, by Mr Paull, Somersetshire. Among the Herefords were a good bull of Mr Jeffries, and a fat ox belonging to Mr Douce, near Oxford. The sheep were in general good, and proved a pretty extensive show. The pigs were neither numerous nor good, and the horses were very few in number. The implements constituted an extensive assortment, the larger proportion of which being contributed by the Messrs Rausome of Ipswich. The general character of the implements was complication of construction, a principle which the Scotch agriculturist endeavours to avoid in his implements.

An exhibition of the working powers of some of the implements was made on Tuesday forenoon, in the presence of a large concourse of people, in an adjoining field to that in which the great show was held. The implements chiefly exhibited were the subsoil-plough, Biddle's scarifier or grabber, a drill for depositing manure for turnips at given intervals, and one or two others. The ground had not been sufficiently prepared to show the respective action of the implements.

A dinner, at which subjects interesting to agriculturists were proposed to be discussed, was presided over on the Tuesday by the Earl Spencer, in the Star Hotel, and which was attended by about 300 persons. After the show on the Wednesday, the great dinner was held within the quadrangle of Queen's College, which was covered over with canvass, and seated to contain, we believe, 3000 persons. Many, we understand, were deprived of the pleasure of attending the dinner, for want of room.

As a first effort, the getting up of the meeting of the 16th July was highly creditable to the English Agricultural Society, and it fully indicates that, if they are capable of such exercise in infancy, what will they not be able to accomplish in maturer years. Indeed, we conceive that the impulse which the Society is likely to give to agricultural improvement in England, will draw so many of the agriculturists of that wealthy and powerful nation around their banners, that they will soon become a larger body than it will be possible for one board of managers to wield their movements. Already the society can number 1800 members, and were the population of 16,000,000 in England to take as lively an interest in their welfare as the 2,000,000 in Scotland take in their Highland Society, such an accession of members will soon so fill their ranks as to render a subdivision of their labours a matter of expediency and necessity. Time, which alone can declare results, can alone determine this assumption, but i would perhaps not be imprudent to anticipate such a result.

MISCELLANEOUS NOTICES.

I. *To Manage a Rearing Horse.*—In preference to the dangerous experiment of pulling a rearing horse backward, I recommend the adoption of the following method:—Whenever you perceive the horse's inclination to rear, separate your reins and prepare for him; the instant he is about to rise slacken one hand and bend or twist his head with the other, keeping your hands low. This bending compels him to move a hind leg, and of necessity brings his fore feet down. Instantly twist him completely round two or three times, which will confuse him very much, and completely throw him off his guard. The moment you have finished twisting him round, place his head in the direction you wish him to proceed, apply the spur sharply, and he will not fail to go forward: if the situation be convenient, press him into a gallop, and apply the spur, and whip two or three times (but not more) severely. The horse will, perhaps, not be quite satisfied with the first defeat, but may feel disposed to try again for the mastery. Should this be the case, you have only to twist him, &c. as before, and you will find that in the second struggle he will be more easily subdued than on the first occasion—in fact, you will perceive him quail under the operation. It rarely happens that a rearing horse, after having been treated in the way described, will resort to his tricks a third time. But on going into other hands, and having another rider, he will be very likely to have recourse to rearing.—*The Sportsman.*

II. *A Perfect Hackney.*—A well-bred, short-legged, lengthy horse, with very good legs and feet, not under 14 nor above 15 hands high, that will walk four miles in the hour, trot eleven or twelve, and, if wanted, will go fifteen in that time in a canter or hand-gallop, without once throwing up his head, or requiring to be pulled up. We are, of course, supposing him to be in good condition, and in strong work, or it would not be fair to exact so much from him. But it is only in cases of necessity that any horse should be made to perform the latter task; for we are averse to trespassing unnecessarily upon the powers and capabilities of so noble an animal. On the contrary, we recommend every indulgence that can be granted to him on a journey, and especially in hot weather. At all times, indeed, it is our interest to do so; but in very hot weather, a few sips of soft water, often given, keep off fever, and replenish the loss he sustains by exhaustion from excessive perspiration. One word more respecting action. We are no advocates for very fast trotting. It forces the animal to the very extent of his powers, which of course wears him out; it induces his owner either to be constantly displaying these powers in private, or matching him against time in public. Add to this, fast trotting is not a gentlemanlike pace; that is, it has not a gentlemanlike appearance, neither is it agreeable to the rider. This is apparent at first sight, when we follow two horsemen on a road, one on a fast trotter, and the other on a good canter; although going at the same rate, the cantering horse and his rider are both much more at their ease.—*Nimrod.*

III. *Physiognomy of Sheep.*—A trifling wager was settled a short time since between Mr Richard Mathews of Huxham, and Mr Wippell of Redway, in the parish of Rewe, which proves the accuracy of memory and power of observation possessed by the latter gentleman in the physiognomy of sheep. Mr Wippel engaged to take sixty ewes promiscuously out of his flock, and have their lambs penned off from them at a distance out of sight, and to go to the ewes, fix upon them, and then proceed to the lambs and select the lamb belonging to the ewe pointed out, and *vice versa*—to take a lamb, and go and point out the dam amongst the ewes. The ewes and lambs were accordingly penned off. An ewe was taken out of the penn by the umpires, and Mr W. directly went and selected the lamb belonging to her; the judges were immediately satisfied by the maternal tokens of recognition of the fact; a lamb was then brought out, and he went immediately and selected the ewe that owed it. Another ewe was taken out, and Mr Weppell said, "that ewe has two lambs," and he proceeded till forty-nine out of sixty had been tried, the spectators declaring themselves surprised, and perfectly satisfied with the trial. One instance was very extraordinary. A lamb was selected, and he said to the boy, "Go and fetch an ewe with a tuft of wool growing out of her neck." It was fetched and proved to be the dam. This wonderful instance of memory and observation was proved before Mr May, Mr Joseph Player, Mr Mathews, Mr Moxhay. Mr Wippell offered to bet L.100 to L.1 that he could at any time repeat it.—*Western Luminary.*—[Such a feat as is here related is nothing remarkable in a shepherd, although we believe few farmers could accomplish it.—*E. Q. J. A.*]

IV. *Turnpike Roads in England and Wales.*—The following statement exhibits the condition of all the turnpike trusts in England and Wales in the year 1836, the latest period to which the returns have been made up, together with a comparison between that year and 1821. The number of trusts in England and Wales in 1821 was 1025, and in 1836, 1119, shewing an increase of 94 trusts; of these, 69 in 1821, and 68 in 1836, were in Wales. The distance of roads in 1836 is not given; in 1821 it amounted to 18,244 miles in England, and 2631 in Wales; together 20,875. The income from tolls and parish composition in 1821 was L.1,083,767, averaging L.52 : 3 : 1¼ per mile. The income from the same two sources in 1836 was L.1,559,467, and exceeded that of 1821 by 43 per cent. As the distance of roads in the former year is not known, no certain account of the increase of produce per mile can be given; but the following estimate will serve in some measure to supply the deficiency. The average length of each trust in 1821 was 20¼ miles; if the same be allowed for each of the 94 additional trusts in 1836, the total length will be 22,788 miles, and the produce per mile L.68 : 8 : 8, equal to an increase of 32 per cent., arising from a corresponding increase of internal communication by roads [illegible] the amount of that increase by steam and canal navigation is [illegible]er, as has been shewn by Mr Porte in "The Progress of the Nation [illegible] examine the returns of revenue and expenditure in the year 1836, we find that the total income amounted to L.1,776,586, but of this L.130,348 was money borrowed. If this sum be deducted, the actual receipts from tolls, statute-duty, and contingencies, was L.1,646,238. The total expenditure was L.1,780,349; but, in order to find the actual expense of maintenance, the debts paid off must be deducted, which amounted to L.17,270. The remainder is L.11,663,079, which exceeds the income by L.16,841. To this annual deficiency (supposing the same state of finance to continue), is to be added a debt of L.8,577,132, which, after deducting the arrears of income and balances in the treasurer's hands, will amount to L.8,159,311. Of the former sum, no less than L.1,031,096 consists of unpaid interest. The amount of bonded or mortage debts is L.7,187,543, of which nearly L.6,000,000 bear an interest of 4¾ per cent. [Of the total amount, L.5,959,259 bears interest at 4¾ per cent.; L.505,629 at 5 per cent.; L.378,838 at 4½ per cent; L.263,224 at 4¼ per cent.; and L.80,593 at 4 per cent.] Hence the total debts amount to four and a half times the total annual income; but as the expenditure exceeds the income, and the arrears of interest already amount to one-eighth of the whole debt, there appears little probability of the debt being diminished by ordinary means. There is also reason to apprehend that the arrears of interest will increase, as the amount paid for interest in 1836 was only L.313,381, while the interest upon the total debts, at 4¾ per cent., amounts to L.407,413. There was likewise a further sum of money borrowed in that year of L.130,348.—*Journal of the Statistical Society of London.*

V. *Meadows of Great Britain.*—In extent of meadow and pasture land, as well as in flocks, Great Britain and Ireland (says a French statistical account), are the most favoured countries in Europe. They contain 5572 square leagues (more than two-thirds of their territory), in meadow and pasture land. Germany comes next, having one-quarter of its surface in this description of land. Prussia, Holland, and Belgium have a fifth; Austria and Switzerland a sixth. France does not reckon in this respect more than a seventh part, namely, 4000 square leagues. Italy, Naples, Sicily, and Portugal, have only a tenth. With regard to woods and forests, they are to be found most extensively in Russia, Sweden, Norway and Germany. In the British Islands they only occupy a twenty-fifth part, so that were it not for coals, these islands would not be inhabitable. In Austria and Prussia a quarter of the country is occupied by them; in Belgium, a fifth; in Switzerland, a sixth; in France, a seventh; in Italy, a ninth; and in Spain, a twelfth part. Belgium and Bohemia have the smallest extent of uncultivated and waste lands, the former having only the tenth, and the latter the ninth part of their territory uncultivated. Spain, Italy, Switzerland, Holland, Sweden, and Norway, are, on the contrary, from various causes, the least cultivated, having nearly half of the land in a barren state.

VI. *Cows fed on Fish.*—Mr De Capel Brooke, in his interesting Travels in Lapland, mentions a *fact* at which the English farmers will be much surprised, viz., that the cattle in Lapland or Finmark are uniformly fed on Fish. I already, he remarks, fancy to myself seeing the English farmer's mouth open, and hearing him express his pity that a poor beast should be born to exist in such a country, and on such a diet. His surprise at the same time will not be lessened, when he hears that the animals not only devour this kind of food with the greatest eagerness, but thrive and do well upon it. What will our great cattle-feeders say to this? or how would they look if they were told that, by the extension of our fisheries, a beast might, perhaps, be fattened in a shorter time, and more economically, upon cod fish, than by the old-fashioned means of oil-cake? or that, instead of manuring the ground with sprats, they may be introduced as an advantageous substitute for turnips, for our sheep in winter? It appears that horse-dung, when it can be procured, is also boiled up with the fish bones, and greedily eaten by the cattle, in Lapland and Norway. As the process by which the food is prepared for the cattle is curious, it may not be uninteresting to the English farmer to read the account:—"About five o'clock in the evening a large iron pot is regularly placed on the kitchen fire partly filled with water, into which is immersed a large quantity of fishes' heads and bones, with the addition of some hay; and this is to boil gently for some time, till a kind of fish soup is prepared. The pot is then taken to the cow-house by the maid-servant, and its contents are placed before the animals, by being poured into their mangers. I was much surprised to observe the extreme relish and greediness with which they devoured this; both sheep and cows appeared equally fond of it. The milk is of a remarkably rich flavour, and the beef and mutton very good.

VII. *Mode of Hatching Chickens.*—"No one, whilst at Ghizeh, should omit seeing the chicken *manufactory*, where two old men perform the maternal duties of as many thousands of the gallinaceous tribe. The eggs are spread out on a flat surface of clay, in ovens kept, of course, night and day at a uniform degree of heat. The old men visit their charge constantly, turning the eggs with long poles, so as to bring every part of their surfaces in occasional contact with the clay bottom of the oven, which is somewhat warmer than the atmosphere. It is an extraordinary sight! Every instant some little animal, in his struggles to enter this world of troubles, bursts its shell and starts into life (an orphan from its birth), keeping the surface in a constant state of *agitation*. They are immediately taken out of the oven, placed in baskets, and sold by *measure* [illegible] every old woman in the neighbourhood buying a pottle of the misera[illegible] little creatures to take home and dry-nurse, until they are of an age [illegible] shift for themselves. I believe this method of hatching chickens is [illegible] throughout Egypt, although I cannot state, on my own autho[illegible] that such is the case. If so, it may account for the degeneracy of [illegible] breed of fowls; for they are invariably small, though the eggs are [illegible]uch less than those usually met with in other countries."—*Captain [illegible] Rambles in Egypt and Can*[illegible]

VIII. *Mode of Sticking Peas.*—The following mode of sticking peas, and especially the taller varieties, is both cheap and simple, and possesses many advantages. Procure a number of strong thick stakes or thin poles, in length according to the height of the peas, from five to ten feet, and drive them into the ground on each side of the row, at the distance of three or four yards. Pass a small line along the poles, taking a turn on each within a few inches of the ground, and, as the peas advance, raise the next turn a little higher, and so on in succession, till they have attained their full height. Sow the tendrils of the peas, and truss them round these lines, by which they will be supported in a better manner than by the common method of sticking. When spread regularly along the lines, they have a fine circulation of air, and pods can be pulled at all times without injuring the haulm, and as the birds have no twigs to alight on, the portion of the crop which they otherwise would devour and destroy is saved. An excellent way to preserve peas or beans from mice, is to chop off the tops of the last year's shoots of furze, and sow them in drills. The author has known it to have been an effectual remedy in several instances, where these mischievous little animals had been very prevalent.—*Vegetable Cultivator, by John Rogers.*

IX. *Improvement in Bookbinding.*—Mr William Hancock has taken out a patent for an invention which, in all probability, will work a revolution in the art of bookbinding. Mr Hancock's invention consists in attaching or binding the leaves of a book by means of a certain preparation of caoutchouc, thus dispensing entirely with the process of sewing or sawing. The term "sawing" is used in the trade to designate a process which is frequently resorted to by those who profess to bind books under the usual charges. Instead of stitching the leaves separately, two or more grooves are made in the back of the leaves at once, which grooves are filled with hemp or some other substance of a similar kind, and covered with paste, after which the boards are put on in the usual fashion. It must be evident that such a mode of binding cannot be durable. The superiority of Hancock's process over the method of stitching consists in allowing the book to open perfectly flat, and without strain on the back. This is of great consequence, especially in day-books, ledgers, and other account-books, where it is frequently very difficult to write near the inner parts of the pages. Another very important advantage resulting from the new method is, that it dispenses entirely with the use of paste, a substance which, it is well known, breeds those destructive insects which commit so many ravages in large collections. The new method is quite as cheap, and much more durable than the old.

X. *Whimsical Calculation.*—What a noisy creature would man be, were his voice, in proportion to his weight, as powerful as that of the grasshopper, which may be heard at the distance of one-sixteenth of a mile. The kolibri weighs about half an ounce, so that a man of ordinary size weighs about as much as 4000 kolibris. One kolibri must weigh at least as much as four grasshoppers. Assuming, then, that a man weighs as much as 16,000 grasshoppers, and that the voice of one of these may be heard at the distance of one-sixteenth of a mile, that of a man, were it in proportion to his weight, would be audible at the distance of 1000 miles; and when he sneezed he would run the risk of bringing the house about his ears, like the walls of Jericho at the sound of the trumpets. Assuming, farther, that a flea weighs a grain, which is something more than its real weight, and that it is able to clear one inch and a half at a spring, a man of 150 pounds weight would, by the same rule, be able to make a spring over a space of 12,800 miles, and consequently leap with ease from New York to Cochin China. Aristophanes represents Socrates and his pupils occupied in a similar computation. They are exhibited calculating the weight of a flea's leg in proportion to that of its body. The ironical calculation of Aristophanes, however, falls far short of that of the *New York Sun*.

XI. *Voltaic Battery.*—A rough fir vessel, five feet long, three and a half feet wide, and two and a half feet deep, was previously sunk opposite the Gun Wharf, to represent the wreck of a ship, having a ring and lines attached to it, which are supposed to be placed by a diver after the vessel has been sunk. 2. A charge of 40 lb. of powder was let down from a boat and hauled into close contact with the supposed wreck, by means of the lines and ring above mentioned. The coil containing the conducting wires, one-fifth of an inch in diameter, by which this charge was fired, was verred out to its whole length of 500 feet, from the same boat. 3. On the signal being given from the boat by a bugle to denote that all was ready, the signal to fire was made also by the bugle. The explosion succeeded admirably. A column of water was thrown up by it, and the fragments of the vessel came up to the surface. 4. Three charges, each of 5 lb. of powder were sunk at the distance of 30 or 40 feet from each other, opposite to the Gun Wharf, having a pair of connecting wires 150 feet long attached to each. The ends of these wires were soldered together by threes, and brought to the two poles of the voltaic battery, which had previously been removed from the boat after the first operation, and placed on the wharf, by which the charges were fired simultaneously, after two bugle sounds, as before. Two of the three charges were exploded simultaneously, and the third was prevented from doing so by a fracture in one of the conducting wires. The battery used was of Professor Daniel's improved construction. The wires in the last experiment were common copper bell wires, about a 16th of an inch in diameter, which were only used from not having any more of the former descriptions. The experiments succeeded perfectly, and to the great delight of thousands of spectators. As we stated in our last, they were preparatory to blowing to pieces the Royal George, which was wrecked at Spithead in 1782, and which has a number of very valuable brass guns of large calibre on board of her, all of which will be recovered after the demolition of the wreck.—*Maidstone Journal.*

XII. *An ingenious Mode of making Paper-Casts of Sculpture.*—My servants made me casts in paper of the sculpture of these two rooms, that is, one of all the sculpture in the three large plates which I now publish. This method of obtaining fac-similes of sculpture in basso-relievo is very successful, and so easy, that I had no difficulty in teaching it to my Arabs. I found stiff, unsized, common white paper to be best adapted for the purpose. It should be well damped; and, when applied to sculpture still retaining its colour, not to injure the latter, care should be taken that the side of the paper placed on the figures be dry—that it be not the side which has been sponged. The paper, when applied to the sculpture, should be evenly patted with a napkin folded rather stiffly; and, if any part of the figures or hieroglyphics be in intaglio or elaborately worked, it is better to press the paper over that part with the finger. Five minutes is quite sufficient time to make a cast of this description; when taken off the wall, it should be laid on the ground or sand to dry. I possess many hundred casts, which my Arabs made for me at Thebes and in the Oasis. Indeed, I very rarely made any drawings of sculpture, without having a cast of the same; and as the latter are now quite as fresh as on the day they were taken, the engraver having not only my drawing, but also these indubitable fac-similes, is enabled to make my plates exactly like, and quite equal to the original.—*Hoskins' Visit to the Oasis.*

XIII. *Corn Puzzle.*—The following "puzzle for the curious" appears in the *Worcester Journal*:—If a person were to take a single wheat corn in his pocket to market on New Year's day, and double the same every week for 52 weeks, or till New Year's day again, it would amount to more loads of wheat, 20 bags each, 3 bushels to a bag, than it would take bank-notes to build a stack 25 times higher than the top of St Paul's, London (supposing a stack could be built), reckoning the building 144 yards, and allowing 190 notes to an inch. 2d, After this was deducted there would be more loads left, 20 bags each, than any ten millers ever bought bags of wheat in their lives, allowing each to buy weekly 2000 bags for eighty years. 3d, After this deduction there would be more loads, 20 bags each, remaining than it would take bank-notes to cover 100 square acres of ground, allowing each note to measure 6 inches by 4. 4th, After this deduction there would be more loads left than the wheel of a coach would turn round times in a distance of 1200 miles, supposing the wheel to measure 17 feet in circumference. 5th, This would leave more loads than it would take barley corns to reach from Worcester to Alcester, a distance of 17 miles, allowing three barley corns to an inch. 6th, This would leave more loads than it would take tons of coal to supply the city of Worcester for 30 years, allowing 83 barge or boat loading to be brought every week for 30 years, and allowing each barge or boat to carry 60 tons, which would load 137,280 boats or barges, 60 tons each.—7th, After these deductions there would be more loads left, 20 bags each, than it would take pounds to build sixteen county courts, allowing each to cost L.50,000. 8th, There would be more loads remaining then than it would take bags, three bushels each, to load 3000 barges, allowing each barge to carry 500 bags. 9th. After all these deductions there would be wheat enough left to find 2500 persons in bread for 66 years, allowing each person to eat annually nine bags. All the quantity of corn together would load 1,125,899 ships, 1000 quarters each. The amount of all the number of corns is 4,503,599,627,370,495. Reckoning 500,000 corns to fill a bushel, is 9,007,199,254 bushels. Number of bags, 3 bushels each, 3,002,399,751. Number of loads, 20 bags each, 150,119,987.

XIV. *Percussion Muskets.*—The superiority of the percussion musket over that in ordinary use has been strikingly exemplified in the recent trials which have taken place at Portsmouth, from which it would appear that, whilst in the course of 2000 discharges from 10 percussion muskets, the cap missed fire only eight times, and the loading failed to ignite in nine instances; in the same number of attempts with the flint musket, the priming missed fire 822 times, and the loading 70 times after the priming had exploded. A great advantage is also gained as it regards expedition by the use of the percussion musket. Thirty rounds discharged by platoon with the percussion muskets occupied 20 minutes; the same number of reports with the old muskets 26 minutes.—*United Service Gazette.*

XV. *Inspection of the Oxford Street experimental Paving.*—Yesterday, in accordance with the arrangements made by the Mary-le-bone Vestry, limiting the period of the trial of the respective experimental pavements laid down in Oxford Street until the month of May, Mr Kensett, as Chairman of the Paving Committee, laid before the Board the state in which each of the experiments were in, and the probability of that which was most advisable to be used. It appeared that the Oxford Street Paving Committee made a public examination of the experimental specimens on Thursday, in the presence of several hundred persons, and, from their minute investigation, the following is the result of their labours:—On examining the bitumen laid down by the Bastienne Gaugac Bitumen Company, they found that it had stood the test of the severe wear and tear of the vehicles passing that road during the whole winter, without any material alteration. That portion laid down by the Val de Travers Company, which had been studded with stone, had stood: but that portion in which the broken granite had been set in, their liquid had totally failed, and must be removed immediately. The Aberdeen granite cubes, laid down by the parish, had proved to be in most excellent condition; that more particularly which had been set in Claridge's asphalte was in a state of superior order, and the stones appeared immoveable. Robinson's bitumen had been taken up some months since, in consequence of having proved a decided failure; and the same course would also be necessary to be adopted as regarded the specimen of the Scotch asphaltum, that having been repaved once, and had again become so dilapidated as to render the portion of the road which it occupies absolutely dangerous. The wooden block pavement, which had been laid down five months since by the projector Mr Stead, had excited the most minute attention and admiration of the Committee. It appeared, on examination, that they formed a road of a most even surface, and carriages passed over without the slightest noise; and of the 12 inches, the length of the blocks, it was found they had not been diminished one quarter of an inch. Their attention, however, was particularly directed to the bottom of the blocks, which, to the extent of about three-quarters of an inch, appeared discoloured by a blue stain, intimating that the first approach of decay was making its appearance. A considerable division of opinion existed among the Committee upon the above appearance being that of decay. They were, however, of an unanimous opinion, that a further trial was necessary in order to enable the Vestry fairly to be satisfied as to the durability of the pavement which might ultimately be decided upon, and that any decision ought to be deferred till the autumn. Yesterday it was ultimately decided in the Vestry, that the application of a gentleman named Geary to lay down a wooden pavement upon an improved principle, should be referred to the Committee, and that the final decision upon the experiments should be deferred to September.

QUARTERLY AGRICULTURAL REPORT.

August 1839.

The dry weather, which permitted the seed-time to be so satisfactorily concluded, came to an end about the middle of June, and was succeeded by heavy rains and high winds. The moisture was beneficial to the growth of the crops, but it came with too much force for the young and tender braird of turnips. It formed a crust too hard for the young plant to penetrate, and the consequence was that many of them died, and caused blanks which could only be supplied by resowing and transplantation, neither of which expedients can ever make up for the loss of a natural supply.

The drought continued as long as completely to destroy the hay crop obtained from the sown grasses. We do not remember of our witnessing so light a crop as of this season. The consequence is, that the hay of last year is selling at not less than a penny a pound. The hay in England being almost all derived from natural grass, is a much better crop; and were it not that the weather is rather precarious for the proper making of the crop, it would be a heavy one.

All the crops are certainly better than last year, with the exception of wheat, which is rather thin on the ground, but well-eared notwithstanding. The barley and oats we would pronounce a fair crop—the latter, in all cases, being the best. When harvest shall commence in Scotland it is difficult to predict; the middle of September will certainly arrive before much grain be ready for the sickle. In the north of England the crops are much the same as in Scotland, but in the southern parts of that glorious country they are all heavy, and the wheat particularly so, and full-eared an standing up, notwithstanding the heavy rains and storms that have prevailed for some weeks past.

The pastures in the early part of summer were completely bared, so that the stock suffered from privation to a considerable degree; and even now that rain has fallen, a pasture early eaten down cannot be expected to recover in that season. The English natural pastures are excellent; but it has been remarked by graziers, that the grass does not feed so kindly this summer. This effect may partly be ascribed to the heavy dewy nights and cold mornings, which are apt to induce starving coats and hard hides.

We have observed but few blanks among the potatoes, which look pretty well; and as there is a very large breadth planted this year, we may anticipate a sufficient supply of that necessary of life for the labouring population. The turnips, we suspect, have received too much wet of late to permit them attaining a heavy crop.

All kinds of live-stock maintain high prices, particularly fat, which are scarce. Of the products of stock, there may be a considerable supply of butter since the fall of the rain, but it will not likely be very rich in quality. We have not observed the prices obtained for wool at the various wool-fairs of the country. The manufacturers, we believe, have not yet bought largely; but, from the state of the trade, prices are not likely to be much below the usual rates of former years.

As we anticipated, the corn markets have been entirely regulated by the weather, rising 4s. a-quarter one week, and falling as much in the next. There is no chance of the high price of wheat being maintained, although the harvest should be late, as sooner or later the new corn will come into hand. Indeed, in Suffolk harvest has been proceeding for some time, and that circumstance is of itself sufficient to act as a check on prices.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of July 1838, *and 5th of July* 1839,—*shewing the Increase and Decrease on each head thereof.*

	Quarters ended July 5.		Increase.	Decrease.	Years ended July 5.		Increase.	Decrease.
	1838.	1839.			1838.	1839.		
	£	£	£	£	£	£	£	£
Customs, ...	4,769,400	4,871,333	101,933	. .	18,790,464	19,606,561	816,097	. .
Excise, ...	2,187,112	2,570,311	133,199	. .	11,439,296	12,132,971	693,675	. .
Stamps, ...	1,692,134	1,647,123	. .	44,711	6,506,980	6,560,275	53,295	. .
Taxes, ...	1,609,508	1 639,372	29,864	. .	3,627,204	3,730,546	103,342	. .
Post-Office, . .	381,000	369,000	. .	12,000	1,544,000	1,536,000	. .	8,000
Miscellaneous,	10,390	14,611	4,221	. .	39,106	94,629	55,523	. .
	10,599,544	11,111,750	269,217	56,711	41,947,050	43,660,982	1,721,982	8,000
	Deduct Decrease,		56,711		Deduct Decrease,		8,000	
	Increase on the Qr.		212,506		Increase on Year,		1,713,982	

TABLES OF PRICES, &c.

Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
May 3.	73 2	42 8	24 10	40 8	39 6	35 10
10.	72 6	41 10	24 10	41 4	38 4	37 4
17.	73 11	40 9	25 9	41 6	38 0	37 11
24.	74 8	41 6	25 9	42 0	38 6	37 7
31.	73 6	40 1	26 0	41 10	38 2	38 8
June 7.	72 4	40 2	25 10	42 6	39 4	39 3
14.	73 1	41 7	26 2	43 6	38 8	37 11
21.	71 3	40 7	27 0	42 4	39 6	39 1
28.	72 7	40 0	26 7	42 6	39 3	38 9
July 5.	72 10	41 0	26 9	43 8	39 7	39 7
12.	72 6	38 10	26 4	42 2	38 8	39 4
19.	72 9	40 3	26 0	39 6	38 6	39 8
26.	73 4	40 3	26 2	44 8	39 10	38 10

DUBLIN.

Date	Wheat per Bar. 20 St.	Barley per Bar. 16 St.	Bear per Bar. 17 St.	Oats per Bar. 14 St.	Flour per Bar. 9 St.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
April 30.	41 0	21 6	18 2	16 2	22 8
May 7.	41 2	21 9	18 6	16 1	22 4
14.	41 5	22 1	18 8	16 3	22 2
21.	42 5	22 10	18 11	18 2	22 3
28.	40 8	23 1	19 2	17 5	22 2
June 7.	42 4	22 1	19 6	16 10	22 6
14.	41 7	22 4	19 4	18 3	22 4
21.	42 2	22 5	20 1	18 2	22 5
28.	40 0	21 10	19 6	18 1	22 2
July 5.	39 3	21 9	19 2	18 5	22 8
12.	39 1	22 2	19 8	18 8	22 8
19.	39 7	22 6	19 1	18 11	22 2
26.	39 3	22 4	18 10	18 10	23 1

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
May 3.	63 9	41 3	26 0	40 6	39 4	43 2
10.	63 5	41 10	26 2	41 6	38 6	39 8
17.	59 10	45 6	27 4	42 4	38 2	39 10
24.	61 7	42 7	27 2	41 8	38 6	42 4
31.	63 8	35 1	27 8	42 0	39 4	43 8
June 7.	60 0	38 8	27 6	41 6	38 2	43 10
14.	63 2	38 6	27 10	42 8	39 3	44 7
21.	57 1	34 1	28 2	43 2	39 8	45 0
28.	62 0	32 9	27 9	42 4	38 10	43 5
July 5.	60 6	32 6	28 3	41 10	38 2	44 4
12.	62 10	32 10	28 7	42 4	39 0	43 9
19.	60 10	32 2	27 0	42 6	38 6	42 8
26.	60 9	32 4	27 3	43 0	38 10	43 10

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
May 8.	66 8	38 0	31 8	42 6	42 9
15.	65 3	38 9	32 3	42 8	42 9
22.	64 9	39 2	32 1	42 0	42 4
29.	65 6	42 8	33 7	43 0	43 6
June 5.	65 6	39 2	35 3	42 6	42 10
12.	66 8	40 0	35 1	42 2	42 8
19.	66 8	40 6	35 2	42 4	42 6
26.	65 7	38 10	34 0	42 0	42 4
July 3.	64 4	38 6	33 8	42 6	42 9
10.	65 1	39 4	33 9	43 4	43 10
17.	65 6	39 6	34 5	42 9	43 0
24.	66 6	40 3	34 10	42 0	42 7
31.	68 0	39 6	33 8	42 0	42 3

***BLE shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN; the Duties payable thereon, from May to August* 1839.**

te.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.
39.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
y 3.	71 0	70 1	10 8	40 6	38 11	4 10	24 11	24 7	10 9
10.	70 6	70 4	10 8	39 8	39 3	3 4	24 11	24 9	10 9
17.	71 2	70 9	10 8	39 1	39 5	3 4	25 8	25 0	9 3
24.	70 8	71 2	6 8	39 0	39 7	3 4	25 10	25 3	9 3
31.	70 5	71 1	6 8	38 7	39 6	3 4	26 4	25 6	9 3
e 7.	69 7	70 7	10 8	38 10	39 3	3 4	26 4	25 8	9 3
14.	69 2	70 3	10 8	39 1	39 0	3 4	26 7	25 11	9 3
21.	68 1	69 10	13 8	38 5	38 10	4 10	27 4	26 4	7 9
28.	68 1	69 4	13 8	38 4	38 9	4 10	27 5	26 8	7 9
y 5.	67 10	68 10	16 8	38 1	38 7	4 10	27 5	26 11	7 9
12.	69 0	68 7	16 8	37 6	38 4	4 10	27 1	27 0	6 3
19.	69 2	68 6	16 8	39 4	38 5	4 10	26 9	27 1	6 3
26.	69 8	68 8	16 8	37 8	38 3	4 10	27 1	27 2	6 3

te.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
39.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
y 3.	40 6	40 2	9 6	39 6	38 0	12 6	38 0	37 6	14 0
10.	41 5	40 5	9 6	38 5	38 1	12 6	38 8	37 10	14 0
17.	41 5	40 7	9 6	38 1	38 4	12 6	39 0	38 3	12 6
24.	41 9	40 8	9 6	38 4	38 5	12 6	38 9	38 6	12 6
31.	40 5	40 10	9 6	38 7	38 6	12 6	39 8	38 10	12 6
e 7.	43 11	40 7	8 6	39 7	38 0	12 6	39 11	39 0	11 0
14.	41 4	41 8	8 6	38 10	38 8	12 6	39 10	39 4	11 0
21.	40 2	41 6	8 6	39 4	38 10	12 6	40 2	39 7	11 0
28.	43 8	41 10	8 6	39 10	39 1	11 0	40 3	39 9	11 0
y 5.	43 7	42 9	6 6	39 7	39 3	11 0	40 5	40 0	9 6
12.	37 8	42 0	6 6	40 2	39 7	11 0	41 0	40 3	9 6
19.	45 3	42 7	6 6	40 6	39 9	11 0	41 0	40 5	9 6
26.	45 9	43 4	5 0	40 11	40 1	9 6	41 0	40 7	9 6

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities of Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantities upon which duties have been paid for home-consumption, during the same Month; and the Quantities remaining in Warehouse at the close thereof, from 5th May to 5th July 1839.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOUSE. From Foreign Countries.	REMAINING IN WAREHOUSE. From British Possessions.	REMAINING IN WAREHOUSE. Total
May 5. 1839.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, . .	213,702 7	. .	213,702 7	177,309 0	. .	177,309 0	41,054 1	173 4	[illegible]
Barley, . .	29,599 0	. .	29,599 0	20,167 3	. .	20,167 3	9,325 4	. .	[illegible]
Oats, . . .	10,707 1	. .	10,707 1	174 2	. .	174 2	245,749 2	. .	[illegible]
Rye, ...	6,215 5	. .	6,215 5	924 6	.	924 6	3,053 4	. .	[illegible]
Pease, . . .	3,757 4	. .	3,757 4	1,412 4	. .	1,412 4	6,371 2	0 7	[illegible]
Beans, . .	3,323 0	. .	3,323 0	417 2	. .	417 2	11,936 7	. .	[illegible]
Totals,	267,305 1	. .	267,305 1	200,405 1	. .	200,405 1	317,490 4	174 3	[illegible]
June 5.									
Wheat, . .	301,505 1	. .	301,515 1	91,890 1	. .	91,890 1	249,501 2	173 4	[illegible]
Barley, . .	84,622 1	. .	84,622 1	52,933 7	. .	52,933 7	41,148 7	. .	[illegible]
Oats, . . .	12,518 4	. .	12,518 4	1,109 2	. .	1,109 2	253,018 4	. .	[illegible]
Rye, ...	15,579 4	. .	15,579 4	107 5	. .	107 5	17,397 6	. .	[illegible]
Pease, . . .	10,620 2	. .	10,620 2	1,806 6	. .	1,806 6	15,461 7	0 7	[illegible]
Beans, . . .	6,423 1	. .	6,423 1	735 2	. .	735 2	17,911 2	. .	[illegible]
Totals,	431,278 5	. .	431,278 5	148,582 7	. .	148,582 7	594,430 4	174 3	[illegible]
July 5.									
Wheat, . .	285,289 6	. .	285,289 6	494,195 2	. .	494,195 2	40,084 4	173 4	[illegible]
Barley, . .	51,483 3	. .	51,483 3	92,151 7	. .	92,151 7	82 4	. .	[illegible]
Oats, . . .	49,062 2	. .	49,062 2	7,723 3	. .	7,723 3	291,234 3	. .	[illegible]
Rye, ...	12,908 7	. .	12,908 7	312 3	. .	312 3	29,056 4	. .	[illegible]
Pease, . . .	7,639 5	. .	7,639 5	2,811 6	. .	2,811 6	19,633 0	0 7	[illegible]
Beans, . .	8,348 4	. .	8,348 4	1,397 0	. .	1,397 0	24,650 7	. .	[illegible]
Totals,	414,732 3	. .	414,732 3	598,591 5	. .	598,591 5	404,714 6	174 3	[illegible]
May 5.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt.
Flour, . . .	54,419 1 7	1,500 0 0	55,919 1 7	36,589 0 24	1,500 0 0	38,089 0 24	23,206 3 17	4,598 1 26	[illegible]
Oatmeal, .	. .	. .	. .	. .	. .	. .	31 2 16	. .	31
Totals,	54,419 1 7	1,500 0 0	55,919 1 7	36,589 0 24	1,500 0 0	38,089 0 24	23,238 2 5	4,598 1 26	[illegible]
June 5.									
Flour, . . .	39,247 1 18	504 0 4	39,751 1 22	13,196 1 21	504 0 4	13,700 1 25	30,411 3 8	4,646 3 9	[illegible]
Oatmeal, .	100 0 9	. .	100 0 9	0 0 2	. .	0 0 2	24 2 11	. .	[illegible]
Totals,	39,347 1 27	504 0 4	39,851 2 3	13,196 1 23	504 0 4	13,700 1 27	30,436 1 19	4,646 3 9	[illegible]
July 5.									
Flour, . . .	52,015 2 4	2,275 0 0	54,290 2 4	33,921 3 11	2,275 0 0	36,196 3 11	32,700 3 13	4,646 3 9	[illegible]
Oatmeal, .	33 0 11	. .	33 0 11	. .	. .	. .	57 0 22	. .	[illegible]
Totals,	52,048 2 15	2,275 0 0	54,323 2 15	33,921 3 11	2,275 0 0	36,196 3 11	32,758 0 7	4,646 3 9	[illegible]

PRICES of BUTCHER-MEAT.

	SMITHFIELD, *Per Stone of* 14 lb.		MORPETH, *Per Stone of* 14 lb.		EDINBURGH, *Per Stone of* 14 lb.		GLASGOW, *Per Stone of* 14 lb.	
Date.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1839.								
May	7/6 to 8/6	7/6 to 8/6	7/3 to 8/	7/6 to 8/6	7/ to 8/	7/3 to 8/	7/6 to 8/	7/ to 7/9
June	7/9 8/3	7/6 8/6	7/6 8/6	7/6 8/6	7/3 8/6	7/3 8/6	7/3 8/3	7/6 8/
July	7/6 8/6	8/6 8/9	7/3 8/6	7/6 8/9	7/6 8/6	7/6 8/6	7/6 8/6	7/6 8/6

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.

Merino, ...	24/	to 26/6
In Grease, ...	22/	24/
South Down, ...	21/	24/
Leicester, Hogg, ...	18/6	21/6
Ewe and Hogg, . . .	16/	17/6
Locks, ...	10/6	12/6
Moor, ...	8/	11/

SCOTCH, per 14 lb.

Leicester, Hogg, . .	17/	to 20/
Ewe and Wether, . . .	15/6	17/
Ewe, ...	13/	15/
Cheviot, white, ...	20/	[illegible]
Laid, washed, . . .	[illegible]	16/6
Unwashed, . . .	10/	12/
Moor, white, ...	[illegible]	[illegible]
Laid, washed, ...	[illegible]	[illegible]
Unwashed . .	[illegible]	[illegible]

THE

QUARTERLY

JOURNAL OF AGRICULTURE.

THE TAINT IN THE POTATO EXPLAINED, AND ITS EFFECTUAL REMEDY INDICATED FROM THE EFFECTS OF NATURAL CAUSES.

By Mr William Aitken, Castle-Douglas.

The failing state of the potato, with the prospect of an annual decrease in the quantity to meet the demand of a rapidly increasing population, is a matter which requires the most serious consideration of the farmers of the empire.

The indispensability of the root as an article of food, the high price, from scarcity, it has of late attained, and the privation and consequent misery which scarcity never fails to entail on the poor, are sufficient apologies for introducing the subject of the potato so repeatedly into the pages of this Journal.

An improved system of cultivation, more in accordance with the nature of the plant, and calculated, if possible, to increase the quantity and improve the quality of the root, is at present a desideratum in agriculture. To promote so desirable a result is my avowed and only object of troubling the readers of this Journal with my lucubrations; and I trust I shall be able to shew clearly in the sequel, that an improved system of cultivation is of easy and simple attainment.

The potato is a plant possessed of properties which it holds in common with several plants, but differing materially from every other plant cultivated by the farmer. From the circumstance of its recent general introduction into the farming of this country, its true properties are as yet but imperfectly understood. Its cultivation, though already certainly widely extended, appears as yet to be confined compared to what it may attain. What the potato suffers at present from disease, I hold to be only the consequence of a want of knowledge, on the part of the cultivator, of its nature and properties. To acquire a thorough knowledge of every particular connected with the nature and cultivation of the potato, is what I consider is still required, and that knowledge would amply reward much scientific study and practical experiment.

When the present disease of the taint or decay by a dry rot of the cut sets, first appeared in the potato crop, now about seven years ago, it was considered as an inexplicable phenomenon, and no one for some time ventured a supposition of its cause. But its annual appearance and progressive increase, yearly assuming a more threatening aspect, extending over the greater part of the three kingdoms, and proving most fatal on all the best soils, at length created general alarm. Its mysterious nature excited a deep interest in the fate of the potato, and created an apprehension that the valuable root might be entirely lost. Numerous conjectures were in consequence ultimately formed and given to the world through the various periodical prints; but for some time they constituted but a mass of conflicting opinions that tended more to bewilder than to instruct.

In 1834, the Highland and Agricultural Society of Scotland, desirous of discovering a means of checking the progress of the disease, awarded a premium for the best essay on the subject. At this early stage of the disease, however, it had not exhibited itself so fully in all its phases, as to afford a satisfactory explanation from observation or experiment. The essayists were ignorant of its nature, and, as I consider, erred most materially in their opinion. They recommended as a cure what ought to have been condemned, namely, the well ripening of the seed-tubers. This, as I consider, has been the rock on which the cure of the taint has been wrecked; and it has doubtless misled many cultivators, and already lost to the [illegible] pounds worth of potatoes. So import[illegible] cannot be too soon exposed, and its evil conse[illegible] [illegible]cted by every possible means.

A[illegible] had from the first appearance of the disease [illegible] attentive observer of its progress, it was not until the [illegible] that I formed [illegible] opinion, which I found confirmed by the further experience of the following seasons, that the cause of the taint was explicable. Previous to that period, there was want of proof on certain particulars which the season of 1836 fully afforded. I then resolved on publishing my views and shewing to the world that the evil was not insurmountable.* This paper is not a repetition of that work, but rather a continuation of it, in which I produce evidence from Nature of the truth of the theory I there advanced. Immediately after its publication, a rather extraordinary circumstance occurred in the progress of the taint. For a number of years previous to 1837, there had scarcely been any frost in winter. In that season it was pretty severe and continued long in the spring. An opinion was thereupon formed and became universal, to the entire exclusion of all further inquiry, that the return of frost would cure the taint. In apparent compliance with this opinion, the taint did disappear that season; the plant appeared to have renewed its age; it assumed a healthy appearance as soon as it appeared above ground, produced flower, ripened seed, and the season proving favourable, there was a good crop everywhere.

The frost was then hailed as the sovereign remedy of the taint, to the total exclusion of every other theory that had been broached; mine was condemned amongst the rest, and I was often taunted with the question of *What is become of your theory now?* I replied that what had happened had effectually, and in a stronger manner than I anticipated, established my theory; and on the same principle I predicted that taint would reappear in the succeeding season of 1838, which it did. I might, therefore, establish a strong claim to the power of prophecy. But the truth is, no supernatural power is required to predict the future state of the potato crop. I have, in the following pages, laid down a plain principle, founded on natural laws, which, if adopted, cannot fail in a short time to make every one such a prophet as myself on that subject. When the nature of the potato is once fully understood, it can, to a certainty, be foretold any autumn, whether or not it will be healthy or diseased the following season. The

* These views appeared in a work with the rather quaint title of "The Potato rescued from Disease," published by Messrs Blackwood and Sons in 1837.

principle does not at all depend upon the absence or prevalence of frost. In the winter and spring of 1837–38 there was a most severe and long-continued frost, yet the taint appeared in the summer of 1838 very generally over the kingdom. In consequence, the frost is now considered an ineffectual cure. The taint is again pronounced inexplicable, and the question is a second time thrown open for discussion. I embrace the opportunity of again appearing in vindication of the opinions I have published.

It is now in my power to establish the truth of my theory on the evidence of facts which cannot be mistaken. The three last seasons, from the circumstance of their opposite qualities, acting by an opposite agency upon the nature of the plant, and producing opposite results, have afforded me conclusive evidence. My object is to lay before my readers, in the most explicit manner, the result of the experience thus fortunately obtained.

Decay, as the effect of age, was, at the first appearance of the taint, a very generally disputed point. I devoted a considerable portion of my former treatise in proving it and tracing an analogy betwixt the potato and plants of a similar nature. I endeavoured to shew that the seed from the flower was the only source of true and primary generation, and that plants produced otherwise, by cuttings, or any similar method, were not renewals by generation. Consequently, by a continued repetition of such means, the plants so wrought upon became old in constitution. That the secondary method of producing plants by cuttings, grafts, &c. is conducive to the profit and convenience of the cultivator there is no doubt; in fact, in some cases it is absolutely necessary and indispensable. But it is the province of the cultivator to take care of this accommodating provision of nature, and not continue it at any time to an undue period, for in so doing he will suffer the consequence of his avarice, by a progressive failure of produce. To render the taint in the potato at all explicable in accordance with the various phenomena, this inherent tendency to decay in the plant must be admitted as the primary cause of the disease. The truth of the possibility of deterioration is, I presume, now almost universally admitted. Its strict consistency with [illegible] *prima facie* proof of its existence.

The seed organs are given to plants for the performance of two grand objects, namely, the renewal of the plant, and its improvement by varieties, without which latter property there could be no change from the original. And what in this world of animal or vegetable nature is denied the possibility of progressive change? But it requires the ingenuity of man to turn that change into an improvement. If he neglect it, he must abide the inevitable consequence, the degeneracy and death of the most useful varieties of plants. In corroboration of this fact, I quote a very strong passage to the point from a late paper by Mr Johnson in this Journal:—"The unanimous experience of naturalists agree in testifying that every organised creature has its limits of existence. In plants it varies from the scanty period of a few months to the long expanse of as many centuries,—but of all, the days are numbered; and though the gardener's, like the physician's, skill may retard the onward pace of death, he will not be permanently delayed. In the last periods of life, they shew every symptom that accompanies organization in its old age, not only cessation of growth, but decay of former developments, a languid circulation, and diseased organs." I am fully satisfied in my own mind as to the indisputable truth of this doctrine. I remain no longer to prove it, it appears so plain a truth borne out by the undoubted universality of death.

That inherent decay in the potato is the primary cause of disease appears evident from the manner of attack uniformly followed by the taint. The effects of those attacks have been ascribed to various causes, but they are all of secondary importance. They have been ascribed to insects engendered in the sets; to insects in the ground from the absence of frost; to a deteriorated soil from too frequent cropping; to improperly prepared manure; to the aridity of the air during the time of planting; to heating or improper keeping of the sets after cutting and previous to planting; and to cutting the potato as an improper practice.

Now the taint in its operations does not originate in consistence with any one of these supposed causes. To suppose insects in the sets, is to suppose the tuber in a previously diseased state, and the disease to be the cause of the insects. This first supposition is confuted by the circumstance that where two or more kinds are planted in mixture some will entirely fail, whilst others will all grow. This phenomenon certainly shews that the primary cause of decay is in the root. How could it possibly happen that the insects would only select one kind, when the whole of the kinds were growing together the previous year, kept together, cut together, and planted together? The thing appears incredible; but, on the contrary, it supports the fact of a decay of constitutional strength.

Insects in the ground, encouraged by the absence of frost, is a supposition as ill supported. How is it possible that one drill should have insects so plentiful as to destroy the crop, and the next drill to be quite free of them? A field planted by various seeds presents various degrees of health, but each degree abides strictly by the kinds of seed, or different days of planting, or the different kinds of manure used. These results appear very unlike the work of insects in the ground. How is it possible that insects should be dispersed in regular stripes, the whole length or breadth of the field, strictly abiding by the drills, destroying the crop of three, six, or nine drills, and again leaving as many quite healthy? The thing is incredible. Besides it is well known that frost cannot deprive insects of life; it may retard their transformation, but cannot destroy their vitality. That a deteriorated soil, worn out by over-cropping, improperly prepared manure, aridity of air during the time of planting, or improperly kept cuts, may all be unfavourable to the health of the crop, and capable of acting as secondary causes of taint, afford nevertheless no evidence of each or either being the primary cause; on the contrary, their power upon the health of the plant clearly points out a diseased original, easily influenced by externally improper or incautious usage. The failure by cutting of the seed-tubers, which has been frequently, and even recently, held up as the whole cause of disease, I consider a most convincing proof of the decayable nature of the root. When any kind of potato is in youth, and in full possession of all its natural vigour, it may with safety be cut down to every eye, and they will all produce healthy plants, but as the kind becomes old, it loses its vegetative vigour, and will not grow if cut small. It then requires the combined strength of the entire tuber to produce a healthy plant. Nothing can [illegible] more forcibly than this the natural decay of the plant.

The potato is a plant from natural causes unlimited in variation. We have only to suppose any number of seedlings, the produce of one plant, say a thousand, or a hundred, and in every one of these is a certain variation from the original, and each individual from its fellow, yet all possessing a uniformity of family appearance as much as an equal number of animals, the offspring of the same parents. But they are not all possessed of equal qualities or of equal degrees of constitutional strength. Hence a careful selection is necessary to maintain the breeding of the root; but more is required, a studied cross impregnation of superior kinds, is the most likely method of procuring still more improved seedlings. The means of performing this ingenious process I have given in full in my former treatise.

In renewing the potato from seed, it is necessary, in order to insure success, or obtain improvement, that it be done in a proper manner. Not only the qualities of the kinds from which the seeds are taken, but also the healthy state of the plants, require special attention. And, besides all this, a most careful and scrutinizing selection of sorts, on comparative trials, is indispensable. A potato perfect in all respects has never yet been discovered, although Sir George Mackenzie, who appears to understand the subject thoroughly, has said that he does not despair of yet finding such a one. In my opinion, there is yet ample scope for every experimentalist to exercise his ingenuity in cultivating the potato. The desired qualities are a good shape, size, and colour, richness of quality for food, healthiness of constitution, abundance of produce, and such a medium of late and early properties as will render the kind suitable to various seasons and soils. The means to obtain these, are, by the inconceivable richness of creative wisdom, amply provided for in the vegetable creation. The vegetable experimentalist has only to imitate the practice of the most judicious breeders of stock, and observe with what precaution they select their males and females in health, youth, symmetry, and strength, and also the gardener in selecting choice fruits and flowers, from his countless progeny of varying seedlings. There is a strict analogy in all similar processes of reproduction, and those of the potato are not less worthy of attention than any of the rest.

It is not above twenty years, I suppose, since the dahlia was introduced into this country as an ornamental plant. It was then a very ordinary flower, but what is it now, after every Horticultural Society in the three kingdoms has, for a number of years, awarded premiums annually for its improvement! The beauty, richness, and variety of colour it has now attained is quite surprising. On the other hand, it is a mournful truth, that the potato, a useful plant, has been allowed to retrograde, when the dahlia, which is only ornamental, has been so much improved. Several individuals have raised seedling potatoes, a number of which I have seen give fair promise of health and increased vigour; but two material points have been entirely neglected, judicious selection, and the health of the plants from which the seeds were taken. One person said, so diseased was the crop from which he collected his seeds, that he had to travel over a large field to procure one small basketful of plums. Now this manner of proceeding will not do, for, as well may we expect to obtain a healthy offspring from very aged or diseased animals, as vigorous plants from a diseased potato stock. It is advanced as an objection against the decayable nature of the potato, that seedlings have failed in the third and fourth year, and that an effectual renovation of the potato is not attainable by such means. With as much propriety may it be advanced, that as infants frequently die of disease, it is hopeless to expect a new and healthy generation to succeed the present. The absurdity of such reasoning is obvious, for though the seed-organs are the natural and ordered source of generation for plants, and their renovation, continuance, increase, and improvement, depend upon them, yet the management of the cultivated species is placed under the control of man, and it is in his power either [illegible] assist or thwart nature. In order to the successful cultiva-[illegible] any plant, it is necessary that the cultivator understand [illegible]y the nature of the plant, and the principles upon which [illegible] depends. If he mistakes its nature in any essen-[illegible] he is like the physician who does not under-[illegible] [illegible]tution of his patient, and who, by improper [illegible], prom[illegible] than removes his complaint. The [illegible] from all other plants culti-[illegible] [illegible] long series of improper usage. The grains, grasses, beans, and pease, also the other roots, the turnips, carrots, beet, parsnep, and the cabbage species, are all derived directly from the seed every time they are raised, consequently every succeeding crop is a new generation; they cannot possibly become old, they have only this direct method of propagation. Their health cannot be influenced to such a degree by the treatment the parent crop receives the previous season as the potato can, which is only a continuation of the same plant, not a renewal by generation. Here, then, is where the potato differs from other plants, it is only a new plant when raised from the seed; it is the same plant continued when raised from the tubers. If these tubers are in any way improperly cultivated, and soils, season, climate, and manure, have each a certain control over the growth and maturity of the tubers, the health of the succeeding plants cannot fail to be affected to a greater degree than if the crop were raised from seed.

This peculiarity in the nature of the potato has been quite overlooked by several writers, who have recommended well ripened tubers for planting, not considering that there is no direct analogy betwixt seeds and tubers, and what is proper treatment for the one may be improper for the other. In nature I conceive them directly opposed, which I shall endeavour to shew. Suppose a new kind is selected from a stock of seedlings possessing superior merits, a careful scrutiny is required in order to insure a progressive improvement. It is evident that the new plant will progress through the successive stages of youth, maturity, and decline. In youth the plant will shew most vigour in stems, flower, and fruit (seed); in maturity, higher perfection as to quality, and in decline a deterioration. Thus there is a gradual progress from youth to age, quite perceptible in the potato, both in the appearance of the stems and the quality of the tubers. In youth they are green and juicy (watery), are not so good for food, but their vegetative powers are more active than at any after period. In maturity they become more dry, and in a better state for food. As they approach to age they become still more dry, and are still better for food, but their cultivation becomes more precarious, being more under the influence of seasons and soils. When the plant, from the weakening of its natural powers by age fails to produce the seed-organs fully, the tubers have then all the advantage of the juices, and consequently become more early ripe. The flower and seeds on the top, and the tubers under ground, are opposite drains, both drawing upon the juices of the plant at the same time. When the flower fails, then the tubers have the advantage, which will increase to great size, and, in dry seasons, on early light soils, will ripen soon, and be uncommonly dry and mealy in the eating. The tubers increasing in size, when the plant otherwise gives appearance of disease, has been laid hold of as a proof of the durability of the plant; but the enlargement is a consequence of the failure of the flowers, the first approach to decay. The late kinds thus assume the properties of early kinds, which do not produce flowers. But even this enlargement is not general in the old kinds; when the decay reaches a certain stage, then the crop fails very considerably, the stems become puny, the leaves shrivel, and the effect is termed the *curl*, a disease that has been long known in the potato, and many conjectures and reasons have been repeatedly formed of the cause of its prevalence. Suppose a perseverance in replanting the tubers of diseased plants, and the next stage is what is now known as the *taint* or *failure*, being an inability in the diminished vigour of the juices of the tubers to produce a plant.

I may now exemplify the influence of soils and climate. Suppose a farmer gets a quantity of a good new kind of potato in full possession of youthful vigour, and suppose he has two farms, one of a good rich early soil, not much above the sea, or banks of a large river, and the other of a cold late soil and high altitude, of 1000 feet above the level of the sea. Suppose [illegible] and grows a part on each of the [illegible] years, what will be the difference [illegible] grown on those opposite soils and [illegible]? The [illegible] warm climate will produce fine, [illegible] cold climate will [illegible] the farms will [illegible] ence points to the [illegible] pered the tubers, which will be hastened into a state of premature age, though but young in years. On the contrary, the same kind will remain quite healthy on the high farm, and a change of seed-tubers from them will produce a healthy crop on the low farm, when their pampered brethren will be sickly and dying. The proof of their healthy state will be found in the superiority of the green juicy tubers of the high land for seed, over the dry, well ripened, or overgrown ones of the low land. Where the potato is never over-ripened, or over-grown, it never shews disease, and will live in the enjoyment of good health to a very great age.

But should it be observed that this reasoning is entirely theoretical, I shall produce what experience shews is the case in reality. I shall for example produce a locality in a high altitude, where the soil is wet and cold, and inquire if there ever was any taint seen in such places? Of Leadhills it has been remarked as strange, that no taint has ever appeared there. Now, Leadhills is said to be one of the highest inhabited places in Scotland. The villagers cultivate small patches of potatoes, and in warm seasons have moderate, but never great crops. In wet cold seasons they have very poor crops. I visited the place myself in September 1838, and the crop, from the nature of the season, was truly very poor, none of the tubers I saw appearing to be larger than a walnut. But a change of seed-tubers from Leadhills has always been found to produce healthy plants, and for such purpose tubers have been taken as far as Glasgow and Kelso. The same thing is found in all places, although at much lower altitude, where the soil is cold and wet. No taint has ever appeared on the whole line of road from Leadhills to Edinburgh, with the exception of a little about Biggar, in 1836. Along this line the land is cold and late, and never produces great crops of potatoes, but they are always healthy. Similar results may be observed to occur in similar situations, and the effects of a change of seed from the high to low fertile lands is very striking. I shall adduce an instance from a narrative related to me by a gentleman in Edinburgh. His father, a farmer in East Lothian, changed the whole of his seed-potatoes, procuring the change from a friend who occupied a farm in a high district on Gala Water. The change was made after the dry season of 1826. The result was, that the crop from this seed was extraordinarily healthy and free of curl, whereas a considerable part of the same field planted by cottars, who used unchanged seed, was curled and unhealthy, and did not yield one-half the produce of the other. The farmer finding that the change had doubled his produce, continued to practise it ever afterwards. His success encouraged him to increase on his farm the cultivation of the potato, and he sold by auction about four acres annually for several years, at from L.20 to L.30 per acre, while other fields in the immediate neighbourhood, of equal or superior quality, bore so unhealthy crops from the curl, that they did not sell for more than L.10 and L.12 per acre. He continued regularly changing the seed while he remained on the farm, but he never understood the principle upon which his good crops were secured.

The influence of seasons may thus be exemplified. Suppose two seasons, the one dry, hot, and early, and the other wet, cold, and late, what will be their effects? The hot will produce dry well ripened tubers, and all old kinds, which are from age naturally losing their juices, will be more readily over-ripened, and become extraordinarily dry. The cold season will produce, on precisely the same soil, and of the same kinds of potatoes, green unripened tubers; and even the most juiceless old kinds will be green and watery. Thus, opposite seasons produce opposite qualities of tubers, which of the two, then, will produce the most healthy plants and general good crop in the following season? The generally adopted opinion would answer for the ripe tubers; but experience, which is infinitely superior to opinion, says the contrary. All kinds of potatoes are invigorated after a wet, late season, [illegible] instance should convince every cultivator, that green [illegible] contrary to, but quite consistent [illegible] require to be artificially [illegible] health of his [illegible]

Pl[illegible] can be made to the seasons in proof of the fore[illegible] 1830 was a very wet and [illegible] son; taint or disease of any kind was not heard of in the crop of 1831, which was remarkably healthy and abundant all over the kingdom. But 1831 was the first of five *dry* seasons that followed in succession. They were not only dry and early, but possessed superior ripening powers; so much so, that the grains of those years weighed, on an average, from three to four pounds per bushel more than had ever been produced in Galloway; but all those years produced tainting tubers. Again, 1836 was a very wet summer and harvest, and it restored the potato, although very much worn out on early and fertile soils, by the enervating influences of a succession of warm summers, each increasing by so many degrees the weakening effects of its predecessor. The taint observed a strict conformity to the degrees of the cause; for it regularly increased in each of the five years. The crop of 1837 was generally very healthy and abundant; but that was again a very warm summer, and the autumn continued to encourage growth, and was free of frost, until the end of October, when the potatoes on early and fertile soils were either over-ripened or over-grown. The potatoes were again tainted in the crop of 1838, which was what I clearly foresaw and foretold would be the case, and was laughed at for my pains by very wise people. The summer of 1838 was again wet and late, and over-ripening or over-growth was generally checked by an early autumnal frost. Accordingly, the crop of 1839 has proved generally healthy. And to pursue the consequences a little farther, I may safely predict, that as this season has been favourable to the growth and well ripening of the potato, with a healthy plant from last year's green tubers, in the low and early soils, so the seed tubers used from this crop in those situations next year will run the risk of failure; whereas, on the contrary, as the crop in high cold situations, from the lengthened effects of rain, is still green and not well ripened, it may be expected that the tubers from such situations will make the most secure seed next year.

No doubt, the present season affords some slight instances of taint, owing to the effects of a very dry spring. Had the seed been as weak this season as it was in spring 1836, there would have been an alarming extent of taint in all the fields planted after the 20th of May; and the taint, such as it is, has been confined to the oldest kinds of seed. Hence to the pink-eyes, old blues, and flat reds, being the oldest in this district, the failure has been chiefly confined. Thus, three times during the last nine years have healthy crops of potatoes succeeded wet seasons, and six times have unhealthy crops succeeded dry seasons.

The influence of the hotness or aridity of the air during the time of planting also requires attention. This influence is only of a secondary nature. It has no power over young, green, juicy cuts, and it is only when the tubers are dry and juiceless, and their vegetative powers in an exhausted and languid state, that they are susceptible of being so affected. To counteract this influence, the farmers are in the practice of planting at an early or late hour of the day, to avoid the heat; or they improperly take the advantage of wet weather. The evil would be much more effectually prevented by the simple process of steeping the cuts in water for twelve hours previous to planting. In this case, internal dryness of the tubers is the cause of the evil, and the water fills the pores of the cuts with such an abundance of artificial, in the absence of the natural, juice, that it has power to resist external drought. A little lime infused in the water has the effect of exciting vegetation, and should not be omitted. By this simple process, all tubers that are not in a very bad state may be saved. But this is not going to the root of the evil: it is only like a physician giving temporary relief to an incurable patient.

A few inquiries, which may be readily answered by every farmer of experience, will still further explain the nature of the disease, and prove its connection with a natural law. First, When and where has the disease in the potato prevailed, and what kinds of [illegible] have been most liable to decay? *When* [illegible] [illegible], and otherwise growing season has [illegible] prevails, a good, rich, low, early [illegible] to climate it is only found [illegible] failure, are only those [illegible] not pos- [illegible]

[illegible] them

selves on the opposite or negative side of the case, and are as readily answered from experience.—When, where, and what kinds of potatoes have resisted disease?—*When* disease does *not* prevail, a wet and otherwise unfavourable season for ripening has preceded it. *Where* disease *never* prevails, is on all cold, wet, poor, or sterile soils; on high or unfavourable altitudes, and where the climate is cold. The *kinds* that most successfully *resist* disease, are only new green kinds, full of youthful vigour, or kinds possessed of late properties, and such as do not over-ripen, when season, soil, and situation all prove conducive to that end.

There are next a few particulars connected with the natural habits of the potato that require special attention. The potato being indigenous to a much warmer climate than ours is, requires care in suiting our management to its proper culture. Accordingly, one important requisite to be observed in its culture is not to plant too early in the season: the sprouts will not push forward until the natural heat of the advancing spring sets in. The progress they generally make before the first of May is very trifling. This is so far well on two accounts; first, it affords time for cleaning and pulverising the soil,—a most essential requisite in the cultivation of the potato; and next, the late advance of the shoots prevents injury from spring frosts. To plant early as a remedy against the taint, is, therefore, an improper recommendation; and those farmers who adopted it in the spring of 1837, had too much reason to repent of so rash a usage to so tender an exotic. It is because the potato only requires a short time to arrive at maturity, that renders it at all fit for cultivation in a cold and variable climate such as ours is. Three or four months of warm weather, devoid of frost, is sufficient for its growth. The warmer, then, the season, the shorter is the time the potato requires to arrive at perfection. But it does not stop when at this stage of perfection; it continues to increase in size, and over-grows itself when placed in favourable circumstances for growth.

The circumstance of the liability of the potato to over-growth here introduces itself for consideration. This is quite a new topic, which has hitherto been entirely overlooked by every writer on the potato. When I first broached the subject, I was frequently told, that the circumstance of the potato being a native of a warm climate would prevent its over-growth in our cold, variable climate. It appears to me, on the contrary, quite obvious, that it is the variable nature of our climate that promotes the over-growth.

All root productions are liable to over-growth, as witness the turnip, carrot, &c. and they are very much deteriorated by that tendency. It is remarkable, that this evil tendency to over-growth has been hitherto neglected, and its existence never once noticed. The fact is, no one ever thought of it further than that every one knows that potatoes are frequently too large, unsound in the heart, and, in that state, are of bad quality for food. In the autumn of 1837, the growth of the potato continued uninterrupted by frost until the end of October, and the consequence was, that whole fields, on certain kinds of soil, were very much over-grown. There are innumerable known instances to prove, that to the planting of sets from over-grown potatoes was the greater part, if not the whole, of the failure of 1838, and the general want of health in that crop, to be ascribed. In taking a retrospective view of past seasons since the commencement of the taint, I find every year of the taint was preceded by one capable of producing over-growth. I thus consider I have discovered a cause that will better account for the general prevalence of the disease, than any yet produced. I am astonished no cultivator should have discovered this sooner. In my former treatise, I gave precautions to guard against pampering the potato with too much manure on soils naturally rich and fertile, as it was on such that disease had first appeared. I then viewed over-growth as only a secondary agent in promoting the taint; but I am now convinced it is the most immediate cause of it. This tendency to over-growth affects all kinds, except those which are strong from the vigour of youth, or are in possession of very late properties, both which [illegible] ...ne, resist that tendency. But [illegible] on certain soils and in certain seasons [illegible] ...urs in high, cold situations, or on wet, or on [illegible] ...ar... or even on early or rich soils, in a cold, [illegible] ...ich. fertile soils, in warm, dry sea- [illegible] the middle or end of August; and should the weather continue good and free of frost, with frequent intervals of showers and sunshine, the growth continues until checked by frost. In 1837 was a recent example of this sort of weather, when numerous notices appeared in all the papers of very large potatoes, and great crops all over the country. But mark the effect: the overgrown and over-ripened tubers produced a very unhealthy offspring; as was witnessed in the tainted and sickly crop of 1838. Overgrowth is of little consequence in the turnip and carrot crops, as they are reproduced from the seed; but the potato being a reproduction from the tuber, its unsound state communicates its weakness to the succeeding crop. Here, then, is another argument for using green, unripened tubers for seed, and by such only can the potato be continued in health. By overgrowth or over-ripening, the natural juices of the plant are changed, and the change hastens the plant into a state of premature age, long before the period of its natural decay would arrive.

These remarks on the effects of soil, climate, season, and age, upon the potato, shew that a high altitude gives healthier tubers for planting than a low; a cold soil than a warm; a new soil than an old; a wet or early frosty season than a dry; new kinds than old,—because the former afford greener tubers than the latter.

A few instances of the propriety of using green tubers for planting may be adduced. This is the general practice in Argyleshire, though there its principle is not understood. The practice was discovered by accident, or rather forced upon them by necessity. Along the coast of that county potatoes are planted on sea-weed, and are always late planted—often as late as June. In these cases the crop is always late, and so bad for food that the potatoes often cannot be so used; but they have always been found to answer excellently for seed, which produces a much more healthy and abundant crop than that from the most ripened. To the same effect, an instance may be related of a farmer in Wigtonshire. He had a field to plant of recently improved moss land, of excellent quality, from which he expected a great crop. He was anxious to procure seed of the best description that could be got; and believing that well-ripened potatoes would make the best seed, he procured what he considered the requisite quantity, but finding a deficiency, he, at a later period, had to purchase another cart-load of such as could be got, and which he considered of very inferior quality, being small and green. Planting seed from a late crop, off a cold soil, and manured with sea-weed, he considered as equivalent to losing the crop, but he had no alternative. The result, however, was quite the contrary of his anticipations. The ripened seed produced a sickly and tainted crop, whilst that from the green seed was healthy, and yielded a great produce, much more than double the other.

The last instance I shall adduce to the same effect is from the experience of season 1836. A farmer on the water of Urr, a low, early situatiön, very subject to the taint, had a quantity of potatoes in the autumn, which were from a part of a field that had been planted a second time about the 1st of June. By a partial frost that passed along the river they were totally cut down when in full bloom, on the 20th of August. When taken up at the usual time, the tubers were found not more than a third of their usual size, and so green as to be entirely unfit for food. But as potatoes were scarce, and high priced that season, he was determined to turn them to good account. He pitted the whole for seed, mixing them well with earth to preserve them, as he dreaded they would not keep without such a precaution. When he opened the pit in April, he found them in an excellent state of preservation, just begun to vegetate. He planted them whole, as the greater part were too small to admit of being cut. They produced an amazingly healthy crop, which flowered in profusion, and yielded an excellent produce.

The inquiry at [illegible] arrived is, can we learn [illegible] not counteract the [illegible] preserve good old [illegible] state of health? [illegible] have our crops [illegible]—all healthy [illegible] appa- [illegible] our power. [illegible] she effects by her usual means as a cure for over-growth,—I mean by cutting off the stems. This process preserves the tubers green. It is a simple and easy means afforded by ever-bountiful Nature, of preserving the health of the potato in its original vigour for a time, although the kinds be old; but it would be folly to believe that the process can prolong the life of any kind of potato to a perpetuity. In adopting it, the cultivator just acts the part of the physician in keeping his patient healthy during the period of natural life.

I shall further observe in support of this practice, that green tubers, obtainable by whatever way, natural or artificial, are in substance much the same as new kinds, as the vegetative powers of both are nearly alike. Any person may prove this assertion by experiment, in the following manner: Suppose you have two kinds, one a new kind only three years from the seed, and another old kind of thirty years' standing. Plant a part of these in parallel drills on the same day; suppose the season does them all justice; take up the old kind fully one month before the new, and you will have both in the same consistency of greenness, and the following season the old kind will possess nearly similar vigour to the new. But reverse the case, and the old will either over-ripen or over-grow, according to the nature of the soil, and if planted the following season beside their young neighbours, will present a striking deficiency of health.

A discovery I lately made in the nature of the potato also proves the efficacy of green tubers on the health of the plant. In the summers of 1833 and 1834, it was generally observed that the potato plants were not producing flowers and seed, and also that they were becoming much earlier than usual. I could not then discover a satisfactory cause for this change. That the absence of flowers would render the tubers more early, I knew was explained by the late Mr Knight; but what caused the absence of the flowers I could not comprehend. This I found out by accident, in an experiment I made in the summer of 1836. I planted a basketful of the dwarf early kidneys in June, and took them up in August, and pitted them mixed with earth. I again planted them early in the following spring, cutting the sets very small, in order to obtain as many sets as possible. They all rose well, presenting a healthy green, and almost every stalk produced flowers, and several bore plums. I had never before observed the same kind of bloom, but the consequence was that the plants were fully two weeks later than usual. Having thus a proof of what would render the potato later, I considered that an opposite cause would produce an opposite effect, and which the experience of the late dry years fully confirms. Hence, by ripening the tubers well, the plant in the following season will be rendered more dwarf and early; for, by taking green tubers, a contrary effect had been produced. It was therefore the over-ripening of the tubers that prevented the potato plants from bearing flowers, as in the summers from 1831 to 1835, which being dry, produced weak seed-tubers, and as those five dry seasons followed in succession, the evil every year increased; but the wet summer of 1836 arrived, when Nature afforded green tubers to the whole country, and the crop of 1837 was consequently generally healthy, and the plants produced flower and seed as formerly. The same thing is perceptible in every field this season (1839), when all kinds of potatoes produced abundance of healthy blossom, and even the dwarf early kinds shewed more than the gardener desired, the consequence of which has been to make the crop more luxuriant, but later than he wished.

This other important inquiry now presents itself, By what means, natural or artificial, can the cultivator procure healthy tubers every season? The natural means are to procure seed-tubers from the descriptions of soils and situations where disease does not prevail, or to use either new and healthy kinds recently procured from seed, or very late kinds.

The artificial means are to plant a portion of the crop for seed, so very late that it will not have time to over-grow or over-ripen, or to take up as much of the ordinary crop so much sooner than usual that the tubers will be sufficiently green, or to cut down the stems whenever it is ascertained the tubers have grown to a good medium size. Select the tubers when they are in such a green state as to be exactly similar to those grown on cold, high situations, or such as have been checked in growth by an early frost. Imitate nature, and you cannot err. When nature performs this work she does it on a grand scale, cutting down, by one night's frost, the stems over the whole country ; but she more frequently performs in a partial manner, only cutting down a part on certain soils and in low situations.

There is, perhaps, no operation in the culture of the potato that requires nicer care than the procuring of green tubers in a warm season ; but it is quite practicable, and as it is a new operation, it will require both practice and careful observation to do it perfectly. When performed by art, it can be done at the precise time required, which is not always the case when nature operates. Of the three artificial plans I have prescribed, I would prefer the cutting down of the stems, and allowing the tubers to mature in the drills, until the ordinary season of taking up the crop, because the drills are the natural bed of the tubers, and the longer they remain in them the better, and the green stems may be turned to profitable account by feeding sheep. Sheep might be enclosed upon the field as upon turnips, the ground thereby enriched by them, and the following crop greatly improved. The sheep would not eat up the stems entirely, but they would crop the green tops and leaves as effectually as to stop the growth of the plant. It should be understood that I am only suggesting this new plan of using the stems of potatoes, as I have never seen it practised, though I think it is worthy the attention of agriculturists, and I hope they will try it.

The winter preservation in consistence with the nature of the potato also requires special attention. The potato is an underground production, and to attempt to keep it in a sound and healthy state, otherwise than in its natural element, is as unnatural as to propose keeping an amphibious animal in a healthy state from water. The common method of keeping potatoes during winter is by storing them in large heaps, covered with straw betwixt the potatoes and the earth. When taken out of the ground fresh and sound in October, potatoes will keep, laid together in a quantity, either in houses or large pits, for three months ; and if the winter is cold and frosty, perhaps four, or even five months. Three months are the utmost in ordinary seasons, beyond which period they begin to shrink and lose in weight, and otherwise become exhausted, and to shew a disposition to premature growth. Suppose, for example, when potatoes are put in a common pit, from five to six feet wide at the bottom, and heaped up to a ridged top, laid closely over with straw, and then covered up with eight or ten inches of turf or mould, they are entirely excluded from intermixture with the earth. Some writers have recommended leaving open air-vents in the pits, for some weeks after the potatoes are laid together, but nothing can be more inconsistent than this with the nature of the tubers. It is not when they are first put together that they heat or grow—they have then a sufficiency of internal strength to prevent either. But it is after they have been so stored for three months, after they have become more or less exhausted from want of support from their natural element, the earth, that they commence to grow, and next to heat, which still further promotes growth, and the heat is increased by coming in contact with the straw, which also becomes hot. Thus a very good hot-bed is constructed to continue and increase the growth, until the pit is opened in March or April, when the heap will be found a completely united mass of growths, with frequently a number of new tubers formed, of considerable size. So closely are the growths interwoven together, that they require to be torn asunder by force, and as every potato must be hand-picked, a great bulk of sprouts are thrown away, the whole substance of which has been extracted from the tubers, which, on trial, will in consequence be found to have lost a fourth or fifth of their original weight. Means more direct than these could scarcely be devised for the destruction of the vitality of the tubers.

The old method of winter preservation was to cover up the [illegible] or lazy beds in winter, and allow the tubers to remain [illegible] until the season of planting. A number of farmers [illegible] made an experiment of this kind in the autumn of [illegible] taken up in April following [illegible] having in every re[illegible] raised roots. But it would no[illegible] to recommend this plan, because it would [illegible] the succeeding crop, and it is not every season that produces no frost. Such a frost as that of 1838 would entirely destroy them. Now it is easy from the above data to devise a plan of keeping potatoes in consistence with their nature. Authors on gardening recommend that parsneps, carrots, &c. should be packed in sand, and kept in a damp cellar; and it is well known that when potatoes have been accidentally left in the ground, they never sprout until April or May. Keeping these facts in mind, this is the plan I would recommend of keeping potatoes in winter, and which is the same as I recommended in my former treatise.

Prepare a pit in a situation free from the possibility of retaining bottom water. Sink it a foot deep, if the soil will admit of it. The width may be from three to four feet. Spread a layer of potatoes along the bottom, not deeper than four or five inches; then throw over them a stratum of the dry well broken mould taken from the pit, then lay another layer of potatoes of the same depth, and more earth as formerly. Add a third or a fourth layer of potatoes, and finish with a gently rounded, not ridged top as usual, of a covering up of eight or ten inches of earth. Cut a trench along both sides of the pit to carry off any water. Be sure to have loose earth nearest the potatoes, and allow as much of it as possible to mingle with them. Take care that the potatoes be dry when so stored, having no wet earth adhering to them, as if laid past in a wet state they never keep well. Use no straw on the top, as I wish the earth above the potatoes to experience the changes of weather, to receive damp or drought alternately, in order that, as near as possible, their bed may resemble that in which they grew. It may be proper to notice that the nature of the soil where the pits are made, will, in some degree, determine the shape of the pit. If in very dry, free, or sandy soil, adhere strictly to the plan prescribed; but if on retentive soil, then ridge the pits more, and use a narrow thatching of straw along the top to turn off rain. The quantity of damp which the tubers require to keep up their consistence depends a good deal on the kind of soil in which they are imbedded. In times of extreme frost an upper covering of litter will be necessary, but it should be cleared away when the season for heavy frost is past, to allow the earth of the pits to be dried by the spring weather.

The winter preservation of potatoes for food is also a matter of considerable importance. When I formerly wrote on the subject, I had not then discovered the injury the potato sustains from over-growth. I recommended the potatoes for food to be fully ripened; I say so yet, but in a more guarded sense, as I have since learned by experience and observation the injury the potato sustains from over-growth. Guard against it therefore every season that has a tendency to promote it. Cut down the stems in good time, and allow the tubers to season in the ground a considerable time before taking them up. Over-growth injures the quality of the potato for food, more than any other kind of improper usage I know of. It causes them to become hard, and unequal in substance, unsound in the heart, very soon to rot in the pits, and to be entirely incapable of long keeping. The late and well growing summer and harvest of 1837 produced a great number of bad keeping potatoes. The same thing followed the five warm seasons from 1831 to 1835, during which period there was a very general complaint of the potatoes keeping ill. Potatoes intended for food during the months of April, May, and June, should be kept in earthed pits until the beginning of April, when they should be taken out, dried in the open air, spread upon a dry floor in an airy house, or on a boarded floor, frequently turned, and all growths rubbed off as often as they appear. If kept in this manner, they will preserve their original weight, which will richly repay for all the extra trouble incurred in storing them.

The last head I shall at present touch upon in connection with the nature of the potato, is its cultivation upon an improved system, of which I was the original proposer in my former treatise. My object then was to shew that the taint could be prevented by a certain kind of treatment, although the seed-tubers were in a precarious state of health. But I am now so much satisfied of the efficacy of green tubers in preventing disease in the potato, that I deem it less necessary to insist upon it. Still, I consider it may be highly useful on account of its affording a much better opportunity of cleaning and pulverizing the soil previous to planting. I have often heard the most absurd arguments advanced against cleaning potato ground, such as the want of time to clean a large quantity of land properly. I would say, plant only one acre well cleaned in place of two ill done. One acre well managed will at any time give a greater produce than two improperly done, and would of course be a great saving of seed, dung, and ground. By paying more attention to the cultivation of the potato, by work, as well as by care to the health of the plant, I am convinced that a double produce would reward the trouble. The potato is an indispensably useful plant, it is therefore an unpardonable crime to use it ill; and as no plant is more under the power of the cultivator, or will go farther in rewarding judicious labour bestowed upon it, let no due care be spared upon it.

The plan I propose is a modification and improvement of the preparation beds and transplanting process which I recommended in my treatise. There has been much difference of opinion in regard to the merits of early and late planting. They both have advantages and disadvantages. My plan aims at combining the advantages of both. In May, which may be considered late, the ground can be effectually cleaned of root-weeds and well pulverised; but April has also its advantages, the crop becoming sooner ripe, is in less danger of being injured from early autumn frosts. The proposed plan affords time, and permits the cleaning and manuring operations to go on during the driest weather the season affords, and still secures the advantages of early planting, as the plants will advance faster in the beds than in the drills.

Select a piece of dry ground in a securely fenced place. When required on a large scale, as will be the case on extensive farms, lay off the ground in beds of five feet in width, with alleys of two feet. Use a garden line and lay them off neatly. From the alleys take earth to cover the surface of the beds, taking care to raise them a little in the middle. A quantity of fine compost earth, consisting of a mixture of moss, earth, and ashes, with a small portion of lime, and enriched with pourings from the dunghill, answer excellently as a covering for the beds. About an inch of this spread both below and above the cuts would very much accelerate their growth and vigour. But when it cannot be conveniently composed, the common earth may be used. The beds may be made in a convenient part of the field, in which the potatoes are to be planted. The beds being thus in readiness, cut the seed potatoes. With the first cut, take off about the fourth part of the root end, and lay it aside for the pigs; and divide the rest into pretty large regular cuts. My reason for rejecting the root end of the tuber is, that in vegetation it is not so strong as in the cuts from the top end. In summer 1838, I examined some drills which had partially failed, and found all the dead cuts were from the root end; had this simple precaution been attended to, there would therefore have been no failure in that, and perhaps in many other cases. The cuts being prepared, proceed to lay them two in depth regularly over the beds. Spread an inch of compost or fine loose earth over them. This done, if the weather be dry, water them well, with a watering-pan, in order to wash the compost or earth amongst the cuts, the quantity of water being regulated by the state of the weather. After the watering, give them another covering of earth, in all about three or four inches in depth. Farther watering will only be necessary if the weather is dry. The chance of the seeds springing in the beds, even should they be diseased, is ten to one compared with the ordinary method. Should the weather prove dry, abundance of moisture can be communicated at any time, and instead of a parched soil robbing the cuts of moisture till they are quite shrivelled, as vas the case with those during the intense drought of May .836 [illegible] either by the fat juices of [illegible] them to remain in the [illegible] ground.

[illegible] to are the field-operations. [illegible] weather in spring as often as [illegible] requires, and gather and cart off or [illegible] When sufficiently [illegible]ked like turnip [illegible] it in in the usua[illegible] and to [illegible]ervation [illegible] the soil in a loose state, choose the driest weather the season affords. The drills should then be either harrowed lightly, or rolled according to the nature of the soil and the state of the weather. If the weather is very dry and the soil rough, a good rolling will bruise the lumps and press down the dung in the drills, both of which will be of advantage in the after operations. Then earth up the drills, laying all the earth to them that can be conveniently moved. Again give the drills such a harrowing as will reduce them down to within a few inches of the dung. The field being now ready for transplanting, choose mild weather. If there has been rain, between the laying on of the dung and the last ploughing, the soil and manure will be incorporated together, and in a proper cool state to receive the cuts ; but if there have fallen no rain, and the ground is very dry, the transplanting should be deferred until after rain has fallen. Any time during the latter end of May, or until the 10th of June, will suit for transplanting. The cuts should be carefully turned out of the beds with a potato grape, lifted as carefully, the loose earth shaken off, put into a cart and placed at convenient distances in the field. In the same morning a plough should run up the centre of each drill fully as deep as the dung. I prefer a small quantity of dung being turned up, rather than not have the drills deep enough. The cuts being put into hand baskets, immediately proceed to plant them by placing them with the sprouts uppermost against the perpendicular side of the furrow, at six or eight inches asunder. Then with the plough lay a gentle furrow to the cuts, taking care not to cover up their tops, and the operation is finished. A few people will thus go over a large quantity of ground in a day.

The extra trouble of this method is not so great as may at first sight be supposed. During the time of putting in the dung, no delay will be occasioned on account of planting. All hands could be set to that particular work and proceed in safety during the driest state of the weather. Extra dunging of potatoes is, however, very bad economy in farming ; to clean well, and manure in moderation, answer a much better purpose. All the hands could then be set to the transplanting, by which method there will be no dread of losing the crop, for the cuts being put into the ground well rooted, will soon catch the dung, and be capable of supporting themselves.

At the proper season have the earth pared off the sides of the drills with the small plough, and the spaces between the plants hand-hoed. Pass the drill-harrow once or twice along the spaces to pulverize and level the earth. At the proper time earth up the drills, and the whole process is finished.

Although I recommend this plan, I am not sanguine enough to expect it to be universally adopted. In cases where the soil is free, and easily cleaned, the old plan of planting the cuts with the dung may still be followed. But in every case I insist that the cleaning and pulverising of the soil previous to planting be more attended to than it is usually. It should be borne in mind, that planting early, or during wet weather, has the bad effect of stiffening the soil; and compressed soil, to an underground crop, is anything but conducive to its prolificacy.

A short recapitulation of the principal incidents which have been alluded to may prove not uninteresting to my readers. By observing the effects of seasons and soils upon the health of the potato, I was progressively led to certain discoveries, which are calculated to shew the cause of disease, and also to indicate its remedy. I found that warm and early seasons produced, on early, light, or sandy soils, over-ripened, and, on damper and richer soils, over-grown tubers. I found, from experience, that either of these two extremes pushes the potato into a state of premature age; and, if the crop grow at all in the following season, it will be diseased, but the root becomes earlier. Thus, I observed, that to render any kind of potato more early than usual, ripen it well, or let it overgrow the previous year, and the object will be attained, but at the expense of the health of the plant.

I found, on the contrary, that tubers, unripened or not overgrown from the effects of seasons or soils, are rendered later than usual. This treatment returns the potato from disease to health. It acts as a temporary renovator; the stems again assume the healthful appearance of youth, the opposite of what they do in the former case; and the seed-organs take precedence of the tubers.

This is, as it were, the *point d'appui* from which to direct the successful cultivation of the potato. It enabled me to shew both what promotes and what prevents disease. It exhibits a property in the nature of the potato that renders it subservient to the will of man. He has only to exercise his power of discernment in order to preserve the health of the plant, independently of the influences of seasons and soils. It is one of those wonderful provisions of Infinite Wisdom designed for the benefit of man.

The cultivator must discern the nature of the soil he cultivates, which may be grouped into three classes, *first*, light, sandy, or very dry soils; *secondly*, damp, deep, or strong earthy or loamy soils; and, *thirdly*, cold, wet clay, or newly broken up moss or muiry soils. The next thing is the climate; it is governed by the altitude and sheltered situation. The last and most important consideration is the season, whether wet or dry, late or early, temperate or frosty. Suppose the season is wet, it will also be late; the potatoes will be green in harvest, and such seasons are the most apt to be visited by early frosts. Should any appear, and cut down the stems, then the cultivator has nothing to do, nature having performed for him; and it is only necessary that he take up such a quantity of the crop, as will be sufficient for seed the following spring, and have them carefully stored in the manner I have described. This natural operation will have effect upon all the three classes of soils, but in degree it will have the least effect upon the first, more upon the second, and most upon the third.

Suppose the season is dry, it will be both warm and early. This is the weather the plant affects; but in it is required considerable attention to prevent over-ripening and overgrowth. The cultivator must interfere, and the first class of soils requires earliest attention. On it take up the seed crop about the end of August, or cut down the stems, when the tubers are quite green. On the second class of soils, take up the crop, or cut down the stems about the middle of September, or before the tubers become very large. On the third class of soils, the season will be very dry, if the crop is in danger; but should any thing like over-ripening or over-growth appear, let it be guarded against by removal of the crop. Neglect on no account the proper performance of these plain injunctions, and preserve the tubers in all cases in earthed pits, and I consider little danger of disease of any kind in the future crop is to be apprehended.

These precautions must be attended to every year, as long as there are old kinds of potatoes in cultivation. Healthy new kinds will not require them for a time, but hot seasons have the effect of hastening them very soon into premature age. I would, however, say, that as these precautions are so easily exercised, and at no extra expense or trouble, to make sure, let them be attended to in all cases.

By the experience of the present season, however, it appears that certain precautions are necessary to be observed at the time of planting. Even should the seed-tubers be well preserved, they may fail to vegetate, by planting them during very dry weather, or at a late period of the season, when they may have become much exhausted by long keeping. To effectually avoid this risk, I would recommend following the plan of transplantation which has been already so fully described. Have in readiness a quantity of spring cuts, or use only entire tubers of a medium size. Old kinds, when well preserved, as has been clearly shewn in a number of cases this season, will grow and produce healthy plants from cut-sets, when planted during mild weather in April, or early in May, but will fail when planted in hot dry weather in the middle of May. Avoid, then, cutting and planting in the usual way, particularly with old kinds of potatoes.

...OILS.

... Member of the ... Hort. ... Society.

... to the ad... have been princi... effects produce by the subsoil, or Deanstonizing system of tillage, so named from being first employed, or at least first brought into general notice, by Mr Smith of Deanston, in Stirlingshire, when he was examined, in 1836, before the Agricultural Committee of the House of Commons. By this system, by means of a subsoil-plough, of which there are several kinds, the subsoil, or under crust of earth, is merely broken and pulverized, say to the depth of from eighteen to twenty inches, without being brought to the surface, or mixed with the upper soil; and it is only after a lapse of four or five years that a portion of the previously disturbed substratum is found, by experience, in a state to be advantageously (by deep ploughing) brought to the surface, it being in this time, by the action of the atmosphere, and perhaps by a partial mixture with the surface-mould, rendered sufficiently friable and fertile. It is of necessity a consequence of this subsoil-ploughing, that the permanent drains of all lands thus cultivated must be constructed rather deeper in the soil than is usual with farmers: the top of those of Deanston are placed at a depth of twenty-two inches from the surface, so as to be completely out of the way of the subsoil which the plough has turned over.

In this instance, as in most other novel agricultural efforts, the zeal of its promoters has sometimes carried them too far; they have even confidently contended, that in most situations, subsoiling will render draining unnecessary; a result which would hardly have been arrived at by the most sanguine subsoiler, if he had paused to recollect that deepening the soil, however it may promote the absorption of atmospheric moisture, can in few situations enable land springs, and stagnant waters, to escape. The object to be obtained by these operations are, in fact, diametrically opposite. The one is adopted to increase the gradual healthful supply of food and moisture by the earth to the roots of the crop, in the degree the most grateful to its habits. The other expensive practice is, to remove that moisture, when (from whatever cause) it becomes too abundant for healthful vegetation, and this removal can only be obtained, in very peculiar situations, by the mere use of the subsoil-plough, and that to a very limited extent, such, for example, as when the crust, or subsoil, is of such a degree of thinness, as to be completely penetrated by the plough; and thus the upper soil, brought, by breaking up the separating crust, into immediate contact with a substratum of earth, of greater water-absorbing properties than the pan-crust, which has hitherto separated them. Lands like these, however, are not very common, or of any considerable extent.

I propose, in this paper, to examine first, what is the chemical effect of the atmosphere upon the broken-up subsoil; secondly, how that substratum is thus rendered more serviceable to the plants growing upon it; and thirdly, the testimony of practical farmers, which has been produced on the question. In entering on the investigation, I will suppose, for the sake of the argument, what is pretty commonly the case, that the chemical composition of the subsoil, and that of the surface mould, is chemically nearly the same, each containing very similar proportions of the earths silica, alumina, and carbonate of lime, and that the surface-soil possesses merely the largest portion of decomposing organic remains. And yet, although this conclusion is one that is very usually correct, yet it is by no means universally the fact, for not only does this dissimilarity of composition, in many cases, appear on a chemical examination, but the practice of many farmers supports the results of a chemical analysis; thus the spade cultivators find, almost always, the advantages of trenching the soil, and in most districts, "a thin-skinned soil" is but another way of describing its poverty. Then, again, the farmers of the chalky soils of Sussex, Dorsetshire, Wilts, and Hampshire, very advantageously raise the substratum of chalk, existing under their lands, and spread it in considerable quantities on the surface. The farmers of Essex and Suffolk in many places do the same, with the under stratum of clay or marl on which their surface-soils immediately rest, and they find this a very profitable practice, because the earths, which constitute all fertile soils being also the necessary constituents of the commonly cultivated grasses, are gradually and incessantly carried off from thence by continual cropping, and consequently in time an advantageous opportunity is afforded for their being replenished with the earths, perhaps contained in the subsoil, in which they may have become deficient. This essential presence of the earths in the commonly cultivated crops, is much more considerable in amount than is commonly imagined, as will be understood by the result of an analysis of two pounds of each of the following seeds, and of rye straw, the products of earths and metallic oxides from each, being given in grains.* From this little table the farmer will not fail to observe, how extensively the earths are absorbed by his crops, and how steadily they are carried away from his lands by all cultivated vegetables:

	Wheat.	Rye.	Barley.	Oats.	Rye Straw.
Silica,	13.2	15.6	66.7	144.2	152.0
Carbonate of lime (chalk),	12.6	13.4	24.8	33.75	46.2
Carbonate of magnesia,	13.4	14.2	25.3	33.9	28.2
Alumina (clay),	0.6	1.4	4.2	4.5	3.2
Oxide of manganese,	5.0	3.2	6.7	6.95	6.8
Oxide of iron,	2.5	0.9	3.8	4.5	2.4

These facts cannot be too carefully considered by the agriculturist, for he will remember that whatever powers, real or imaginary, a plant may possess of absorbing and decomposing water, the gases of the atmosphere, or those evolved during putrefaction, so as to form purely vegetable substances, yet the most profound philosophers have never concluded that they possess the magic property, by such combinations, of forming the earths, alkalies, and metallic oxides, which are as invariably and as essentially the constituents of plants, as the carbon, the hydrogen, and the oxygen which abound throughout the vegetable world. The first great class may, and most certainly are, absorbed from the atmosphere and from water, and formed into new combinations by some mystic process of the plant, but the earths can only be absorbed from the soil.

The chemical effect of pulverizing and breaking up a subsoil, is certainly advantageous to the plant in two ways, besides others with which we are very likely at present unacquainted, first, it renders the soil penetrable to a much greater depth by the roots, or minute fibres of the plant, and consequently renders more available any decomposing matters, or earthy ingredients, which that substratum may contain; and secondly, it renders the soil much more freely permeable by the atmo-

* Schrœder Gehlen's Journ. vol. iii. p. 525.

sphere, rendering, in consequence, a greatly increased supply not only of oxygen gas to the roots of the plants, but also yielding more moisture, not only from the soil, but from the atmospheric air, which moisture, let it be remembered by the cultivator, is in all weathers as incessantly absorbing by the soil as it is universally contained in the atmosphere, abounding most in the latter, in the very periods when it is most needed by the plants, that is, in the warmest and driest weather. This property possessed by the soil of *absorbing* moisture from the atmosphere, and the importance of increasing that power by pulverizing the soil, is not nearly so well understood as is desirable, although the farmer has the means of convincing himself of the fact by the most simple experiments. It is, in truth, an almost unfailing test of the comparative value of soils, as was long since observed by Sir H. Davy, a conclusion in which I have often had occasion to agree. "The power of the soil," says this great chemist, "to absorb water by cohesive attraction, depends, in a great measure, upon the state of division of its parts; the more divided they are, the greater is their absorbent powers. The power of soils to absorb moisture from air, is much connected with fertility; when this power is great, the plant is supplied with moisture in dry seasons, and the effect of evaporation in the day is counteracted by the absorption of aqueous vapour from the atmosphere by the interior parts of the soil during the day, and by both the exterior and interior during the night. The stiff clays, approaching to pipe-clays in their nature, which take up the greatest quantity of water, when it is poured upon them in a fluid form, are not the soils which absorb most moisture from the atmosphere in dry weather; they cake, and present only a small surface to the air, and the vegetation on them is generally burnt up almost as readily as on sands. The soils that are most efficient [illegible]n supplying the plant with water by atmospheric absorption, are those in [illegible]hich there is a due mixture of sand *finely divided,* clay and carbonate of [illegible]me, with some animal or vegetable matter, and which are so loose and [illegible]ght as to be freely permeable to the atmosphere. With respect to this [illegible]uality, carbonate of lime and animal and vegetable matter are of great [illegible] in soils, they give absorbent power to the soil, without giving it like[illegible] sand, which also destroys tenacity, on the contrary gives [illegible] power. I have compared the absorbent powers of [illegible] moisture, and I have always four[illegible] [illegible] soil[illegible] [illegible]hat it affords one method of judg[illegible] [illegible] celebrated [illegible] fro[illegible] [illegible] of finely divided matter, of which eleven parts were carbonate of lime, and nine parts of vegetable matter, when dried at a temperature of 212°, gained in an hour by exposure to air saturated with moisture at a temperature of 62°, eighteen parts. 1000 parts of a very fertile soil from the banks of the river Parret, in Somersetshire, under the same circumstances, gained sixteen parts. 1000 parts of a soil from Mersea, in Essex, worth 45s. per acre, gained thirteen parts. 1000 parts of a fine sand from Essex, worth 28s. an acre, gained eleven parts. 1000 of a coarse sand, worth 15s. per acre, gained only eight parts. 1000 of the soil of Bagshot Heath gained only three parts."*

And this absorbent power of atmospheric moisture is not only an inherent property in all fertile soils, and a property which is increased by their pulverization, but it exists in a still more remarkable degree in the commonly employed manures of the cultivator, and that, too, nearly proportionate to their commonly assigned value. The following are the results of my own experiments: †—" 1000 parts of horse-dung, dried at a temperature of 100°, absorbed, by exposure for three hours to air saturated with moisture at 62°, 145 parts. 1000 parts of cow-dung, under the same circumstances, absorbed 130 parts. 1000 parts of pig-dung absorbed 120 parts. 1000 parts of sheep-dung absorbed 81 parts. 1000 parts of pigeons' dung absorbed 50 parts. 1000 parts of a rich soil worth two guineas per acre, absorbed 15 parts."

This attractive power of the earths, and of manure, from the moisture of the atmosphere, is one of the most important facts to be kept in mind by the farmer, when he is considering the pulverizing and deepening his soils. It is also a property which all plants possess in a certain measure, but some in such a perfect degree, as to depend entirely upon it for all the moisture they need. Thus, the Aërial Epidendron (*Epidendron flos aëris*), is often employed by the natives of the east, on account of the elegance of its leaves and flowers, and the exquisite odour which it diffuses, as an ornament, suspended by a silken cord from the ceilings of their rooms where, from year to year, it continues to vegetate, putting forth new leaves, new blossoms, a new fragrance, entirely supported by the moisture and gases of the surrounding atmosphere. Many of the native plants of the east nearly support themselves in the same way; some of the mosses of this country almost do the same.

The quantity of water consumed by plants when in a state

* Lectures, p. 182. † Essay on Salt, p. 19.

of healthy vegetation, is in fact so great, that, if it was not for the gentle steady supply thus imperceptibly furnished to the soil by the atmosphere, vegetation would speedily cease, or only be supported by incessant rains. Thus, Dr Hales ascertained that a cabbage transmits into the atmosphere, by insensible vapour, about half its weight of water daily; and that a sunflower three feet in height transpired in the same period nearly two pounds weight.* Dr Woodward found that a sprig of mint, weighing 27 grains, in seventy-seven days emitted 2543 grains of water. A sprig of spearmint, weighing 27 grains, emitted in the same time 2558 grains; a sprig of common nightshade, weighing 49 grains, evolved 3708 grains; and a lathyris of 98 grains emitted 2501.†

It has been shewn by the experiments of M. Saussure with some sprigs of peppermint, that, when supplied with pure water only, and allowed to vegetate for some time in the light, that they nearly doubled the portion of carbon they originally contained.‡ This they could have procured only from the atmosphere; and, under these circumstances, there is now little doubt of the correctness of the conclusion of M. Berthollet, that plants, by means of their leaves, have the power of decomposing the water, as well as the carbonic acid of the atmosphere, and furnishing with these elements new combinations. How essential a free access of the atmosphere is to the roots of plants, was long since shewn by M. Saussure, who found that oxygen gas is absorbed by the roots of plants, as well as by their leaves, and that it is at the roots united with carbon, and transmitted to the leaves to be decomposed. Even the branches absorb oxygen: in its absence flowers will not even expand.‖ The advantages of a free access of oxygen to the roots of plants, has been still further shewn experimentally [illegible] that their vegetation is greatly [illegible] with water impregnated with [illegible] of rain-water. Some [illegible] Mr Hill, demonstra- [illegible] oxygen gas being

[illegible] p. 193.

[illegible] p. 35[illegible].

applied to their roots. Hyacinths, melons, Indian corn, &c. were the subject of the experiments. The first was greatly improved in beauty, the second in flavour, the last in size, and all in vigour. This is another use of a free access of atmospheric moisture, for M. Humboldt has clearly shewn that a dry soil is quite incapable of absorbing oxygen gas. Now, it must be evident, even to the most listless observer, that the more deeply and finely a soil is pulverized, and rendered permeable, the greater will be the absorption of both oxygen and watery vapour from the surrounding atmosphere.

It is perhaps needless to prove that the roots of commonly cultivated plants will penetrate, under favourable circumstances, much greater depths into the soil, in search of moisture, than they can from the resistance of the case-hardened subsoil commonly attain. Thus the roots of the wheat plant in loose deep soils, have been found to descend to a depth of two or three feet, or even more; and it is evident, that if plants are principally sustained in dry weather by the atmospheric aqueous vapour absorbed by the soil, that then that supply of water must be necessarily increased, by enabling the atmospheric vapour and gases, as well as the roots of plants, to attain to a greater depth; for the interior of a well pulverized soil, be it remembered, continues steadily to absorb this essential food of vegetables, even when the surface of the earth is drying in the sun.

And by facilitating the admission of air to the soil, another advantage is obtained, that of increasing its temperature. The earths are naturally bad conductors of heat, especially downwards; thus it is well known, that, at the siege of Gibraltar, the red-hot balls employed by the garrison were readily carried from the furnaces to the batteries in wooden barrows, whose bottoms were merely covered with earth. Davy proved the superior rapidity with which a loose black soil was heated compared with a chalky soil, by placing equal portions of each in the sunshine;—the first was heated in an hour from 65° to 88°, while the chalk was only heated to 69°.* This trial, however, must not be regarded as absolutely conclusive, since the surface of the black soils naturally increase

* Elements of Agr. Chem. 178.

more rapidly in temperature when exposed to the direct rays of the sun, than those of a lighter colour. A free access of air to all soils also adds to their fertility, by promoting the decomposition of the excretory matters of plants, which otherwise would remain for a longer period, to the annoyance of plants of the same species.

To the truth of these conclusions and laborious experimental researches of the chemist, does not the practical testimony of the ablest cultivators of all countries and in all ages concur? Thus, in enforcing the advantages of rendering the soil more completely permeable by the atmosphere, nearly two thousand years since M. P. Cato asked the Italian farmers, "What is good tillage? To plough. What is the second? To plough. The third is to manure." Cato, however, mistook the cause of the benefit, for he says, "He who stirs his olive-ground oftenest and deepest, will plough up the very slender roots; if he ploughs ill, the roots will become thicker, and the strength of the olive will go to the root." * Virgil, where giving an erroneous explanation of the advantages of paring and burning, says, "The heat opens more ways and hidden vents for the air, through which the dews penetrate to the embryo plants." †

Do not, at this very period, Lord Leicester and all the best of England's agriculturists, find the greatest advantage from stirring the ground between their rows of drilled turnips, for the sole purpose of promoting the access of the air to their roots? And that, too, on soils where a weed is hardly to be seen? Is not one great object of fallowing to produce, by pulverizing and deepening the soil, the same result? Did not Jethro Tull labour long, and sometimes too sanguinely, [illegible] illustrate [illegible] same position? And does he not support [illegible] says, — [illegible] of instances, which con- [illegible] soil (be it rich or poor) [illegible] tillage. For [illegible] without dispute, that one [illegible] may have more internal superficies than a thous[illegible] cal feet o[illegible] same or any other earth tilled in the common manner, [illegible] I believe no two arable earths in the world do [illegible] one another [illegible] bical foot of the richest is not able to produce an equal quantity of vegetables, *cæteris paribus*, to twenty cubical feet of the poorest; therefore it is not strange that the poorest, when, by pulverizing, it has obtained one hundred times the internal superficies of the rich untilled land, should exceed it in fertility; or, if a foot of the poorest was made to have twenty times the superficies of a foot of such rich land, the poorest might produce an equal quantity of vegetables with the rich. Besides, there is another extraordinary advantage when a soil has a larger internal superficies in a very little compass; for then the roots of plants in it are better supplied with nourishment, being nearer to them on all sides within reach, than it can be when the soil is less fine, as in common tillage; and the roots in the one must extend much farther than in the other; to reach an equal quantity of nourishment, they must range, and fill, perhaps, above twenty times more space, to collect the same quantity of food. But in this fine soil, the most weak and tender roots have free passage to the utmost of their extent, and have also an easy, due, and equal pressure everywhere, as in water."*

And it is fortunately in our power to prove that a thorough subsoil-ploughing or trenching is a *permanent* improvement of the soil,—is productive of continued good results for a series of years after the operation has been performed. I have often had occasion to remark this in my own experience; and that how slowly ground which has been once disturbed acquires its original degree of solidity, every railroad contractor or builder can furnish satisfactory evidence. Neither are the good effects of this deep-soil cultivation merely dependent upon the effects of the manure being more deeply placed, or more widely diffused in the soil; the mere loosening and extended pulverization of any soil, is certain to render that soil more productive. It is seldom that any experiments can be carried on to any extent, which will prove this fact more conclusively than those made some years since by Mr Withers and other planters in Norfolk, with their timber plantations, of which, nearly in his own words, the following is the detail. In the year 1811, five acres of poor black sandy land were planted in the parish of Holt. The land had been recently inclosed from the common, and was covered with heath and whins. Scotch fir, and a proper assortment of deciduous trees, were planted in large holes. The fir succeeded pretty well, but the other trees made no progress; and although, he adds, "I yearly filled up the vacancies occasioned by death and decay, I found, at the end of four or

* Tull on Tillage, 43.

five years, that all the trees but the Scotch fir, with very few exceptions, were either dead, or in a dying state. I then had all the ground *trenched*, and all the vacancies filled up with oak, ash, chestnut, elm, and other trees, and I have kept it regularly hoed, and free from weeds ever since. The consequence has been, that the last-mentioned trees have made such a rapid growth, that I have been enabled to clear away the greater part of the fir, and the remainder must be taken out in a year or two, to give space for the other trees. One mountain-ash, which had escaped the deadly effect of the heath, whins (and iron-bound soil), gave a decided proof of the advantages of trenching and cleaning the land. This tree had barely kept alive, not making more than two or three inches of wood in a season; but in the year following the trenching, it threw out two leading shoots, the smallest of which, when cut off at Michaelmas, measured six feet two inches." In the spring of 1819, another piece of ground, containing half an acre, adjoining the five acre field, was planted with the same description of trees. "This land was trenched two feet deep, and has since been kept perfectly clean; and so great is the advantage of preparing the land properly, in the first instance, that the trees in this piece are now much superior to those planted eight years before, although the latter have had the benefit of hoeing for the last nine or ten years." *

Some plantations, made in the same years, adjoining those of Mr Withers, and on the same kind of soil, which is more like that of Bagshot Heath than of any other with which I am acquainted, entirely confirm the conclusions I have here drawn from those of the former. Mr Hardy's were planted in holes dug in the heath,—Mr Gurney's land was previously ploughed; both were planted with a good assortment of forest trees: but, at the expiration of three years, Mr Hardy, finding many of his trees dead, and the others making little or no progress, trenched the land, and filled up the vacancies, and has since kept it regularly hoed, and free from weeds;—his neighbour's land has been entirely neglected, and the heath and whins suffered to grow to the height of several feet; the consequences are, that while in the one (which is divided from the other only by the road) there is a fine valuable plantation, in the adjoining all the deciduous trees are dead, and nothing remains but Scotch and larch firs. Another experiment of Mr Withers, begun in 1823, on fifteen acres of the same land, is not so decidedly applicable to my argument, because he

* Memoir on Forest Trees, p. 7.

there employed a quantity of manure, yet it still affords a very valuable practical illustration of the advantages of pulverizing and subsoil-ploughing.

"I caused," he says, "the land to be double-ploughed, first with two horses, and then with four, following in the same furrow, by which means the soil was stirred to the depth of eighteen to twenty inches. I fortunately found the remains of an old marl pit in the field, from which I barrowed and spread twenty cart loads per acre. This I suffered to lie and pulverize all winter; and in the following April (1824) I spread twenty loads per acre of good rotten dung, ploughed it in, and planted the land with oak, ash, elm, chestnut, and black Italian poplar plants. They took exceedingly well, and many of them made vigorous shoots the first summer; the second year they nearly covered the ground; but during the next summer their growth was prodigious, many of the trees making shoots upwards of five feet long, and, upon an average, increased that year full three feet in height. The severe drought, which has burnt up trees on land in a foul and poor state, has had the effect of adding considerably to the growth of these. *They have never had the appearance of wanting moisture*, although not a drop of rain fell upon them for a period of several weeks during the very hottest part of the summer of 1826. This luxuriant growth I attribute to the deep ploughing,—to the highly manured state of the land, and to its being constantly kept clean *and loose upon the surface*, by means of the hoe; and I firmly believe, that, when land is in this state, the weather in England can never be too hot for forest trees." *

The experience of the great Scotch planters confirms all that is here advanced. Thus Sir Walter Scott himself,—no inconsiderable planter,—tells us, when speaking of manuring and fallowing the soil intended for plantations:—"Every plantation which the proprietor desires to see rush up with unusual rapidity, ought to be prepared by one of these methods; or, which is best of all, by deep trenching with the spade." † Scott, however, thought that the advantage of trenching woodlands ceased in ten or twelve years. "At a certain period the fibres reach the subsoil, which the spade or plough has not disturbed, and thus the final growth of the tree which has enjoyed this advantage, is often not greater than that of its neighbour, upon which no such indulgences were ever bestowed."

Granting that these conclusions of Sir Walter Scott were, in some instances, correct, yet still he has assigned to one cause effects which are more certainly attributable to another. In ten or twelve years the ploughed soil will, if undisturbed, gradually become very nearly, if not quite, as close as case-

* Memoir, p. 19. † Quarterly Review for 1829.

hardened, and as little permeable by the atmosphere as any of the unploughed soils. It will then be nearly equally ill supplied with moisture, by absorption, as that which has rested totally untilled. I am able, too, to add the testimony of Sir Henry Steuart to the truths I am endeavouring to illustrate. "Trees," he says, "more than agricultural crops, require depth of soil to raise them to perfection; . . . and as it appears plain, that, both in the north and in the south, the size of the wood will be mainly attributable to the depth of the soil on which it grows, it should be the chief object of the planter to promote that capital object. . . . Deepening can only be executed with effect by trenching or double digging (for the plough can do little in such a business); and pulverizing is naturally combined with that process. . . . Pulverization, or the mechanical division of parts, is applicable to all soils in proportion to their adhesive texture, as even the most siliceous, if not duly stirred, will become too compact and dense for the admission of air, rain, and heat, and, by consequence, for the free growth of plants. . . . Strong upland clays, not submitted to the plough or the spade, will, in a few years, be found in the possession of fibrous-rooted perennial grasses, which form a clothing on their surface, or of strong tap-rooted trees, such as the oak, which force their way through the interior of the mass. For these reasons, the first and great object should be to give scope to the young roots and fibres, because, without fibres in abundance, no woody plant can shoot freely and develope its parts, whatever be the richness of the soil. . . . Manure is ineffectual towards vegetation until it becomes soluble in water; and it would remain useless in a state of solution if it so abounded as to exclude air, for, in that case, the fibres or mouths of plants would be unable to perform their functions, and they would soon drop off by decay. . . . Let it be observed, also, that an open soil, besides being favourable to the transmission of nutriment to the roots of plants, is likewise favourable to their extension, and thereby enlarges the field, whereby nutriment is derived. Nor are these the only benefits resulting from a friable soil, for, in addition to its being the best adapted to supply vegetables with food, it is always most suitable for effecting those changes in [illegible] equally necessary to the preparation of such [illegible] substances, exposed to the alternate ac[illegible]t, and air, undergo spontaneous decomposi[illegible] of it, would not take place. . . . Soils [illegible] by aeration, and the free admission of the wea[illegible] This is generally considered as the princi[illegible]portance in gardening is proved by sum[illegible] Tull," (adds Sir Henry Steuart in all of [illegible] flourished about a century ago, been [illegible] at present [illegible]oved, he would not have [illegible]

He was unquestionably the first practical advocate for the power of pulverization, but he was deceived by its astonishing and various effects, without being able to perceive its limits. Hence, he was led into the erroneous belief, that pulverization could even supply the place of manures in farm management."*

I have quoted the experimental researches of these scientific planters at considerable length, because their examinations were confined to crops which were to be advancing to maturity for a series of years. Both the trenching and the hole-planting, when once completed, were to remain undisturbed and unmanured for a lengthened period. If, then, there was any advantage in subsoil-ploughing, or in pulverizing the soil, the trees growing upon it would certainly sooner or later betray the fact. And both Sir H. Stewart and Mr Withers concur in proving that they did so. The results of the latter gentleman's system of planting I have witnessed; and I have, on a very small scale, experienced the same advantages of trenching in my own garden and plantations.

With regard to field crops, the testimony in favour of subsoiling the same kind of light sandy soil is equally important and unanswerable. Thus, Sir Edward Stracey, the inventor of the Rackheath subsoil-plough, says, "I have broken up nearly 500 acres of heath land with the plough. My crops have been nearly doubled. The wheat produced on the land so broken up has been fine plump grain, weighing about 63½ lb. to the imperial bushel, has produced the best price in the market, where, before the deep ploughing, the same land scarcely produced the seed. The wheat was so poor and shrivelled, that nobody would look at it; and, as I had no manure to lay upon the ground, I can ascribe the goodness of the crop to nothing but the deep ploughing."†

And for heavier soils, the evidence in favour of subsoil-ploughing is nearly equally valuable. In the year 1838, an experiment was made by Sir James Graham, which is important in several respects. It was on a field of about eight acres, of the poorest and wettest land. "The surface-soil is about five inches deep of black earth, of a peaty quality. The subsoil is a weeping retentive clay, with sand and rusty gravel intermixed. This clay extends to the bottom of the drains, which are of tile, laid thirty inches deep in every furrow. This field was rented by the out-going

* Planter's Guide, 464.

† Brit. Farm. Mag. vol. i. p. 235.

tenant at 4s. 6d. per acre. It was in pasture of the coarsest description, overrun with rushes and other aquatic plants. After draining on one-half of this field, I used Mr Smith's subsoil-plough. On the other half I trench-ploughed to the depth of ten inches, by two ploughs following in succession. In the first part, not mixing with the surface any of the subsoil; in the last part, commingling the surface and the subsoil in nearly equal proportions. The whole field was heavily, but equally manured, and planted with potatoes; and though the potato crop, even on good land in this neighbourhood (Cumberland), was below an average, yet the crop in this field exceeded an average, and yielded about twelve tons per acre. The field is equally drained in every part. The crop was so equal throughout the field, that I am unable to pronounce positively which part was the best, but I am inclined to give the preference to that portion where Mr Smith's subsoil-plough was used." *

Such has been the effect of subsoiling on a retentive clay substratum. I am able to give, from the same Journal, an account of the result of the same operation on "a light sandy soil, from five to seven inches in depth, covering a stratum of hard gravel. This stratum varies in depth from eight to twelve inches; and below it there is a yellow sand, with a very slight admixture of loam." The experiment, which was very successful, was made by the Speaker of the House of Commons, Mr Shaw Lefevre, at Heckfield in Hampshire, in 1836, at an expense of 30s. per acre; and the effect upon the soil may be perceived, by contrasting its produce before and after the subsoil-ploughing.

Year.	Produce per Acre.	Year.	Produce per Acre.
1833.	Turnips, not quite 2 tons.	1837.	8 tons.
1834.	Barley, not quite 4 sacks.	1838.	10 sacks.†

It is always refreshing to find the observations of the farmers confirming the experiments of the chemist, as in those which have been [illegible] the Hampshire farmers, who find, in the retent[illegible] their stiff clay-formations, such as [illegible] when they are reduced [illegible] state, so that the atmo- [illegible] that then the sur[illegible] [illegible]ist, and continues [illegible] finely the soil is

[illegible]

divided, the more steadily moist the surface of the substratum becomes. The farmers of the chalk-formation in the same county also have remarked, in the wheat crops growing on the edge of chalk-pits, that as the soil near the edge of the pit becomes thus loosened by the removal of the earth, that then the roots of the wheat-plants growing in the immediate neighbourhood of the pits, elongate themselves in a remarkable manner, some of them reaching to a depth of three or four feet, and this, too, in the same chalk, of which the superstratum is principally composed. In this and similar instances, the extension of the roots of the plant in search of nourishment is well worthy of remark, as proving the efforts which a plant thus situated makes to acquire nourishment, which, in such instances, is most likely either moisture, or the gases of the atmosphere, since here we find, that the chemical composition of the substratum is very similar to that of the surface-soil. The required ingredient, therefore, could not be chalk or silica; and it is not likely that alumina was needed, from the small proportion in which it exists in plants. Decomposing organic matters must be nearly absent from the iron-bound substratum, so that atmospheric air and water were the only food of plants likely to be found by the roots of the wheat-plant in diving so deeply into the loosened chalk.

Such, I think, are the reasonable advantages derivable from the subsoiling system, benefits which, on most soils, must be more or less easily within the reach of the cultivator. It possesses, too, the great advantage of improving the land from its own resources. No other district need be impoverished, no expensive artificial fertilizers procured, to enable the farmer to render that portion of his land productive, which he may have hitherto neglected. He has only to avail himself of the advantages which the improved construction of agricultural machinery now offers for his service.

ON AUSTRALIA.

By Mr GEORGE MACKILLOP, Hobart Town.*

Although I am nearly at the antipodes, perhaps a few lines from me on the subject of these far distant colonies will not be without interest to many of your readers.

They know, probably, that the objects to which colonists in these regions usually turn their attention are—merchandize, whaling, and sheep-farming. On the first subject I do not mean to enter, as the details would probably fail to interest, and occupy more space than you could afford to give them; nor on the second either, as the process of fishing here is the same as in other parts of the world. My letter will, therefore, be confined nearly entirely to the prospects of the sheep-farmers in these colonies.

During the first two years, 1835 and 1836, that I resided here, I had many letters from persons in England, proposing investments of funds in sheep here and in New South Wales; but as young ewes, with fair fleeces, were then worth 40s. in Van Diemen's Land, and 50s. to 60s. in New South Wales, I could not recommend an investment of the kind.

The crisis, however, that lately took place in the English money-market, has been felt from Canton, in China, to the west coast of America, in short, wherever English commerce has yet found its way; and hence, even in this "Ultima Thule," the effects of that crisis are still pinching many an industrious colonist, though the storm with you has long since lulled into a calm.

In consequence of the great fall that took place in the value of colonial wool in England during the crisis, of the present great scarcity of money among the farmers here, owing to heavy redrafts on them from London, on account of their wool, shipped from this in the end of 1836, not having sold for enough to cover the bills of exchange they had drawn against it, and to the low prices they obtained here for their wool of 1837, and to the consequent depression that has taken

* This is the paper which should have reached us from Mr Mackillop before the one that appeared in the last number of this Journal.—EDITOR.

place in the value of all descriptions of live-stock, many of the farmers are now obliged to sell part of their flocks to meet their pecuniary engagements, and hence young ewes, such as were in 1836 worth 40s. are now to be had here at 15s., and at Sidney and Port Phillip are, or were lately, to be had at 20s.

This state of things, it must be obvious, is very favourable to any one now commencing sheep-farming, as they can scarcely go lower, but will, on the contrary, most probably increase in value, as soon as the wheels of commerce in England begin to move again with their usual rapidity.

There are not many sheep at present in the new colony in Spencer's Gulf, the colonists there not having as yet generally turned their attention to this branch of farming. The voyage, too, from this, or Georgetown, at the mouth of the Tamar, to Adelaide, being rather long for sheep stowed closely together, and the wind often unfavourable, as many as 50 per cent. of those which have been shipped from this island, are said to have died on the passage, or immediately after their arrival. The pasture there, however, is generally described as excellent; and if all that is stated in a pamphlet lately published by Captain Sir John Ross, of North Pole celebrity, on the subject of the improvements that have lately been made in the different parts of the machinery of steam-boats be realized, and the five large steamers (the property of a company in London) now shortly expected in these colonies from England, come out, fitted up with these improvements, there will be no difficulty, nor great risk nor expense, in supplying the colonists at Spencer's Gulf with all the sheep they may be willing to pay for, either from this island or Port Phillip.

There is coal in many parts of this island; but this government having managed to supply Hobart Town with coal of pretty fair quality for household purposes from the penal settlements at Port Arthur, near the mouth of this river, coal fit for steamers has never been sought for, but will most probably be found as soon as it may be actually required. When, in 1826, the New South Wales government sent a colony to Western Port, a few miles to the eastward of Port Phillip, Captain

Wright, in charge of the expedition, wrote officially to the government, that he had found excellent coal at Western Port; and gentlemen now at Port Phillip have written to me to the same effect. This coal will probably be made available for one or more of the five steamers just referred to, that may be stationed at Port Phillip (especially if good coal should not be immediately found in this island), as with it they could, owing to the great saving of fuel effected by Mr Collyer's boilers, make the voyage from Port Phillip either to Adelaide, or Van Diemen's Land, and back without a fresh supply of coal. They have plenty of good coal at Sydney, and two or three large steamers constantly running between that place and Hunter's river.

I have, I observe, already often referred to the new colony at Port Phillip; and as it has lately become a place of much importance, I propose to give you a very brief account of what has lately taken place there, and of its prospects.

A settlement was formed there as far back as 1802, by the New South Wales government. The party sent, however, consisted nearly entirely of military, under Colonel Phillip, and convicts. They set themselves down at the SE. extremity of the lake, not far from Arthur's Seat, where there is little good water. The want of that indispensable article, and ophthalmia, which almost immediately afflicted a number of the men, were perhaps the chief reasons which induced Colonel Phillip shortly after to leave the place for the Derwent, and hence the commencement of the settlements in Van Diemen's Land? Sheep were not then an object of importance, or Colonel Phillip could not have failed to observe, that the country in which the new town of Melbourne is now situated, is as fine as any in these colonies for sheep. Some of his party were there, as in 1836, tea-cups, panikins, &c. were found on the banks of the river close to Melbourne, and which had no doubt been left there by a boating party from Arthur's Seat fourteen years before.

Messrs Hume and Howell, two New South Wales colonists, came on an exploring expedition from thence overland to Port Phillip in 1825–26, but no subsequent attempt was made to colonize it till 1835, when land for the depasturage of sheep having become expensive in Van Diemen's Land, a Mr Batman went there to explore, and in consequence of his report, and of that of several other persons who followed him almost immediately, about 35,000 sheep were shipped in 1836, and 40,000 in 1837, for Port Phillip from George Town. Sheep have also been sent across in the present year; and in the course of the last fifteen months, flocks, amounting in the aggregate to about 60,000, have arrived there from Yass in New South Wales, following the route, nearly, by which Major Mitchell, the surveyor general of New South Wales, returned to Yass from Portland Bay some time before. The total of the sheep and lambs now at Port Phillip, I reckon at about 300,000, or not far short of a third of the flocks in this island.

It may be asked, why the New South Wales farmers have sent so many sheep to Port Phillip? Sheep runs are not nearly so expensive in New South Wales as in Van Diemen's Land; but as the road from Sydney to the chief sheep districts is generally fenced in for 100 to 150 miles from Sydney, the farmers are obliged, in bringing their wool there, to stop at the inns on the road for food for their servants and feed for the bullocks in their drays; hence, the expense of bringing their wool to Sydney is often considerably more than the freight from thence to England. At Port Phillip this is not likely to be the case for many years, as so much land is not likely soon to be sold there, as to prevent the wool carriers from stopping for refreshment in the open plains wherever they may please.

There is, however, a considerable drawback to be encountered at present by those who have sheep at Port Phillip. Though small vessels now leave this and Lanceston every week with many passengers for Melbourne, the number of inhabitants has not increased so fast as the sheep, and hence butcher-meat is already as cheap there as at Sydney, and would perhaps be lower, were it not expected that the steamers already referred to, will carry many sheep from Port Phillip to Adelaide, and probably also fat wethers to this place and Lanceston, especially if we should, in the course of a few months, as expected, have favourable accounts from England of the state of the wool market. When wool has formerly been high, Hobart Town has sometimes imported live-stock for the butchers to the value of L.60,000 to L.70,000 in one year from Newcastle and Twofold Bay, chiefly from the latter place. These importations have ceased for the present; but if one of the steamers, shortly expected from England, be employed between this and Sydney, freights of live-stock from Twofold Bay (at which she can touch in passing) for this place, are more likely to pay than any thing else.

The retail price of mutton was here eighteen months ago, when wool was high, 6½d. and 7d. per lb., now it is only 5d. At Melbourne it is 4d., and at Sydney the same. At Adelaide it can scarcely be quoted, but a gentleman, who lately arrived there by land from Yass, with 340 head of cattle, not being able to dispose of them immediately, got a butcher to retail the meat of his fat bullocks, and is now getting 1s. per lb. for it. There can be no doubt that the Spencer's Gulf colonists will soon be supplied with cattle in abundance from New South Wales; but it is much more hazardous to attempt to drive sheep through an open and barren country, as the former travel easily thirty miles a-day in case of need, but the latter with difficulty accomplish fifteen. They are, too, when hungry and on a journey, more apt to feed on herbs that disagree with them; hence several persons who have attempted to drive sheep from Port Phillip to Adelaide have failed in the undertaking, and returned with their flocks to their old stations.

It has been observed, that most of the English colonies are *manufactured* in London, and it appears to me that in the formation of them great want of attention has been shewn to this essential fact,—that all colonies require very large supplies of various descriptions from England, and hence, to succeed, they must have articles of export to yield a return for these supplies. In the Australian colonies there are, as yet, only two articles of export of any great value, wool and oil. King George's Sound and Swan River are so far from this, that, though they have plenty of fine land (to be purchased even at 6d. to 1s. per acre), the risk and expense of sending live-stock there is so great that no one thinks of doing so. Even Adelaide would probably have languished for many a year, if it were not for the steam-boats shortly expected from

England, and for the possibility that the settlers at Port Phillip will be able by and by to supply it with sheep by land.

Port Phillip, on the contrary, is a *colonial colony*. No ships or colonists have yet gone there direct from England; nor has it even, I suspect, obtained much notice there. Yet the place will rise much more rapidly in importance than any of the other new colonies. It will ship in this year 600,000 lb., and in 1839 1,000,000 lb. of wool. When will Swan River, or Adelaide even, do as much? Many of the gentlemen who have been far to the NW. of Port Phillip, and also who have come there from New South Wales, describe the sheep runs as of excellent quality, and of almost unlimited extent. As, too, many parts of the country are particularly well adapted to agricultural purposes, I doubt not the population will increase rapidly, and then it may be expected that the price of meat will also improve. Hence, I would recommend those now coming from England with the intention of turning their attention to sheep, to visit Port Phillip before they settle elsewhere. There being an abundant supply of good sheep even there, they are not likely to be dearer there than in the other colonies.

In 1836, the best sheep runs in Van Diemen's Land sold readily at 40s. per acre. At present, unless there were very much fencing, they would not sell for more than 30s., owing to the depression which has taken place in the value of live stock; but, taking the average at 20s., and say that it will take 1½ acre (which it will do) to feed a sheep, at 10 per cent. per annum interest, the lowest rate at which money is ever lent at interest in these colonies, the expense for a run for a sheep in Van Diemen's Land is about 3s. per annum. This is what has induced many of the Van Diemenlanders to send flocks to Port Phillip, where they are likely to be fed for the next ten years on government land, free of all expense. On the other hand, though breeding ewes are now cheaper here than at Port Phillip, fat meat is, and is likely to continue, dearer here than there, owing to the greater extent of population settled here; and this is the solitary advantage possessed by this island as a sheep country. Many of the old and intelligent settlers here, however, have sent their sons with flocks to Port Phillip, in the expectation that they will do better in the long run; and they, I suspect, are better able to form correct opinions on this subject, than any one unconnected with these colonies in England. Few or none, comparatively speaking, have gone from this to Adelaide.

At first, the settlers at Port Phillip had a good deal of difficulty with their servants; but since there has been a magistrate there, this has not been the case. It is usual to make part of their wages dependent on their success with the flock with which they are entrusted. They are usually *emancipists* (men who were formerly convicts, but who have obtained their freedom), or Irishmen who come out free. Neither the one nor the other can generally be said to be good servants, yet we manage with them better than could be expected. In Sydney, they are getting shepherds from India and China. Of the latter, I know too little to speak. The former may do well in warm districts like Wellington, but will never be found to answer in a high table-land like Monera. I should not, for instance, like to have sheep under the charge of Indians in a snow storm, for they would then be of no use whatever. It is remarkable, that though during winter the thermometer of Fahrenheit is sometimes in the morning as low as 21° at Port Phillip, snow has not been seen to fall there. As, however, the variations in the temperature are so extreme, I doubt that any class of people that could be brought from Calcutta would answer as shepherds.

I do not think that the colonists in Spencer's Gulf will derive much advantage from the free servants they bring with them from England. If wages be high at Port Phillip, and steamers be constantly plying between that and Adelaide, it will be impossible to keep servants at low wages at the latter place. Shepherds at Port Phillip now get about L.27 by the year, but as they are now, at their own request, paid a great part of their wages in tobacco and slops, at some advance on the cost price, and as mutton and flour are now cheap, I do not estimate that each man costs in all over L.45 per annum. If, however, real good shepherds could be got from England. I should consider it more desirable to give them L.30 to L.33 wages per annum, than to give L.27 to the men we now get. Yet, with our present men, I have at Port Phillip, for the last two seasons, reared 95 per cent. of lambs each year, though very few of our Merino or Saxon breed of sheep have ever more than one lamb. Before the late depression in the price of wool, wages were L.3 to L.5 higher than they are at present.

This is a very hasty sketch, but I think you will find that there is no exaggeration in my statements. It will be long before these colonies *progress* as the Canadas have done,—chiefly from the want of good mechanics and labourers, and also of industrious farmers; and, above all, from the great expense all persons incur in coming here.

Parties coming from England to this colony may bring their funds in Spanish or American dollars, they being all current here, by act of the Legislative Council, at 4s. 4d., if they will give a profit selling at that rate. Sovereigns usually sell at par, to 1 and 2 per cent. premium, they being sometimes required by parties purchasing land at Port Phillip, and the payment of which has, of course, to be made in Sydney. Those coming from Scotland generally bring the Royal Bank's bills on Coutts and Company, London, at 30 days' sight: these usually sell here at par, and, I understand, that a bill for L.102, 10s. is obtained for every L.100 paid into the Bank. A letter of credit from a respectable house in London would nearly answer the same purpose. Goods should be avoided, unless the party coming be well acquainted with the state of the market, and the description of goods required in it.

At Sydney sovereigns do not bear any premium, and dollars are not current. Bills on England are now there at one and two per cent. discount. They were lately, when money was very scarce, at five per cent. discount. At Port Phillip all purchases are yet paid for by drafts on this island or Sydney. The Derwent bank here has for some time past had an agent there for exchange operations, and the bank of Australasia is now sending a branch. The head quarters of that bank are at Sydney, with branches here and at Lanceston; it should, therefore, be able to afford great facilities to the colonists at Port Phillip.

About 200 half-acre allotments have already been sold in

Melbourne, and which have produced to the Sydney government about L.9500. One of the conditions of the sale of each lot is, that a house or cottage, of the value of L.50, shall be built on the ground within twelve months. Hence there are now many houses being built in Melbourne, and the wages at present given there to mechanics are excessive; none, who can make themselves useful in the construction of buildings, earning less than 10s. per day. This has been the case for the last twelve months; but as there are not many buildings now being constructed in Hobart Town, many mechanics have left this for Port Phillip lately, and hence it would be imprudent for workmen in England to embark for Port Phillip, under the impression that these rates of wages will be continued. Wages, however, are likely to be as high there as elsewhere in the colonies, and neither meat nor other necessaries expensive.

As my earnest desire in writing this letter is, not to say any thing that may lead to disappointment, I remark, that the quotations given of the value of sheep in 1836–37 are about the highest prices that were then obtained. Abundance of good sheep could now be got at my present prices; but I expect that sheep will improve considerably in value all over the colonies, before any one can arrive from England, acting on the information now given; there is not the least chance, however, of their being nearly so dear as they were in 1836.

About 29 000 acres of the Port Phillip land is advertised for sale by auction at Sydney, six weeks hence, in small sections, the minimum price being 5s. per acre. This land is generally near Melbourne, and will probably bring high prices. About 100,000 acres, I understand, have been measured by the surveyors, but the government do not wish to sell more [illegible] place has received an accession of population, when it [illegible] that the competition [illegible] will be increased. It [illegible] acquainted with such [illegible] have been sold at Melbourne, [illegible] South Wales to favour the [illegible]polis" Sydney, they having [illegible]siderable hardship to com- [illegible] weeks' duration at least, whenever they wish to purchase land. The expense of such a journey, too, is very great; in short, from the expense and detriment their property would sustain in their absence, it would be *ruination* to small settlers to undertake it. Yet it is the particular province of governors to look to the interests of this class of settlers; the wealthy have generally influence enough to protect themselves.

The quantity of black oil shipped from this last year was about 3000 tons, nearly all procured on the east coast of this island. The fishing is now going on again, but I hear that the parties have not generally been nearly so successful as they were during last winter.

	Present Prices.	Usual Prices.
Wheat per bushel, usually being about 63 lb.	6s. to 7s.	6s. to 9s.
Flour, 1st quality, per cwt. . . .	17s. to 19s.	17s. to 24s.
2d ditto.	14s. to 15s.	14s. to 20s.
Tea, hysson skin, per chest, . . .	L.4, 10s.	L.4 to L.5.
Sugar, raw from Mauritius or Bengal, per cwt.	23s. to 25s.	24s. to 35s.

HOBART TOWN, 5*th August* 1838.

BRITISH GRAPE WINE.

By Mr TOWERS, C. M. H. S.

In a former Number, there appeared an article bearing the somewhat singular title of "*Farmers' Luxuries.*" It referred to the production of what are called "forced fruits," by calling in aid *that heat* which is always developed during the fermentation of large bodies of manure, rendering it an available stimulus of vegetation, instead of expending itself uselessly "in the desert air."

All things are perhaps *luxuries*, which are not indispensably required for the support of life and comfort, otherwise we might be inclined to consider every such appliance as a wise economy of means. Be this as it may, that article has been the origin of the present communication; and we hope to shew, that wines of excellent quality—and, in point of salubrity, far surpassing the highly brandied mixtures which are advertised and puffed off as the genuine wines of Spain and Portugal—can be prepared, at a very trifling cost, little, indeed, exceeding that of rich and potent ales. The originator of these fine, and all but perfect wines, which so closely resemble those of the Rhine and Moselle, was a North Briton: we allude to Mr MacCulloch; for, though British sweets had been made during the course of centuries, and receipts for their manufacture are to be found in every book of domestic economy, yet, until Mr MacCulloch wrote his treatise on wine-making, the world possessed no data on which to place reliance. He took a philosophical view of the processes, and thus laid the foundation of permanent and assured success. Mr Roberts has followed in the path chalked out by Mr MacCulloch, and has appended the great improvement of assuming the specific gravity, or density of "*the sweets*," as the base or groundwork of the fermenting process, and, by consequence, of the ultimate strength and body of the wine.

But *grapes*, many will say, do not commonly come to maturity in the north. Be it so. We require not the fruit to be ripe, believing with Mr MacCulloch, that the wine made from ripened grapes is, at the best, very inferior. *Green fruit*, three-fourths green, that is, just in that condition when the seeds are tender, yet quite formed, is, in all respects, to be preferred. It is not *flavour* that is required, but the presence of a vegetable juice abounding with *leaven*, or the extractive matter which has the quality of bringing the sweet or saccharine principle into that condition which produces vinous alcohol, by the liberation of a certain volume of *oxygen*, united with *carbon*, in the form of carbonic acid gas. This *leaven* exists in great perfection in the expressed juice of unripe grapes, as does also the tartarous acid, chemically known as the *bitartrate of potassa*, and familiarly as the argol of wine, or cream of tartar. These two principles are essential to good wine: they are found pretty accurately balanced in the *ripe grapes* of the best wine districts of more southern Europe; and hence the perfection of the unadulterated wines of France and of the Rhine. Our climate and soil are unpropitious to the maturing process of the fruit, at a period when solar power and light are at their maximum. Our spring season has passed away ere the blossoms of the vine are developed, even in the southern counties; and it frequently happens that the fruit is not fully mellowed when the first frosty rimes of the autumn are seen on the herbage. We therefore are obliged to add a considerable quantity of sugar to the juice of all our fruits, and also a certain volume of water, and thereby produce an artificial compound, which bears little resemblance to the pure juice of highly saccharine grapes. Thus, we labour under considerable disadvantage.

Three seasons have followed, in succession, wherein the spring has been of a character so rigorous, as to retard the early progress of the vines to the extent of three or more weeks: therefore the wood has ripened later in each succeeding autumn; and in 1838 few samples of well ripened grapes could be produced. The crop also was deficient in quantity. Individually, we have never failed to ripen our grapes upon a wall exposed south by east in a situation due west of London, and therefore on the same parallel of latitude; but so reduced was the crop, owing to the nature of the season, that we were obliged to purchase unripe grapes late in September, and these could by no possibility have become mature. The chills of autumn 1838 set in so early, that much of the wood failed to assume its healthy brown tint. Yet the late winter was mild in its character, and every promise of an early spring was afforded during January and February. Appearances, however, changed, and the frost became severe. The latter part of April, and the first week of May, were warm, a powerful sun creating a maximum temperature of 70° to 74° in the shade, brought the vines into full activity, and much fruit appeared. But how fallacious are appearances! On the nights of the 15th, 16th, and 17th of May, after reiterated snow showers, frost of no common severity (2° to 6°) occurred, and then, for the first time, we witnessed the destruction, as if by fire, of two-thirds of the young fruit-bearing laterals. Thus, locally at least, the vintage promise has been falsified, and its hopes annihilated. We would not have alluded to this singular and anomalous phenomenon, which can hardly apply to the climate of Scotland, were it not for the purpose of introducing the following fact.

It must now be admitted, as has also been avowed by Mr

MacCulloch, that seasons may be such as to prevent the production of *unripe* grapes! How, then, can grape wine be manufactured? Fortunately it has been proved, by direct and conclusive experiments, in France as well as in England, that the young tender shoots, the leaves, and the tendrils of the vine—in a word, the *prunings*—contain principles very similar to the fruit, and as available to the vinous process as the unripe berries; therefore vines may be cultivated in the wild way, without cutting and training, for the express object of preparing *grape-leaf* wine.

We come now to consider the processes for the preparation of both these wines; and first, that from *green grapes*, by two methods, the one to obtain a creaming and sparkling wine, like that of champagne; the other, to carry on the fermentation till the sugar be subdued, and converted to a dry vinous liquor; and we assume six gallons as the final quantity.

Take 30 lb. of the clusters, the stalks not to be removed, rejecting, however, all foul or injured berries; bruise them, a few at a time, effectually, avoiding as much as possible to crush the seeds; place each quantity, so prepared, in some clean open vessel, as a deep stone pan, or nine-gallon cask, standing upright, one of its heads being taken out. Examine well the quantity of juice and pulp, and add, of clear river or pond water, as much as will make the quantity about six gallons.

As the season will be generally about the end of September, or first week of October, attend minutely to the temperature, and conduct the process in some room free from any unpleasant smell, where the mercury may not decline below [illegible]0° or 55° of Fahrenheit.

Th[illegible] quiet, covered with a flannel, [illegible] specific gravity of the liquor [illegible] which instru- [illegible] at a moderate [illegible] ghts with pure rain or dis- [illegible] decimally, will [illegible] of the [illegible] glass, with [illegible] 000 grains [illegible] water: water, at 60° of heat, is the usual standard of gravity, and it represents 1, as a unit, or 1000. 1000 grains of water might be taken, though the quantity would be inconveniently small. A capillaire bottle answers well; but there are vessels made expressly for the purpose. Weigh the water accurately in a delicate balance, and, supposing it to be 3000 grains (*i. e.* 50 drams apothecaries weight), mark the exact level of the fluid with a file or diamond. The water being poured off, supply its place with the liquid to be tested, at the same temperature. The difference will shew the density. Every pound of good loaf-sugar dissolved in one pound of water, is found to increase the density or specific gravity of the fluid about 36 parts in 1000. The extractive product of the grapes also increase the specific weight of the water employed; therefore, after the materials shall have remained together twenty-four hours, it will be proper to compare the weight of exactly the same volume of pure water, and the extracted juice, and this before any creaming or sign of fermentation commence. Suppose, then, that after straining, forcibly pressing, and rincing the pulp, to obtain all the juice, the mixed liquors weigh 1.028 grains, when compared bulk for bulk with 1000 of water, the specific gravity will be called 1.028; but, were the pure grape-juice of the wine countries to be so weighed, it would be found to be much heavier. Mr Roberts estimates the expressed juice of " foreign grapes brought here in jars" to be from 68 to 70, or 1.068–70, compared with water at 1000.

This gravity is insufficient to produce a firm and durable wine, and, for this reason, the finer wines of France, those, for instance, of Burgundy and Macon, cannot with safety be imported in the wood. Mr MacCulloch, in his allusions to Champagne, Burgundy, and Vins de Bourdeaux, overlooks the all important criterion of the specific gravity of the expressed juice of the several varieties of grapes employed in their manufacture: this is to be regretted. However, we may safely conclude that it is not under 1.080; yet even this density will not ensure the vinification of any of *our* prepared artificial sweets; therefore we agree with Mr Roberts, that from 1.100 to 1.120 are indispensably necessary. If, then, the expressed juice of 30 lb. of green grapes, digested with water, and made up to the quantity of six gallons, be found at 1.020 without any sugar, the operator should add that material, and honey in the proportion of one-fourth of the sugar, by degrees, stirring well after every addition, and then noting the increase of specific gravity. The sweetening should be perfected with all needful dispatch, before fermentation be excited, otherwise a delusive indication will be afforded. The gravity of the sweets prior to fermentation might range between 1.095 and 1.105.

If these points be duly noticed, and the results written down, fixed principles will be acquired, the quantity of sugar will be discovered, the specific gravity produced by that quantity correctly ascertained, and thus every future process will be rendered an affair of comparative certainty. We repeat, that it is indifferent whether the gravity be determined by decimal calculation, by comparison of bulk or volume, or by the saccharometer; but determined it must be by every one who affects to prepare wines upon fixed scientific principles, free from ambiguity and empiricism.

In order to lay a good foundation for the preparation of all brisk or creaming wines which retain a portion of unsubdued sugar, we will have recourse to the authority of Mr MacCulloch, and cite literally his description of the French process for the preparation of the celebrated "*Vin de Champagne*," as we find it in p. 112 of his book:

"In making Champagne, the pattern of all our brisk wines, the grapes are first squeezed by a gentle pressure, and poured into the vat, where they remain for one night only. The next morning the liquor is transferred into casks. If the wine is intended to be red, the fermentation is allowed to continue some time longer on the husks, till the red colour has been extracted; but the seeds are carefully separated, as they communicate a harsh taste. The first fermentation in the casks is violent, and the discharge of the yeast is encouraged for ten or twelve days, by keeping them full to the bung-hole. It then becomes more moderate, when the bung is put down, and a gimlet-hole, fitted with a spile, is made by the side of it. When the cask is thus closed, the vent-hole is opened every day or two, according to the state of the fermentation, for a space of eight or ten days, to allow the carbonic acid to escape. When this state is passed, fresh wine, reserved for the purpose, is poured in at the vent-hole, about once a-week, for the first three or four weeks, according to its waste, so as to fill the cask. This operation is then performed at longer intervals, of a month or more, till the end of December, when the wine usually becomes clear. It is afterwards decanted from the lees into a fresh cask, where it is fined with isinglass, in the proportion of half an ounce to a pipe; and this process of decanting is carefully executed in dry clear frosty weather. A new fermentation is now excited, by which the wine loses a portion of its sweetness, and becomes still further meliorated. If it should prove too sweet, this first operation of decanting is not performed until the fermentation in the first cask has been rendered more vigorous, which is done by stirring up the lees, and rolling the pipe; and by this the sweetness is overcome, and the wine strengthened and improved. To insure the fineness of this wine, which is one of its essential properties, and to render it at the same time durable, it is at the end of six weeks decanted a second time into a fresh pipe, and once more fined with half the quantity of isinglass. It is then completed, and is put into bottles in March,—clear dry weather being also chosen for this purpose. Notwithstanding all this care, a fresh deposite is still formed in the bottles, from a renewal of the fermenting process, which goes on in them. To remove this, and to render the wines marketable, those of the best quality are decanted clear into fresh bottles in about fifteen or eighteen months, when the wine is perfected. A certain loss, amounting to one or two bottles in a dozen, is sustained, by their exploding previous to this last stage. Another process is sometimes adopted for getting rid of the sediment, without the trouble of decanting. In this mode, the bottles are reserved in a frame proper for the purpose during a certain number of days, so as to permit the foulness to fall into the neck. While in this position, the cork is dexterously withdrawn, and that portion of the wine which is foul allowed to escape, after which the bottles are filled with clear wine, permanently corked, and secured with wire and wax."

This description of the manufacture of French champagne, though not applicable to our colder and less propitious climate, is very valuable, in as far as it instructs us that, the production of a lively, creaming wine, depends upon the abstraction of a certain portion of the *leaven* or yeast, by permitting it to *flow over* from the bung or vent-hole of the casks, and thereby leaving a preponderance of the sweet principle in the liquor.

There *is* such a thing as an exact balance between the two principles; and the result, if not interfered with, must be a dry and duly fermented wine, neither inclined to become tart nor harsh—a sound keeping fluid, vinous, and of rich full body, but not in any degree sweet. But the chance in nine cases of ten is, that either the sweet or the fermenting principle will predominate, and the former condition much to be preferred, because the extra quantity of sweet, which cannot then be subdued, will remain in the wine, rendering it more or less sweet and luscious; whereas, if the leaven surmount the sweet, one of two evils must inevitably be incurred; the first, and that most to be dreaded, is the conversion of the wine into vinegar, if air be not perfectly excluded; and the second, the absolute conversion of every particle of sugar into a weak, harsh, and austere liquor, unpalateable, and almost worthless. Wine is the result of the decomposition of the sweet principle, a substance which differs materially from pure sugar. It will ferment spontaneously when diluted to a certain degree, which pure sugar will not, unless it be excited by yeast, or by some leaven which can supply its place. When the vinous fermentation is once fairly established, it cannot be wholly arrested till the saccharine matter be laborated, on the one hand, or till the whole of the leaven be neutralized, on the other; hence the art of preparing a lively beading wine consists in carrying on the fermentation for a very short time in the open tun,—in throwing off the froth and yeast as fast as they are formed, through the bung-hole of the barrel, then by fining and racking from time to time, and finally, in bottleing directly when the liquor shall have become quite clear and bright. Still, however, the process is not subdued, it proceeds silently in the bottles, wherein the carbonic acid remains confined till those vessels which are too weak, or have some flaw in them, burst; or till the cork be withdrawn, when the effervescence becomes manifest by the extrication of the confined gas. These lively wines will not keep long *as such*, for they must either run on to the acetous fermentation, or become a luscious sweet liquor, like the Malmsey Madeira, the Constantia of the Cape, or the "Mountain" of Spain.

We have written enough to explain the rationale of effervescent wines, and by inference to lead to that of *dry* or perfectly fermented wines,—for, if the abstraction of the leaven tend to produce the former, it must be self-evident that its retention, and the full exercise of its power will, of necessity, operate the complete laboration of the sweet principle, and convert it into vinous alcohol; here, however, one or two points of great moment demand consideration.

The *must*, or prepared saccharine fluid, prior to fermentation, cannot with safety be converted to a dry wine, unless its gravity be considerable, because the leaven will act energetically upon a light and weak fluid, decompose the sugar in a very short period, and cause the poor thin wine, which will be the result, to run speedily into the acetous fermentation; therefore, to prepare *a dry and keeping white wine* from green, immature grapes, it will require an increased quantity of both materials; and the following receipt may with confidence be taken as a standard, let the quantity be considered six gallons.

Grapes bruised without crushing the seeds, 36 lb. to be digested with water in a pan or tub, covered at top with a flannel as before stated. The gravity of the liquid should be tried after the materials have stood together two hours, again, after twelve hours, and a third time at the end of twenty-four hours. The water first added should be in quantity sufficient to cover and float the pulp, perhaps four gallons may be generally used. During some hours the gravity will increase, and while it does so, the materials should remain together, and be stirred five or six times. The temperature of the room might be about 55°, and the eye of the operator should be on the alert to discern, and his hand ready to arrest the very minutest appearance of fermentation, indicated by small groups of air bubbles.

The liquor is to be strained off—the pulp squeezed or pressed,—and finally, washed with more water,—strained and again pressed,—and its gravity noted down. We will state this gravity at 20 in 1000 above water at 60°, *i. e.* at 1.020. The liquor should measure five gallons at the least, and to it may be safely added 15 lb. of good loaf-sugar; or twelve pounds of sugar, and three pounds of honey, which latter always tends to confer a soft and vinous character on the "must." If the gravity do not rise to 1.120, more saccharine material (sugar or honey) must be added cautiously, till that density be acquired. Fermentation may then be suffered to take place quietly, without any extraneous aid, and be promoted by warmth and agitation if the weather be cold.

The liquor should be retained in the tun or pan till the gravity be reduced to 1.085, at which it will have acquired a decidedly vinous odour.

It will be understood that the fluid is to be made up seven gallons by water before the fermentation begins, always adding sugar till the gravity be found 1.120. This quantity will suffice to fill the barrel to within an inch of the bung-hole, leaving a reserve of nearly a gallon for filling up, after the fermentation is nearly completed; the reserve is to be kept apart, in a stone bottle, covered with a small piece of flat glass.

The cask must be perfectly clean, sweet, and dry; it should be raised a few inches above the floor of a good arched cellar, the temperature of which remains pretty equable at all seasons. The wine must not throw off its yeast, it is to be agitated by rolling, or stirred with a clean stick, let down through the bung-hole. This hole is subsequently to be covered over with a piece of tile or slate, placed over a grape leaf. After the hissing shall have subsided to a gentle fretting, the clearest portion of the reserved wine is to be poured into the barrel, when the hole may be partly closed, by fitting it loosely with a sound and clean bung.

In order to afford an example of the progress of vinification, we extract from a journal the minutes of several observations made during the season of 1838.

Sept. 29. The materials used to prepare 6 imperial gallons of wine were—grapes 33 lb., 2¼ lb. grape leaves or tips of shoots digested in 2 gallons of boiling-water, pressed when cold, and the liquor poured over the crushed grapes; 16 lb. of loaf-sugar, and the washings of a few clean honey-combs, after the honey had been drained from them; the gravity was at least 1.120, and the bulk of "must" was made up 7 gallons.

Oct. 4. The gravity of green grape liquor or "must" after the fermentation had been established during a few hours, 1.115.

Oct. 6. (Temperature of the room 50° to 55°), gravity 1.096.

—— 8. (Idem), barrelled at noon, ... 1.0840.

The hissing continued regularly,—the bung was loosely fitted,—and the wine was permitted to be at rest, in a temperate cellar, till February 1839, when it was found quite clear, pale, and rich, but not luscious.

April 1. The gravity was reduced, by throwing off carbonic acid, and the production of vinous alcohol, to 1.026; 30 grains of isinglass, dissolved in a pint of the wine, poured in as "finings."

April 6. Racked off, reserving the bright wine, and bottling the lees to settle.

Cleaned the cask perfectly, adding half an ounce of powdered white marble, and one pint of old bucellas. Returned the clear grape-wine, and bunged the barrel. As it was not quite full, the wine reserved in bottles, which became bright as the lees precipitated, was poured into the barrel, in which it is intended that it shall remain till March 1840.

The *wine from the leaves*, tender shoots, and tendrils of the vine, if judiciously prepared, is so excellent, that Mr MacCulloch compared it to "white hermitage." The *claret* vine leaves, as he observes, will produce a red colour, and this tree could be cultivated for the express purpose.

Having repeatedly prepared red and white *leaf* wine, we can with the greater confidence offer a few abbreviated extracts from Mr MacCulloch's book, previously observing, that the specific gravity of the liquor must here also be taken as the criterion of strength; the proportions are calculated for ten gallons of wine.

"The leaves should not have attained their full growth, and must be plucked with their stems. On forty or fifty pounds of such leaves, seven or eight gallons of boiling water are poured, in which they are to infuse for twenty-four hours; the liquor being then strained off, the leaves are to be forcibly pressed. A gallon more water is to be added, and the leaves again are to be pressed. A screw wine-press, with hair bags, is very useful in this process.

"Sugar, varying from 25 lb. to 30 lb., is then to be added to the mixed liquors, the quantity is to be made up to ten gallons and a half."

Such are the essentials of Mr MacCulloch's directions. We need only add that, if a fermenting, lively wine, be contemplated, the manufacture must be conducted as in the process for *champagne*, and the smaller of the two proportions of leaves, &c. is to be employed.

The specific gravity of the *must* should be 1.110 to 1.115.

The fermentation must be carried on for a short time in the open vessel, or till the gravity be reduced to 1.090; and the barrel will require to be filled, and be kept full, in order to carry off the froth and leaven that rise to the top of the liquor. But we apprehend that grape leaves are better qualified to produce a dry wine, and therefore the larger proportion of leaves, &c. should be employed, and sugar, to an extent that will raise the gravity to 1.120.

In this case the fermentation must be conducted in the manner already stated for the production of a dry wine from green grapes; and when perfected, and the wine become bright, it is to be fined and racked off, during clear and cold weather, then returned to a clean and sweet cask, and bunged close. A second fining and racking may be required.

Grape wine, made from the green berries, we have ever found delicious in flavour, and quite fit for the table in two years or less. But the liquor obtained from *the leaves* contains a quantity of vegetable extract, which conveys a flavour that time alone can subdue; hence, we recommend that it be always retained two years in the cask, and be bottled in the second winter. It also ought to remain during an entire year in the bottles.

The cost of any kind of wine must be calculated by that of the materials.

The sugar is the chief article of expense, but used to the extent of 3¼lb. per gallon, at 10d. per lb., the expense so incurred will not be 7d. per wine quart. If bees be kept, and honey to the extent of one-fourth of the weight of sugar be substituted, the flavour of the wine will be more mellow, and the process rendered still more economical; but it will be wise to boil the honey during a few minutes in three or four times its weight of water, as thereby some waxy feculences will be separated. In a good honey season the washing of the clean combs will yield a sufficient supply, and the sweet fluid is to be poured when cold on the fruit. The gravity will indicate the quantity of sugar subsequently to be employed.

It must be remembered that grape leaf wine is made, generally, in the hottest season of the year, for in July the vines are most frequently pruned and trimmed, therefore it will be prudent to conduct the fermentation in a cool cellar, or other room, which is never exposed to the sun, and can be freely ventilated. Vinous fermentation is liable to become too violent if the temperature exceed 60°.

AGRICULTURAL CHEMISTRY.—NO. VI.

By Henry R. Madden, Esq. M. D., Edinburgh.

We shall now resume the examination of the three remaining manures, viz. kelp, saltpetre, and common salt.

Kelp.—This will first engage our attention. It consists principally of carbonate of soda, mixed with various other mineral substances; and, in general, contains a small quantity of charcoal likewise. It evidently owes much of its power as a manure to its alkaline properties, which are very strong, and, consequently, it will be extremely useful in all cases where land, containing large quantities of inert vegetable fibre, is required to be enriched, and, at the same time, cleared of its fibre. We should hence argue that it would be found a very useful application to peat, and also to old pasture-land when it is broken up for the purpose of cropping. We have already observed, that *sea-ware* owes its superior fertilizing powers, as compared with other green vegetable manures, to the presence of this substance. A certain degree of caution is requisite in the use of this manure, as it is acknowledged by all who have employed it, that, if applied in too large quantities, it is hurtful in place of being beneficial. This is easily understood when we consider, that carbonate of soda, in common with other alkalies, dissolves vegetable matter, and, consequently, would be extremely apt to dissolve the delicate fibrils of the roots of the plants themselves, more especially since it is well known that all chemical solvents act first upon the softer and more fluid parts; and there can be no question that the *spongioles*, and minute extremities of the roots of growing plants, contain much more fluid than the dry roots of the growth of former years. It would therefore be advisable, either to apply this manure in small quantity, or to form it into compost, prior to its being incorporated with the soil; or at least to apply it to the soil some time before the sowing of the crop, in order that it may loose its caustic effects, by combining with the *humic acid*, produced by its acting upon the vegetable fibre, prior to the formation of those delicate structures which, as above stated, would be so liable to receive irreparable damage.

In reference to the constitution of the various other mineral substances contained in kelp, I may remark, that some of them are of considerable importance, and their presence will fully explain the following remark, which occurs in the report upon "Kelp as a manure," laid before the Highland and Agricultural Society, by a committee appointed to investigate the subject, viz. :—" that kelp would appear to possess *other qualities* as a manure," besides that of " rendering the animal and vegetable matter soluble." For instance, the insoluble matters of kelp have been proved to contain a considerable proportion of *sulphuretted hydrogen* and *lime*, the presence of which will render it a peculiarly useful manure for turnips, as chemical analysis has proved that the saline matter of this plant contains the *hydrosulphate of lime*, which is produced by the union of sulphuretted hydrogen with lime, and, consequently, can be readily supplied by kelp. As a practical proof of the correctness of this remark, I may quote the following sentence, which occurs in Mr Cuthbert Johnson's paper upon this manure, in the British Farmers' Magazine for October 1838 :—" A portion of the lands of Bangholm were manured with kelp of an inferior quality, at the rate of one ton per acre, and the land sown with yellow turnip: the crop, upon examination, is considered to be fully equal to that part of the field which has been manured with dung." Again, in a report by Mr Ker upon this manure, which appeared in the Highland Society's Transactions for 1831, the author observes, that the effect upon old pasture was very promising, " *especially in the increase of white clover.*" Now, the analysis of the insoluble matters of kelp, proves the presence of a large quantity of gypsum, or sulphate of lime, which, as before noticed when speaking of this substance, is *essential* to the success of the clover crop. We hence perceive, that kelp is a valuable manure, not only as a chemical solvent of vegetable and animal matters, but likewise as a *specific manure*, on account of its possessing various saline substances, which are of the utmost consequence for the well-being of some of our most useful crops.

Saltpetre.—The very valuable effects of this salt are well known to every cultivator, but still there is probably no manure, unless it be common salt, of whose action a less satisfactory account can be given; the remarks therefore which follow, so far as they are original, must be considered rather the light of suggestions than decided opinions, as I have not hitherto had any opportunity for submitting them to the rigid, but unerring test of *practice.* In considering the subject I shall premise a few remarks upon the origin of this saline combination. The elements of which this salt is composed are three in number, viz., oxygen, nitrogen, or azote, and potassium, or the metallic base of potassa; these are combined in the proportion of 14 parts of nitrogen, 48 of oxygen, and 40 of potassium; they, however, are not supposed to be arranged indiscriminately, but are combined thus: 14 parts of nitrogen, and 40 of oxygen, are united together, and form the well known acid, nitric acid, or *aqua fortis*, and 40 parts of potassium, with the remaining 8 of oxygen, form pure or caustic potassa,—and the whole constitutes the *nitrate of potassa.* With reference to the natural production of saltpetre, there is a great deal of obscurity, and many facts relating to it are totally inexplicable. It occurs abundantly on the surface of the soil in several parts of the world, especially in the East Indies, and is manufactured in considerable quantities on the Continent, by mixing soil and lime, or chalk, with various animal and vegetable refuse matters, and allowing the whole to remain exposed to the air for some months; in this manner, not only nitrate of potass, but the nitrates of lime and magnesia, when this latter earth exists, are produced in considerable quantities. The origin of the nitric acid appears to be from the nitrogen of the animal and vegetable matters combining, either with the oxygen of the atmosphere, or with that contained in the organic matters themselves; or most probably with oxygen obtained from both these sources. Now, it will very possibly be observed by many of my practical readers, that all this may be very interesting to chemists, but of what use can it be to farmers? to which very natural inquiry I shall reply by remarking,—1st, That as this salt is *always* produced when azotised substances are exposed to the air in mixture with lime and soil, it follows as a consequence that saltpetre must be produced upon the surface of *all rich soils*, because they contain all the ingredients requisite for its formation; 2d, That since azotised manures are so very important for the success of almost every cultivated plant, and since, at the same time, the proportion of azote contained *in* the crop, is so much less than the quantity possessed by the manure required for the growth *of* the crop, we may very plausibly conjecture, that the nitrogen of the manure has other offices to perform than merely supplying the plant with the proportion of that substance requisite for its growth, more particularly as M. Boussingault has lately proved beyond doubt, that plants *can* obtain nitrogen from the air, so that some part at least of this important element may be procured by plants, altogether independently of the soil or the manure.

With these remarks upon the origin of saltpetre, I shall proceed to detail the results which have been obtained by practical men, and shall then, in endeavouring to explain its beneficial action, revert to the above observations, as I trust they will throw some light upon this very obscure portion of agricultural chemistry. As the general result of the recorded experiments with this manure, it appears that it is most useful in damp seasons, especially when applied to light soils; it appears particularly adapted for grasses of all kinds, and likewise for grain crops. When used, however, it is necessary not to apply too large a quantity; in fact, the usual proportion is very small, being only from 1 cwt. to 1½ cwt. per acre. It is supposed by some, to increase the liability to mildew when applied to wheat, but this point is doubted by other experimenters—all appear to agree that it increases considerably the quantity of straw, and renders the blade of a much darker colour. Sir Humphrey Davy, in speaking of this manure, seems to think that it owes its fertilizing properties to the nitrogen which it contains; this, however, is extremely doubtful, both from the facts which we have already noticed, and likewise on account of our having no grounds whatever for sup- [illegible] the [illegible] of decomposing any [illegible] me as nitrate of potass, [illegible] elements is very con- [illegible] that this salt performs [illegible] any decomposition [illegible] least, three [illegible] 1st, It [illegible] its forming [illegible] for ex ample. 2d, From the observations we made upon the formation of this substance in all rich soils, and the suggestion we there threw out concerning the use of highly azotised manures being partly to promote its production, we may infer that it is of considerable importance to *all* plants, its action probably being as a *stimulant* to the roots, in order to increase their solvent power over the undissolved portions of their food, or as a *condiment* to promote the function of assimilation. 3d, But here we must suppose that the salt undergoes decomposition produced by the action of the organic matter of the soil. It is not impossible that, from its highly oxidised nature, it may be capable of assisting in the formation of carbonic acid, from the superabundant carbon of the vegetable fibre. We thus perceive that feasible suggestions can be made, in reference to the action of this very valuable substance; but, at the same time, I should be extremely sorry, were it supposed that I had decidedly adopted any of these opinions, as it is by no means improbable, that they may not stand the test of experiment. It is, however, a subject very well worth the investigation of any scientific person who possesses the requisite opportunities for pursuing it, with sufficient care and assiduity.

Common Salt.—In reference to this substance, still less is known scientifically than of the preceding one, nor is its practical value by any means so distinctly proved; for although it has been used at various times for many centuries, still, we are even yet very much in the dark, as to its real practical value. This, undoubtedly depends, in a great measure, upon the careless and unscientific manner in which the experiments have been performed, and consequently, in many instances, so much has been employed, that it has acted as a direct poison to the plants. The chemical composition of common salt, throws no light whatever upon its *direct* action as a manure, but *indirectly*, will explain much of the benefits derived from its employment. The true constitution of the substance is as follows;—chlorine 59½ per cent., and sodium (the metallic base of soda), 40½ per cent.; but when this substance is dissolved in water, it is generally supposed to become muriate of soda, by the decomposition of water, and the subsequent union of its hydrogen with the chlorine, to form muriatic acid, and its oxygen with the sodium, to produce soda. Now, the mode in which this bears upon the indirect effects of salt as a manure, is dependent upon the chemical action which is exerted between *muriate of soda*, and *carbonate of lime*, which latter is so constant an ingredient of *soil.* When these two salts are brought in contact, and kept in a moist state, a gradual interchange of acids and bases takes place, and, the resulting compounds are muriate of lime, and *carbonate of soda*, of the value of which latter salt we have already treated; and I may here remark, that it is more than probable that this is the chief benefit derived from salt, viz. the gradual production of carbonate of soda; in which case, we may likewise add, as a necessary consequence, that salt should be most beneficial upon *chalky* soils. There is no doubt, however, that salt acts also *directly* in a beneficial manner, both to the soil, and the crops to which it is applied. In reference to this point, there are some most excellent remarks by Mr Cuthbert Johnson, in the British Farmer's Magazine for July 1838, to whose papers upon various manures, I have already had repeated occasion to refer. In the place alluded to, Mr Johnson enumerates six different ways in which this substance appears to act beneficially, viz. 1. Salt has been proved by Sir James Pringle and Dr Macbride, to promote the decomposition of animal and vegetable substances, when used "*in small proportions.*" 2. "It destroys vermin, and kills weeds, which are thus converted into manure." 3. Mr Johnson mentions the obvious way in which it is beneficial, viz. that it forms a "direct constituent" of some plants, and hence, of course, is absolutely necessary for their wellbeing. 4. He states that Dr Priestley has proved that "salt acts as a *stimulant* on ve- [illegible] vegetables from in- [illegible] temperature of the atmo- [illegible] salt can [illegible] beneficial [illegible] er, holding [illegible] readily [illegible] soil will [illegible] the situa- [illegible] ders "earth more capable of absorbing moisture from the atmosphere." By far the most important practical consideration, and, indeed, one of vital consequence to the success of any experiments with this substance, is, that it is extremely easy to err by applying *too large a quantity*, in which case, as already remarked, the result is just the opposite to that for which the farmer has been induced to apply it to his soil.

3. *Mixed Manures.*—The substances now to be brought under our consideration are *Bones*, *Ashes*, *Soot*, and a few general remarks upon various *Composts*.

Bones.—As has been already remarked in a foot-note to one of my preceding papers, the origin of this manure would justly entitle it to be placed among the *animal manures*, but from the observations which we shall have to make in reference to its mode of action, I think it will be abundantly evident, that its value depends in many instances as much upon its *mineral*, as its *animal* constituents, and, consequently, in an examination like the present, it should undoubtedly be considered along with the class of mixed manures. The introduction of the use of bone-manure may, beyond doubt, be considered as forming a most important æra in the agriculture of the present time; and that its value is justly appreciated by the farmer, is sufficiently evident, not only from the annual increase of the quantity used, but likewise from the great number of articles, both practical and otherwise, which have of late years appeared in every work and periodical which has been published in connection with agriculture,—indeed, so many practical observations have already appeared in this Journal, that, in the following remarks, I shall confine myself almost entirely to various points referring to its *mode of action*, and I trust that I shall be able to shew, that bones possess many properties, which so evidently render them important as manure, that, had a chemist been searching the whole organic kingdom for the substance best qualified in every respect to answer the most sanguine expectations of the farmer, it is more than probable, that he would have fixed upon bones, as combining the greatest number of advantages, both economical and practical.

Chemical analysis has shewn, that bones are composed of the following substances:—1. *Animal matters*, consisting chiefly of *gelatin*, *albumen*, *animal oils*, and *fat*, about 38 per cent., and 2. *Earthy matters*, composed of *phosphate of lime*, *carbonate of lime*, *fluate of lime*, *sulphate of lime*, *carbonate of soda*, and a small quantity of *common salt*.

(1.) I shall consider the value of the various components in detail; and first, the *animal matters*. In speaking of animal manures, I have already had repeated occasion to remark, that these are at all times the most powerful, both on account of their containing a large quantity of azote (nitrogen), and likewise from their greater tendency to decomposition: of course, therefore, the presence of 38 per cent. of such substances must of itself render bones very useful as manures. But, moreover, the peculiar kind of animal matter in this instance, increases still more their fertilizing effects; for the combination of gelatin and albumen with various fatty matters, such as occur in bone, possesses the property of entering very speedily into the putrescent fermentation, the result of which is, that putrefaction takes place very rapidly, whenever they are placed under anything like favourable circumstances, the important consequences of which are the following: 1. That the animal matters of bone will enter into putrefactive fermentation so rapidly after they are ploughed into the soil, that no previous preparation is required. 2. That from this property, the animal matters of bone may be said to act the part of a *ferment* when added to soil; for there is no doubt of the fact, that when a very putrescible substance is mixed with other matters in which this tendency is much less powerful, the former acts upon the latter in such a manner, that putrefaction goes on much more rapidly in the whole mass, precisely in the same manner as yeast excites the vinous or spiritous fermentation in all fluids capable of undergoing that change; but which, of themselves, would have required a much longer time to effect it, or probably would never have fermented at all. And, 3d, a practical deduction from the above facts, of considerable consequence is, that since these valuable properties of bone belong in a greater measure to the fatty matters and gelatin, than to the albumen, any process by which they are deprived of a part of these ingredients, lessens, in a very great degree, their value to the farmer.

(2.) So much for the animal matter of bone; now let us see in what respect its *earthy* constituents render it valuable in the estimation of the agriculturist. We see that it contains six different compounds, one only of which is not well known to act beneficially, viz. the fluate of lime, and as it occurs in very small quantities, it may be neglected altogether; of the five others, four have already been treated of, viz. carbonate of lime, sulphate of lime, carbonate of soda, and common salt. We have, therefore, to say a few words concerning the remaining one, viz. *phosphate of lime.* This substance evidently acts as a *specific* manure: or, in other words, will be beneficial by adding to plants a substance which is essential to their nourishment; for chemical analysis has proved, that, next to the carbonate of potass and lime, this salt constitutes one of the commonest constituents of vegetable saline matter—for example, among the cultivated plants, wheat, barley, oats, pease, and beans, besides a great many garden plants, contain this salt in considerable quantities; and, consequently, to all these, phosphate of lime is *absolutely necessary.* We thus perceive that the earthy matter of bone contains no less than *five valuable mineral manures,* and that the animal matter is of the *best possible kind.* There is one circumstance, however, of considerable consequence, which must be borne in mind in reference to bone manure, which is, that *if repeated upon the same land for a series of years, it will gradually lose its effect.* The cause of this is obvious. Bone-manure, as already stated, owes its importance to two distinct circumstances; 1*st,* its earthy constituents being almost entirely *specific manures*; 2*d,* its animal matter acting as a *ferment.* With regard to the first of these, viz. bone-manure being capable of acting *specifically* upon many crops, it must be remembered, that these specific substances are required in very small quantities, and hence the repeated use of *bone-manure* would, in time, produce a *useless accumulation* of these substances, and, consequently, would *lose its effects* in this respect. And, 2d, as its animal matter owes its fertilizing powers not only *directly* to its *nutritive properties,* but likewise *indirectly* to its *reaction* upon the *organic matter previously existing in the soil,* it must, of necessity, be in this respect an *exhausting manure;* and hence, of course, the land will be gradually rendered *poorer* by its constant use, and the *good effects* of the manure itself will consequently *diminish* in the same proportion. I may, however, here observe, that, in all probability, *turnips* will be the very *last* crop by which its good effects will be experienced; or, in other words, that it will continue to produce good turnip crops, after it has begun to fail in its good effects upon all the others to which it has been applied.

Whenever this unpleasant effect should occur, the remedy is obvious and simple. Bone-manure must be *discontinued* for a few *rotations*, and its place supplied by some rich *organic manure*, of which *farm-yard dung* will always be found the most valuable. By this precaution, the land will be revived, and bone-manure may be again applied with the confident assurance of its wonted success.

NINTH ANNUAL REPORT OF THE PROCEEDINGS OF THE GLENKENS SOCIETY FOR IMPROVING THE CONDITION OF THE WORKING CLASSES.

By WILLIAM GRIERSON, of Garroch, their Secretary.

All are agreed regarding the leading points in physical science. They have been ascertained by diligent observation and careful experiment, and no room has been left for doubt. But, if we turn from these subjects to the investigations which have been undertaken with the view of improving the condition of the mass of mankind, nothing can be more striking than the contrast. Here philosophers of the highest name have arrived at conclusions directly at variance with one another, and, in some instances, not a little astounding to the common sense of plain men. According to Godwin's views, it is not at all impossible that man, under proper training, may become immortal, and subsist on the labour of half an hour a-day. This he gives as a legitimate inference from his premises, and, far from its leading him to doubt of their soundness, he regards it as a happy discovery. Malthus went to the opposite extreme, and held that the Author of our being has not even provided sufficient food for the human race, constituted as it is, and allowing to death his regular amount of victims. Sadler, again, replied to Malthus with a degree of asperity scarcely consistent with philosophical decorum, and came to the determination that there is a principle in the human constitution which renders an excessive population impossible. None of these philosophers was induced to make the slightest change on his opinion by the theories of his rivals. In the controversy which ensued between Malthus and Sadler, no concession was made on either side; and even Godwin, in a publication which issued from the press shortly before his death, and after both the other systems had been long before the public, still looks back on his own with all the fond partiality of a parent, and dwells with much complacency on the recollection of the popularity which it had enjoyed. We surely, then, do not go too far when we say, that, as authorities, these theories are completely destructive of one another. However much we may admire the ingenuity and talent displayed by any one of these philosophers, and however confident he may be in his own views, we find him met by equal talent and equal confidence, and we look in vain for any substantial benefits resulting from his exertions to make good his claim to a preference. We are not aware of one system which has so far prevailed with the public as to induce them, in the slightest degree, to alter their ordinary course.

Is there no rule, then, to direct us in this matter? We see different communities, in circumstances apparently altogether similar, possessed of very different degrees of comfort; and we see differences equally great in the situation of the inhabitants of the same country at different periods of their history. May the probable causes of these differences not be discovered, and suggest what ought to be sought and what avoided, and may the actual truth not be ascertained in this as in other matters, by experiment? The statistical reports of the Scottish parishes which were completed about fifty years ago, and are again in course of publication, furnish excellent materials for such an inquiry; and what are the changes which they exhibit?

In the first place, it may be observed, that, since 1791, the wages of agricultural labour have undergone a rise from 50 to 100 per cent. At that period, from 8d. to 1s. per day was about the average summer wages of a country labourer, out of which he had to provide himself with every thing. The summer wages of the same class at present run from 1s. 6d. to 2s. In some counties they are a little higher and in others a little lower, but these rates may be considered a fair average. The wages of the manufacturing classes are in general much higher than those of agriculturists, and manufactures, which in 1791 were in their infancy, now employ a large portion of the population. The wages of tradesmen have also undergone a similar rise. While the whole of our industrious classes are thus receiving much greater wages per day than their predecessors in 1791, their employment has become much more constant, and the wages earned by each individual in the course of the year have risen in a much higher proportion. No less remarkable an improvement has taken place in the pecuniary circumstances of their employers. Many, in fact, of our most respectable commercial men have, much to their credit, raised themselves from the humble rank of operative tradesmen to the possession of splendid fortunes; and the land rentals of the country have in many cases tripled and quadrupled, and scarcely any where less than doubled.

If we look again at the articles of necessary consumpt which must be purchased, we find the present average price of oatmeal, potatoes, and wheat, little if at all different from their prices in 1791; every article of dress is both much cheaper and much better; and many foreign products which, at that period, were within the reach of few are no longer esteemed luxuries, but so much reduced in price as to be enjoyed by all; yet, with these low prices, our merchants and manufacturers have made their fortunes, and our farmers, notwithstanding of the high rents and high wages paid by them, and the comparatively low prices which they receive, are in much better pecuniary circumstances than in 1791. So much for the food and clothing of the population at these two periods.

The rents paid for lodging do not admit of being compared in the same way, the accommodation being entirely different. But we can be at no loss to perceive that in this respect even a more wonderful change has taken place for the better. We have before our eyes some of the town-houses occupied, at the former period, by people of the highest distinction. They are now possessed by persons in a very humble rank, not a few of them by beggars; while, in the same towns, families in very moderate circumstances are in possession of houses greatly superior to what they ever were. The country-houses of the higher orders have been either entirely built or altogether renovated within that period. In many counties new steadings have been erected almost on every farm, superior to the former mansions of the proprietors; and the accommodation of the cottars, though still very inferior to what we would wish, is now greatly better than most of the farm-houses of that period. There can be no doubt, then, that all classes are now infinitely better fed, clothed, and lodged than the population of 1791. The consequences are apparent in their improved health. Ague and many other complaints then prevalent have either disappeared or become greatly mitigated, and there is scarcely a parish which does not lay claim to great salubrity of climate, and adduce in proof the longevity of its inhabitants. Many of the reporters state that morals and religion have advanced along with these physical improvements, and almost all declare that in these respects their flocks are deserving of commendation. Indeed the solemn stillness of a Scottish Sabbath, and the almost total absence of military from the country, would attest the high moral and religious character of the nation to a stranger unacquainted with the language.

Whence this astonishing improvement? Certainly it has not arisen from the adoption of Godwin's principles of political justice, for they have been entirely forgotten. Neither can we derive any aid from Malthus in answering this question, for, although the country has had the benefit of his theory for the greater part of that time, all his cautions have no way retarded the progress of population. In 1755, the population of Scotland was 1,255,663, and in the thirty-six years which expired in 1791 it had only advanced to 1,514,999, being an increase of 259,336. But in the succeeding thirty years which expired in 1821, it had become 2,093,456, shewing a rise of 578,457, considerably more than double that which had occurred in the preceding thirty-six years. In the next ten years, ending in 1831, it had increased to 2,365,807, the addition in that period being 272,351, considerably beyond the increase in the whole thirty-six years from 1755; and, since 1831, the progress of population has certainly not been less. Yet, rapid as its progress has been during the whole period from 1791 down to the present time, contrary to all the prognostications of Malthus, the increase of the means of subsistence has been greatly more rapid still. Sadler would leave things to take their natural course, but that has been done in other countries as well as in Scotland, without any similar improvement in their condition; we believe that she stands at this moment without a single parallel in Europe.

The general opinion is, that this prodigious improvement can be ascribed to nothing but a better use of the gifts of Providence. The country is the same now as it was in 1791; the materials which it contains are the same. The sole difference consists in the uses to which they are applied. In the first place, the present generation possess much more intelligence; education is both more general and better conducted, and parish libraries, and private collections of the best authors, every where afford the means of obtaining information on all subjects. This enlargement of mind has led to better arrangements in every department of business; banishing superstition, it has diffused more correct views of the solemn truths and duties of religion, and it has withdrawn our countrymen from the gross and expensive indulgences of former times to cheaper and more refined recreations. In the second place, our tradesmen have become much more dexterous at their different occupations. They are not only more rapid, but they are enabled to execute works to which their predecessors were altogether unequal. In the third place, they are more industrious; many no doubt are still subject to indolent habits, but, generally speaking, there is much less time now thrown away in absolute idleness than at the former period. To all this must be added, that our countrymen have not been wanting in economy. The capital of the country has very much increased. It is from the savings of individuals that this increase has arisen, and the growth of Savings Banks is a proof that these economical habits reach to a very humble class.

These causes combined are quite sufficient in our opinion to account for the very great increase which has taken place in the produce of the country, and the general comforts of its inhabitants. With the machinery furnished by the skill, dexterity, and industry of modern tradesmen, from the capital thus accumulated, one man is enabled to throw off as much cotton thread as 200 could produce sixty years ago.* Weaving, bleaching, printing, have made similar progress. Hence the low price of all kinds of cotton fabrics, and hence, too, the multitude supported by that branch of manufacture. The same may be said of all our other manufactures. Agricultural machinery may not be as yet quite so perfect, but the improvement of all the arts connected with agriculture has been very great, and the works which have been executed in that period have been wonderful. Great part of the land has been divided and fenced,—much of what was waste has been reclaimed,—the best implements of husbandry in the world have been introduced,—ploughing has been brought to perfection,—the proper succession of crops has been carefully studied, and in the opinion of Mr Dudgeon, since 1784, by a mere change in the rotation, the produce has in many places been increased tenfold,—almost universally the thrashing-machine has superseded the imperfect and expensive mode of separating the grain by hand labour,—and finally, the live-stock of the country has completely changed its character. As we are indebted for all this to the improved intelligence, dexterity, industry, and increased capital of our countrymen, so are we also for our improved lodging, and improved means of transit by common roads, steam-boats, and railroads, which have made it an easy matter for districts the most remote to exchange their surplus produce, and to command the luxuries of the most distant climes.

If the remarkable improvement which has taken place in the circumstances of the great body of the people is sufficiently accounted for by their improved use of the materials afforded by Providence, we believe that the misery which is still to be found in some districts may, with equal certainty, be traced to the neglect or misuse of means quite as well adapted to the

* Lanark, p. 148.

supply of their wants, and many have little idea to what extent this negligence prevails.

The reports from the Lewis state that the huts of the peasantry are "in general indescribably filthy. There is only an annual sweeping of their houses. The people and cattle are under the same roof, and on the same area. Very few of the country dwellings have a single pane of glass. There is one hole in the roof to allow the excess of smoke to escape, and another on the top of the wall; the latter at night, or during a storm through the day, being stopped with a wisp."* * * * "Wood is so scarce and so dear that it cannot be had in sufficient quantity to make a good roof."† * * * "The roofs have no eaves. The thatch in general is made of stubble or potato stalks, which are spread on the scanty wooden roof, and bound by heather or straw ropes, which again are at each side of the roof fastened by stones, called anchors, resting on the top of the broad wall. On this wall it is no unusual sight to see sheep and calves feeding, and making a short passage into the byre through the roof. The doors of the houses are so low, that whoever would gain admittance must humble himself, and continue in that posture till he reach the fire, which is always in the middle of the floor, and very often he must grope his way, or be led by the hand. From the slightness of the wooden rafters, much straw or stubble cannot be laid for thatch, but just sufficient to exclude the day-light. The thatch is not expected at first to keep out much rain until it is properly saturated with soot, but to compensate for this defect, the inmates are practical chemists; they keep plenty of peats on the fire; the interior is soon filled with smoke. The smoke and increasing heat repel the rain, for a great proportion of what fell on the roof is returned to the atmosphere by evaporation. These houses after a smart shower appear like so many salt-pans or brew-houses in operation."‡

This account is said to apply very generally to the habitations of the whole of the small farmers. Good management of any kind is not to be expected from people whose domestic habits are so barbarous. They depend upon the produce of the place for almost everything. Even their clothing is almost exclusively of their own manufacture.§ Their time, when occupied at all, is "devoted indiscriminately to the mixed avocations of husbandry, fishing, kelp-making, grazing," &c.‖—Their agriculture is wretched. "The women are miserable slaves; they do the work of brutes, carry the manure in creels on their backs from the byre to the field, and use their fingers as a five-pronged grape to fill them."¶ "The thatch of the houses saturated by the smoke with sooty particles

* Ross and Cromarty, p. 128. † Ibid. ‡ Ibid.

§ Ibid. p. 130, 147. ‖ Ibid. p. 166. ¶ Ibid. p. 131.

is considered valuable, for every summer the roof is stripped and the inner layer of straw, which contains the soot, is carried carefully to the potato or barley field and strewed on the crop."*—" Small tenants and cottars generally till the ground by the Chinese plough of one stilt or handle, and the cas-chrom, a clumsy instrument like a large club shod with iron at the point, and a pin at the ancle for the labourer's foot. It is a disgrace to see women working with it."†—" No sickle is used for the barley among the small tenants. The stalk is plucked, the ground is left bare."‡

The return is very scanty in some places, occasionally insufficient for the consumpt of the population.§

It can excite no surprise that, with all these discomforts, the inhabitants of the Lewis, in the opinion of a medical man resident on the spot, " may be said to die at an early age."|| Still they are deeply attached to the land of their birth; a great proportion of them are altogether uneducated, and it is said that the people of Barvas even keep their children from school, lest, being thus made acquainted with better countries, they should be induced to leave their own inhospitable home. ¶ Yet inhospitable as the Lewis is at present to its possessors, it is no way deficient in the means of comfortable subsistence. " The peasantry do not much experience the want of food. In winter, the most of them may have beef and fish if they choose."**—" None need be in absolute want if they have health, except through laziness. Sometimes in summer, after a severe winter, having given their potatoes to the cattle, they fall short of provisions, but while the sea is open and plenty of shell-fish on the shore, they cannot be in absolute want;"†† and all the reporters concur in opinion that the land might be made much more productive.‡‡

While the inhabitants of the Lewis are left in their present wretched condition, by neglecting to cultivate the means of subsistence which are within their reach, there is another much more numerous class who are from time to time reduced to even greater want, through total mismanagement of these means after they have been realized. We allude to a large portion of the manufacturing classes, who, though earning much higher wages than the best paid of the agriculturists,

* Ross and Cromarty, p. 129. † Ibid. p. 131. ‡ Ibid. p. 131.
§ Ibid. p. 166, 148. || Ibid. p. 119. ¶ Ibid. p. 150.
** Ibid. p. 129. †† Ibid. ‡‡ Ibid. p. 132, 148, 156, 166.

are such slaves to intemperance, that they and their families are frequently left without the necessaries of life. In fact, those among them who have the best wages are most prone to this vice, and, as a necessary consequence, are really the most miserable. The child is fixed upon a loom or in a mill at nine or ten years of age without the vestige of education; he is placed among seniors as ignorant as himself, and learns like them to consume in intoxication whatever spare money and spare time may be at his disposal—the Rest of the Sabbath forming no exception. Not unfrequently the father of a family makes his home the scene of his debauch, and assumes his wife and children as his associates.*

The amount thus squandered is almost incredible. The value of ardent spirits consumed in the parish of Stevenston in Ayrshire, with a population of 3681, exceeds the whole land rental of the parish, L.3836.† In Lochwinnoch, in Renfrewshire, "as in the neighbouring parishes, three or four times more money is expended in this manner than is required to support the churches and schools and all the religious and charitable institutions."‡ In Glasgow there is a spirit-shop for every fourteen families.§ In 1834, it was given in evidence to the Committee of the House of Commons on Drunkenness, that the amount thus squandered in that city alone was "nearly equal to the whole amount expended on public institutions of charity and benevolence in the entire United Kingdom." It was ascertained by this committee that, throughout England, Ireland, and Scotland, there is a place for retail of spirits for every twenty families, and the conclusion at which they arrived was, that, looking at the value of grain destroyed, the abstraction of labour from its proper employment, the property sacrificed by sea and land, the deterioration of mental and physical powers, the increase of pauperism, and spread of crime, and the retardation of all kinds of improvement, the loss to the country from this cause alone "might be fairly estimated at little less than L.50,000,000 per annum," exceeding the whole revenue of Great Britain, and ten times greater than the amount of the poor-rates. The evil is complained of in all parts of the country, but the manufacturing classes are its principal vic-

* Ayrshire, p. 472. † Ibid. ‡ Renfrew, p. 111.
§ Lanarkshire, p. 195.

tims. No wonder that extensive misery should be the consequence, but the existence of this misery will not be received as a proof that the produce of the country has been insufficient for the support of its population. It has evidently not arisen from a deficiency of produce, but from the destruction of what has been produced.

Our conclusion, then, on the whole, would be, that the same Providence which brought man into the world has provided amply for his wants, and that if they remain unsatisfied or imperfectly satisfied, it is because man does not apply the materials afforded to the uses for which they were intended. Had the energy of the present generation been possessed by their fathers, they would have enjoyed equal comforts. Were the inhabitants of the Lewis endowed with the intelligence, dexterity, industry, and economy which distinguish a large portion of our countrymen, their miseries would be at an end; so also would those of the manufacturing classes, could they only be taught to apply the money in their hands to its proper use. And even that portion of the community who have done most, we feel assured, are capable of doing a great deal more, and of adding still farther to their own comforts and the comforts of society. The knowledge of the wisest comprehends but a small portion of the riches of creation, and the most dexterous are far from having reached perfection. It follows that the most effectual way of benefiting either an individual or a community, is to induce them to cultivate those mental attainments which are alike necessary for the conduct of business and the enjoyment of leisure, and those arts which are required for converting to use the materials within their reach. The desire for this would make them industrious, and if industrious they could scarcely be otherwise than economical.

But how is the aversion to labour, either mental or bodily, with which all are more or less infected, to be overcome? We must answer this question by another. What has been the motive for all the exertions already made which have wrought such a change upon this country? Not certainly the mere pressure of physical want, for we see many spend their whole lives in a state of misery without making the slightest effort to relieve themselves; neither has it been the wish for expensive animal enjoyments; else the struggle would end when the means of gratifying that wish have been realized. But the desire to rise becomes stronger with every advance. The grand motive for all these exertions has plainly been to command that respect which never fails to accompany success in any honourable undertaking. It is equally prized by the humble artisan and the rich merchant; and the labours of both only require a beginning; as a few pounds saved by the merchant lead to the accumulation of thousands, so one difficulty conquered by the tradesman carries him on to grapple with another, till he arrives at proficiency. The great object, then, is to give the first impulse, and experience has shewn, that if a man can be induced to place himself in competition with others of his own standing at any kind of work whatever, that object will infallibly be gained. The expedient has accordingly been resorted to in all ages. Sometimes this stimulus has been applied to promote the arts of war, sometimes those of peace,—sometimes to the fine arts, sometimes to the useful. We are indebted to it for the unrivalled excellence of our ploughmen, for our improved management of green crops, for all our improvements on stock, and we see no reason why it may not be applied with equal success to every art which can benefit society. Were the whole population trained by these means to the arts required for converting to use the materials afforded by each locality, we do not think it possible that any portion of them could remain without profitable employment; and were the same care taken in the cultivation of their minds, their labour would be applied with infinitely more effect and a security would be obtained against the misapplication of their means. At all events it surely appears from what we have said, that these consequences are sufficiently probable to authorize an experiment.

Our association has been regulated by these principles, and their effect with us will give some indication of what may be expected from them elsewhere. In this idea we have, from time to time, communicated reports of our proceedings to those interested in such matters, and we have been honoured with flattering marks of approbation. Thus encouraged, and deriving additional confidence from our continued experience, we now venture to solicit the attention of a wider circle.

The Glenkens is a retired district of the Stewartry of Kirkcudbright, comprehending the parishes of Balmaclellan, Carsphairn, Dalry, and Kells. It contains about 330 square miles, and, according to the last census, the population amounted to 3929, no part of them connected with manufactures. The district is chiefly pastoral; there is, however, a considerable extent of ground also under the plough. It is neither among the best cultivated, nor the most neglected portions of the kingdom, and may be taken as a fair average of a considerable part of Scotland.

We began our operations in 1830, with the parishes of Dalry and Kells; Balmaclellan was added in 1832, and Carsphairn in 1833.

It will be readily conceived that education occupies the first place in our attention. We, however, look upon it only as a foundation for what is to follow. We would by no means wish to see mere mental cultivation superseding bodily exertion, and men taught to rest satisfied under wants which may be removed by the use of their own hands. We would have the hands trained along with the head as far as possible, and we can in no degree participate in the regrets expressed by many of the reporters, that the attendance of the children at school is injuriously interrupted in agricultural districts, by their being called away in summer to give what assistance they can in the labours of the field. However desirous we may be for the improvement of their minds, we cannot forget that those who are to earn their bread with the sweat of their brow, require to be instructed also in the arts by which they are to gain a livelihood, and that it is necessary for them to acquire habits of useful industry at an early age. These instructions, if not received at home as with us, must be given at school, as in Prussia; and we have only to look at the system of agriculture produced in Prussia by this means, to be satisfied of the immeasurable superiority of our own method. Mr Jacob, in his Report on Prussian Agriculture, published in 1826, says, "The harrows are made of wood, without any iron even for the tines or teeth. The waggons are mere planks laid on the frame loose, and resting against upright stakes fixed into the sides. The cattle are attached to these implements by ropes, without leather in any part of the harness. The use of the roller is scarcely known, and the clods, in preparing the fallow ground, are commonly broken to pieces with wooden mallets." "The produce of the soil, whether in corn or cattle, is of an inferior quality, and bears a low money price. The scale of living of all classes is influenced by this state of things. The working classes, including both those who work for daily wages, and those who cultivate their own little portions of land, live in dwellings provided with few conveniences, on the lowest and coarsest food." Such was the state of matters in Prussia in 1826, and Mr Loudon, in his Encyclopædia of Agriculture, repeats the same account in 1831.*

This may satisfy us that in the part of a peasant's education which relates to his manual labours, we have nothing to learn from Prussia. Indeed, we cannot imagine a system better than that which prevails in Scotland, the winter given by the young peasant exclusively to mental culture, the summer to such bodily labours as may suit his strength. He becomes skilled in the works of the country, not merely by lectures or experiments by way of illustration; but in contributing his share of labour to operations of real utility, under the direction of his seniors, he advances step by step, till he attains a complete equality with his instructors. Nor is the cultivation of his mind necessarily impeded by this. A child who has acquired the rudiments of reading and writing, may pursue his studies at home, not merely to his own benefit, but also to that of parents who may not have had the same advantages. Indeed, with the aid of these private studies, we have known many in a higher rank who have made a most creditable figure in life with very little school education.

But, although it does not seem necessary that the whole childhood of the peasant should be spent in school, it is of the utmost importance that his time while there should be properly occupied, and that the instruction which he receives should comprehend all that is of real practical use. Writing and arithmetic are indispensable. Every peasant should be able to note his receipts and payments, small as these may be, to estimate the cost and profit of any job in which he may be employed, and to hold communication with the absent mem-

* Loudon, p. 91.

bers of his family. It is also of the utmost consequence that he should cultivate the talent of retaining whatever information he may acquire either from reading, hearing, or observation, not allowing either words or things to glide past him without notice, but treasuring up for use whatever comes within his reach. This is all that seems absolutely necessary for the peasant and others in the same rank of life. We cannot consider a person who has been so far instructed as ill educated, and to all who may incline to go farther, this introduction will render the progress easy. We confess, however, that we should like to see drawing added to the ordinary branches of education in our parish schools, as scarcely any work can be undertaken in which it would not be of very great use. And a knowledge of mathematics also is so essential to the right understanding of mechanics, and forms such an excellent training to sound modes of thinking on all subjects, that we should be glad to see this branch of study more generally cultivated. This is but a small portion of what usually passes under the name of primary instruction, but we believe few of the children of the humbler classes who do not aim at a place in society above that occupied by their parents, would have time for more. These, then, are the branches of education which chiefly interest the great body of the people. Let us now see what provision has been made for their due cultivation.

The subject of education attracted the attention of the Scottish Legislature at a very early period. The first statute on this head is dated so far back as 1494, and it was followed by many others in the course of the two next centuries. By these enactments, the whole system was placed under the management of the clergy, who are, in many respects, peculiarly well qualified for the trust. The curriculum of study through which they have to pass, secures their possession of very high literary and scientific attainments, and many of them also possess that practical knowledge of the art of teaching which in Prussia is held to be essential to a school inspector. Nor has their zeal in the cause been inferior to their ability. Not only have they done their utmost for the schools established by the State, but by their own exertions, they have supplied many of the wants of the State provision, and have shewn themselves at all times ready to respond to the wishes expressed by the public. The Normal Schools lately instituted by them are an instance of this. By means of them, we are in hopes that improved modes of conducting the branches of education already taught in our schools will, ere long, be generally introduced, and that drawing will become a regular part of our school instruction. A very general call has been made for a uniform series of school-books; and here, again, we observe the Church giving her powerful countenance to the efforts of a society formed for that purpose. Nothing, in fact, has been omitted which they deemed necessary for perfecting the system. Still we do not deny that it is yet susceptible of improvement.

According to the present regulations, each school is examined once a-year, by a Committee of Presbytery, which reports to its own court. The Presbytery reports to a standing Committee of Assembly, and that Committee reports to the Assembly of the year. The central management, however, may be said to rest with the Committee, the short sessions of the Assembly being too fully engaged with business to admit of much time being devoted to the details of education. The Assembly is too numerous a body to infer that personal responsibility in its members which is necessary to insure the due discharge of duties of this nature; and there is no reason to regret that its other employments prevent it from undertaking their performance. But the same objection also applies in no inconsiderable degree to the Committee to which these duties are delegated. The members are twenty-six in number, taken from different parts of the country. There is not one individual among them who has not other duties specially requiring his attention—not one on whom the public have the slightest right to call for a greater sacrifice of time than he may incline to make. If we say, then, that in some respects the arrangements of the Committee are not the best possible, we are only saying that they have failed in doing what it was impossible for men so situate to accomplish.

It of course belongs to this Committee to frame and distribute the schedules for the reports of Presbyteries. Upon this the entire working of the system depends, so far as regards the central management, as they can know nothing of what passes except through these reports. The Presbyteries are required by the Committee to state if the masters are properly qualified; if the schools are well taght; if religious instruction is properly attended to; and they are to give the numbers of pupils in all the higher classes, Greek, Latin, French, &c. *but they are not to give the numbers in the elementary classes.* We confess we see no reason for this exclusion of the only branches of education which can be within the reach of the great body of the population; and although we believe it has had no effect in lessening the attention of the examinators to these classes, that would have been a very natural consequence. Farther, Presbyteries are not required to give a specific report of the state of each school, so as to enable the Committee to judge what schools are advancing, and what declining; nothing is asked but a slump account of the state of the whole schools within the bounds of the Presbytery, which may be curious as a piece of statistical information, but of very little use, we should conceive, in any other view. We can scarcely be surprised that reports which are to be productive of so little good, are very irregularly furnished, and it is not immaterial to observe, that the metropolitan Presbytery, from which a majority of the Committee of Assembly are taken, have been themselves among the number of defaulters. This shews the value set upon these reports by those who have the best means of forming an estimate.

There being thus no means of bringing forward merit through the medium of the central management, the ministers of each locality have recourse to the provincial newspapers, and by means of notices inserted in them the public are informed what schools are particularly deserving of their patronage. Such notices, however, give but a very imperfect idea of the merits of different teachers. In most cases, much more depends on the writer than on his subject, and they have become so frequent as scarcely to excite attention. They are, however, evidence of a praiseworthy ambition, which longs for an opportunity of being gratified, and in the Highland counties this has been afforded by the Celtic Society. In the year 1825, they divided the Highlands into a number of distinct districts, and instituted competitions for prizes in each, to which the whole schools of the district were invited to send their pupils. The merits of the pupils were of course to determine also the merits of the teachers, who were thus brought together not merely to dispute and theorize on the subject of education, but each to shew the working of his own plans, to see the working of those of his neighbours, and to regulate his future practice by the issue. The system was found completely to answer the expectations which had been formed of it. It has been continued by the Celtic Society, and, we believe, has been adopted by other bodies.

This also is the plan which we have pursued; but having had no communication with the Celtic Society till after our own arrangements were made,—indeed, being quite ignorant that such a plan had been tried by them, we differ a little from them in details. The Celtic Society takes in every branch of study that is taught; we confine ourselves to writing, arithmetic, and Scripture history, our chief object being to promote the improvement of the humbler classes. The two first are absolutely necessary for the proper conduct of their worldly concerns; the last is not only an important training to habits of attention, but secures a firm ground for a rational faith. The Celtic Society lays down no rules of competition, except that they do not wish their prizes to be monopolized by any individual,—a rule which in practice has been understood to exclude the winner of a prize for writing from competing for one for arithmetic. We conceive, that if punishment ought to be certain to deter from crime, reward ought to be as certain to prove an incentive to merit, and that if the possession of excellence of one kind is to be a bar to the acknowledgment of excellence of a different description, the desire to reach either will be materially diminished. We therefore place no restriction on the accumulation of prizes in the same person, except that an individual is not to contend again for a prize corresponding to one which he has won in a former year. It has been our study to form such regulations as to free the judges from any possible charge of partiality, and in this we think we have completely succeeded. Our only difficulty has been with the class of Scripture history. Here we have found a propensity to get by rote which has been very difficult to overcome; we have, however, lately adopted a plan somewhat similar to that which is followed in selecting the pupils for the Normal School of Potsdam, and we think it promises to answer the purpose. A passage is selected by the judges, and read over once or oftener to the competitors, who are examined upon it at once, without allowing of further preparation. The capacity of retaining what is heard, is thus assumed as the test of the information which is possessed. Finally, the Celtic Society have only district competitions, and these only occur once in three years in each district: our competitions are annual, and we begin by competitions in each parish, and then place the winners of the parish prizes against each other for those of the district.

The improvement which has been produced with us is astonishing. The specimens of writing are before us from the commencement, and those exhibited this year from a class which only began a year ago, are scarcely inferior to the best specimens produced by the oldest scholars at our first competition. Arithmetic has made equal progress; and in Scripture history, although entirely a new study with us, our schools will bear a comparison with most others in the country.

This may be said to be the opinion of a prejudiced person. We might quote the reports of the clergymen published in the newspapers, against whom no such objection can lie. But we shall only mention one fact, which speaks the general sense of the country. The competitions begun by us have been extended in every parish of the district, by means of funds raised within its own bounds, not in large sums from a few individuals, but in contributions of small amount, from the whole body of the population. This was first done in one parish, then in another, and has at last been done in the whole. Upwards of 130 volumes have been distributed this last year from the funds thus collected, over and above all that have been given by the Society; and Grammar, Geography, Mental Arithmetic, English History, Latin, Greek, &c. have all had their allotted prizes in each school. In no case have more than two gone to the same class, so that each of these volumes has been the subject of an anxious struggle to a number. At the special request of an influential individual of the district, and with the perfect approbation both of the examinators and of the teachers, English history has now been added to the subjects of our district competitions.

Thus far, then, we think there can be no doubt of the perfect efficiency of our system. Indeed, to this extent we are hardly entitled to call it our own, as it belongs to us in common with a body so much more influential.

Among the humbler classes, the period of school education generally terminates at the age of fourteen, boys usually entering about that age on the different occupations which are to employ them through life. In this country it is a universal complaint of tradesmen, that, during the first years of apprenticeship, lads are quite listless and indifferent to every thing. They may have been distinguished for energy at school, and their new employment may have been their own deliberate choice, but the effect is still the same. An entire change of character takes place so soon as they enter the workshop.

This cannot arise from any apathy peculiar to the age; for, in the opinion of all teachers, at no time of life does the mind, under ordinary circumstances, engage with such enthusiasm in any task to which it may be applied. It must then arise from some peculiarity in the new situation, and there are certainly circumstances connected with it very disheartening. At school a boy is placed beside his equals in age, and feels that he can maintain an equality of rank. In the workshop he is borne down by the unapproachable superiority of his shopmates, and is discouraged from exertion in the same way as a boy at school who is put into a class beyond his years. While he is unfit for the proper work of his trade, he is put to others of the most degrading nature, in which he cannot possibly take an interest, and he is apt enough to contract a disgust at the entire line of life, and to acquire idle and dissipated habits, from which he never recovers.

Nothing, so far as we know, has been done either here or elsewhere, to rescue young men from the evils and dangers by which they are surrounded at this period. Here a system of superintendence like that which has been established over schools could obviously do nothing. But, if we are correct as to the cause of the prostration of spirit with which apprentices are seized, the same means which have been applied by us for the improvement of education, are perfectly applicable to them. Place them again in competition with their equals, and they will be as desirous for distinction in their new employments as they were in the different branches of study at school. There can be no difficulty in arranging a meeting of the apprentices of a district at least once a-year, and the preparation for so important a contest would be a subject of constant interest, and relieve the tedium of all their other occupations.

A district like ours does not afford much variety of trades, but we have tried this plan upon two with perfect success. For a number of years we have had annual competitions of joiners' apprentices, assigning a two-inch mortise and tenon at right angles as the task of the junior class, and a mortise and tenon at an angle of 45° for the senior class. We also instituted an annual competition of blacksmiths' apprentices in the operation of horse-shoeing. In the opinion of all the tradesmen of the country, these competitions have been productive of the greatest benefit. Such is the importance attached to them, that on three several occasions, joiners' apprentices have come to them from jobs in which they were engaged, at a distance of eighteen and twenty miles; and on the suggestion of one of our most intelligent master blacksmiths, we have farther instituted an annual competition in flat filing, which has proved quite as satisfactory. In fact, we believe no agricultural district of the kingdom is now supplied with better tradesmen. One of our master carpenters has been contractor for various works of considerable extent, and given perfect satisfaction to his employers, and some of our young men have gone to Manchester, and even there have been considered excellent workmen.

The prizes given by us to both classes of joiners, and also to the class of blacksmiths for flat filing, have always consisted of works on mechanics, requiring a considerable knowledge of mathematics in order to be read with profit. Our tradesmen were, in general, quite unacquainted with this branch of study when our competitions commenced; but, since that period, they have given themselves to mathematical studies in private, with such energy, that our books are now perused by them with much interest; no doubtful proof we humbly apprehend of the excellence of the foundation which has been laid at school.

We have had an annual ploughing match, which has been attended by about thirty ploughs. The whole population have turned out on these occasions, and given proof of the estimation in which these contests are held, by liberal contributions, which have been increasing every year. They have had the same effect with us as everywhere else. The display of implements, harness, and cattle, has been alike creditable to the district, and we are informed by judges, that there is a visible improvement on the cultivation of the land. One circumstance we must notice as shewing the proficiency which may be produced by these means at a very early age. Two years ago our fourth prize was won by a lad little more than fourteen years of age; and this year, at the age of little more than sixteen, the same young man has proved himself the best ploughman in a field of thirty-two.

We have also had competitions in spade-work and dyke-building, and the awards in both gave perfect satisfaction. But our dyke-builders are much spread over the country, and our premiums have hardly been of sufficient amount to collect them. The spade-work of the district is chiefly executed by Irishmen, and them we excluded, being desirous to raise our own countrymen to an equality with them in spade-work; but here also the smallness of our premiums, and the very low rates at which jobs are undertaken by Irish labourers, have prevented our having many competitors.

With us, as in most other parts of Scotland, there is much carelessness in the management of manure. The dunghill is generally placed in a very offensive situation, very little attention is bestowed in collecting and depositing in it what are nuisances anywhere else, and as little care is taken to preserve from waste what has been collected. With the view of effecting some improvement in these respects, we have offered a prize for the best kept dunghill in each parish, and another for the best in the whole district. In three of the parishes competitors have appeared. In one of them we had not less than eleven this year, and already there is a decided change for the better.

Our remaining efforts have been directed to a much more difficult matter, yet not unconnected with this last subject. We allude to the reformation of the domestic habits of our peasantry, which have long been a subject of national reproach. However uncomfortable their accommodation, it is not easy to open the eyes of those who have been accustomed to it from their childhood to any of its defects, nor is it easy to discover the means of a fair competition where circumstances are so various. Our plan is to give a specification of what we think absolutely essential to comfort, and insist upon its conditions being complied with by every competitor. Upon these matters, accordingly there is no competition, but these express requisites being fulfilled, the preference is given to those who have displayed greatest taste in ornamenting the exterior of their houses with the ground in front, and at each gable,—particulars in regard to which the worst house is nearly on a par with the best. We conceive that the eye which has been accustomed to a tasteful exterior will not easily allow a defect to remain long unrepaired, or tolerate much discomfort within. We give two cottage prizes in each parish, and another for the best kept cottage in the district; and we also give an additional prize in each parish for the best kept cottage garden, with a district prize over and above. These prizes have been well contested, though not without all our efforts having been used to bring forward candidates, our peasantry having a very general reluctance to offer themselves. We are still much behind many other districts in this respect, but a decided improvement has been produced, not merely in the habits of those who have competed, but of the whole population of the district. Many of our respectable tenantry have adopted the suggestions offered by us to the cottagers; neat shrubberies are to be seen where nothing of the kind was ever thought of, and they uniformly bespeak corresponding comfort in the interior. Unless where a change of tenants has taken place, we have had few instances of cottages thus improved being neglected, and we believe we may say none of them have ever relapsed altogether into their former state.

In our report for 1834, we observed that "if we do what can be done now towards the improvement of the habits of the peasantry, as the present uncomfortable fabrics tumble down, others will rise in their place adapted to the improved taste of the population." This anticipation has already been fulfilled to an extent beyond what we could have conceived possible. In various parts of the district new cottages have sprung up of a very superior description to the former ones; and in the village of Dalry alone, containing about 110 houses, which had for many years received little addition to their numbers, not less than ten old houses have been superseded by excellent new ones. No doubt a considerable part of the money which has been thus employed has come into the country since the date of our report; but most of those houses are occupied by tenants, and had the population not acquired a taste for better accommodation, they would hardly have given rents sufficient to induce capitalists to make these erections. We must add, that the Highland and Agricultural Society have all along, with their usual liberality, bestowed their cottage medal on the winner of our highest cottage prize, and have now done us the honour to remodel their own cottage premiums very much upon our plan. The experiment has been attended with the most signal success, and promises to effect that reform which has been so much desired in all parts of Scotland. Although this is only its second year, there have been 24 competitors in one parish, 16 in another, 11 in a third, 10 in a fourth, &c ; and from parts of the country quite unconnected, the same gratifying reports have been made,—that " a very great improvement has been accomplished ;" that " throughout the whole parish the houses are much improved ;" that " a great stimulus has been given, and much improvement taken place." Neither the poverty of the houses, nor the occupations of their possessors, have prevented their coming forward; and in one parish both of the Society's prizes were won by colliers.

We have been enabled to institute another competition this year through the kindness of the Messrs Chambers of Edinburgh, who, without any connection with the district or its inhabitants, and purely from that philanthropic spirit which characterizes all their undertakings, have placed a full set of their edition of standard works at our disposal. A portion of these have been appropriated to the raisers of the best specimens of garden produce, and have brought forward an excellent display from nearly thirty competitors. There was a very full attendance of spectators, who were much pleased with the exhibition, and some of them intimated their intention of increasing the interest of next year's exhibition by adding some gardening implements to the works of Messrs Chambers which remain undisposed of.

These have been our principal competitions, and such have been their effects. The circumstances in which the experiment was undertaken were any thing but favourable. Five-sixths of the land of the district belong to absentees. The society originated with absentees. They still form the chief body of our members, and our office-bearers all along have been taken from this class. Yet, notwithstanding of all these disadvantages, we have now the satisfaction of seeing almost every competition begun by us extended by the resident population. Our labourers of all kinds never were so fully employed as they have been during the present year. The district is in a state of rapid improvement, and we believe we may say, that, in the opinion of the whole inhabitants, that improvement has in no small degree been advanced by the operations of our society. To our clerical friends we are under the greatest obligations, particularly to Mr Murray of Balmaclellan, who, as general superintendent of our company, has performed all the duties of a resident secretary; and we are also much indebted to all who take an active part in the public business of the district. But their continued support while it was indispensable to our success, affords the best possible proof that, in the estimation of those who have had the best opportunity of forming an opinion, our scheme is effecting the objects for which it was instituted.

Let us next consider whether there is such ground to anticipate similar effects in other quarters from the operation of the same principles as to justify an extended trial; and this question has been already so far decided in the affirmative by the success which has attended the exertions of the Celtic Society to improve the system of education in the Highlands, and by the success which has attended the efforts of the Highland Society in the most difficult of all tasks, to alter the inveterate habits of the peasantry. The question, however, demands a more careful examination.

The subject of education has been growing on the notice of the public, and never interested them so keenly as at the present moment. Regarding its importance all are agreed, but a variety of opinions exist as to the manner in which it ought to be conducted. It is admitted that there is much of excellence in our Scottish system, that it has undergone very great improvements of late years, and that these improvements are steadily advancing. We should be sorry if its progress should meet with any interruption from changes suggested either by ingenious theorists among ourselves, or by the practice pursued in foreign states. Prussia and Holland have been the models chiefly held up to us, and the systems of both we believe to be admirably adapted to those countries. That of Prussia rose by slow degrees, some of the ordinances regarding it being dated as far back as 1728, and the enactment of 1819 which established its present form being little more than a consolidation of a series of previous statutes. It partakes much of the despotic character of the government, and, though perfectly suited to Prussia, we are quite sure that it would not be tolerated for a twelvemonth in this country. The system of Holland is somewhat more liberal, and better adapted for a free country. Like the other, it grew out of the habits and circumstances of the people for whom it was intended, borrowing nothing from Prussia or any other country. It originated with the Society for public good, which was instituted not longer ago than 1784. But such was its progress, that, in 1801, a legislative enactment was passed founded on the principles of the Society, and by the laws of 1803 and 1806, the system was fixed as it now stands. Of this last enactment, it is remarked by Cuvier, in his excellent Report of 1811, that its authors were "*on their guard against a desire to remodel every thing anew*; on the contrary, they recognised all the existing schools such as they then were, and by whatever means they were maintained, but they subjected all to one regular and uniform system of superintendence."*

We trust that the same caution will be observed with us.

* Appendix to Cousin's Report, translated by Mr Horner, p. 264.

For nearly a century and a half, a uniform system of superintendence has been established over the schools of this country, under which they have produced many eminent men, and raised the Scottish character to what it is. The example of Holland would certainly not countenance the subversion of this system, the benefits of which have been abundantly proved to make way for another, which, however well adapted to some countries, may be found quite unfit for ours. At the same time we are far from saying, that the Scottish system of education may not in some respects be altered for the better. We expect much from the normal schools; yet they are not without their inconveniences. They can only reach the rising generation of teachers, and they are any thing but favourable to the introduction of improvements which do not originate with themselves. An obscure teacher will find it no easy matter to obtain a fair hearing for a plan, however excellent, which is opposed to the practice of the normal school.

The great improver of education with us, hitherto, has been public opinion, and, next to securing a due attention to religious instruction, the chief benefit resulting from the annual examinations of the clergy, has been the opportunity afforded by them to the public of forming a judgment on the merits of different systems and different masters. Our inspectors cannot, like those of Prussia, degrade a master once appointed because he has not equalled the expectations entertained of him, nor are they much in the habit of visiting negligence even with censure. They do their utmost to make known merit wherever it exists, but they leave those who want it to the animadversions of their fellow-citizens, and it appears to us that no plan could be better suited to a free country. But the public would be very much aided by such competitions as we have described in coming to correct decisions; and looking at their effect not merely with ourselves, but with the influential society to which we have alluded, we feel assured that they would be a valuable improvement on our national system. They have been shewn to be perfectly suited to the ambitious character of Scotsmen, and if we are to follow not the mere forms of Prussia and Holland, but the principles of legislation which produced the educational systems of those countries, we really see no addition to our establishment which is so much called for.

Very little alteration of the present machinery would be required to carry these competitions into full effect; indeed, we may say none but what is absolutely necessary to qualify it for performing its present functions. Both in Prussia and in Holland the whole responsibility centres in an individual, who is aided by a council, but to himself the public are always entitled to look as the prime mover; and it does not appear to us that the duties of the Committee of our General Assembly can ever be properly discharged till an individual, paid from the public purse, and possessed of high qualifications, shall be vested with the chief charge, and devote his whole time to the office. His natural place would be that of Secretary; and to do this work well would afford him complete employment, even with all the aid which he might derive from the members of the Committee. Thus far, we would have our system assimilated to those of Holland and Prussia, but we would imitate them in nothing else. We would not have our central management to exercise an officious control over the plans of individual schoolmasters, through the medium of the presbyterial inspectors. It may be proper for them to prescribe what shall be taught, and to publish from time to time prize essays on the art of teaching for the information of teachers, but we would leave every master at perfect liberty to adopt what method he may think best. In the annual competitions which we have proposed, and which the Committee, thus assisted, would have no difficulty in conducting, we would have a perfect security against any improper system being long pursued. However perfect a system may be in the opinion of its author, it will soon be abandoned by him if he finds that it places his pupils and himself in an inferior situation when brought to a comparison with other schools. On the other hand, if a new method shall turn out to be a real improvement, these competitions would force it on the notice of the public, by whatever weight of authority it might be opposed. As the duty of the presbyterial examinators would thus consist mainly in bringing forward the merits of different systems, and of different teachers, within their own bounds, so the duty of the central management would be to collect this information and give it to the public in methodized reports.

It does not occur to us that our present system of education calls for any farther amendment. By the plan proposed, it would become the aim of every master in the kingdom to discover the best mode of conveying instruction, and to practise that method in the best possible way, and the reports of the Church would make the results of their efforts universally known, and apprize the country and the Government, from time to time, of any deficiencies which might require to be remedied We feel assured that, in a very short time, the Scottish system would, under such management, become equal to any in the world.

With regard to the arts required for converting to use the materials afforded by different localities, these must vary according to circumstances. It appears to us that, in the Lewis, the spade is the implement which at present demands chief attention. The inhabitants are not absolutely without the means of subsistence, but they are thoroughly destitute of every thing deserving the name of comfort; and their wants of this kind are only to be supplied by raising a surplus produce, which may be exchanged for the produce of other parts. At one time, the return from their fisheries in some degree answered this purpose, but those failed on the introduction of the kelp manufacture;* and being now deprived of that resource also, they have scarcely any other export but their cattle. The produce of the soil is thus all that they have to look to. How, then, is this most likely to be increased?

"The Island of Lewis was not inappropriately compared to a gold-laced hat in the former statistical account; for the cultivated parts of the coast bear the same proportion as yet to the bleak moss in the interior, as the gold lace of the hat to the whole superficies of the chapeau." †

The interior is rather flat, but at one place rises to a height of 700 feet.‡ It is everywhere intersected by arms of the sea and small rivers,§ each having a sufficient fall for a small mill; and over the whole surface there are numerous fresh-water lakes.

* Ross and Cromarty, p. 135. † Ib. p. 120. ‡ Ib. p. 116. § Ib. p. 164.

The climate is extremely humid,* and the soil is soaked with water; but there is obviously no difficulty in getting rid of it by draining, and then there would be room for the successful application of the means of improvement detailed in the reports.

The soil is in general peat of the best quality,† resting upon a subsoil of hard red clay, which it is found advantageous to mix with the moss.‡ There are beds of sand and gravel in many parts of the interior,§ and along the coast, shell sand is to be found.|| In various places, "the natives expect a bursting of the shell-fish banks once every seven years; then immense masses are thrown up, and found at low water; but this bursting happens oftener than once in seven years. The Reporter has seen huge heaps thrown ashore twice during that period, which employed many carts and creels for several days in carrying them away for food and manure."¶ There is a little lime at Garrabost.** Irish lime may be commanded everywhere, at a moderate price; and along the whole coast there is a plentiful supply of sea-ware.

Many parts of Scotland have been reclaimed with nothing like these advantages. The climate of the Lewis may forbid the continued cultivation of corn crops to any great extent; but there can be no doubt that, by the proper use of the means afforded, the pasture might be made much more abundant, and the cattle might both be increased in number and improved in quality. As draining must be a preliminary to every other improvement, to perfect the people in spade work ought plainly to be the first object; and if, by means of competitions, a lad of sixteen has been brought to master the plough with us, we see no reason to doubt that, under the influence of the same stimulus, the young men of the Lewis might acquire the complete use of this much simpler implement at as early an age. They would, indeed, enter on competitions of this kind under very great advantages,—a considerable number of the cottars and small farmers now using the spade in the cultivation of their small possessions.†† The command

* Ross and Cromarty, p. 118. † Ib. pp. 121, 140, 141, 143, 150, 151, 156, 160, 168. ‡ Ib. pp. 117, 120, 143, 151. § Ib. pp. 121, 143, 159. || Ib. p. 117. ¶ Ib. p. 123. ** Ib. p. 120. †† Ib. pp. 131, 148, and 166.

of the spade, with the industrious habits by which it must necessarily be accompanied, would tell immediately upon this the lowest grade of the population, in their improved and extended crops;—and they, and indeed, the whole population,—would be still farther and more essentially benefited, by the enlarged improvements which the higher class of farmers would be enabled to undertake. Indeed, the inert, sluggish disposition of the natives, forms the great objection to tenants of skill and capital, from other parts of the country, settling among them. Were that objection overcome,—as we think it would be by the means suggested,—were such tenants certain of finding in the Lewis an industrious, intelligent peasantry, capable of executing the improvements required to render the land productive,—their assistance would soon be obtained. It is impossible to say to what extent the produce might be increased by these means. But we must remember, that, by mere improvement in management, districts by no means so barbarous as the Lewis have already raised their produce tenfold.

We might mention other matters;—premiums for green crops might be of use, and premiums also to induce the people to collect their manure into well placed dunghills, would both benefit the land, and render the houses more comfortable. But the great misfortune of the people of the Lewis is, that their employments are too miscellaneous. Their object is thus, not to do their work well, but to get any job which presents itself out of hands. There is no chance of overcoming this slovenly disposition by offering a variety of different things to their notice. But if they can be so much interested in any one species of work, as to desire to become proficients in it, the industrious habits thus acquired will presently carry them on to others. For these reasons, we would confine ourselves now to spade work, as that which promises to be most generally useful.

But many, we know, hold the opinion, that it is utterly impossible to overcome the indolence of the present race of Highlanders, and that no effectual improvement can be undertaken till they are removed, and their place occupied by a more civilized population. This opinion has not only been maintained in theory, but acted upon in practice, and in some instances with a degree of rigour which must have been scarcely less painful to those by whom it was exercised, than to its unfortunate objects. Indeed, on a late occasion, after the civil power had failed, and submission had been compelled by a military force, carrying with it the dread of a repetition of the horrors of Glencoe, the measure was actually abandoned. This has so far been the work of individuals; but a petition has lately been presented to Government, from an influential body of Highland proprietors, setting forth, that, from the failure of the kelp trade, a large portion of the Highland population are now destitute of work; and entreating that they may be removed to some of her Majesty's colonies at the national expense.

We do not at all question the motives of the distinguished petitioners; we are quite sure that they intend the change not only for their own benefit, but for the benefit of those whom they would send away. But, however rich the country of the emigrants' destination, and however poor his own, still to leave it he regards as banishment; and for our own part we must say, that the measure appears to us as impolitic as it is harsh. Where is the evidence that the Highlanders are incapable of improvement? If we look a very short way back into the history of the best cultivated parts of Scotland, we shall find them in the hands of people little more civilized. In the county of East Lothian, up to the middle of last century, farm servants were "poorly paid, and scantily fed; and with the feeble cattle, and ineffectual implements of husbandry, were ill fitted, in any portion of time, to perform a reasonable amount of labour. Lord Kaimes, when writing about the implements of husbandry then used, says of the harrows, 'They were better fitted to raise laughter than to raise mould,' and every thing else was of a piece; and so feeble were the cattle, that when making the barley seed,—a serious matter in those days,—it was necessary the labour should be performed early in the morning, and late in the evenings, when the sun's rays were comparatively weak, otherwise the starved animals were unable to crawl." * "The cow, from the want of summer grass, was often scarcely worth the milking; and still more, potatoes were then hardly known. The consequences were, that the poor hind was miserably fed, poorly clad, feeble, and particularly liable to sickness. At that period, regularly in

* Haddington, p. 376.

the spring, in every hamlet and village, the ague made its appearance in almost every family; and there can hardly be a doubt of that sickness having often been the natural effects of poverty and filth, more than any thing else." * In some districts of the south, about this period, we have heard that people were occasionally reduced to the necessity of drawing blood from their cattle to obtain a wretched meal. Not eighty years ago, the husbandry of Berwickshire was as follows:—" On an eligible spot, sheep were penned for a sufficient time, to prepare the ground for crop, when it was torn up by a ponderous plough, drawn by four horses and as many oxen, yoked two and two abreast. Grey oats were sown on the same place two or three years successively, then peas and beans, or barley, after which it was left a prey to weeds, or lay naked and barren, till restored in some measure by the lapse of time." † Nearly the same account is given of the state of agriculture in Fife about this period.‡ Panniers were the only means of carriage in all parts of the country. Even in the memory of one of the Wigtonshire reporters, manure was carried in creels in that county, and "the people sometimes carried the creels on their own backs." § "Fifty years ago, one-half of the road between Dirleton and North Berwick was repaired every spring by the very primitive method of ploughing, rolling, and harrowing." || In Fife, "70 years have not elapsed since the best farmers had but a thin partition between their bed-rooms and bestial."¶ And, in the southern part of Dumfriesshire, at the date of the former statistical report, " most of the farm-houses were built with low mud walls, covered with straw, which had scarcely a frame of glass in their windows."** This was the case even in the parish of Cummertrees, where the cottages of the peasantry are now little inferior to any in England.

In all this we cannot help thinking there are to be seen precisely the same features which are observed in the character of the Highlanders of the present day, and which appear to us to be no way peculiar to any particular race, but to belong to men, in all quarters of the globe, while in a state of imperfect civilization. As the awkwardness and indolence of former days have been overcome in so many parts of Scotland, we see no reason to doubt the possibility of getting the better of them also in the Highlands, though stormy seas, and bleak mountains and moors, have cut off their communication with

* Haddington, p. 377. † Berwick, p. 220. ‡ Fife, p. 609.
§ Wigton, p. 45. || Haddington, p. 222. ¶ Fife, p. 369.
** Dumfries, p. 255.

other parts of the country, and have necessarily retarded improvement. But we will not trust to our own opinion on this. Let us hear that of the intelligent clergymen of the Lewis, who have the best opportunity of knowing the circumstances, and judging of the capacity of their flocks,—"If the natives had the means to purchase proper implements of husbandry, and were ordered by those in authority to pursue a different plan of tillage, the Island would have in a few years a very different aspect, and, without doubt, the climate would change for the better."* There is no want of ability or will; and so tractable are these poor people, that those placed over them have only to direct their industry to make it productive. The same reporter even says, that "A great deal has been done during the last twelve years by consuming the moss, draining, and trenching; and if these operations be continued with vigour, very great improvement may be expected.† So far is the failure of the Kelp trade from being regarded by the reporters as a loss, that one of them says:—"Had the ware, burned and exported, been given to fields in culture, or put upon new tilled land to stimulate and feed it, the profits, though not so large, would be annual, yea perennial; and in the course of a nineteen years' lease, the old arable land would retain its stamina, and the new land would be pulverizing. The rents would then be certain and easily secured; besides, at the end of the lease, the lots or farms would be worth at least double the former rent. But when thousands are engaged all the summer season making kelp, their crofts and lots are neglected,—potato-fields are overrun with weeds, consequently, the return is small, and part of the gain by kelping is lost in their potato-crop; their cattle are much neglected, corn-fields are destroyed." "Many of the herd boys that should attend the cattle during the summer heats are kelping; many beasts are lost in mossy veins, and fall from rocks when they run wild during an excessively hot day; so that in this way the gain by kelp becomes a loss." ‡ These judicious observations are powerfully confirmed by what has actually occured in East Lothian§ and Fife, in both of which counties kelp was made in former times, but the practice was given up long before the fall in the price of that article; and the whole sea-ware of these coasts has for many years been given to the soil.

In the Lewis then, at least, there seems no reason to anticipate any difficulty in bringing about that change in the character of the population, which is necessary to enable them to

* Ross and Cromarty, p. 132. † Ibid. p. 121.

‡ Ross and Cromarty, p. 134, 135. § Haddington, p. 216.

live comfortably in their native land, and to make an adequate return to its proprietors.

We have confined our observations to one locality, as the surest way of testing our theory, and we have made choice of the Lewis as the lowest in point of civilization of any yet described in the Statistical Reports. If we have made mistakes, there must be many who are able to correct us; but if in this instance we are right,—if the reformation which we anticipate may be effected in the Lewis by training the inhabitants to spade husbandry in the manner proposed, assuredly that is not the only district which might be benefited by this mode of treatment. Throughout the whole of Scotland, the improvement, at once the most important and the most expensive, is draining. Mr Smith of Deanston, an authority of acknowledged weight, in his treatise on this subject, says:—"There is no want of employment for all the spare labour and spare capital of the country in the general cultivation of the soil; and if properly gone about, it will afford ample remuneration to the individual possessors and farmers of the land, while the wealth of the country will be greatly increased." That there is no general excess of population is evident from the universal rise of wages; and if such an excess should be found to exist in particular places, by giving the people the command of the spade, they would be enabled to obtain employment in those districts in which there is a want of labourers, without being forced permanently to give up their present residence. In fact, an instance of this offers itself in the case of the inhabitants of the parish of Stenscholl in Skye, who regularly spend their summers in spade and other work in the low country, and return to their homes in winter, with the wages which they have earned.

With ample occupation, then, for the whole population of the country,—with a population devoted to that country, and who want nothing but instruction to become the most valuable means of increasing its wealth, would it be expedient that the funds of the nation should be expended in exporting, as useless lumber, those thews and sinews by which alone the improvement can be accomplished? We trust that this question will be deliberately considered. To answer it in the affirmative would appear to us in no degree less preposterous than to say, that with an enemy at our gates, we ought to disband a body of Highland recruits, because, undrilled, they are unfit to cope with veteran soldiers. The experiment which we propose is neither expensive nor troublesome, and cannot by possibility do harm. We have some hopes that the Highland Society, who have done so much for the plough, may be prevailed upon to extend their powerful patronage also to the spade ; and if they should, we are sure that Highland proprietors will not withhold their countenance from competitions which may possibly render the possessors of their estates useful at home, and certainly will induce habits of industry, which will render exile more tolerable to them, should it still be deemed proper to follow out the plans of emigration.

What we have said regarding our own district and the Lewis, may be applied more or less to the whole agricultural population of Scotland.

With regard to the urban population, there is a call in many places for manufactures for their employment. But machinery is of use for this purpose only by increasing the produce of human labour, and thereby lowering the price and extending the demand ; and any other expedient which has these effects, will operate precisely in the same way. The first introduction of manufactures is at all times an operation of extreme difficulty, requiring not merely buildings and machinery, but people habituated to the work ; and we have had far more failures than successful experiments of this nature. But an improvement in arts, already established, is attended with no such risk ; while its effect in giving increased employment must be precisely the same. If, by improved intelligence and dexterity, the produce of a man's labour is increased ten per cent., he can afford to dispose of that produce at a price reduced in the same proportion ; and, in general, the effect of a reduction of price is to extend the demand in a much greater degree. With increased consumption comes a greater division of labour, which operates still farther in the same way, increasing the produce of good workmen, and giving useful employment to many hands which would be quite unfit for any operation of difficulty. At last, simple operations which require to be frequently repeated are committed to a machine, and a new manufacture is begun to which no one can prescribe a limit.

Instead, then, of endeavouring to effect an object so precarious as the institution of manufactures altogether unknown in the place, it would surely be much more prudent to direct attention to the improvement of those kinds of work with which the population are already familiar; and here, again, competition suggests itself as the surest mode of accomplishing the end. We know of no art to which it would not apply—may it not teach the use of the pencil as well as of the pen—may it not be equally serviceable to the engraver, the carver, the sculptor, the compositor—may it not be as well applied to other works in wood, as to the formation of a mortise and tenon, and to all operations in metal, as to the work of the forge and the file. There is no art, however complicated, which may not be resolved into a small number of elementary operations, each forming a fit subject for a comparative trial of a certain class, from the merest beginner up to the perfect workman; and if it should operate elsewhere as it has done with us, this training of the hands would lead to a corresponding cultivation of the mind, and to a general elevation of character.

There is one kind of work so universally useful, and which appears to us to admit of being so easily improved and extended, that we cannot help noticing it more particularly. We allude to the construction of the wooden work of cottages. The building of a cottage is at present so accidental a circumstance, that recourse is had to the nearest tradesman. He has to collect a portion of all the materials required for a house ten times its size. In building a large house, the plan which answers for one door or window, may serve for a dozen; but, in building a cottage, it may possibly be required for no more than one. Throughout the whole work on a cottage, there is a constant loss of time in passing from one kind of labour to another, and a still farther loss must be sustained from the carelessness of the hands employed in such small jobs, as cannot always be under the eye of the master. But it is no uncommon thing for a carpenter carrying on business on an extensive scale, to construct in his own workshop the whole wooden work of a large house, leaving nothing to be done on the spot but to fit each piece to its place; and we speak on the opinion of an intelligent tradesman, when we say that this would be perfectly practicable in the case of cottages; nay, that they offer many conveniences for such an arrangement. There would be no objection to the doors and windows of the whole cottages of the country being made of the same dimensions; and there would be a manifest benefit in having the glass of the windows all cut to the same size, as in that case a constant supply could be kept in every village, and any labourer would be enabled to repair his own windows without the assistance of a tradesman. This branch of business might be carried on to great advantage in every sea-port at which wood is imported, and it would connect very naturally with the saw-mills which are in general already erected at these places, nor would it be of trifling amount. A very great proportion of the cottages throughout the country require to be rebuilt, and there are very few, indeed, which should not have their accommodation doubled. The work of the carpenter is a very considerable item of the expense. By the means proposed, there would be a saving of time, a saving of carriage, and a complete security against bad workmanship, ill-seasoned wood, and the endless delays of country tradesmen. The attention of the landed proprietors has been fully awakened to the subject of cottage improvement; and a call has been made by the Highland Society on the rich counties of Perth and Ayr, which is not likely to remain unanswered. In these counties, then, in particular, we would say that such an undertaking could scarcely fail to prosper.

Among those engaged in manufactures, the want experienced is not of means, but of management. To that portion of them who are employed in hand labour, our present remarks will apply, as well as to the inhabitants of towns in which there are no manufactures; and any improvement upon them would tell upon the other working classes of the place, all being disposed to imitate whatever excites their admiration. But our chief hopes of reforming the great body of the manufacturing classes are built upon an extension and improvement of the means of education. Were these as perfect as they might be, they would open up a thousand sources of rational enjoyment, which would withdraw them from their present degrading indulgences. This we are entitled to antici from the change which has uniformly been produced by a tivated taste. Not much more than "sixty years since," tavern was the only place in which the higher orders met the transaction of business, and was equally their resort amusement. Even a private party in the hall not ur quently ended in a brawl in the village alehouse; but in rank of life all such barbarisms have yielded to a higher de of cultivation. A similar change is remarked by nearly all clergymen as observable in the agricultural population, an them also it is attributed to a better education, and the resou which it furnishes. Among the educated part of the manu turing classes we see the effects of the same causes in soirees, chanics' institutes, lectures on scientific subjects, &c.; nor is extension of abstinence societies to be omitted in enumera the symptoms of general improvement everywhere appar Their beneficial effects have been too powerfully manif in the United States, by the closing of 2000 distilleries, 6000 spirit shops, to admit of their being endangered by n theoretical objections;* and we must regard them as grat ing proofs that a decided disgust at the vice which they intended to repress is growing up with the taste for more fined recreations.

It has been shewn by Mr Smith of Deanston, Mr Bucha of Catrine, and several others, that it is in the power of r ters very materially to contribute to this improvemen character, and to put the manufacturing classes in posse of a degree of comfort beyond that enjoyed by any agricult labourer. The Messrs Chambers also, to whom the cou owes so much, and to whose generosity we are ourselves deeply indebted, in the annual entertainments usually give master printers to their workmen, by converting what was merly a mere jollification into an intellectual repast, have troduced a new feature, in which it is difficult to say whe the conduct of the employers or the employed is most deser of applause. In the address of Mr Forsyth, on behalf of him and his brother workmen, will be found sentiments which w

* Report of the Committee of the House of Commons on Drunken in 1834.

do honour to any man, expressed in language which would do honour to any author.* Dr Neill has still farther improved on this reform, substituting a rural excursion for a city banquet, and inviting the wives and daughters of the usual guests to join the happy meeting. We refer to these changes with pride, as harbingers of a general effort among masters for improving the habits and comforts of those in their employments.

Nor have the higher orders been wanting in contributing their share to the promotion of this spirit of improvement among the humbler classes. To all institutions for this purpose they have readily given their patronage ; and we observe that the Legislature have now under their consideration the means of supplying the crowded population of large towns with public walks. At present it must be admitted that we contrast very unfavourably with the Continental States in this particular ; the public being entirely excluded from almost all the gardens, museums, &c. which we possess. That this is no way called for by the character of our countrymen, has been sufficiently proved by their conduct whenever the rules have been relaxed in their favour. We may refer to the rejoicing on the day of her Majesty's Coronation, when not a leaf was injured, although every place was thrown open ; no armed police was required with us to preserve order, the proper feeling which everywhere prevailed being quite sufficient for the purpose. We may refer likewise to the occasion of George the Fourth's visit to Scotland, when the becoming deportment of our citizens was equally striking ; and we may refer to the equally gratifying conduct of our countrymen of the west at the late splendid festivities in Ayrshire.

It might not perhaps be prudent to depart all at once from a system which has prevailed so long, but what we have seen shews that there would be no harm in occasionally allowing the humbler classes to share these indulgences with those whom fortune has placed in a higher station. Even associations who have formed institutions of this kind at their own expense, might concede this much ; and from such of them as have grants from Government, this might with much propriety be required, as a condition of the allowance being continued.

* Chambers' Journal, No. 389.

Such meetings would at once improve the taste and manners of the lower orders, and promote that general good will which ought always to subsist among persons acknowledging a mutual dependence.

And here it is impossible for us to avoid expressing our regret that, while those in the humbler walks of life are excluded from sources of recreation, which would invigorate their bodies and improve their minds; the dram shop everywhere offers them its baneful seductions. We by no means say that intemperance would altogether disappear, though these nuisances were abated to the utmost. For the extirpation of that vice, we trust to the taste for amusements of a higher kind, which is everywhere gaining ground, and which it is the great object of our humble endeavours to promote by every means in our power. But there can be no doubt that the advance of this taste is very much retarded, and the evil of intemperance greatly increased, by the unnecessary multiplication of spirit shops. At present when the authorities have to consider an application for a license, they are apt to be carried away by the testimonials of the applicant, without thinking whether an additional establishment of the kind is needed or not. But surely the first question ought to be what number are required to supply the wants of the place. This should be determined without reference to any of the applications for license, and although to reduce the numbers at once to this amount, might be attended with individual hardship, there could be no hardship whatever in refusing every new application till the numbers may fall to the determinate amount.

Such is the plan for improving the condition of the humbler classes, which we have been endeavouring to reduce to practice as far as in our power, and which we now humbly offer to the consideration of the public.

Many of our countrymen have risen to eminence from very poor beginnings, overcoming every obstructing difficulty, and, to their infinite credit, have uniformly endeavoured to make their kindred partakers of their elevation. But many also have never looked beyond the passing hour, nor known a hope above mediocrity; their life has gone on without plan, their money has been thrown away with companions equally reckless; parents have been allowed by them to hang a load upon public charity, and they have looked to no other resource themselves when the infirmities of age have disabled them from earning a livelihood.

These two classes may be said to divide the community; few remain stationary; most men are either rising or falling, and partake more or less of one or other of these two characters. To which class an individual is to belong is determined at his very outset. Even of those who have sunk the lowest, there are few who have not at first had some spark of honourable ambition, which, rightly managed, might have led them on to respectability. The object of our whole exertions is to cherish this spirit, wherever it appears, from its earliest dawn till the character is completely formed, and the means in which we place our chief reliance for accomplishing this is the patronage of the influential classes. Mere money will not do; nothing less than their personal presence can enable them to judge of the qualifications of the candidates for their favour, or induce the poor man's son to believe that his merits may recommend him to persons so much above his sphere. Their absence would not only cut off this hope, but deprive him even of the countenance of persons of minor note, whom the tyranny of fashion compels to follow their example. In a district like ours where the principal proprietors are non-resident, their place may be supplied by the presence of those on whom other public duties are devolved; but, when proprietors live on their estates, and attend personally to the business connected with them, this duty must be performed by themselves personally, or all such attempts must be abandoned.

Assuredly we have no lukewarmness to fear from the higher orders of this country, to any measure which promises to promote the public good. Here the good men of all parties, whig, tory, and radical, meet on neutral ground, throw aside their political differences, and are at all times ready to combine their most strenuous assistance. We cannot help thinking that the exhibitions to which we would direct their notice would prove not only beneficial but interesting. We see no reason why a contest in any useful art should afford less amusement than the turf, the chase, or any of those displays of skill and dexterity which occupy so prominent a place in the attention of the public; or why even the philosopher should not find in them matter of attractive contemplation. "The proper study of mankind is man." If there is pleasure in observing the habits of the humblest insect, how much more must there be in disclosing the laws which govern our own species? If the attractions of dead matter form a pleasing subject of investigation, how much more interesting must it be to trace the principles of that moral chemistry by which mind acts upon mind, of that influence by which a man of no natural activity springs into life, when the eyes of the public are fixed upon him, and performs labours to gain their good opinion, which a regard for his own comfort, and that of his family would never have impelled him to undertake? The effects of this power have been manifested in many different ways, and are scarcely less remarkable than those of the galvanic influence upon the dead subject; yet it has hardly received the attention due to so important an agent. How it may be most effectually called into action, to what extent it may be carried, and how applied, are questions well fitted to arrest the attention of the inquiring mind; but questions which no one can be in a situation to answer without carefully observing its operations. But if the proposed exhibitions are thus inviting to others, with what feelings must they be witnessed by those in a higher rank of life, who form the centre of the system, whose countenance is indispensable to its very existence, and whose encouraging words, whose encouraging looks, whose mere presence, are thus the prime agents in metamorphosing a whole community; supplying its physical wants from the inexhaustible resources of its own industry, supplying its mental wants from the equally inexhaustible stores of a cultivated understanding, and inspiring the whole with those high-minded generous sentiments, which are the natural fruits of independence thus achieved! With such attractions, could these exhibitions be deserted—with such spectators, could any talent remain uncultivated—with a ladder by which the meanest mechanic in the most wretched lane of the crowded city, the humblest peasant in the most secluded glen, might ascend by sure and easy steps to that place of honour and of usefulness which he is qualified to fill, could any man possessing the merest embryo of merit linger in obscurity? We do not think it possible.

Still we propose the subject only for experiment; and looking at the success which has attended all the efforts hitherto made to improve the educational institutions of this country, conducted upon the principles which we have endeavoured to explain; looking at the effect of precisely the same principles in the hands of the Highland Society, in every department of their multifarious operations, more especially in that most difficult task in which we have the honour of sharing their labours; looking in fine at the result of our own humble efforts, we entertain considerable hopes that our proposal may be favourably received. If an experiment should be made to any extent, we trust that it will be followed out with that patience which has been found requisite in all similar undertakings. The chemist does not at once throw aside the crucible though his first attempt should fail, but looks for the cause of his failure and endeavours to discover a remedy. The mechanic does not abandon his schemes though his first machine should not equal his expectations. Nothing could be more discouraging than our own beginnings. In fact, for the first two years we did almost nothing, and if we have now in part accomplished our object, it has been by abandoning plans from which we, at one time, had high hopes, but which experience convinced us were defective, and by adopting others which seemed free from the like objections. It is more than probable that something similar may occur with all who enter upon the same field, but we trust that the failure of one plan will only induce the experimenter to try another. As it is by this system of investigation that physical science has attained its present height, we have a strong assurance that it will also conduct to the certain means of improving the condition of our countrymen; nor do we see reason to apprehend that it will be found inapplicable to any other portion of the human race.

EDINBURGH, 11*th November* 1839.

ACCOUNT OF THE GREAT MEETING OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND AT INVERNESS IN OCTOBER 1839.

This report of the Society's meeting will be somewhat different from any which have hitherto been given, inasmuch as a new feature was introduced in the conducting of the dinner of the General Committee, which usually takes place on the day previous to the great Show. Hitherto the enjoyment of this dinner has been confined to those who received special invitations from the Directors, and the topics entertained at it were chiefly of a complimentary nature. On this occasion, however, the dinner was accessible to all members of the Society; and, instead of the usual complimentary speeches, papers were read, and sentiments delivered, on subjects previously chosen by persons appointed for the purpose.

Reserving our remarks whether the experiment has been successful or not, we shall, in the first instance, give the subjects which were descanted on, and the papers at length which were read.

I. How far is it a wise and prudent measure to cultivate so largely the Short Horn Breed of Cattle, to the risk of the entire loss, or at any rate to the deterioration of the fine native Breeds of Cattle?

II. Whether it would be better to feed Sheep fat for market, or bestow the extra keep raised in this northern district of the country upon the young Stocks; and how far crossing different Breeds of Sheep may be carried on with advantage?

III. What is the best system of Thorough Draining?—The advantages of Surface or Hill Drainage, usually called "Sheep Drains," will also be adverted to.

IV. Can Bone Manure be considered effectual for a Crop succeeding Turnip, without being a second time manured, or ate off by Sheep; and if so, what quantity will the acre require?

Mr Heriot of Ladykirk spoke thus on the first subject, viz. "How far is it a wise and prudent measure to cultivate so largely the Short Horn Breed of Cattle, to the risk of the entire loss, or at any rate to the deterioration of the fine native breeds of Cattle?"—In proceeding at the request of the Committee of the Highland and Agricultural Society of Scotland to give some account of the origin and present state of that remarkable description of improved short horn cattle, I have thought it more respectful to this Committee that I should commit names and dates to paper, rather than commit any mistake on so important a subject.—I shall, therefore, without farther preface, proceed to read a short history of the Short Horn Breed, which I trust will not prove uninteresting to this Committee :—

In obedience to the wishes of the Committee, I shall most willingly make a few observations, founded on facts consistent with my own knowledge, relating to that splendid description of farming stock, technically called "improved Short Horns," at present in such extraordinary demand.

Previous to the year 1788, when the great improvement took place with regard to "Short Horns," there had existed, perhaps, for a century, a very good race of cattle, known as the Teeswater breed, in the possession of proprietors, or extensive farmers, of the name of Colling, Hill, Charge, Maynard, Brown, and perhaps, a few others. The feeding qualities of these cattle were good, and they attained to a heavy weight. Many of them were well-shaped and gay in colour, but not remarkable for yielding much milk. At this period, the knowledge of ascertaining the qualities of live stock by touching or handling, was in its infancy; but the handling of those Teeswater cattle has been since described by those who brought the "Short Horns" to the highest perfection, as not what would *now* be called the best, being somewhat like the touch of chamois leather.

Mr Maynard of Airey Holme, on the Yorkshire side of the Tees, one of the gentlemen to whom I have already alluded, had a cow, which, from what afterwards happened, appears to have possessed very remarkable properties. This cow was purchased from Mr Maynard by Mr Charles Colling of Ketton, near Darlington, for thirty guineas. The male progenitor of the present race seems to have been chiefly a bull called Foljambe's bull, bred by Mr Charles Colling, and got by a bull called Barker's bull, whose genealogy appears to be not so well established. He came from the Swale side, and is said to be traced to the cattle of Sir William St Quinten of Hunmanly, in the East Riding of Yorkshire. Foljambe's bull, among many other cows put to him, had Maynard's cow, sometimes called Lady Maynard, and produced Old Phœnix and Strawberry. These two cows (Strawberry I perfectly remember) seem to have been the original stock of the "improved Short Horns," as Strawberry bred Bolingbroke, and from them sprang Favourite, Young Phœnix, Venus, Comet, &c.

I have already remarked that a great improvement had taken place in those Teeswater cattle about the year 1788. They had become well known throughout Yorkshire and as far north as the Tweed, without, however, the breeders on the Tees being able to obtain any extra price for what they sold.

It is exceedingly curious to trace the steps by means of which the brothers Colling brought their cattle to such a degree of perfection, which, as will be seen by referring to the Herdbook (and I know it to be accurate in this respect) was effected by breeding "in and in," and none could be more robust than the cattle bred in this way for a certain time. But, as early as the year 1791, Mr Charles Colling perceiving that by continuing this close breeding, he was rendering the stock delicate, took the remarkable step of putting a Galloway bull to some of his best cows. As it bears upon the subject, I may here remark, that in the first number of the Journal of the English Agricultural Society, a distinguished nobleman, in his article on the Breeding of Cattle and Sheep, has been led into error; for that noble lord says, "The most successful cross between two different breeds of cattle, of which I am aware, was the one between a Durham bull and a Galloway Scotch cow, made by Mr Charles Colling. The produce from this cross sold for enormous prices at his sale, and at the present day a majority of the best short-horned cattle are descended from it." This is certainly a mistake. The cross was between a Galloway bull and short-horned cows. From this cross were produced several splendid females; but eventually he gained neither fame nor profit by the experiment; and although by this time the stain is probably washed out, breeders who possess the best herds, have always carefully guarded against the blood thrown in by this cross, which has ever since been technically called "the alloy."

At length, in the year 1789, Mr Robertson of Ladykirk, then a young gentleman of good fortune, and enthusiastically attached to country affairs, went to the county of Durham and the adjoining parts of Yorkshire, accompanied by my father, on purpose to inspect narrowly this improved breed of cattle, of the superior qualities of which he had heard so much. He immediately saw the vast superiority of those cattle, and anticipated the mighty improvement which has since taken place in the stock of the Border counties, by introducing the breed now called the "Short-Horn."

In the years 1789, 1790, and 1791, Mr Robertson purchased from the Messrs Colling, and Mr Charge, twenty-five females, which were, in his opinion, the best of the respective stocks of those gentlemen, and also two of their best bulls. Thus, the best of the family of the "Short-Horns" were transferred to the north side of the Tweed. The prices given for those cows and heifers, varied from twenty to fifty guineas. One bull cost forty, the other fifty guineas. Thus an extra price was, for the first time, put upon the "Short-Horns," which, in after years, rose so enormously. As an example of the prices which Mr Charles Colling received a few years afterwards, he sold a heifer to the late General Simpson of Pitcorthie in Fife, for 300 guineas, and at his sale, as is generally known, a single bull brought 1000 guineas.

It is certainly an undoubted fact, that the splendid animals in the possession of the Messrs Colling, and a few others, thirty years ago, were produced, as I have already mentioned, by putting the sire to his own progeny. But with those animals, that extraordinary mode of breeding appeared to stop,—for, by unfortunately pursuing a similar course for eight years, the fine stock brought to the Tweed side by Mr Robertson, became not only extremely delicate, but many died of consumption, so that he was obliged again to apply to the Messrs Colling for fresh and more distant blood than his own. He hired from Mr Charles Colling the capital bull Wellington, out of Peeress, and the celebrated animals Midas and Barmpton, from Mr Robert Colling. He used them during ten years, and his herd, altogether clear of the "alloy," again became superb.

The effect produced on the race of cattle on the Border counties, by the use of bulls of the pure breed, has been most remarkable. I perfectly recollect the time when, generally speaking, the cattle of Berwickshire and Roxburghshire, although of a breed of "Short-Horns," were kept to a great age, and then fattened with difficulty, while now, the race in these districts possesses all the qualities of profitable stock. The "improved Short-Horns" are now spreading far and wide.

Mr Craig then read the following statement on the same subject:—

First, he contended, that the crossing must deteriorate the native breeds. That this must ultimately happen is beyond a doubt. At present the rage over all Scotland is to cross the cows and heifers of the Scotch breeds of all sorts with short-horn bulls. The consequence of this is that parties will see their error when it is too late, as the excellent and hardy breeds of Galloway, Fife, Angus, Aberdeen, and the West Highlands will be gone; and the whole of Scotland, from John O'Groats to Berwick, not excepting the Isle of Skye, will be filled with a mixed and spurious race of cattle. That parties will, in the first instance, select the finest cows and heifers to put to the short-horned bulls, and that the *first* cross will be in most instances large and handsome, is not doubted; but then, from the neglect that must ensue (and it has already begun) of keeping bulls of the native breed, the supply of pure Scotch cows and heifers must run out, and the consequence will be that people must and will breed from the crosses, and it is generally allowed that a second cross is a failure. What then will happen? As stated above, in a few years nothing will be found in Scotland but a mixed and bad breed of cattle. Many people say, we can breed pure short horn cattle,—so they can, but will that be for their interest? The short-horn breed is soft, delicate, and liable to many casualties, which Scotch cattle are not, and are not so fit to travel the roads. Some again say, we do not want them to travel, as we can now send them to market by sea. Many cannot do this, and besides, the whole cattle in Scotland cannot be fattened at home for London and other large towns; and let it be kept in mind that short-horn cattle or even crosses from them, are very inferior beef, generally selling at 6d. to 2s. a stone less than the fine grained and beautifully mixed beef of Scotland. It is not denied that well bred short-horn cattle are very handsome to look at, but they are made so at a very great expense. Earl Spencer, who is allowed to be among the best breeders in England, has a herd of very fine animals of that description, but how are they kept? Why, they are fed, groomed, and clothed like race-horses;* and it is very questionable if there are many farmers in Scotland disposed to be at that expense, and if they were so inclined, would it not be wiser to give the extra feeding to the best Scotch cattle, which invariably fetch a higher price per stone in market? But with the management of cattle in England we have nothing to do, although it may be remarked that there the people do not run upon short-horned cattle as the majority of Scotch landlords and farmers do, although England is the native place of the short-horns, and the climate there is much better suited to the breed than that of Scotland. In a such thing, many of them would not, for any consideration, contaminate their fine Devons, Herefords, Long-horns, &c. by infusing one drop of short-horn blood into them. It may also here be observed, that short horn cattle are to Scotch cattle something as Leicester sheep are to Cheviot sheep. Now, there is not a Cheviot sheep farmer, who knows his business, in the Highlands of Scotland, but would say that by crossing his hardy Cheviot ewes with the finest and highest bred Leicester tups, his stock would be ruined, and his own ruin would soon follow. If individuals only were likely to suffer from the propagation of this (to Scotland) foreign and soft breed, no one would mind; but it is too much to be feared, that the whole of Scotland must soon feel the bad effects of the measure, and it is, therefore, humbly submitted if the subject be not worthy of some attention.

Mr Dudgeon of Arboll, then spoke to the second question, namely:—"Whether it would be better to feed Sheep fat for market, or bestow the extra keep raised in this northern district of the country upon the young Stocks; and how far Crossing different Breeds of Sheep may be carried on with advantage."

He stated that any observations he would read were meant to apply to the district of Scotland north of the Spey, viz.:—The counties of Moray, Nairn, Inverness, Cromarty, Ross, Sutherland, and Caithness. As matters stand at present, the growers of turnips will dispose of them most advantageously by feeding sheep for the market. Ultimately, I mean, when the period has arrived when matters are ripe for it, the general welfare will, I think, be most promoted by all extra winter keep in the low districts being given to young stocks from the mountainous districts. The reason why I give the preference to feeding at present is, that the extent of turnips grown so far exceeds the demand of the sheep farmers for their young stock, that they obtain them in general at the very low rate of one farthing per hogg, per night. This price is quite inadequate to compensate for the expense of manure, and of cultivating turnips; moie than double per acre has of late years been realized by feeding wedders, and sending them by steamers to the Edinburgh, Glasgow, and London markets. I have long contemplated a change by an

* This assertion regarding Lord Spencer's stock was firmly contradicted by Mr Wetherell of Durham, and Mr Wood of Kimbleworth near Durham.—Edit.

increased demand from the high parts of the country for turnip wintering for young stock, and this is evidently gaining ground. Had not a succession of unfavourable lambing seasons occurred, it would ere now have been more general; as it is, there is a great addition to that system—twenty-five years ago there were not above 2000 hoggs wintered on turnips in the low districts of Ross-shire; this year I do not think there will be under 10,000—a proof of the conviction operating on Highland farmers of the profit arising from this mode of management. Indeed I can hardly think but it must do so on every one who reflects on the security from loss in low sheltered situations, where stock have a competent supply of good food, compared to their being exposed on high stormy lands, in danger of being buried under wreaths of snow, or starved to death by inability to find food. It, therefore, seems to me that the period is fast approaching when fattening of sheep will be superseded in the north, and that the high and low districts working together, extra keep will be most advantageously used in giving it to young stock. But it is too great a sacrifice of interest to expect from the turnip-growers that they are to give their turnips at a farthing per night for hoggs, and although it will occasionally happen that they will be disappointed in the south country for fat, yet it seems to me more for their interest to take chance in this way, than submit to a price that is anything but remunerating. As to crossing different breeds of sheep, I have no doubt it may be practised to much advantage, and carried further than it has been hitherto, when greater attention is paid to wintering. That the breeders may dip more into Leicester blood in many cases,—I say more; for I am decidedly of opinion that the best stocks of Cheviots in the north have already a share of it, and to this are they indebted for their superiority in carcass, wool, and propensity to fatten. As sheep-walks vary in their qualities, so should the stock vary; while what I have ventured to assert may be adopted with the best advantage, probably in a general point of view judicious crossing of the Cheviot stocks by that kind of tups from different stocks may be the most eligible, and on the inferior or wildest ground, the blackfaced or hardy mountaineers, pure or crossed, would probably give more pay than the other. These matters can be best determined by professional men, whose minds are imbued with liberal ideas, and not too much wedded to the practice of their forefathers. When kept in view, the saving of lives, the additional weight of carcass, of wool, and the earlier age at which improved breeds attain maturity, it will be strikingly obvious that good wintering in the low country is worth a great deal more than is presently paid for it. I am doubtful if capital is yet invested in sheep farming in the northern Highlands of Scotland to that extent which may be done to good account, and of which the country is susceptible; the tenements are so large as to require what may be termed men of fortune to stock them. Holdings capable of supporting from 10,000 to 20,000 sheep not only require a large capital to stock, but when nearly the whole of the sheep are intended to remain on the Highland farm throughout the year, prudence dictates that the stock should be kept moderate, with the view of guarding against ruinous loss in case of severe winters occurring. The more effectual way of guarding against this would, in my opinion, be by providing largely in the low country, wintering of turnips, &c., by approximating to the Spanish system of summering on the mountain ground, and wintering in the low districts. Even in favourable winters, the great saving of lives of young stock which are cut off by braxy, by pining, or vincus, accidents by flood and storm occasioned principally by poverty; these, combined with the safety of the stock at home, additional weight of carcass and wool, would amply compensate for the additional expense, supposing the present farthing-the-night system was doubled. I am far from recommending overstocking, or even heavy stocking; my idea is,—have a due regard to the elements, to summer and winter; keep stock improving as large a proportion of the year as possible, and avert loss from diseases so far as you can, particularly from poverty. the worst of all. Providence appears in a particular manner to have intended the low districts of the counties alluded to, to go hand in hand in promoting an immense addition to human sustenance, and in wool for clothing, and affording employment for our manufactures. The climate of these districts (I speak from an experience of thirty-six years) is milder than in the counties of Scotland south of the Frith of Forth. The branches of the Moray Frith penetrate into the interior, on the margin of which snow never lies to a depth formidable to sheep. Tracts of uncultivated moor land in many cases lie on an elevation less than 100 feet above the level of the sea, valuable as an outrun for young stock getting turnips in winter. Extensive tracts are covered with fir plantations, the branches of which are keenly devoured, and afford wholesome food for sheep in winter. Probably not less than nine-tenths of the arable lands are adapted for the turnip husbandry. These sources afford a supply in the most rigorous seasons and protracted storms, and seem to hold out an inexhaustible supply in such emergencies for the whole of our mountain flocks. A paternal Government has given access to these by roads and bridges. Thus has a benign Providence ordered all matters so as to render the northern counties of Scotland particularly useful in rearing herds and flocks for the use of man. The system is rapidly adjusting itself to that effect, and amongst many others, holds out many comfortable prospects for the stability and prosperity of the British empire.

Mr Horne of Langwell spoke as follows:—Mr Chairman—I labour under disadvantages which do not apply to some of the intelligent agriculturists who have preceded me; in so far as that, until I arrived at Inverness, I was not aware that it was either desired or expected that I should take any part in this interesting discussion, and that I do not possess their practical experience; and being thus deprived of an opportunity of preparing myself on the important subject assigned to me, you may believe that nothing but an ardent desire, by every means in my power, to give a fair trial to the arrangements they have made for the proceedings of this day, would have induced me thus unprepared to venture to address so highly influential, numerous, and intelligent an assemblage; and I throw myself on its indulgence, when I attempt to comply with the wishes of the Directors. These difficulties are, however, somewhat alleviated by the reflection that I shall not find it necessary to differ very materially from my friend who has just addressed you.

The question, as stated in the printed paper, embraces two points; which must be treated of separately.

1st, "Whether it would be better to feed sheep fat for market, or to bestow the extra keep, raised in this northern district, upon the young stocks?" and,

2d, "How far crossing different breeds of sheep maybe carried on with advantage?"

Although both these questions are confined to the northern districts, still that district is so extensive, and its resources so varied, that no general principle can be brought to bear on the whole; and, therefore, very much must depend on the resources, capabilities, and facilities of each section of it. And, moreover, as regards the first part of the question especially, such changes have recently taken place by the extent of draining which has taken place, and is daily going on, and the introduction of bone-dust as a manure, whereby a very great increase of green food is now raised, for which our soils are, generally speaking, so peculiarly adapted; and by the facilities afforded by steam conveyance (particularly from the east coast) for the transport of fat stock to the southern, and even London markets, that it appears to me a very great change has commenced in our agricultural system, the working and rapid progress of which must, in my humble opinion, be productive of the greatest advantages to this our northern district, and bring us much nearer an equality with our southern friends.

1st, I freely admit to you, that, taking the first point in a general or national view, the most natural, and perhaps more advantageous course would be, to breed in the northern districts, and to feed fat in the southern parts of Scotland, or in England. Until the introduction of steam conveyance, this was almost the only course which could be advantageously followed, on account of the great distance from market; but now when our fat bullocks and fat sheep can in so incredibly short a time, and at so moderate an expense, be sent to market from these districts, which are so peculiarly adapted for the extensive production of green or winter food, I am of opinion, that it is of advantage to feed off a portion for the immediate market; scrupulously avoiding, however, to encroach on the number of the breeding stock, or to relax in the care to be shewn to them. I am confirmed in this opinion by my knowledge of the working of the system in some localities, and I will illustrate it, by stating an instance.

Take a farm, capable of being managed on the regular five-shift system of rotation, with one-fifth under green crop of the different kinds of turnip; and suppose that green crop to be entirely consumed by a breeding stock by the 1st of May, and the pastures (particularly in a backward season), not then fit to carry on the same extent of stock, the breeder would have his hands full of stock not fit for market at the most critical season; whereas, if he had consumed a proportion of his green food in feeding fat, he could sell or ship them for market in the months of March and April, and get free of them at the best season for sale;—while he would thus secure the further advantage of having all his pastures for his remaining breeding stock.

The example just given contemplates a breeding and feeding farm, but the same rule would apply to a farm not so much adapted for breeding as for feeding, with this difference,—that the feeding stock would be purchased in;—and they can now be had in abundance in every part of this district, from the neighbouring breeding farms.

I admit, Sir, that the example I have given does not exhaust the whole question, and that it does not strictly apply to the agricultural districts where young sheep (hoggs) from the hill-flocks are sent to be wintered on turnips. That system I know is extensively carried on in many parts of the district, with advantage to the agriculturist and to the sheep-farmer; but the system is not applicable to many localities where a great breadth of turnips is raised; and, as a mountain sheep-farmer, I venture confidently to maintain, that, where the hoggs can be kept on their native pastures (that is, on farms that will hogg) without being sent to turnips, it is a much better system to follow; because, though no doubt hoggs attain greater size by turnip-wintering, it is known to every stock-farmer, that they winter very indifferently in the following year (as dinmonts) without similar pampering; and that not unfrequently there is great loss amongst them even at that age. The sheep-farmer has had no reason to complain of prices for some years; but few of them will admit that even such prices,—would afford the expense oft urniping hill-stock for two successive winters. But where extensive sheep-farms (and there are many so situated) do not contain lands adapted for hogging, the system of taking turnips for them in the low country is the only one that can be followed; and I repeat, that it is attended with many advantages, both to the agriculturist and store-farmer. I know of no country better adapted for it than the eastern part of Ross-shire, (where my friend Mr Sim is justly esteemed as an exemplary agriculturist,) and even some parts of this county of Inverness.

2. With regard to the second part of the question, I shall not detain you long. It is confined to the crossing of sheep; and I think it depends even more than the first question on the advantages arising from locality. In low and sheltered districts, the crossing between Cheviot ewes and Leicester tups has been most advantageously introduced, and is on the increase; but I shall confine the few observations I have to make t regular stocks on mountain sheep-farms.

I would then confidently state, that the Cheviot stock-master cannot bestow too much care in excluding from his flock, the infusion of the smallest drop of Leicester blood. That it has taken place, is true; but, I believe there is not a stock-master who hears me, who does not regret it, and who would not avoid it by every means in his power. There is no point connected with the judicious management of a Cheviot stock, which requires more attention than the proper selection of pure Cheviot tups;—and though it may be difficult, and requires great discrimination to select them, they are still to be had in plenty in the western parts of the great range of the Cheviot hills.

There is, however, a cross (that between the old black-faced breed and the Cheviot), which prevails pretty extensively in many of our districts, particularly in wester Ross and Inverness-shire; but though this cross has fully answered expectation, I believe it will be found, that, in most instances, it has arisen from necessity, and not from choice,—and that it has been resorted to mainly where a farm was under a black-faced stock, and where it was found impracticable to make the change at once to the Cheviot. The stock-master commenced the crossing, and very useful and valuable stock has been produced; and if the first cross could be retained, I believe they would prove permanently so; but by crossing more than once, a nondescript is produced; and it is difficult to say what may be the result. To be sure, in some instances it has already been carried *so far* as at last to *pass* them off for a Cheviot stock; but I believe I may safely say, that, though some of them *may appear* to resemble a pure Cheviot, a whole hirsel has not yet been produced, where the original *stain* does not distinctly exhibit itself to the eye of a judge.

I will not detain you any longer, and I beg most gratefully to thank the meeting for the patience with which it has listened to the observations I have, in virtue of the commands of the Directors, ventured to make on these important points.

The Marquis of Tweeddale after a short introduction, read the following paper on the third subject, viz.:—"What is the best system of thorough Draining?—The advantages of Surface or Hill Drainage, usually called "Sheep Drains," will also be adverted to."

Thorough and Parallel Draining on Impervious Clay Land.

In discussing a subject, where, from local circumstances, as well as other causes, there may be a difference of opinion, as to which is the best and cheapest manner of making an improvement, I think it may be more agreeable to the company, as it certainly will be to myself, to state the different methods in use in those parts of the country which have more particularly come under my observation, and leave it to them to draw their own inference. Tile draining (in parallel lines) as it is generally called, has of late years been considered one of the greatest improvements ever made in this country. It is to this branch of improvement I shall now call your attention, and for your convenience separate the subject into different heads.

1st—Soil in which this improvement is made.

In most parts of Scotland where frequent draining in parallel lines is found to be useful for the improvement of the land, the surface soil is generally found to have a subsoil impervious to water, which is the cause, excepting in very dry weather, of keeping the roots of plants imbedded in water; and in the winter time they are much weakened by the change from wet to frost, which is generally supposed to be the cause that wheat plants are thrown out of the ground in spring, and that all suffer in an equal proportion at other seasons of the year. The effect of frequent draining is to relieve the land of its stagnant water, to remove the soil from which the crops formerly suffered, and to enable the farmer to grow those crops on the improved land, such as potatoes and turnips, which were supposed (until this species of drainage was introduced into the country) to require what is commonly called turnip soil to produce an abundant crop.

A subsoil impervious to water is not only found under a poor weak surface soil, in its natural state, producing little or nothing, but it is also found under a surface soil composed of the richest mould, having the impervious subsoil sometimes close to the surface, at other times at a considerable depth.

The quality of subsoil retentive of water that I have found in my experience is various—where frequent drainage is required, that most common is generally called *till*, composed of clay of different degrees of strength, mixed with various kinds of soft sand, and frequently impregnated with iron.

The colours of the till under a poor surface soil are various, sometimes of a sickly yellow ochre—frequently of a rusty iron colour, but more frequently of a weak white and grey colour.

Under a rich black or red coloured surface soil, the subsoil is generally strong clay; sometimes of a rich red, at other times inclined to yellow, occasionally with a shade of green.

There is another species of subsoil that partially holds water, viz.:—Muirband Pan, of which there are two species, the one where gravel is the principal component part, the other is of sand.

On my own farm I have found gravelly muirband in strata of wet clay.

On Millfield plain (Northumberland), I found the gravelly as well as the sandy muirband lying in strata by themselves, sometimes in different parts of the same field, having a dry thirsty light purple sand above and below the strata of muirband. The surface soil in some places was six, nine, and twelve, to twenty inches in depth. When the surface soil was shallow, little or nothing grew on it—that is to say, from six to nine inches. Where it was deep the turnips were most luxuriant.

The Mode of Draining Land having an Impervious Subsoil.

Some agriculturists prefer their drains being made longitudinally, other transversely.

Experience has taught me that the drains ought to be made longitudinally and in the furrows; the distance of the drains from one another ought to depend upon the quality of the subsoil; in those subsoils where I have had experience, 15, 18, and 30 feet are the distances I have found most effectual, and perfectly sufficient.

The Depth of Drains, Filling them, &c.

When the ridge is 15 feet, and the drains at that distance from one another, the depth is 24 inches—at 18 feet, 30 inches—at 30 feet, 36 inches.

I have invariably observed in subsoils (excepting in the strongest clay) seams of sand from a quarter of an inch, sometimes to an inch and a quarter in thickness, lying horizontally connected with one another, by seams of different thickness, descending at different angles, through which the water oozes into the horizontal seams, and ultimately into the drains. These drains should be cut, having an aperture on the surface of 8, 10, and at most 12 inches, sloping gradually to the bottom, which should be the exact breadth of the tile, so as to give a support to the lower part of the tile, that no weight from above may move it from the position in which it is intended to stand.

In cutting a drain with economy, it is necessary that the workmen should be possessed of spades of various sizes: in general three sizes are sufficient—a common working spade, one on a smaller scale, with the sides of the iron contracted towards the bottom; the third of the breadth and shape of the bottom of the drain. These spades are to be found in all the hardware shops in the South of Scotland, and are in general use. When the soles and tiles are laid in the bottom of the drain, a covering of straw, of the small branches of spruce or Scotch firs, or faggots, &c., ought to be strewed over them. This, a work of the greatest importance to the future stability of the drain, should be executed by a man accustomed to lay tiles, and who is a good judge of the accuracy of the level. There is no economy so bad as not using flats; and I have no doubt, if tile drains are ever found to be deficient in durability, it will be owing to a bad quality of tile, or laying them without a sole. In filling up the drain above the tile, several plans have been adopted, depending on the locality of the farm; gravel, sand, small field stones, quarried stones broken small, or the surface soil, are generally used. Gravel or sand appears to me to be the best covering, as the water filters through either, taking nothing along with it, but what the farmer wishes to get rid of. The surface soil is the next best, then the small land stones, and lastly, quarried stones broken small. The objection I have to the broken stones, is, because they are most expensive, and neither kind of stones filters the water. If the drain is 3 feet deep, it is frequently filled with a foot of stones above the tile; a sod is placed above the stones; the remainder of the drain is filled up with surface earth. The subsoil that comes out of the drain should be spread equally over the ridge.

On land where the surface soil is very shallow on the sides of the drain, it should be taken from the crown of the ridge to cover the tile, and fill up the drain.

In laying off the lines of drains, the straightest side of the field should be selected; the first drain should be made as parallel to it as possible; the other drains should then be measured off at such distances from the first drain as the farmer may think most convenient, giving due attention to the quality of the subsoil, and making that the rule by which he is to be guided.

In subsequently ploughing the field, the ploughman can have no difficulty in laying off the breadth of the ridges.

Expense of Draining.

The expense of draining land on the above-mentioned principles, done by piece-work, the labouring men being supposed to make from nine to eleven shillings a-week. The table of expenses is here annexed—

Depth of Drain.	Rate per Rood of 6 Yards lineal.	Feet apart.	Roods per Acre.	Rate per Acre for cutting.	Rate per Rood filling in.	Rate per Acre filling in.	Rate per Rood laying Tiles.	Cubic Yards per Rood.	Cubic Yards per Acre.	No. of Tiles per Acre 14 in. long, at 30s. per 1000.	Rate of Tiles per Acre.	No. of Half-Flats per Acre, at 15s. per 1000.	Rate of Soles per Acre.	Total Expense.
f.	d.			L. s. d.	d.	s. d.	s. d.				L. s. d.		L. s. d.	L. s. d.
2	3	15	161⅓	2 0 4	¾	10 1	4 0	1	161⅓	2489	3 14 8	1245	0 18 8	7 7 9
2	3	18	134⅘	1 13 7	¾	8 4½	3 6	1	134⅘	2072	3 2 1½	1036	0 15 6¼	6 3 1½
2	3	24	100 5-6th	1 5 2½	¾	6 3½	2 6	1	100 5-6th	1556	2 6 8	778	0 11 8	4 12 4
2	3	30	80⅔	1 0 2	¾	5 0½	2 0	1	80⅔	1244	1 17 3¾	622	0 9 3¾	3 13 10
2½	4½	15	161⅓	3 0 6	1	13 5½	4 0	1 10-27th	221	2489	3 14 8	1245	0 18 8	8 11 3½
2½	4½	18	134⅘	2 0 4½	1	11 2½	3 6	1 10-27th	184	2072	3 2 1½	1036	0 15 6¼	7 2 9
2½	4½	24	100 5-6th	1 17 9¾	1	8 4¾	2 6	1 10-27th	138	1556	2 6 8	778	0 11 8	5 7 0½
2½	4½	30	80⅔	1 10 3	1	6 8¾	2 0	1 10-27th	112	1244	1 17 3¾	622	0 9 3¾	4 5 7¼
3	5½	15	161⅓	3 13 11	1¼	16 9½	4 0	1 20-27th	282	2489	3 14 8	1245	0 18 8	9 8 0½
3	5½	18	134⅘	3 1 6½	1¼	13 11½	3 6	1 20-27th	235	2072	3 2 1½	1036	0 15 6¼	7 16 8
3	5½	24	100 5-6th	2 6 2½	1¼	10 5½	2 6	1 20-27th	176	1556	2 6 8	778	0 11 8	5 17 6
3	5½	30	80⅔	1 16 11½	1¼	8 4½	2 0	1 20-27th	141	1244	1 17 3¾	622	0 9 3¾	4 13 11½
3½	7	15	161⅓	4 14 1	1½	20 2	4 0	2 1-9th	315	2489	3 14 8	1245	0 18 8	10 11 7
3½	7	18	134⅘	3 18 4	1½	16 9½	3 6	2 1-9th	287	2072	3 2 1½	1036	0 15 6¼	8 16 3½
3½	7	24	100 5-6th	2 18 10	1½	12 7	2 6	2 1-9th	215	1556	2 6 8	778	0 11 8	6 12 2
3½	7	30	80⅔	2 7 0½	1½	10 1	2 0	2 1-9th	172	1244	1 17 3¾	622	0 9 3¾	5 5 9

Direction of Drains.

Some of the reasons that appear to me in favour of longitudinal over transverse drainage, are as follows:—

1*st*, The main object being to get the water as rapidly off the land as possible; and as most fields have a slope, it is quite evident that water, falling on a 30-foot ridge, following the declivity of the land, will escape into the drain much more rapidly, having only 15 feet at the greatest distance to find the lowest level in the drain, than if the ridge lay across the declivity where it might have 20 or 25 feet to pass through the soil.

2*d*, In a five-course rotation, which is acknowledged to be the best for the quality of land under consideration, by making the turnip-drills across the ridge, you ensure that the water will, under no crop of the rotation, have to run more than 15 feet.

Some farmers think that cutting the drains across the declivity catches the water sooner. This appears to me to be a fallacy. If they were trying to cut off the water of a spring from injuring the lower ground, then I think they would have reason on their side; but we are now trying to get rid of surface water on an impervious subsoil, where it remains stagnant on the spot on which it falls. It, therefore, appears to me that the reasons I have before given, in support of longitudinal drainage, overcome the reasons given in support of transverse drains.

Ploughing the Land after Draining on an Impervious Subsoil.

There is one manner of treating land after drainage, having an impervious subsoil, that has been made known to the agricultural world by an enterprising agriculturist, Mr Smith of Deanston, the inventor of the Subsoil Plough. Mr Smith has, I am told, explained the effect of his invention, and the purposes for which it is to be used, in a pamphlet, much more intelligible than I can pretend to do. In most parts of the country, farmers are practically acquainted with its merits. It is needless, therefore, for me to say more than that it is one means of treating land after drainage, which has a number of admirers. I should even say, I have heard it is used and found effective and productive of great benefit to light land, but never having used the instrument myself, I can give no practical opinion of its use. The system I have adopted for the treatment of the lands on my own farm, where the soil and subsoil are of the weakest quality, such as I have previously described, is as follows:—A great proportion of the land is valued at five or ten shillings. After it is drained in grass, the land is trench ploughed, making the furrow from 14 to 16 inches deep. The sod, of course, is turned into the bottom of the furrow; the ploughing is done by two ploughs, each having a pair of horses; as the work is harder upon the horses that turn up the till, they every hour change with the plough that turns over the sod. The till remains exposed to the frost during the winter; in the spring, the land is cross ploughed, the sod is found quite rotten, and mixes with the till; oats are sown; the crop is considerably better than before the land was drained. After the crop is cut, the land is ridged up with a winter furrow—turnips are sown in spring. In ridging up the land for turnips, there is little or no appearance of till. The best crop of turnips to be found in the same district of the country are not superior to those grown after this management of the land. The land, after the turnips are ate off, is ploughed for barley; no appearance is now to be seen of till; there is an excellent crop of barley, and the grass seeds are always well planted during the two years of grass which follow the barley. The fields have the earliest grass in the district of the country, the largest number of sheep per acre to feed on them, and the produce are the fattest animals. The grass that formerly grew in these fields was of the worst quality, and sheep would scarcely eat it. No extra manure or lime has been applied to these fields, except on a part of one of them, which, for six years, remained without growing anything that an animal would eat, consequently it was left without stock; in the third year since it was in that state, it is growing as good a crop of turnips as can be seen in the country, and no stranger that saw the land in fallow would believe it to have been what the people of the country knew it to be previous to its improvement. In consequence of doubts being entertained as to the accuracy of the results of this system, I requested five or six of the most eminent agriculturists, living in different counties in the south of Scotland, to value a piece of land of the above description, and to return and inspect the first crop cut. They will examine into the expenses that have been incurred during the improvement, and will report faithfully to the agricultural world the result. It is evident, that the only extra work in following out this system is trench-ploughing once. This, however, is done with the ordinary plough used for working the land, and the horses are never oppressed. In conclusion, I think it will be satisfactory to state, I have an equal dread with other farmers to bring till, such as I have previously described, to the surface, before the land is drained. It is only after that operation has been effectually executed that I consider the till or subsoil, when properly pulverized, forms a new soil, the most valuable and easy to work of any I know; for in a wet season, the rain water escapes by the drains; in a dry season, the till or clay subsoil that has not been removed, retains sufficient moisture for the plants growing in the pulverized surface-soil, to supply food for them by the exhalations caused by the heat of the weather.

Sheep Drains, viz. Open Cuts in the Hill Lands.

In Lammermuir a great extent of sheep or hill-drains have been executed, which have been found highly beneficial for the improvement of the grass or heather, by relieving the lands of the stagnant surface water, and by that means removing one of the causes prejudicial to the health of sheep, namely, the rot. The mode of executing, and the expense of cutting, those drains, is as follows:—On the sides of hills, drains of a foot in depth, and eight inches in width, are cut, and the sods that are first removed are placed on the lower side of the drain to increase its depth to this extent, taking care to place them close together, and to give the drains a gentle run towards the burn into which they are to discharge themselves. In some situations these drains ought to be cast 50 feet apart; in others, at a greater distance. This must depend upon the porous or impervious nature of the soil, and the quantity of rain that falls. In the valleys, where sprots, rushes, and other sub-aquatic plants grow, drains are of the greatest advantage; they are generally made to humour the ground, at the distance of 30 feet apart; after a year or two, clover and finer grasses replace the sprots, &c. The same kind of drain should also be applied to flat lands holding stagnant water, at the same time having a sufficient declivity to carry it off when assisted by artificial means.

Expense.

The expense of casting open sheep or hill drains of a foot deep, by 18 inches broad, with the sod laid on the lower lip of the drain, is one penny per rood of 6 yards. Where 100 roods are contracted for, it can be done at eight shillings. These drains, with very little additional expense, if well executed in the first intance, will last a nineteen-years' lease. I feel convinced, from what I know of the pasture-land in the West Highlands, nothing will repay the proprietor or tenant so much as using those drains, as well as give to the Highland population of that country the means of gaining an industrious livelihood.

Mr Sim, Drummond, after a few prefatory remarks, read the following paper on the next subject, viz.—"Can Bone Manure be considered effectual for a crop succeeding Turnip, without being a second time manured, or ate off by Sheep; and if so, what quantity will the acre require ?"

If the nature of bone-dust as a manure had been made the subject of inquiry to any number of agriculturists in our northern counties, at the period of the last Highland Society's Show in this place, I believe I may safely say, scarcely one could have been found in a situation to give a decided opinion on the subject; for this article, now so important to us, was then almost unknown in practice in this quarter, and, however highly it might have been recommended to us from other places where its use was established, a few only of us were beginning to put it to the test of experience, and that mostly in small quantities. The case is now different—the consumption has become very considerable. The use of bone-dust forms part of the system of management on nearly every extensive farm where the soil is suitable for turnips; and even on small ones, down to crofts, it is yearly coming more and more into favour. Sveral causes have operated to accomplish this. Besides the general progress of attention to greater correctness in cultivation, and the endeavours to increase the quantities and value of the produce of our fields, to which, during part of the time, we were urged by difficulties, occasioned by extremely low prices of grain, two particular causes led us to a greatly-increased growth of turnips, and, consequently, to an increased consumption of bones. The first of these was the enlarged demand for wintering by the sheep farmers; and the second, the introduction of steam-conveyance, affording access to markets for fat stock, from which, by local situation, we were formerly in a great measure debarred. Under these altered circumstances, many amongst us can now speak decidedly on the beneficial effects of bone-dust; but yet there are considerable numbers unable to do so, as unconnected with the eating of turnips by sheep; as they do not think of raising this crop without the view of its being so appropriated in some proportion or other. Certainly, where there are proper turnip soils, the one thing seems so intimately, I might say necessarily, connected with the other, to bring out the greatest extent of advantage, that it may nearly with certainty be predicted, that shortly it will be considered strange to see them unconnected. It appears to me, that the rapidly-increasing population of the empire will not only continue to make it advantageous to provide animal food for its wants, but render it more so than at present; and that it is to this we must again look when grain becomes, as at times it will assuredly be, again depressed in value. At present, however, there is no doubt that in some circumstances, in light soils, the connection between turnips and sheep is not found where it ought to be; and that in others, on strong and wet soils, sheep cannot be folded properly during the winter. For one or both of these cases, the question now under discussion seems particularly to have been raised. For the former, in my opinion, there ought to be no necessity for it, but we must take it as we find it; for the other, that is, for strong and wet lands, there is good reason that it should be put. In future times, perhaps, even for these there will be no such occasion, when the system of furrow-draining, now in its infancy, shall become generally practised. Having on view at present both these cases, we now come more immediately to the question. I confess that, from my own practice, which is to feed on the ground, I have but little experience to lead me to a conclusion; but, from observation, I think I have strong grounds for forming an opinion; and I have considered it right, on the present occasion, to make inquiry of able agriculturists in different parts of the neighbouring country. The result of the answers I have received is not so conclusive as I could have wished; for though I am told that many fields are not folded, I find very few cases where other manure is not applied. One gentleman informs me, that last year he had four quarters barley after turnips raised with twenty bushels of bone-dust, crop consumed on the ground; but that he thinks he would have had two quarters per acre more if he had given a little dung, and, in general, that it is found advantageous, on light land, to follow this practice. Another mentions that he has had a capital crop of turnips, and a succeeding one of grain, from twenty-five bushels; but his present practice now is, to give a slight dunging for turnips, with ten or eleven bushels of bones. The information I have just detailed, is principally from Morayshire. In Ross-shire, almost all land suitable, is appropriated to turnips and sheep, and the value of the system is much appreciated; but there are instances where the nature of the land prevents its being carried into effect. I have in view one particular extensive farm of strong land, where bone-manure is used to raise annually twenty Scotch, or twenty-five English, acres of turnips for cattle. The owner and occupier of this farm, a gentleman well known for his activity, intelligence, and attention to all departments of agriculture, informs me that he gives twenty bushels per Scotch acre to his turnips, and that he raises fair crops of them, succeeded by good crops of oats; but he also says that he attributes the latter good crop more to the quality of the land than to the bone-manure; and I agree with him. I do not think that twenty bushels can have much effect on such land, after being on it all the winter, nor even a great deal more so applied.

Indeed, he has told me, that after trying fifty bushels on a single acre, he could see no difference. But I think there is a way by which he might have derived the benefit he was entitled to expect from so great an expense, and that is, if he had reserved half to harrow in with the spring seed furrow. I am led to this opinion by an experiment that I made this season. On a field of uniform fertile and rather strong land, after a bulky crop of pease, raised without dung, I laid down different portions with different kinds of manure; and amongst the rest, one Scotch acre, equal to about one and a quarter English, with ten bushels of the dust of bones, mixed up with four bushels of kiln ashes, formed principally from peat, and on this portion I have cut a heavy crop of barley, not yet thrashed, but which has the appearance of 60 or 64 bushels, equal to 48 or 51 bushels per English acre. On a portion dunged from the farm-yard, I have about a quarter more per acre, but the expense is fully equal to the difference on this one crop. Taking every thing into view, I be-ieve that on light soils, where a sufficient quantity is applied, bone-manure may undoubtedly be considered effectual for the crop succeeding turnips; but that on heavy lands, and lands requiring to be furrowed up in winter, it is not to be so considered, if the whole of the bone-dust is applied to the turnips; but that if part of this manure be given in spring, it is likely to be then effectual. With regard to the quantities to be used, so much depends on the different descriptions of soil, that no fixed rule can be laid down. To determine what should be allotted to any particular field, we must either be able to analyze the soil, or we must find it out by our own trials, or the experience of our neighbours on similar land. This is an instance of the advantages to be looked for, if we could generally apply chemistry to the purposes of agriculture. We would not need, then, to confine ourselves to one trial, but could at any time ascertain the state of our lands; and the time may be, when analyzation will be considered frequently necessary. Many of us know that lime, when frequently repeated, ceases to operate so advantageously as at first, nay, that it may be absolutely hurtful; and I apprehend that such has already been the case with bone-manure, in parts where it has long been in use; and that it may come to be so with us. With the aid of chemistry, it appears quite possible that we could ascertain proper quantities, and also when to abstain from using bone-manure; and the same with respect to other manures. Connected with the subject, and well deserving attention, are the quantities and modes of application where turnips are to be wholly or partly eaten on the land; but as this has not been made part of the discussion, I might be considered as encroaching too much on the time of the meeting, were I to enter upon them; and I shall therefore conclude, with the expression of my hope, that what I have said may be considered only as an introduction to further elucidation of the question, by gentlemen who have had opportunities of becoming thoroughly acquainted with its bearings.

The expediency of introducing at the General Shows some topics of special interest to the farmer, besides the exhibition of stock, has for years been brought before the notice of the Society. The dinner before the day of the General Show seems a befitting opportunity for introducing such topics, in lieu of those merely complimentary speeches which are usually indulged in on that particular occasion. It was imagined, in opposition to all such propositions, that discussions on technical subjects, however interesting, and conviviality were incompatible in the same meeting; at least, that it would be extremely difficult to introduce a discussion on any topic at a convivial party, which might not lead to the expression of difference of opinion in rather warm terms. So unfortunate an issue should justly be deprecated for its own sake; and it might, moreover, injure that well-earned popularity with which the great meetings of the Society have been received in every part of the country, by every class of the community. However, as the certain effect of any suggestion cannot be predicted without an experiment, it was determined to make a trial at the Glasgow Meeting in 1838, by acquainting the meeting with the proceedings of the Society during the subsequent year. A sub-committee was in consequence appointed to draw up a digest of those proceedings, but for some unexplained cause, the document was not read.

A much better plan was pursued, by the suggestion, we believe, of the Marquis of Tweeddale at the Inverness Meeting of this year, namely, the expression of individual sentiments on given topics, applicable to the peculiar circumstances of the district in which the show was to be held. The individuals appointed to express their sentiments respectively on the various subjects fixed upon, were those which the reader has just seen.

We own we had our fears for the successful issue of this experiment; but on considering its result at Inverness, we are of the opinion that it will succeed very well everywhere, and that the plan is a happy substitution for the dullness that invariably pervaded the Committee dinner on every other occasion. The desire to gain admittance, even at a high price, evinces the strong interest which the experiment excited in the minds of the farmers; and from this we conclude, that the experiment will succeed the better the oftener it is repeated, for, like the manifest improvements of the arrangements and of the show at every subsequent repetition at the same place, this experiment, in our opinion, will improve progressively by experience. True, a jar of discord interrupted for a moment the harmony of the meeting, but judicious arrangement will prevent the recurrence of the like at future meetings. Stringent rules should be laid down for the guidance of the chairman, speakers, and auditors, and they should be stringently put into execution. Too many topics should be avoided. Rather select a few of peculiar interest to the district, than introduce a variety of subjects to distract the minds of the audience. In the second place, it is desirable to hear the sentiments of two eminent agriculturists on any one subject; who should be selected from farmers occupying farms in different circumstances, in regard to soil and situation, whereby the entire bearings of the subject to different localities will be the more fully understood. In the third place, all *discussion* properly so called, on the subjects spoken, and every attempt to express a difference of opinion on the part of the audience, should be strictly prohibited. The danger of altercation can only be encountered in the violation of this rule. In the fourth place, only plain and distinct *questions*, directly relating to what has been spoken, for the sake of elucidation or illustration merely, should be allowed to be put by the audience, and every interruption by a third party, until the question in the possession of the meeting is satisfactorily answered, should be instantly prevented. In the fifth place, for the better preservation of distinctness in the sentiments of the speaker, the sentiments should be committed to paper and read, and not permitted to be delivered orally. In the sixth place, all the papers on the various subjects should not be read immediately in succession. A little conviviality should be thrown in between the various topics, to relax the minds and release the good humour of the audience; as was very happily remarked by the Duke of Richmond, on the occasion at Inverness, that "all work and no play, makes Jack a dull boy." This could be easily effected by the appointment of toast-masters, whose toasts should be shaped to suit the nature of the subject previously treated of.

As we have alluded to the note of discord which was heard at the meeting, it is necessary that we revert to it here, on account of the different versions of the effects it produced, which have found their way throughout the country. It simply arose from this circumstance. After the Marquis of Tweeddale had finished reading his paper on draining, Major Cumming Bruce of Roseisle asked a question in regard to his Lordship's opinion of filling drains with broken stones, like road-metal, as recommended by Mr Smith of Deanston. As his Lordship did not distinctly hear the terms of Major Bruce's question, it having been put in a low tone of voice, his Lordship simply referred him to what he had just read regarding filling drains with small field stones—which reference bore, that all the drains which had been made at Yester by the late Mr Stephens, with rumbling stones without conduits, had filled up, and that where similar attempts would be made elsewhere, it was his Lordship's opinion that the money so expended might as well be thrown into the sea, leaving it to be inferred that tiles formed the best materials for drains. Upon this Mr Ainslie of St Colme rose to explain to Major Bruce the peculiar advantages of Mr Smith's system of draining, and in consequence of the manner in which the explanation was given, a slight unpleasant feeling was observed both in his Lordship and Mr Ainslie. Had there been no interference on the part of Mr Ainslie, with any attempted explanation, or had the interference been prevented, as long as Major Bruce had possession of the meeting, no discordant note, we are convinced, would have been heard at this meeting. It was evident there existed a misapprehension about the subject of Major Bruce's question by the Marquis of Tweeddale: Major Bruce asked his Lordship's opinion regarding Mr Smith's mode of filling drains; the Marquis all the time imagining that the question referred to his own mode of draining, the account of which he had just read to the meeting, and, as he could give no farther explanation of it than what was contained in that account, naturally referred Major Bruce to what he had just read. Had Major Bruce been allowed to go on with his questions, the misapprehension would assuredly have been removed; and his Lordship would have told him, that as he had never perused Mr Smith's pamphlet on his mode of draining, or seen the operations on the farm of Deanston, he could give Major Bruce no opinion on that particular subject, and would have referred him to Mr Smith himself. That this was the true state of the case, we had ample opportunity of ascertaining the following day, at an accidental meeting which took place between his Lordship and Major Bruce, at which we were present, and at which the whole misapprehension was cleared up in the way we have described; and a statement of which was drawn up on the spot, by the short-hand writer of the Society, whose notes of the meeting were consulted by both parties.

As to the Marquis of Tweeddale's statement regarding the use of rumbling stone-drains without conduits, some people may perhaps think it rather strongly expressed, but we have no doubt his Lordship is quite prepared to defend his own opinions by reference to facts within the sphere of his own experience.

THE SHOW.

Early on Thursday, the Committee who had duties to perform, connected with the Show, were on the alert, and the Stock was promptly arranged in the positions and divisions allotted to each class. People poured in from all quarters of the country, to witness the exhibition, and the streets of Inverness presented an uncommonly lively and bustling appearance.—Fortunately the day was favourable, and as soon as the doors were opened for the admission of the public, the grounds were thronged by a highly respectable assembly, composed of people of every grade. The total number of people who were present, exclusive of those engaged in the business of the Show, was upwards of 4000, and the sum received for admission amounted to upwards of L.200. The following gentlemen were appointed Judges of the respective classes of Stock, viz.:—

For the West Highland Breed of Cattle.—Mr Stewart, Auchadashinaig, Mull; Mr Macdougall of Gallanach, Argyleshire; and Mr Carmichael of Raploch Farm, Stirlingshire.

For the Short-horn Breed.—The Marquis of Tweeddale; Mr Heriot of Ladykirk, Berwickshire; and Mr Wood, Kimblesworth, Durham.

For the Aberdeen, Angus, and Galloway Polled Breeds.—Mr Carmichael, Raploch Farm, Stirlingshire; Mr Glen, Hawkhead Mains, Renfrewshire; and Mr Stronach, Muiryfold, Banffshire.

For the Ayrshire Breed.—Mr Bartlemore of Seabrae, Ardrossan; and Mr Glen.

For any Breed.—The Judges of the Short Horns.

For Crosses—Cattle.—Capt. Barclay Allardyce of Ury; and Mr Watson, Keillor, Forfarshire.

For Horses.—Colonel M'Lean of Ardgower; Professor Dick of the Veterinary School of Edinburgh.

For the Black-faced Breed of Sheep.—Mr Gillespie, Bodinglee, Lanarkshire; and Mr M'Nab, Morven, Argyleshire.

For the Cheviot Breed.—Mr Grieve Branxholm, Roxburghshire; and Mr Robson, Kielder.

For the Leicester Breed.—The Judges of the Short Horns.

For the Southdown Breed.—The Judges of the Cheviot and Leicester Sheep associated.

For the Crosses of Sheep.—Capt. Barclay; Mr Watson; and Mr Mundell, Inverlael, Lochbroom.

For Swine.—The Judges of the Short Horns.

For Wool.—Mr Nixon, Hawick.

For Implements.—Sir Neil Menzies of Castle Menzies; Mr Hunter of Thurston, East Lothian; Sir Francis Mackenzie of Gairloch, Bart; Mr Slight, Edinburgh; and Mr Stephens, Edinburgh.

For Roots, &c.—Mr Smith, Garden Architect, Edinburgh; Mr Sellar of Morvich; Mr Macpherson Grant, younger of Ballindalloch; Mr Lawson, Edinburgh; Mr Mackintosh of Geddes; and Sir Francis Mackenzie, Bart.

For Extra Stock.—The Judges of those in the corresponding classes, with the addition of Capt. Barclay and Mr Watson.

The Premiums were awarded as follows:—

I. CATTLE.

West Highland Breed.—Of this class of cattle there were fifty-nine lots entered for competition, besides those exhibited in the Extra Stock.

For the best Bull, calved between 1st January 1833, and 1st January 1837—Twenty Sovereigns—to Mr Alex. Stewart, Mains of Dalvey.

For the second best ditto—Ten Sovereigns—to Mr Donald Cameron of Lochiel.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal—to said Mr Alexander Stewart.

For the best Bull, calved after 1st January 1837—Seven Sovereigns—to Mr John Campbell, Balachroam.

For the best two Heifers, calved after 1st January 1837—to the Duke of Sutherland.

For the best Breeding Cow, calved between 1st January 1831, and 1st January 1835—Ten Sovereigns—to Messrs Alex. and Archibald Stewart, Inverscadle, Ardgower.

The portrait of this Cow was recommended to be painted for the Society's Museum.

For the second best ditto—to Major Gilchrist of Ospisdale.

For the third best ditto—to the Duke of Sutherland.

For the best two Oxen, calved after 1st January 1835—Ten Sovereigns, or Plate of that value—to Colin Campbell, Esq. of Jura.

The portrait of one of these Oxen was recommended to be painted for the Society's Museum.

For the best two Oxen, calved after 1st January 1836—Seven Sovereigns, or Plate of that value—to Hugh Davidson, Esq. of Cantray.

For the best two Oxen, calved after 1st January 1836, which have never been housed or confined in the straw-yard since Whitsunday 1837—Ten Sovereigns—to the Duke of Sutherland.

For the best lot of Stot Stirks, not fewer than six, calved after 1st January 1838, bred by the Exhibitor—Seven Sovereigns—to the Duke of Sutherland.

For the best lot of six Queys, calved after 1st January 1838, bred by the Exhibitor—Seven Sovereigns—to the Duke of Sutherland.

The judges commended the Cow belonging to A. K. Mackinnon, Esq. of Corry; the Oxen belonging to the Duke of Sutherland, Major Gilchrist, and Mr John Cameron, Corrichoillie.

Short-Horn Breed.—Of this class, thirty-nine lots were entered for competition.

For the best Bull of the pure short-horn breed, calved after 1st January 1832—Twenty Sovereigns—to Robert Innes, Esq. of Thrumster, Caithness-shire.

For the second best ditto—Ten Sovereigns—to the Duke of Richmond.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal—to Mr William Smith, Shedlaw, near Coldstream.

For the best Bull Stirk, calved after the 1st of January 1838—Seven Sovereigns—to Mr Gregory Burnett, Ardross, Ross-shire.

For the best Bull Calf—to Major Mackenzie of Fodderty, Ross-shire.

For the best Quey Calf, bred by the Exhibitor—to Mr John Denham, Dunglass, Ross-shire.

For the best Heifer, calved after the 1st of January 1838—Five Sovereigns—to Mr Wm. Sim, Drummond.

For the best Cow of any age—Ten Sovereigns—to Mr F. Simson, Mains of Pitfour, Aberdeenshire.

For the best Cow calved after 1st January 1835—Eight Sovereigns—to Mr Alex. Geekie, Baldourie, Forfarshire.

For the best Ox of the same breed, calved after 1st January 1837, bred by the Exhibitor—Seven Sovereigns—to William Horne, Esq. of Scouthel.

For the best two Heifers, calved after 1st January 1837—Seven Sovereigns—to Mr Geekie, Baldourie.

Aberdeen, Angus, and Galloway Polled Breeds.—Of this class there were also thirty-nine lots entered for competition.

For the best Bull, calved between 1st January 1832 and 1st January 1837—Twenty Sovereigns—to Mr Watson, Keillor, Forfarshire.

For the second best ditto—Ten Sovereigns—to William Mackintosh, Esq. of Geddes.

For the third best ditto—Five Sovereigns—to Mr James Anton, Coltfield, Morayshire.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal —to Mr Robert Colville, Balnabreich, near Brechin.

For the best Bull, calved after 1st January 1837—Seven Sovereigns—to Mr Simson, Mains of Pitfour.

For the best Cow, calved between 1st January 1831 and 1st January 1836—Ten Sovereigns—to the Duke of Richmond.

For the second best Cow—Five Sovereigns—to Æneas Mackintosh, Esq. yr. of Mackintosh.

For the best two Heifers, calved after 1st January 1836—Seven Sovereigns—to Mr Alex. Craig, Kirkton.

For the best two ditto, calved after 1st January 1837—Five Sovereigns—to the Duke of Richmond.

For the best two Oxen, calved after 1st January 1835—Ten Sovereigns—to the Duke of Richmond.

For the second best two ditto—Five Sovereigns—to Mr Craig, Kirkton.

The Judges commended two Heifers and two Oxen, belonging to Mr Craig.

Ayrshire Breed.—Of this class only eighteen were entered for competition.

For the best Bull, calved between 1st January 1832—and 1st January 1837—Ten Sovereigns—to Mr R. Logan, Mains of Kilbirnie, Ayrshire.

The portrait of this bull was recommended to be painted for the Society's Museum.

For the second best ditto—Five Sovereigns—To Mr Thomas Ross, Queenzieburn, Stirlingshire.

To the *Breeder* of the best Bull in this class—the Honorary Silver Medal —to Mr James Walker, Kilbirnie, Ayrshire.

For the best Bull, calved after 1st January 1837—Five Sovereigns—to Mr Thomas Ross, Queenzieburn.

For the best two Heifers, calved after 1st January 1837—Five Sovereigns —to Mr Ross, Queenzieburn.

For the best Cow, calved after 1st January 1831—Seven Sovereigns—to Mr Wm. Walker, Farm Overseer, Gordon Castle.

For the second best ditto—Five Sovereigns—to Mr Ross, Queenzieburn.

The Judges commended a bull belonging to Mr Robert Macewen, Drumrosack.

Any Breed.—Of this Class five Lots were exhibited for competition.

For the best pair of Fat Oxen, of any pure breed except the Short-horn, calved after 1st January 1835—Ten Sovereigns—to Mr Alex. Craig, Kirkton.

For the Second best ditto—Seven Sovereigns—to Mr Craig.

For the best two Oxen of any pure breed, or of any cross—Five Sovereigns—to the Duke of Richmond.

Crosses.—Of this Class eleven Lots were entered for competition.

For the best two Oxen, a first-cross between a short-horn Bull and an Aberdeenshire horned Cow, calved after 1st January 1837—Ten Sovereigns—to Mr James Geddes, Orbliston, Morayshire.

For the best two Oxen, a first cross between a Short-horn Bull and an Aberdeenshire polled Cow, Angus polled Cow, or Galloway polled Cow, calved after 1st January 1837—Ten Sovereigns—to the Duke of Richmond.

For the best two ditto, calved after 1st January 1836—Five Sovereigns—to the Duke of Richmond.

For the best two, cross between Short-horn Bull and West Highland Cow, calved after the 1st January 1836—Five Sovereigns—to James Traill, Esq. of Ratter, Caithness.

For the best two Oxen of any cross, except those above specified, calved after the 1st January 1835—Ten Sovereigns—to William Horne, Esq. of Scouthel, Caithness, which the judges considered very near the point of perfection—cross between a Short-horn Bull and Caithness Cow.

For the best two ditto, calved after 1st of January 1836—Five Sovereigns—to Mr F. Simson, Mains of Pitfour.

II. HORSES.

Of Horses there were sixty-seven Lots entered for competition.

For the best entire Horse for agricultural purposes, not under five years, and not exceeding eight years and six months old, bringing evidence of having had produce in the former year—Twenty-five Sovereigns, or Plate of that value—to Mr Marcus Gunn, Ratter, Caithness-shire.

For the second best ditto—Fifteen Sovereigns—to Mr Duncan M'Lachlan, Stirling.

For the best entire Colt for agricultural purposes, not exceeding four years and six months old—Ten Sovereigns—to Gregory Burnett, Esq. of Ardross.

For the best Breeding Mare for agricultural purposes, having had at least one Foal, and not being under five nor exceeding twelve years and six months old—Ten Sovereigns—to Mr James Lumsden, Braco, Banffshire.

For the second best ditto—Seven Sovereigns—to Mr Robert Walker, Mains of Portlethen, Kincardineshire.

For the best three year old Filly for agricultural purposes—Five Sovereigns—to Mr Alex. Lawson, Old Mills, Morayshire.

For the best two year old ditto—Five Sovereigns—to Mr Craig, Kirkton.

For the best Highland entire Pony, not exceeding fourteen and a half hands high—Ten Sovereigns, or Plate of that value—to Sir Francis A. Mackenzie of Gairloch, Bart.

For the best Highland Breeding Mare, not exceeding thirteen hands high—Seven Sovereigns—to Mr Alex. M'Intosh, Burgie, Morayshire.

For the best Highland Pony for the saddle, not under four and not exceeding seven years and six months old, and not more than thirteen hands high—Five Sovereigns—to Lord Lovat.

For the best pair of three year old Colts, said breed for agricultural purposes—Ten Sovereigns—to Mr John Denham, Dunglass.

For the best Pony Mare, or Highland Garron, not under thirteen and a half hands, and not exceeding fourteen and a half hands high—Five Sovereigns—to the Duke of Sutherland.

III. SHEEP.

Black-faced Breed.—Of Black-faced Sheep, there were 12 Lots entered for competition.

For the best two Tups, not exceeding forty-five months, which served a hirsel of Ewes in autumn 1838—Seven Sovereigns—to Mr Archibald G. Macdonald, Inverlair.

For the second best two ditto—Five Sovereigns—to said Mr A. G. Macdonald.

For the best pen of five Ewes, not exceeding five years and seven months old, selected from a hirsel of a regular breeding stock, not less than 200, and the pen having reared lambs for the season—Six Sovereigns—to said Mr A. G. Macdonald.

For the second best pen of ditto—Five Sovereigns—to Mr Greig, Tulloch, Inverness-shire.

For the best pen of five Gimmers—Five Sovereigns—to Mr Greig.

For the best pen of five Wedders, not exceeding five years and seven months old—Five Sovereigns—to Mr Alex. Wilson, Relugas.

Cheviot Breed.—There were 36 Lots of this class entered for competition.

For the best two Tups, not exceeding forty-five months old, and which served with a hirsel in the autumn of 1838—Ten Sovereigns—to Messrs Young and Craig, Bighouse, Sutherlandshire.

For the second best ditto—Seven Sovereigns—to Mr Thomas Houston, Kintradwell, Sutherlandshire.

For the best pen of five Ewes, not exceeding five years and eight months old, and which reared Lambs for the season—Seven Sovereigns—to Mr Patrick Sellar of Morvich, Sutherlandshire.

For the second best pen of five ditto—Five Sovereigns—to Donald Horne, Esq. of Langwell, Caithness.

For the best pen of five Gimmers—Five Sovereigns—to ditto.

For the best pen of five Wedders, not exceeding four years and eight months old, shewing symmetry, fat, and weight—Five Sovereigns—to Messrs Young and Craig, Bighouse.

For the second best ditto—to ditto.

For the best pen of five fat Wedders, not exceeding three years and eight months—Five Sovereigns—to Messrs Young and Craig, Bighouse.

These competitors had other lots that were commended by the Judges.

Leicester Breed.—Of this class 31 Lots were entered for competition.

For the best Tup, not exceeding four years old—Ten Sovereigns—to Hugh Davidson, Esq. of Cantray.

For the second best ditto—Five Sovereigns—to the Duke of Richmond.

For the best Shearling Tup—Five Sovereigns—to the Duke of Richmond.

For the best pen of three Ewes, not exceeding three years and eight months old, and having reared lambs for the season—Seven Sovereigns—to Hugh Davidson, Esq.

For the second best ditto—Five Sovereigns to the Duke of Richmond.

Southdown Breed.—Only 9 Lots of this class were entered for competition.

For the best Tup, not exceeding four years old—Ten Sovereigns—to the Duke of Richmond.

For the best pen of three Ewes, not exceeding three years and eight months old—Seven Sovereigns—to the Duke of Richmond.

Crosses.—Of Cross-bred Sheep 14 Lots were entered for competition.

For the best pen of five Wedders, cross between Leicester Tups and Cheviot Ewes, not exceeding three years and eight months—Five Sovereigns—to James Traill, Esq. of Ratter.

For the best pen of five ditto, not exceeding two years and eight months—Five Sovereigns—to P. Brown, Esq. Linkwood, Morayshire.

For the best pen of five Dinmonts, cross between Leicester Tups and Cheviot Ewes, not exceeding one year and eight months—Five Sovereigns—to James Traill, Esq. of Ratter.

For the best pen of five Wedders, cross between Leicester Tups and Black-faced Ewes, not exceeding three years and eight months old—Five Sovereigns—to J. H. Mackenzie, Esq. of Cromarty. The Judges considered this a useful cross in certain districts.

For the best pen of five Wedders, first cross between Cheviot Tups and Black-faced Ewes, not exceeding three years and eight months old—Five Sovereigns—to Major Gilchrist of Ospisdale. In breeding this cross the Judges recommend as much attention to the breeding of the tup as the ewe.

For the best pen of five Wedders of any cross, not exceeding thirty-two months old—Five Sovereigns—to William Horne, Esq. of Scouthel.

IV. SWINE.

Of Swine, 29 Lots were entered for competition.

For the best Boar—Five Sovereigns—to the Duke of Richmond.

For the second best ditto—to Mr Lumsden, Braco.

For the best sow—Five Sovereigns—to Mr Wm. Paul, Kilnflatt, Morayshire.

For the second best ditto—to Mr Walter Burnside, near Glasgow.

For the best three Pigs, not exceeding forty weeks old—Five Sovereigns—to Major Cumming-Bruce of Roseisle.

For the second best ditto—to Mr Joseph Mackie, Nairn.

For the best Boar, of the breed most suitable for curing—to Mr Wm. Sim, Drummond.

For the best Sow, of the breed most suitable for curing—to Mr George Mackenzie, Munlochy, Ross-shire.

V. WOOL.

17 Lots of Wool were entered.

For the best sample of Leicester Wool, shewn by the breeder of the Stock, not fewer than seven fleeces—Five Sovereigns—to Mr William Mylne, Bolton, Haddingtonshire.

For the best sample of Cheviot Laid Wool, shewn by the breeder of the stock, not fewer than seven fleeces—Five Sovereigns—to Mr Duncan Mactavish, Garthbeg, Inverness-shire.

For the best sample of Black-faced Laid Wool, shewn by the breeder of the stock, not fewer than seven fleeces—Five Sovereigns—to Mr Alex. Mactavish, Aberchalder.

For the best sample of Wool, cross between Leicester Tups and Cheviot Ewes, shewn by the breeder of the stock, not fewer than seven fleeces—Five Sovereigns—to Mr W. Mylne, Bolton.

For the best sample of Wool, cross between Cheviot and Black-faced, shewn by the breeder of the stock, not fewer than seven fleeces—Five Sovereigns—to Mr Robert Gentle, Dell, Inverness-shire.

EXTRA STOCK.

In this class, which, consisting of 77 lots, contained as great a variety of animals as is usual upon these occasions, the Silver Medal was awarded to each of the following exhibitors:

Of Cattle.—To Mr Cameron, Corichoillie, for three superior breeding Highland Cows. To the Duke of Sutherland, for two two-year old Highland Stots. To the Duke of Richmond, for ten polled Aberdeenshire Cows with eight Calves: Three of the cows produced this season twin calves each. This lot, in the opinion of the Judges, was of first-rate quality. To Lord Lovat, for two cross bred polled Bullocks. And to Peter Brown, Esq. of Linkwood, for a three year old Heifer, being a first cross between a short-horn bull and polled Aberdeenshire cow.

Of Horses.—To Hugh Davidson, Esq. of Cantray, for a bay Arabian Stallion, from Bombay. By crossing Highland ponies with this stallion, the Judges considered that a fine handsome herd might be produced. To Elphinstone Dalrymple, Esq., for a remarkably handsome grey Arabian Stallion. To Mr Sim, Drummond, and Mr Anderson of Gorthleck, for a Highland pony each. To Mr Alexander Wilson, Kilnhillock, Banffshire, for a yearling Clydesdale entire Colt, which promises to be a valuable stallion.

ROOTS AND SEEDS.

The exhibition of Roots was extensive and varied, and attracted considerable attention, as this department of the Society's exhibition always does. Among those exhibited, the Judges recommended the following exhibitors as each deserving a Silver Medal :—

To Mr Grigor, Forres, for his general collection of seeds and plants, and particularly for specimens of Norway maple valuable for resisting sea breezes. To Messrs Dicksons Brothers, Inverness, for their general collection of plants and seeds. To Messrs Cleghorn and Co. Edinburgh, for their interesting collection of new varieties of turnip, particularly the Pollexfen yellow, yellow globe, Gordon's yellow, and Scottish purple-topped; and the pearl-white wheat, which has the character of being prolific and of fine quality. We have seen a very fine sample of this kind of wheat in the Edinburgh market this season, grown after potatoes, by Mr Reid of Ballincrieff in East Lothian. To Mr Hannay, Dalquharn, for the importation of potato-tubers from South America. To Mr Robert Gentle, Dell, for good specimens of turnips raised by him at 1000 feet above the level of the sea. And to Sir Francis Mackenzie of Gairloch, Bart. for specimens of Potter's and Zealand barley, which produced nine quarters per Scotch acre.

Mr Lawson exhibited a great variety of seeds, plants, and vegetables, highly deserving of commendation, particularly a new sort of Tare called the Hopetoun, the yellow and red Globe Mangel Wurzel, gigantic Flax from Siberia, a new oil plant, called *Madia sativa*, suited to the climate of Britain, and a large collection of Pines—the Pine Sapo being the first specimen of its kind shewn in this country. A specimen of sandy oats by the Duke of Richmond, was recommended for high wet situations as an early and productive kind. The Lancashire Witches, Winter and Tartarian Oats, were considered valuable varieties for the northern climates in some situations. The Talavera Belonensis and the Jersey Danzig Wheats were recommended for this northern climate, and the Talavera of *Le Couteur* as a Spring Wheat.

It may be interesting to our readers to be informed of the girths and weights of the specimens of turnips exhibited:

	Girth. ft.	in.	Weight. lb.
By Messrs Cleghorn & Co. Edin.			
Gordon's yellow, . .	2	6	10½
White globe, . .	2	4½	11½
Green globe. . .	2	3	9½
Green-topped yellow bullock,	2	4	8
By Messrs Dickson Brothers, Inv.			
White globe, . .	2	6½	14½
Purple-topped yellow, .	2	3¾	10
Green-topped yellow. .	2	3	7
Lawton hybrid, . .	2	6	11
Dale's hybrid, . .	2	6½	11½
Scotch imperial purple-topped,	2	4½	11
By Mr Grigor, Forres.			
Purple-topped yellow, .	2	3½	7
Purple-topped globe, .	2	3½	7½
White Norfolk, . .	2	3½	5½
Green-topped globe. .	2	2	6¼
By Sir Francis Mackenzie, Bart.			
White globe, . .	2	10	11
Red-topped white Swedes,	2	2	11
By Lord Lovat.			
Yellow purple-topped, .	2	9	14
Green-topped white, .	2	5	13½
Purple-topped globe, raised on new land with 26 bushels of bone-dust per acre, .	2	4	7½
By Mr Robert Gentle, Dell. (Raised at 1000 feet above the level of the sea).			
Green-topped white. .	2	9	10½
Red-topped yellow, .	2	9	10½
Green-topped yellow, .	2	5	8½
By Mr Davidson of Cantray.			
White globe, . .	2	6½	8
And . . .	2	2	9½
By Mr Wm. Mackenzie of Holm.			
Pomeranian, , .	2	2	12½
By Major Mackenzie of Fodderty.			
Purple-topped Swedes,	2	2	7
By Mr Sim, Drummond.			
Globe. . . .	2	5	9
By Thos. Ogilvy, Esq. of Corrymony.			
Globe, . . .	2	9	15½
Do. . . .	2	6½	9½
Green-topped yellow, .	2	5	7½
By Mr John Mackray.			
Purple-topped Swedes,	2	4	11½
Do. do. .	2	1	9½
By Mr Downie of Appin.			
Green-topped white, .	2	3	7½
Green-topped yellow.. .	2	3	6

IMPLEMENTS.

The exhibition of Agricultural Implements was not numerous, but they all possessed the essential merits of utility and good workmanship. The Silver Medal was given to each of these:—

To Mr Robert Law, Shettleston, for exhibiting a light and useful Lea Plough, a Drill Plough with hoes attached, and a green-crop Harrow. L.3 were also awarded to Mr Law to assist in paying expenses in bringing those implements from a distance. To Dr Mackenzie of Kinellan, for a very neat model of a Whin or Straw Cutter. To Mr Edmonds, Banbury, for two Turnip Cutters, which seemed to do their work in a superior manner. And to Mr John Gray, gardener to W. F. Campbell, Esq. of Islay, for a wooden pump of simple construction for liquid manure; for a mallet with a hoe attached to the one side, and a pick on the other, which may be advantageously employed in cleaning drilled crops.

THE AGRICULTURIST'S NOTE-BOOK.—NO. IX.

Bread without Yeast.—We have already in these pages given an admirable recipe for bread-making, in which yeast forms an essential ingredient; we are now about to detail a plan for preparing this necessary of life, from which that ferment is excluded. A month or two since, we met with the following communication, in the "Magazine of Domestic Economy," addressed to the Editor.

"I have for some time been experimenting upon making bread, and have now to offer to the notice of your readers, the most perfect system of making bread which, I believe, has ever been practised. It embraces every advantage that can be desired, both for quality and wholesomeness, and is particularly suited for persons of weak stomachs. The bread retains the whole nutrition of the flour, and, when baked, has nothing in its composition but flour, salt, and water. The ingredient as substitute for yeast, will retain its goodness any length of time: and, having it always at hand, a loaf of bread can at any time be prepared for the oven in a few minutes, which, when baked, resembles a light, good, home-made bread, of a superior quality and colour, and will keep good as long as any other bread. It is scarcely possible for any person, with the slightest attention, to make bad bread: bitter, heavy, or bad flavoured, is quite out of the question. I believe, if generally adopted by those who make their own bread, it would be found a great advantage, and a great convenience to farmers, and other families who live in retired situations, at a distance from towns; and a new loaf of bread would be very palatable to travellers on a sea voyage. As regards expense, it may, at first glance, appear rather more expensive, but it will be found that the whole nutrition of the flour being preserved, with an increase in the quantity of bread, will more than compensate for the additional expense; and, indeed, the waste that occasionally occurs from bad yeast, will amount to much more than the cost of the ingredients.

"Dough fermented with yeast in the usual manner, contains little or none of the real saccharine matter, or sugar of the flour; but in its stead, a certain portion—nearly half its weight—of spirit, which imparts a vinous smell, and is volatilized in the oven. In the new system, the saccharine matter or sugar contained in the flour remains undecomposed; consequently the bread is more sweet and nutritious.

Proportions of ingredients for bread.

	2 pounds of flour,
Troy-weight 2 drachms, = ¼ ounce.	120 grains of carbonate of soda,
	144 minims of muriatic acid,
	2 small tea-spoonfuls of common salt,
	15 ounces of water,—colder the better.

"We speak of minims, because they are a regular division or part of a drachm or ounce; sixty minims equal one tea-spoonful, or one drachm, which is one-eighth of an ounce troy weight, whereas drops vary very much according to the size of the neck of the bottle. Therefore, a family should keep a set of weights and one glass of graduated minims up to 480, equal to one ounce, which should be very narrow and high; also a graduated glass with ounces. The quantity of acid used, should never more than just neutralize the carbonate of soda.

"*Method of making Bread.*—Put the flour into a suitable sized earthen pan, take the carbonate of soda, and salt, rub them between the hands into the flour, and continue rubbing the flour, soda, and salt, about a minute or two, or while well mixed; then add the acid to the water, which just stir up with a small wooden spatula; a steel knife should not be used. Knead it sufficiently,—the less the better, and, as usual, make it up into loaves at pleasure. The less this dough is worked up the better, so that it be evenly mixed. It is much the best put into the oven as soon as the loaves are formed, and at no time should it be kept out longer than twenty minutes. One sack of good flour will make 100 four pound loaves.

"I strongly recommend druggists in every town to sell the articles in quantities at a cheap rate, for if sold at the common retail price, it must prohibit their use. A druggist can afford to sell five pounds of carbonate of soda, and five pounds of muriatic acid, both for five shillings, leaving him a profit of seventy per cent.; and a family would find it a great convenience to have the ingredients for making bread, always at hand; and it would be well for families to put three pints of water to one pint of muriatic acid; then use four times the quantity in my directions, because when the muriatic acid is thus diluted, in case of a spill it would do no injury; but remember, in that case, there would require one ounce less water to each two pounds of flour. If the dough should be a little too wet or dry, a little more flour, or water may be added, yet it is best to have the right quantity at first, which a little practice will readily determine; a little milk improves bread or cakes, but never use more than half milk. Some may be curious to know how this process operates.

"It may be said that the bread is raised or lightened, and made porous, upon the same principal agency as by yeast, that is, by the escaping of carbonic acid gas; the one produced by the fermentation of the yeast at the expense of a portion of the flour, and the other by the composition of sesquicarbonate of soda and muriatic acid, when the following chemical change takes place in the dough. The chlorine of the acid unites with the sodium of sesquicarbonate of soda, and forms chloride of sodium, or what is commonly called salt; at the same time the oxygen and hydrogen unite and form water, while the carbonic acid becomes liberated, and by the heat of the oven is volatilized and expands, making its way through the bread, leaving nothing as the component parts of the bread, but flour, salt, and water, without a particle of the flour being destroyed.

"When a person buys a fresh supply of muriatic acid, it would be well to test it, first as to its purity, and then as to its strength. Unless the acid will be very pure, there will be a little iron in it, if not much, it is of no importance, though it has a tendency to discolour the bread. To test its purity, drop a little bit of prussiate of potash into the acid, and if there be no iron in it, it will remain colourless; but if the acid change to a full blue it is very impure; if of a very pale blue, the quantity of iron is of no consequence.

"The process of making muriatic acid perfectly pure is expensive, and quite unnecessary for bread. If the acid be of the proper strength—

120 grains of carbonate of soda,
144 minims muriatic acid,

will be neutralized and become salt.

"Take 120 grains of soda, and dissolve it in a quarter of a pint of hot water in a pint pot, and when nearly cold, add 140 minims of muriatic acid, diluted with about its own quantity of water, by degrees, and when the effervescence is over, take a slip of litmus paper, and dip it in. If it comes out more blue, it shews the soda predominates; then put in a minim or two more of acid, and try another slip of litmus paper; if it reddens, it shews that the acid predominates, by which means you may ascertain the exact number of minims of muriatic acid that will neutralize a certain quantity of carbonate of soda. It is always best, in making bread, that the soda of the two predominates. If the two ingredients are in proper proportions, from five to twenty grains more or less in a two-pound loaf is not material, except as a loss by expense.

"In making cakes, it is better to use a little more of the ingredients,—

say in two pounds of flour, instead of using 120 grains of carbonate of soda, use 160; and instead of 144 minims of acid, use 180 minims of acid."

Having tried the foregoing directions with care, and repeated the experiment with accuracy many times, we propose to give the results.

In the first place, the writer has aimed at proving too much, and having failed, our disappointment is proportionably great. We are of the (probably) very few who are, like himself—fond of experimenting; therefore have not been deterred by the somewhat formidable array of weights and scales, minims, sesquicarbonates, acids, alkalies, tests, and litmus-paper: consequently we hope and believe that our testimony may be relied on. If the principals of all private families were able and willing to undertake the entire management of the process,—if the chemical ingredients can be easily obtained,—if yeast-bread be unattainable, and oat-cakes be banished with the plaid,—then we think this chemical bread may obtain suffrage. In his first assertion, we have found the writer to be mistaken; it is *not* "the most perfect system of making bread," nor does it "embrace every advantage that can be desired both for quality and wholesomeness." We have tried it, at the same time, in the same oven, weight for weight with yeast-bread; the loaves, when baked, were not half the size of the latter; the outer surface was almost as pale coloured as when they were put in, though the usual loaves were of a fine rich brown; they were close and weighty, having, when cut, not the appearance of "sad" or "heavy bread." but of gingerbread, nay not even so porous was the texture as of that condiment. The flavour was as if some chemical salt predominated, and this we found to be caused by an excess of the saline ingredients; for, in fact, the *salt* ordered to be mixed with the flour is a supernumerary article, since the acid and soda form salt; we, therefore, omitted the salt, with advantage.

We ascertained also that the proportions ordered of the soda and acid were not sufficient to expand the flour; but even when the increased quantities were employed, which are directed for cakes, the size of the loaf was not a third so large as one containing the same weight of flour, made with yeast. How, then, can the chemical bread "be wholesome, and particularly suited for persons of weak stomachs?"

It is a grand mistake to suppose that bread which has undergone the fermentative process, by means of yeast, is likely to be refermented after it has been eaten, and has gone through the process, which the substance under consideration has not; and, therefore, that liability to create flatulency and a feeling of oppression, by acting upon fermentable substances, which is peculiar to weak stomachs, is much more likely to be induced by eating flour in the state in which this newly discovered bread is left when it leaves the oven.

On weighing the two kinds of loaves, of similar quantity, that is, pound for pound, we found a decided defalcation in the medicated bread,—another fallacy.

It may be very true that "a druggist *can* afford to sell" the requisite materials much cheaper, but *will* he do so? If not, that part of the feasibility is rendered nugatory, for we are told that "if they are sold at the present retail price it must prohibit their use."

That a succedaneum for yeast-bread has been obtained then, we stoutly deny; the medicated bread is too heavy, cloying, and compact, for a constant article of consumption; but it would be unjust to deny, that an occasional cake made of these materials is by no means to be despised, and for this purpose, we are pleased with the invention. In the event, too, of the weekly batch of yeast-bread running short, it is desirable that persons residing at a distance from a brewery should be enabled to make a loaf, although it should be less agreeable and less "wholesome." We have had no opportunity of trying the acid and soda, in the manufacture of oat-cakes; but are inclined to think that they might be used with advantage; we should like to hear that any of our readers shall have tried the experiment, and hope they will report the result of it in the pages of this work.

It is always desirable to encourage attempts at improvement, and equally so to point out fallacies in plans that profess to aim at benefiting, while they mislead the community. We conscientiously believe that every syllable we have written is not only strictly true, but published with the best intentions, to endeavour to rectify an error committed in over-anxiety to establish a favourite system. We too may have erred, from not having manipulated in the right way, but we believe that the fault does not rest with ourselves; certain we are that we have, to the best of our judgment, followed implicitly the directions above quoted; and as we are not only open to conviction, but really anxious to prove the assertions of the writer, we shall feel obliged to any person so disposed, who will take the trouble to point out to us how, and in which part of the process, we may have failed.

Notices of the New Forest, Hampshire.—By JAMES DUNCAN, M. W. S.

> ——Arched walks of twilight groves
> And shadows brown, that sylvan loves,
> Of pine and monumental oak.

That portion of Hampshire known by the above name, has long enjoyed such a degree of celebrity, that there are few places in the south of England which a traveller from our northern clime approaches with more pleasurable anticipations. Its vast extent, the great age, beauty and variety of its timber trees, the diversity of its surface, mildness of climate, magnificent views alternately of woodland and elevated heaths, disclosing, in many directions, wide reaches of the blue expanse of the ocean, together with the many rare and peculiar plants and animals which inhabit it, conspire to render it a scene of great interest both to the lover of the picturesque, and to the student of natural history. Having been the favourite resort of many of our ancient monarchs, it has been the theatre of important events in our national history, and as the most extensive nursery now existing of oaks fit for the purposes of ship-building, it may be regarded also as in some measure connected with our national glory.

The writer of these desultory notes made his approach to the New Forest, by crossing Southampton Bay to Hythe, a small village, beautifully situated on the water's edge. The bay at this place is about three miles broad, and affords very extensive views on all sides; wood and water, and picturesque .dings, in finest combination, forming the panorama, while the town of Southampton, with its conical spires, rises a conspicuous object in one direction. Looking towards the New Forest, the horizon is completely bounded by woods, stretching away to an extent that seems to be interminable; southward appear the blue waters of the bay, studded with numerous white sails;* the misty air line of the Isle of Wight terminating the prospect. To the northward, similar elements enter into the landscape, but the water-line round the head of the bay appears finely curved, and the shore is fringed with white buildings, many of which have the appearance of handsome villas.

On landing at Hythe, we are within the limits of the New Forest. It is, of course, quite foreign to our present purpose to enter at all into its history or statistics, as these may be found amply detailed elsewhere, and a volume would scarcely suffice to do justice to the subject. But it may be allowable briefly to state, for the sake of those who have no other means of information at hand, that the New Forest occupies the south-western extremity of Hampshire, extending from Southampton Water on the east, to the river Avon on the west, and nearly from the Salisbury road on the north, to the Solent and English Channel on the south. Its limits have undergone great variations at different periods. At present it may be estimated at upwards of 50 miles in circumference, and to contain nearly 92,365 acres. The whole of that extent, however, must not be understood as consisting of forest land, or to be in possession of the crown. Manors, freehold estates, copyhold, and leasehold property, and likewise what are called *purprestures*, or unwarranted encroachments on the forest lands by poor cottagers, occupy a surface of no less than 28,000 acres. In all these, however, the crown possesses certain rights or interests, such as a right to the game, timber, &c.

To one familiar with the scenery of other portions of the southern division of Hampshire, the New Forest, at first view, presents nothing very striking or peculiar. In its general

* The vessels frequenting Southampton Water are mostly of small size, the majority of them being gentlemen's yachts. Their numbers may be inferred from the fact that, on a clear day, from a point near Netley Abbey, the writer counted about sixty sail within view.

aspect it is quite similar to many other parts of the country, which are densely clothed with wood, most of it evidently of great age. Indeed, there is every reason to believe, that the southern part of the county formed at one time almost a continuous forest, so numerous and extensive are the wooded tracks which have still survived the encroachments of agriculture and population. Not fewer than *five* forests are enumerated within the limits of the county: and although several of these are reduced to mere vestiges, some of them are of considerable extent,—such as Holt Forest, Waltham Forest, and the Forest of Bere; the latter covering an area of about 16,000 acres. An interesting relict of the same kind, although on a comparatively limited scale, exists in the immediate vicinity of Southampton. It lies to the northwest of the town, and is usually called the *Common*. It comprehends a space of several hundred acres, for the most part rather flat, but rising at one extremity to a sufficient elevation to give variety to the surface, and display to advantage the beautiful wood with which it abounds. Nothing can exceed the gracefulness and picturesque beauty with which this natural wood is, in most cases, grouped and distributed. In some places it forms dense and pretty extensive masses, with a sweeping undulating outline; in others, the continuity is broken by glades in which the turf is soft and green; while patches, clumps, and insulated bushes are scattered over the surface at intervals. A group of trees seldom stands alone with the trunks exposed, but are closely surrounded by an undergrowth of bushes (chiefly thorn and holly), so that the whole forms a dense pyramid of foliage. Many of the insulated bushes, especially those of holly, are of very large size, and at the proper season they are commonly festooned with honeysuckle, or ornamented with the elegant cordate leaves of the *Tamus*,—perhaps the most graceful of our native climbing plants. The whole of this interesting spot has the appearance of an extensive park; but it still retains so much of its original character, as to be strictly a forest scene, free from the formality which, in such cases, always more or less attaches to human art, however skilfully exercised.

Appearances so little correspond to the idea we are accustomed to attach to the word "forest," that most people probably experience a feeling of disappointment on first visiting the New Forest. The popular acceptation of the term, leads to the expectation of a dense and almost imperviously wooded track in all its natural wildness, untouched by the labours of the agriculturist. But here we move along well made roads, often bounded, for many miles together, by fertile fields, carefully enclosed, and not unfrequently surrounded by hedge-rows, with the trees pollarded and otherwise mutilated (according to the disgusting practice common throughout England), presenting the very antithesis to forest scenery. At other times, we cross extensive heaths wholly destitute of trees, and covered with tufts of dwarf furze,* and occasionally a considerable marsh presents itself. But from all the elevated points, we at once discern that we are in the vicinity of extensive woods,—we seem placed, as it were, upon an island, amidst a sea of verdure—stretching in some directions as far as the eye can reach, and varying in tint and character according to the nature of the component ingredients; and we have only to diverge a little from the beaten track, to realize all the conceptions we may have formed of a forest,—dense and compact masses of foliage, stately trunks encrusted with lichens, the vouchers of their antiquity, and occasionally an entangled and almost impervious growth of underwood, all expanding in every variety of form, and in the unchecked luxuriance of nature.

——————— In bowers
More shaded or sequestered, though but feigned,
Pan nor Sylvanus never slept,
Nor nymph nor Faunus haunted.

The carriage-road often intersects these extensive assemblages of aged trees, and has then all the appearance of a fine avenue; and an idea can be formed of the interior recesses of the forest without incurring any personal fatigue. Of this description are the road from Brockenhurst to Lyndhurst, so much commended by Gilpin for its picturesque beauty; that leading along the Boldrewood to the west of Lyndhurst, &c.

* The exposed portions of these heaths are commonly occupied by the *Ulex nanus*, or dwarf furze; in other situations, the more common species abounds, and in some places attains an extraordinary size.

The grand defect in the scenery of the New Forest (one which it shares in common with such a large portion of the southern and central parts of England) arises from the comparative flatness of the surface. There is scarcely an elevation of any consequence, except at Stony-Cross, in the neighbourhood of the supposed scene of the death of King Rufus, and a few other places. The consequence of this too great uniformity of level is, that the landscape presented to the eye is very seldom complete. In many places it consists merely of a foreground; when a more extensive view can be obtained, the intermediate parts are so foreshortened, that it seems composed solely of a foreground and a distance; we seldom find a decided midground, or second distance, on whose subdued, but still warm tints and blending images, the eye delights to repose, as it is thus led, by insensible gradations, from the strongly defined objects immediately around it to the vapoury obscurity in which the view terminates. Neither is the tendency to monotony and tameness arising from this cause, much interrupted by the presence of rivers; for, with the exception of the Beaulieu and Lymington rivers, there are scarcely any others deserving the name; and even these become inconsiderable as soon as they are beyond the influence of the tidal currents. Their course over such a country is also of necessity gentle and slow, producing no precipitous banks, horrid crags, and foaming cataracts, to add character and dignity to the wild grandeur of a forest.

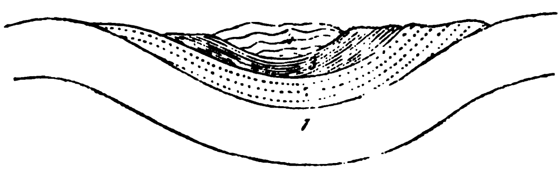
In such an extensive district of natural wood, many different kinds of trees may be supposed to exist; but by far the most interesting and characteristic product of the forest is the oak. This occupies incomparably the largest portion of the surface, as might be presupposed to be the case, in a domain more especially set apart for its protection and culture. It is impossible for any one, in the least accustomed to notice what naturalists call the habit or *facies* of trees, not to be at once struck with something peculiar in the character of the New Forest oaks. The principal branches generally diverge from the trunk at no great distance from the ground, and carry with them such a large portion of its substance, that the central stem soon disappears. These branches commonly grow in a horizontal direction, and are very much bent, zig-zagged, and twisted. Such is likewise the case with the subsidiary branches, down to the smallest ramifications, giving to the whole tree a remarkably gnarled and contorted appearance. The foliage, too, is sparse, and the individual leaves small, permitting, in most cases, a distinct view of the whole skeleton of the tree. All these circumstances tend greatly to enhance the beauty of these trees as picturesque objects, and they likewise render the timber more valuable, by adapting it better to the purposes for which it is chiefly employed.

It will be inferred from this description, that the New Forest oaks are not of great size ; and they are certainly no way remarkable in this respect. Among such a multitude, some will occasionally be found exceeding the average dimensions, —such, for example, as the group called the Twelve Apostles, at Burley Lodge, the oak in Langley Wood, described in South's letters, &c. ; but these are exceptions to the general rule, and are by no means the most characteristic examples.* The height is seldom very considerable, but the lateral expansion is usually very great in proportion. Owing to the mildness of the climate and its comparative freedom from high winds, the branches expand regularly on all sides, and the balance of the tree is finely preserved: contrasting strongly in this respect with our Scottish trees, which, in situations at all exposed, completely lose their proper poise, the branches being so much thrown on one side by the prevalence of the south-west wind, that there is seldom any difficulty in at once determining the cardinal points by observing one.

The peculiarities alluded to, viz. the comparatively low growth of the New Forest oaks, the horizontality, great expansion, and remarkable crookedness of their branches, as well as the scantiness of the foliage, are all, we conceive,

* The Burley Lodge oaks here alluded to, are figured in Strutt's *Sylva Britannica*, pl. xxxiii. Having mentioned this plate, we may refer to it as an example of the New Forest oaks, the peculiarities of which will be more readily understood from figures than description. But, as above stated, we do not consider these as very characteristic examples ; because we conceive, that the very circumstance which occasioned their unusual size, would tend also to diminish the peculiar mode of growth which we have attempted to explain.

occasioned by the character of the soil of which the New Forest is composed. When the reader is informed that it differs from any found in Scotland, Ireland, or Wales, and from that of all other parts of England, excepting a portion of the eastern coast, he will be less surprised that one of its principal productions should deviate somewhat from the prevailing type. The Hampshire basin, which includes the New Forest, belongs to what geologists call the tertiary formation, one of the more recent of the great geological deposits composing the crust of the earth. It here exhibits the appearance presented by the annexed wood-cut. No. 1. is a substratum of chalk, which is the base of all the tertiary strata; No. 2. a layer of plastic clay, consisting of variegated sands and clays; No. 3. chiefly thick blue clays; No. 4. fresh-water beds, composed of fresh-water shells in marl or limestone.



In a general way, therefore, the soil of the New Forest may be described as a sandy, gravelly, or shelly loam, immediately superincumbent on beds of clay of various depths and density. The heaths and commons, according to Vancouver,* composing the higher lands, are composed of a thin black gravelly mould, and a moist grey loam, on substrata of sand and gravel, strong white and yellowish clay, potter's clay, and brick earth. Intervening between these and the top mould, is often found a thin subsoil of gravel. The soil in the neighbourhood of Beaulieu, he goes on to state, may be regarded as of two characters; one, a mild gravelly loam, approaching to hazel colour, lying on an open subsoil, sometimes terminating in sand or gravel, but more frequently intercepted at various depths by a deep bed of red, blue, and white marl below; the other a thin light-black gravelly mould, generally of a moderate depth, and lying on a close stratum of clay and brick

* General View of the Agriculture of Hampshire.

[redacted]

earth of various colours, and under which, at a still greater depth, is occasionally found the same field of marl just noticed.

This light gravelly soil, aided by a surface-dressing (if it may be so called) of vegetable earth, formed by the decomposition of the leaves, which fall in plentiful showers every season, is exceedingly well fitted to cause rapid growth, especially in such a climate. It is acted upon immediately by atmospherical influences; the rain is instantly absorbed; the solar heat is soon diffused through it; so that all its vegetative powers are excited to speedy action. The young oaks, accordingly, are found to make a much greater annual increase than they can possibly do in North Britain; the same thing is observed in most other trees, *especially when young;* but the effect of this soil is best shewn in herbaceous plants. The growth of these is extremely rapid; and when compared with full-grown specimens of the same species from the vicinity of Edinburgh, they are generally found to attain a much larger size.* But it will be perceived that the same qualities which bring the powers of the soil into speedy operation, tend also to render them the more liable to be exhausted. It is well calculated to produce a most vigorous vegetation within certain limits, but these limits do not extend very far. After the oaks have advanced a certain length, which, as already intimated, they do more rapidly in this quarter than perhaps any other part of Britain, the sustentive properties of the soil begin to fail them. The available portion of it is mostly superficial, and as the tree acquires considerable size, the supply of nourishment becomes inadequate to the demand. It is well remarked by Strutt, that, as the oak advances to maturity, the depth and extent to which it strikes its roots, make much

* No one accustomed to observe the appearance of our indigenous plants, can fail to be struck with this fact when visiting the Isle of Wight, particularly the Undercliff, or southern coast of that island. In the absence of a continuous and properly managed series of thermometrical, barometrical, and particularly *hygrometrical* observations, it is usually adduced as a proof of the superior mildness of the climate. But while herbaceous plants and shrubs grow so luxuriantly, there are very few trees on the island, and scarcely any that attain the size of timber trees: a circumstance to be explained by the considerations referred to above.

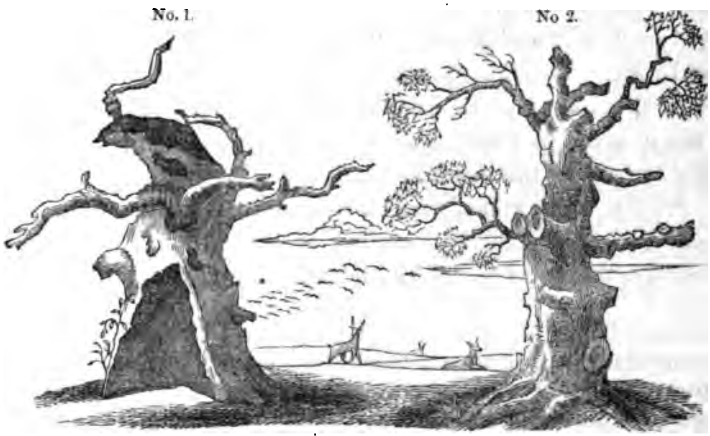
both of its magnitude and vigour depend on the congenial and uninterrupted field it may find for its powers. But here it can seldom strike its roots deep, because they soon encounter strata of cold clay, dry sand, or harsh gravel, from which little or no nutriment can be extracted. The tree, therefore, endeavours to compensate, as far as it may, for this want of vertical expansion, by stretching its roots horizontally, and twisting them in every direction so as to extend over as great a surface as possible. Now, it is ascertained that a certain correspondence or parallelism obtains between the growth of the tree above ground and below. In deep alluvial soils, where the tap-root shoots downward to a great depth without obstruction, the tree is tall and erect, and it is in such situations that the largest and most stately oaks will generally be found. But in such localities as that mentioned above, the sympathetic stem and branches follow the same indirect course above which the roots do below,* and hence they are found to run so often in a horizontal direction, and to be extremely elbowed and irregular. We can thus find in the character of the soil, an explanation of all the peculiarities exhibited by the New Forest oak.

The same influences may be supposed to operate more or less on the other trees of the New Forest; and to a certain extent this is the case. Next to the oak the beech is the most plentiful tree; and in many places it assumes an appearance which I never saw it present elsewhere. The trunk is invariably short, and the limbs, which are very numerous, and therefore mostly of small size, generally diverge from nearly the same point, and stand out at acute angles with the stem, running into long parallel lines, which produce a very formal and unpicturesque appearance. In the Boldre Walk, where the beeches are chiefly congregated, and where they grow with great luxuriance, they seldom form so agreeable an object as this tree often does when standing alone in our Scottish parks. Its various beauties are eulogised by Gilbert White of Selborne, who preferred it to all other trees. It is perhaps from having studied the beech chiefly in the New Forest, that

* Gilpin's Forest Scenery (Lauder's Ed.), vol. i. 64.

Gilpin has been led to speak of it so slightingly, and certainly to underrate its merits in any light in which it can be regarded.

It does not often happen, in perambulating the forest, that we see old oak trunks in a state of decay, probably because the trees are felled for ship-building before they are allowed to fall into that condition. Two very venerable relicts of that kind, however, were observed in a marshy bottom not far from the road leading from Boldrewood to Lyndhurst, on the south-west side, whose highly picturesque forms the following is an attempt to preserve.



No. 1. has the lower part of the trunk excavated, and the hollow is sufficiently large to hold two or three people. The branches are remarkably gnarled and contorted; they, as well as the trunk, are completely denuded of bark, a condition in which it appears to have remained for a very long period. The other, No. 2. stands at a few hundred yards distance, and is evidently coeval with it. The stem is nearly entire, it retains its bark, and a few stunted branches still afford some indications of vitality. There is also a very large trunk, in a state of decay, not far from Boldre church.*

* It is impossible to mention this old and venerable structure without remembering that it was here that William Gilpin spent a portion of his life, and where he matured those beautiful views which have been the means of guiding so many since to the discovery of the good and the beautiful in the aspects of external nature. Strutt has given a view both of the church

The forest affords many plants, which the botanist would seek for in vain in a much more northern quarter of the island; but a formal enumeration of these would probably be of little interest to our agricultural readers. In many of the glades and open places, the turf is chiefly composed of a small and very pretty species of grass, which seems to be confined to the light and gravelly soils of the south of England. This is the *Agrostis setacea*, which may at once be distinguished from the congenerous species by its glaucous hue.* The leaves are very narrow, almost resembling a bristle, and grow in very dense scopiform tufts, forming a fine turf. It was not easy to ascertain whether it was a favourite food with sheep and cattle; probably not, for the herbage seems rather dry and rigid. At all events, this is a matter in which northern agriculturists are little concerned, for there is no likelihood that it would be found adapted to the soil and climate either of Scotland or the north of England.

Of the larger animals which frequent the forest, there are only two which can be regarded as in any respect peculiar, namely, the breed of horses and the forest swine. Red and

and the adjoining burial ground, the one the scene of his former labours, as the other is now of his rest from them. But while the dendrographer delineates Gilpin's tomb, he has omitted—if indeed it was an omission—to supply the inscription. This, as we never happen to have seen it in print, we shall take the liberty to subjoin. "In a quiet mansion beneath this stone, secure from the afflictions and still more dangerous enjoyments of this life, lye the remains of WILLIAM GILPIN, some time Vicar of this parish, together with the remains of MARGARET his Wife, after being above fifty years in happy union. They hope to be raised in God's good time, through the atonement of a blessed Redeemer for their repented transgressions, to a state of joyful immortality. Here it will be a new joy to meet several of their good neighbours who now lye scattered in the sacred precincts around them. He died April 5. 1804, at the age of 80. She died July 14. 1807, at the age of 82."

* It is not a little surprising, that in this and several other instances to which we could refer, Dr Hooker, in his British Flora, has entirely overlooked the most obvious and characteristic marks of specific distinction, and adduced others of very subordinate importance. The grass named above is unique in its genus, on account of its colour, and *Asperula cynanchica* (to name no others), for having three red lines on the petals, yet none of these peculiarities are introduced into the specific character, *and are not even mentioned in the description appended thereto!*

fallow deer occur,—the latter in numerous and extensive herds; but the former, although at one time abundant, are now scarce, and a stranger may roam about the forest for days together, without being gratified by the sight of a single example of this the most majestic and appropriate denizen of such a scene.

Many of the horses are of the largest size of the class called ponies, others are more diminutive; but they differ considerably in their make from any of our northern breeds, and indeed from all others found in this country. The most remarkable of their peculiarities consists in the length of the back, which is considerably depressed or curved downwards; it is probably owing to this formation of the spine, in connection with the circumstance of their food always consisting of grass, that the belly is unusually large and prominent, appearing as if the animal were with foal. The head is large and somewhat clumsy; according to Gilpin, it is ill set on, having what the jockeys call a stiff jaw. Although clean and tolerably handsome, the legs are generally too short in proportion to the length of the body; this is particularly the case with the fore-legs, so that the animal does not appear to carry his head well. These properties by no means indicate a handsome horse; but the forest ponies are found upon trial to be possessed of many excellent qualities. They are hardy to a degree, capable of enduring great labour, and extremely sure-footed. In their native wilds, they become extremely rough and shaggy in their appearance during the winter season, and are often exposed to great hardships from the difficulty of obtaining food when the ground is frozen or covered with snow; even at midsummer, we have seen tufts of blanched hair hanging from their sides not less than three inches in length, and resembling flocks of wool. The occasional scantiness of their fare, and their habit, in winter, of browsing on heath and furze, the latter of which they are said to pound with their feet till it becomes fit for mastication, has procured for them the not inappropriate appellation of *heath-croppers*. The mane and tail are at all times remarkably long and copious; the former is free, floating, and graceful, often falling over the head in such profusion as nearly to conceal it. When confined in a warm stable, and properly groomed, the coat, of course, soon becomes short and sleek, and the symmetry of the animal undergoes a corresponding improvement.

The New Forest is, we presume, the only place in Britain where hogs are to be found in any thing like a wild state; and it is certainly not a little surprising, that, in the present day, they should exist at all in that condition in any part of this country. They are gradually becoming more scarce, and the forest may be visited oftener than once without an opportunity occurring of seeing a truly wild herd. The most curious circumstance in the history of these swine, is the striking general resemblance they bear to the wild boar; but whether this results from their being directly descended from the wild boar, and but partially changed by intermixture with domesticated races, or merely from their reverting to the original type of form, as there is a tendency in animals to do, after having been subjected to artificial influences and subsequently left to run wild for many generations, is a matter that cannot easily be determined. In this animal, as in the wild boar, (it has recently been remarked by an anonymous writer), the volume and strength are concentrated upon the anterior parts, the shoulders being thick and the neck massive, as compared with those of what are esteemed the most valuable domesticated breeds. The wild hog of the New Forest has certainly not the same volume of body as the indolent tenant of a stye or farm-yard, but there is a vigour and fleetness to which the other has no pretensions; and one who forms an opinion upon this species of animal from what is seen in domestication, is greatly in error as to its real characters. The domesticated hog is a heavy and lumbering animal; and instead of being able to gallop along, which is the natural swift motion of all the Pachydermata, to which order the horse and hog belong, simple walking with the alternate foot seems a painful operation. The appearance of the forest hog, when left to find his own food in the forest, is very different from this. In the hinder parts he is light and slender, while he is strengthened in front, has an elevated crest on the neck and shoulders, with a thick mane of bristles, which he can erect at pleasure.

His colour also approaches to that of the wild boar as still found in the continental forests, being generally dark brindled, and sometimes entirely black. His ears too are short, firm and erect; and when he is excited, there is a fiery glance or glare in his eye. His spirit is also true to these indications; for a single dog, untrained to the sport, must be staunch indeed before he will venture to go in upon the wild hog of the New Forest.

These qualities can generally be traced, more or less obviously, even in the domesticated hogs of this district, indicating that they are of common origin with the less reclaimed kinds. While driving along the forest *walks*, we frequently meet with them grazing by the road sides, in the vicinity of cottages, commonly of a black colour, but little encumbered with fat, and evidently left in a great measure to shift for themselves. When lashed by the whip (which a driver has always an uncontrollable itch to apply to every living thing coming within its range), instead of scampering off, as most fully-civilized hogs would think it expedient to do, they evince the natural fierceness of their disposition by turning suddenly round, throwing themselves into attitude, erecting the bristles of their mane, and shewing fight. The flesh of this race of swine is not so fine or well-flavoured as the almost proverbially celebrated Hampshire bacon usually is; that being, for the most part, obtained from other breeds which have long been subjected to domestication, and ameliorated by all the devices which human ingenuity can make to bear on the subject.*

The district in question has been long known to be a favourite resort of the feathered race; and there is perhaps no portion of the kingdom of equal extent where a greater number are to be found, that is, if we take it in connection with the adjoining sea-coast. Certain parts of the latter probably enjoy as high a temperature during the winter months as the Undercliff in the Isle of Wight; and shelter of every kind is

* In the sketch of the New Forest swine in Sir Thomas Dick Lauder's edition of Gilpin's Forest Scenery, their peculiar character is completely overlooked; it is admirably expressed, however (especially in the left-hand figure), in the representation of them in the original edition of Gilpin's work.

so abundant, that it seems very likely some species pass the winter here, which are now supposed to migrate to a much more southern land. It is, at least, certain that several are permanently resident here, which are migratory in more northern and inclement parts of the island. The most interesting of the kinds that fell under my own observation, were the turtle-dove, the great spotted-woodpecker, the green-woodpecker, the nightingale, and the bearded-titmouse.

The former of these does not seem to be plentiful, but an individual is occasionally seen winging its way across the forest glades, or over the tops of the trees. They are very shy and difficult to approach. The winter residence of this graceful and delicate bird is said to be extra-European. The great spotted-woodpecker (*Dendrocopus major*, Sw.) is rarely to be seen even in this locality, which might be supposed to be one admirably adapted to its habits. I obtained, however, a distinct view of one individual, as it was running up the trunk of a large oak, where it was soon lost among the foliage. The green-woodpecker (*Brachylophus viridis*, Sw.) is more frequently to be met with, two or three examples having been seen in the course of a forest perambulation of two days' duration. All of them were on the wing; their flight is low and heavy, and the hinder part of the body considerably inclined, as if the bird were just about to perch. They uttered at intervals a short harsh scream or call-note, which, in the stillness of the forest, might be heard at a considerable distance, and had a very peculiar effect.

It is pleasing to any one whose curiosity has been excited regarding the song and habits of the nightingale, to find, on visiting this district, or almost any other of the adjacent parts of the south of England, that he enjoys such ample opportunities of gratifying it. In this place, that "angel of the air," occurs in considerable plenty; in some of the adjoining districts it may almost be said to be common. This is the more gratifying from the fact, of which we are apprised by writers on ornithology, that this celebrated songster is gradually withdrawing from many places which it formerly used to frequent, so much so as to give rise to the apprehension that it may ultimately desert our island altogether. But, although it may be contracting its outposts, the main body is still in great force, and, according to all probability, it will find in the New Forest a secure stronghold to retreat upon for centuries to come. Numerous parts of the forest afford in perfection the kind of locality which it prefers. It never from choice enters the deep recesses of the woods, but resorts to the open glades, covered at intervals with tall bushes and tufts of coppice-wood. The wilder the scene, the more congenial it is to the nature of this shy and unobtrusive bird, which rarely approaches cultivated or inhabited spots, and owns no companionship with man. Southampton Common, formerly alluded to, affords a good example of the kind of haunt best suited to its disposition; and one can seldom visit that beautiful spot, either by night or by day, at the proper season of the year (the early part of May), and when the weather is fine, without hearing four or five in full song at the same time. For the purpose apparently of concealment, they almost always, upon alighting, immediately make their way into the heart of the bush, seldom perching on a projecting spray like others of the Sylviadæ. So true is it that they are usually in "shadiest covert hid," that, having occasion to shoot a few specimens for the purpose of examining some points in their anatomical structure, it was generally found necessary to fire, in some measure at random, into the thickest of the bush, the bird being so surrounded with twigs and foliage that it was scarcely possible to take a distinct aim.

It is scarcely necessary to remind the reader that the nightingale visits this country solely for the purposes of incubation. Approaching our island from a more southern latitude, the New Forest is probably the first place on which the migratory flock alights. The precise period of the year at which this takes place necessarily varies somewhat with the character of the season; commonly, however, it is about the end of April. On visiting the northern shores of Southampton Water last spring in the beginning of May, we found that they had by that time arrived in no small numbers, and had even made considerable progress in constructing their nests.

It is perhaps fortunate for the musical reputation of this interesting bird, that it is usually listened to when all the other choristers of the grove are mute, and when the stillness of night gives intensity to its notes and enhances their melody. Unquestionably the most remarkable quality of its voice is its strength—its volume. The lowest note it utters is so clear, full, and penetrating, that it can seldom be confounded with that of any other bird; and when it strains its voice to the highest pitch,

> ——— "and disburthens its full soul
> Of all its music;"

the distance at which it can be heard is surprising. But it may well be questioned whether the other qualities of its voice have not in some respects been overrated. The variety of its notes is not nearly so great as usually represented; and in flexibility and sprightliness they are certainly surpassed by those of the skylark. A great degree of richness or mellowness must obviously be conceded to them. The plaintiveness for which the song of the nightingale has obtained so much credit is not very obvious; it has probably been thought more remarkable than it really is owing to the season at which it is usually heard, and the contemplative state of mind which that season is apt to inspire in the observer. Even the poets themselves, who were the first to celebrate this property, are at variance respecting it. One of them at one time adopts Milton's words, and hails the "minstrel of the moon" as a "most musical, most *melancholy* bird;" while, at another, he exclaims,

> "A melancholy bird? Oh! idle thought!
> In nature there is nothing melancholy.
> But some night-wandering man, whose heart was pierced
> With the remembrance of a grievous wrong,
> Or slow distemper, or neglected love,
> (And so, poor wretch! filled all things with himself,
> And made all gentle sounds tell back the tale
> Of his own sorrow), he, and such as he,
> First named these notes a melancholy strain,
> And many a poet echoes the conceit."

The forest affords many rare and interesting insects, which, however, must not be here particularized. The most conspicuous we observed is the gigantic stag-beetle (*Lucanus cervus*), some specimens of which we kept alive for a time with a view of observing their habits. The food they most delighted in was the strawberry, which they held between their formidable looking mandibles while they extracted the savoury juices. Examples were shewn at Southampton of the rare and richly ornamented swallow-tail butterfly (*Papilio machaon*) which had been found within the limits of the forest in the course of last summer,—thus adding another to the few ascertained localities. But there is one insect more especially appropriated to the forest, which must not be passed over without notice. If the weather be warm, the traveller, in driving or riding along the forest-walks, will soon find his horse beset by a multitude of grey flies, which cause the animal a great degree of annoyance. They fix themselves to his skin by means of their formidable serrated claws, almost resembling the open fangs of a rat trap, or run about among the hair with a sideling crab-like motion, which produces an intolerable itching, causing the skin to creep and the animal almost to shudder. Their bodies are smooth and flat, and they lie so close that they are not easily unsettled; at the same time they are so hard and thin that they cannot well be killed by pressure, like the common blood-sucking horse-flies (*Tabanidæ*). When closely examined, they are found to be about four lines in length; the thorax, or that division of the body just behind the head, shining dark brown, with three yellowish spots posteriorly; the abdomen brownish-grey; the legs rusty-red, with a few dark rings. They are called forest-flies, because found most abundantly in such places; the scientific name is *Hippobosca equina*; by some French naturalists they have not inappropriately been named spider-flies (*Mouches araignées*). We have met with them occasionally in many different parts of the country, but in general they are scarce. In the New Forest, they abound to a most troublesome degree, although they are not frequent in other parts of Hampshire, where they might apparently meet with precisely the same conditions for their welfare. Another tribe very nearly allied to them (genus *Ornithomyia*) live on birds, and with these the true forest-flies have been occasionally confounded.*

* See Sir Thomas Dick Lauder, in his edition of Gilpin's Forest Scenery, vol. ii. p. 318.

Not only the anatomical structure of these insects, but their modes of propagation and transformation are curious and anomalous, insomuch that naturalists have had the greatest difficulty in determining how to dispose of them in their scientific arrangements. By way of indicating their affinities and characteristic properties, they have sometimes been defined as *apterous (or wingless) insects, with wings!*—an expression, however, be it observed, in which there is a great deal more than meets the general ear.

To Sweeten Goose Feathers.—All thrifty farmers' wives save the pluckings of their fowls, either for sale or for use. If for the latter purpose, it is necessary to be very particular in making them quite sweet. Every one is aware that the feathers of cocks and hens are very inferior to those of geese and ducks, for the purpose of filling beds and pillows, and consequently it is scarcely necessary to mention that the former should be kept separate from those of the two latter fowls. As the birds are plucked, the large feathers should be selected and placed asunder. Paper bags are the best recipients; the pinion feathers should be stripped from the quill, and added to the other feathers; and if great caution have not been used in plucking the birds, they should be carefully looked over to see that no part of the skin has been torn and adhering to the base of the quills, as it would putrefy and become almost incurably offensive.

The bags of feathers should be placed in the bread-oven on the day after it has been heated, and, after some hours, removed to a dry airy place; and this ought to be done every week.

Notwithstanding every apparent caution shall have been used, however, the feathers are frequently found to be tainted, either from carelessness in plucking, or by neglecting to attend to them afterwards; and no subsequent baking or picking will be found available to restore them. In this case, the only method to render them sweet, is to boil them, which is to be effected in the following manner:—One or two large canvass or calico bags must be made, into which the feathers from the small paper bags must be emptied and tied up; a washing-copper must be nearly filled with rain water and made to boil. The calico bags then—one at a time—are to be dipped, and by means of a stick, pushed about and squeezed and kneaded for the space of four or five minutes, then lifted out, and taken out of doors, and being tied together,—and the openings kept secure that no feathers may escape,—they must be hung over a line and left to drain and dry. Several times a-day the bags are to be shaken up and turned over; and as soon as the feathers appear to be light and drying,—which will not be the case for nearly a week,—the bags must be hung out during dry weather only, and taken in every night. In about a fortnight the feathers will become perfectly sweet and ready for use; and the water in which they were boiled will sufficiently indicate that this plan was not only necessary, but efficacious, in cleansing them from impurities which would else have rendered them useless. Having tried the method ourselves, we can assure our readers of its eligibility.

Soot as a top-dressing for Grass.—We have been struck with the vivid greenness of the pasture land around Newcastle-upon-Tyne, and have been informed that it entirely arises from copious top-dressings of soot which it receives every year. We can believe the statement, for we have observed its excellent effects on grass land in Ireland. It possesses the advantage of being a cheap manure, its cost *not exceeding* two shillings a quarter, and five quarters are a sufficient dressing for an acre. It may also be successfully used in compost, as the following statement shews, and its effects are thus much more durable than when used alone.

"When spread early in the winter on meadow lands, the beneficial effects of soot are frequently observable for three successive seasons, but when mixed with earth and dung its use is attended with even greater success; a soapy earth is formed which is beneficial to almost all kinds of plants, and its use quickens vegetation. The mixture should be formed of two parts of earth, one of soot, and one of dung. A layer of earth should be covered with soot, over which a layer of dung should be placed, and thus alternate layers must be arranged in a bed about three or four feet high, and three wide. Soot mixed with the earth dug from ditches, in the proportion of 1-4th, may, in about six months afterwards, be used with success in dressing meadows. Of this latter mixture about thirty bushels should be used to the acre; spread on wet soils it will destroy the moss, and neutralize the bad qualities of the soil. Cattle are observed to prefer the grass grown on lands dressed with soot, which owes its valuable properties to the quantity of carbonate of ammonia which it contains, and which is a most active stimulant. On this subject we would remark that soot, like many other articles, is even subject to sophistication by the unprincipled vender, who mixing it with charred saw-dust, and many other carbonaceous substances, the refuse of many chemical operations, renders it comparatively inert and valueless."

Bone-dust as a top-dressing for Grass.—The greatest benefit of bone-dust as a manure has been derived in this country, by turnips; and in raising them no considerable quantity is required, 16 bushels per imperial acre being found quite sufficient for the purpose of any kind of bones. By the following experiment of bone dust as a top-dressing to grass, it appears that about 32 bushels gave no perceptible advantage until the third year, but that 6 quarters and as much of riddled coal ashes, produced immediate beneficial results. The expense, however, of 6 quarters of bone dust at 3s. per bushel, or L.7, 4s. per acre, we must say, is purchasing grass or hay, however good, at a very dear rate.

"In the month of March 1835, I caused to be sown on 600 square yards of unproductive grass land, which is mown every year, four bushels of unboiled bone dust, about four quarters per acre, the effect of which to the succeeding crop of grass was not perceptible, and scarcely so to that of 1836, but very materially so to that of 1837, and to that of this year 1838, quite satisfactory. Again, in the month of September 1836, I had spread on the same field, and immediately adjacent to the above, a mixture of boiled bones and coal ashes (the cinders being riddled out) at the rate of *six quarters each per acre*, the effect of which was immediate, and the crop of grass of 1837 most abundant. Last week I had the produce of a portion of land so dressed, and also the produce of an equal portion which has received no dressing (and which is immediately contiguous) taken into an adjoining field, and there separately made into hay; in which state I have weighed the produce of each, and find that from the land dressed as above described to exceed the other by 15 cwt. per acre, and the quality of the hay superior in at least an equal proportion. The above experiment has been made in a field not 100 miles from Ferrybridge, Yorkshire."

Locomotive versus *Stationary Engines.*—It has hitherto been considered impracticable for locomotive engines to surmount highly inclined planes on railways. Stationary engines are therefore employed for dragging up and lowering down trains in such situations. But if the statements contained in the following extract from a letter addressed to the National Gazette of Philadelphia, by "Mr William Norris, Engineer," be a near approach to truth, and not a mere Americanism, we may expect to see locomotives surmounting any elevation, and propelling any weight of trains over them. After sneering at the puny efforts of English engineers, and accusing a writer in Fraser's Magazine, on American railroads, of impudence and falsehood, Mr Norris proceeds to aver that "We plain Philadelphians can prove that there is some little science and mechanical research on this side of the Atlantic, and are proud to say, that in some of the arts we excel even Old England. *We know, for instance, that our locomotive engines are superior to the best English; three years' experience are sufficient to satisfy us on that point.* The performances of my engines on the inclined plane at the Schuylkill have exceeded the very best performances of the best English engines by *seventy per cent.*, as will be seen on comparison. I therefore reply to this writer's "Argumentum ad ignorantiam" by a simple statement of facts, presented in the following record of a few extraordinary performances on the inclined plane near Philadelphia. This plane is 2807 feet in length; ascent in that distance 196 feet; equal to a grade of 369 feet rise per mile, or one foot rise in 143.10 feet.

"*1st.* July 9. 1836.—The George Washington, weighing 8700 lb. on the driving wheels, ascended to the top in 2 minutes 1 second, dragging up a load of 19,200 lb., and with the same load descended, stopping frequently in the descent, and moving up and down for the space of fifteen minutes.

"*2d.* July 19. 1836.—The same locomotive made another performance in the presence of several scientific gentlemen from the city of New York, who visited Philadelphia for the express purpose of witnessing what they had not believed. Messrs D. K. Minor and G. C. Schaeffer, the editors of the New York 'American Railroad Journal,' were present. They came doubting, and on arriving at the the foot of the plane, with a large party of Philadelphians, they still doubted the practicability of overcoming so steep an elevation. Anxiety was on every face—a bolder attempt had never been made. A load of 31,270 lb. was then attached, consisting of the tender with fuel and water, 2 passenger cars, and 53 passengers. The engine was started at the base, and reached the summit in 2 minutes, 34 seconds. I quote the editor's own words:—'The enthusiasm of feeling manifested cannot be described; so complete a triumph had never been obtained. The doubts that had been entertained by some, and the fears of others, were dispelled in an instant. The eager look that settled upon every one's face gave way to that of confident success, while all present expressed their gratification in loud and repeated cheers.'

"The performance was witnessed by fifty-four gentlemen of science, and of the highest respectability, whose signatures, in my possession, attest the fact. This performance, made nearly two years ago, has exceeded by 70 per cent. any other performance in Europe or America to this day. I have in my possession duly authenticated documents to prove the above, as well as several other performances on the same plane, equally as extraordinary. Several of my machines have been kept on duty for fifteen days in succession on the said plane, doing all the duty of the stationary engine, while the same was under repair, dragging up at each trip never less than 25,000 pounds.

"It is not only in the *power* of ascending inclined planes that we excel the English, but in every particular. Their *best* performance on their roads, with engines of the same class, has never equalled the every-day regular business of my machines; my results in power and speed are one-third better; and in durability and economy in fuel, I have abundant and substantial proof that my machines excel in a high degree.

"M. Schoenerer, Esq. a distinguished engineer from Austria, visited all the railroads and workshops of England. He examined carefully the machines of all makers, and witnessed their best performances. After a visit to this country, where he discovered that we were not 'Munchausens,' as the sapient writer calls us, and after thirteen successive days' close attention to my machines (being with the engine man, on the engine, each and every trip) he decided that my machines were better than the English, and immediately contracted with me. His locomotive, called the 'Pennsylvania,' was shipped in February last to Austria. I have this day shipped a locomotive to Saxony, engaged by a company there; and expect, in the course of the summer, to ship one to Germany and one to Switzerland. Surely these are evidences that the English machines are inferior. I hope on some of these roads we may come in contact; all that I desire is fair play, and I am confident of the result."

The steepest inclined planes on railways that we have seen are on the Dundee and Newtyle railway. The inclined plane at Dundee surmounts 244 perpendicular feet in 760 yards, or at the rate of 1 foot rise in 9.3 feet; that at Balbeuchly rises to the height of 200 perpendicular feet along 1690 yards, or at the rate of 1 foot of rise in 23.3 feet; and that at Newtyle rises 244 feet perpendicular height in 1025 yards, or at the rate of 1 foot of rise in 12.6 feet. We have a strong desire to see Mr Norris's "George Washington" surmount the Dundee inclined plane with a few thousands of pounds attached to its tail.*

* See this Journal, vol. iv. p. 1.

QUARTERLY AGRICULTURAL REPORT.

November 1839.

We have left ourselves very little space to give anything like a report of agricultural matters during the last quarter, which would be commensurate with their importance.

The topic of greatest interest at the present moment, is the actual condition of the crop just saved, whether it is as fine and as prolific as was once expected. Judging from the very various qualities of grain presented from different parts of the country, we conclude that the last season had affected the crops in the different parts of the country very variously. For example: the season was considered dry in East Lothian, in Morayshire, and on the Borders, and in consequence, the wheat in those quarters is of fine quality, and likely to be prolific; whereas in the latitudes of Forfar and Perth shires, West Lothian, and Alnwick, the season was certainly wet, and consequently, the grain in those localities is of inferior description. We believe that the crop was better in England than in Scotland; of that of Ireland we have heard little said. The straw is not deficient in bulk, and the general yield will, perhaps, not be under the average rate, though much inferior wheat and barley will be presented to market in a short time. But fortunately, the special food of the poor, oats and potatoes, are the most abundant of the crops. This harvest has certainly been the longest in our recollection, extending over a period of four months, having seen oats in the stook on the 21st July, and we believe there is still, in November, corn unhoused in this country.

Stock, both lean and fat, still fetch high prices. The turnip crop is pretty good everywhere, but we question that its abundance, even in England, is sufficient to account for the present high prices of lean beef and mutton; certainly that will not account for the scarcity of fat stock. We suspect that the low prices of fat three or four years ago, had the effect of checking the breeding of stock, and the consequences of that check are now felt in a deficiency of supply. As a corroboration of this conjecture, the largest markets have been scantily supplied this season. Now if the stock had been in the country, the high prices would have drawn them out.

The prices of grain have been gradually declining, and it is highly probable will continue to decline for a time to come. No deficiency of bread corn can be felt during winter, when the foreign ports may be expected to be closed by frost; but should it be felt in spring, which we do not anticipate, then the foreigners will be ready to pour in their supplies upon us, as upon a recent occasion. In any way we should be thankful that there will be plenty of bread in the land.

The unusual length of some articles in the number has precluded many which we wished to insert. Our numerous correspondents must therefore have patience until another opportunity. But they "who really wish to see themselves in print," in a forthcoming number, should transmit their favours at the commencement instead of the end of the quarter. Many topics of present interest should have received attention at our hands, such as the connection between subsoil-ploughing and thorough-draining, the corn-law agitation, the scarcity of gold, but must now "bide their time." Meantime, several notices of books, and valuable communications, are accusing us of neglect.

TABLES OF PRICES, &c.

*'he MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, **shewing the Quantities of Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantities upon which duties have been paid for home-consumption, during the same Month; and the Quantities remaining in Warehouse at the close thereof, from 5th Aug. to 5th Oct. 1839.***

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOUSE. From Foreign Countries.	REMAINING IN WAREHOUSE. From British Possessions.	REMAINING IN WAREHOUSE. Total.
Aug. 5. 1839.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.
Wheat, . .	110,560 3	. .	110,560 3	18,525 4	. .	18,525 4	131,571 2	173 4	131,744 6
Barley, . .	41,194 5	. .	41,194 5	39,112 5	. .	39,112 5	2,905 6	. .	2,905 6
Oats, . . .	127,436 5	. .	127,436 5	244,529 7	. .	244,529 7	192,195 7	. .	192,195 7
Rye, ...	11,422 0	. .	11,422 0	421 5	. .	421 5	39,696 7	. .	39,696 7
Pease, . . .	13,118 3	. .	13,118 3	2,713 5	. .	2,713 5	28,299 0	0 7	28,299 7
Beans, . .	7,681 1	. .	7,681 1	3,425 4	. .	3,425 4	28,609 3	. .	28,609 3
Totals,	311,413 1	. .	311,413 1	308,728 6	. .	308,728 6	423,278 1	174 3	423,452 4
Sept. 5.									
Wheat, . .	235,840 2	25 0	235,865 2	2,172 1	25 0	2,197 1	360,465 1	173 4	360,638 5
Barley, . .	42,362 3	. .	42,362 3	37,938 5	. .	37,938 5	7,073 7	. .	7,073 7
Oats, . . .	266,539 2	. .	266,539 2	394,381 6	. .	394,381 6	64,764 6	. .	64,764 6
Rye, ...	47,259 6	. .	47,259 6	86,500 7	. .	86,500 7	788 2	. .	788 2
Pease, . . .	14,401 0	19 7	14,420 7	14,233 0	19 7	14,252 7	28,425 3	0 7	28,426 2
Beans, . . .	9,958 5	. .	9,958 5	9,471 3	. .	9,471 3	29,659 7	. .	29,659 7
Totals,	616,361 2	44 7	616,406 1	544,697 6	44 7	544,742 5	491,177 2	174 3	491,351 5
Oct. 5.									
Wheat, . .	407,199 4	1 1	407,200 5	774,641 1	1 1	774,642 2	2,718 4	173 4	2,892 0
Barley, . .	34,414 1	. .	34,414 1	30,863 3	. .	30,863 3	8,505 7	. .	8,505 7
Oats, . . .	66,525 7	. .	66,525 7	25,637 6	. .	25,637 6	99,983 4	. .	99,983 4
Rye, ...	28,932 7	. .	28,932 7	30,215 3	. .	30,215 3	. .	. .	. .
Pease, . . .	13,839 2	0 1	13,839 3	8,835 3	0 1	8,835 4	32,584 0	0 7	32,584 7
Beans, . .	6,131 4	. .	6,131 4	7,710 5	. .	7,710 5	27,155 4	. .	27,155 4
Totals,	557,043 1	1 2	557,044 3	877,903 5	1 2	877,904 7	170,947 3	174 3	171,121 6
Aug. 5.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.
Flour, . . .	39,781 0 24	19,937 1 2	59,718 1 26	644 1 3	17,865 0 15	18,509 1 18	59,300 2 10	6,718 3 24	66,019 2 [illegible]
Oatmeal, .	353 0 14	. .	353 0 14	362 1 27	. .	362 1 27	13 3 11	. .	13 3 11
Totals,	40,134 1 10	19,937 1 2	60,071 2 12	1,006 3 2	17,865 0 15	18,871 3 17	59,314 1 21	6,718 3 24	66,033 1 [illegible]
Sept. 5.									
Flour, . . .	28,273 1 23	4,815 3 10	33,089 1 5	409 0 25	6,840 1 21	7,249 2 18	80,600 2 2	4,649 3 14	85,250 1 [illegible]
Oatmeal, .	7 1 6	. .	7 1 6	1 1 0	. .	1 1 0	19 3 17	. .	19 3 1[illegible]
Totals,	28,280 3 1	4,815 3 10	33,096 2 11	410 1 25	6,840 1 21	7,250 3 18	80,620 1 19	4,649 3 14	85,270 1 [illegible]
Oct. 5.									
Flour, . . .	65,449 3 9	1,817 1 1	67,267 0 10	127,810 3 1	1,820 3 1	129,630 3 3	14,967 0 17	4,646 1 14	19,613 2 [illegible]
Oatmeal, .	14 3 22	. .	14 3 22	. .	. .	. .	19 3 17	. .	19 3 1[illegible]
Totals,	65,464 3 3	1,817 1 1	67,282 0 4	127,810 3 1	1,820 3 1	129,630 3 3	14,987 0 6	4,646 1 14	19,633 1 [illegible]

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1839.												
Aug. 2.	74	10	39	8	26	0	42	4	38	6	39	4
9.	75	2	37	9	25	7	43	6	39	6	39	9
16.	75	1	40	7	24	3	44	2	40	4	40	4
23	73	2	31	11	23	8	44	6	40	6	39	10
30	75	1	33	3	24	9	45	8	38	6	40	1
Sep 6.	75	5	37	2	24	10	46	6	39	4	40	3
13.	76	4	37	11	25	7	47	0	38	10	40	7
20.	75	4	35	11	26	7	46	2	40	2	41	3
27.	78	11	34	9	26	1	45	4	40	4	41	0
Oct. 4.	74	9	45	11	26	10	44	6	42	6	43	5
11.	72	6	45	10	28	1	42	0	42	2	43	8
18.	70	1	44	8	26	6	41	5	43	0	44	7
25.	70	0	44	4	26	3	40	6	43	2	44	0

DUBLIN.

Date	Wheat per Bar. 20 St. s.	d.	Barley per Bar. 16 St. s.	d.	Bear per Bar. 17 St. s.	d.	Oats per Bar. 14 St. s.	d.	Flour per Bar. 9 St. s.	d.
1839.										
Aug. 6.	42	3	22	4	15	3	18	10	25	3½
13.	42	9	20	6	14	2	18	5	25	8½
20.	39	3	18	6	13	5	17	2	25	5
27.	43	7	19	4	13	11	17	5	25	5½
Sep. 3.	43	7	20	6	14	2	18	5	25	5
10.	42	1	19	10	15	3	19	5	25	3
17.	41	7	19	3	15	4	19	10	25	8
24.	40	10	19	10	15	6	18	6	25	11
Oct. 1.	39	3	19	10	15	7	15	10	25	10
8.	40	6	20	10	15	4	15	6	25	6
15.	41	9	21	2	15	7	15	8	25	4
22.	39	11	21	5	..		15	10	25	5
29.	41	5	22	7	17	3	16	3	25	1

LIVERPOOL.

Date	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1839.												
Aug. 2.	71	7	32	6	28	2	40	6	42	6	44	0
9.	74	1	33	6	27	5	42	2	43	4	44	6
16.	71	3	34	3	27	0	43	6	42	2	42	5
23.	70	1	35	7	27	4	44	0	42	0	43	2
30.	74	7	34	5	27	2	44	6	43	2	45	2
Sep 6.	76	3	36	6	27	1	45	2	41	10	43	5
13.	70	5	37	10	29	6	46	0	42	8	45	6
20.	70	3	40	9	30	7	46	6	43	6	45	9
27.	78	8	42	2	32	4	45	6	44	6	46	10
Oct. 4.	69	2	37	6	30	6	44	8	45	2	47	10
11.	66	0	38	8	30	0	43	8	44	8	45	3
18.	67	2	47	6	27	5	42	0	44	10	46	6
25.	66	0	41	9	25	3	41	6	46	2	47	1

EDINBURGH.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.	Beans. s.	d.
1839.										
Aug. 7.	67	0	38	10	33	0	42	0	42	2
14.	66	6	38	8	32	1	42	6	43	3
21.	67	2	37	10	33	0	42	8	43	2
28.	68	2	38	0	33	6	42	6	43	6
Sep. 4.	68	6	37	9	33	0	42	10	43	4
11.	70	0	35	8	28	6	43	6	44	4
18.	72	0	33	6	31	4	44	0	44	6
25.	74	0	32	6	27	0	44	0	44	6
Oct. 2.	72	0	32	2	26	6	43	8	44	3
9.	68	3	34	6	25	1	44	0	44	8
16.	70	6	36	6	26	1	45	0	47	0
23.	71	6	36	2	24	10	46	0	47	2
30.	71	8	35	10	24	8	47	0	47	6

TABLE showing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN; the Duties payable thereon, from August to November 1839.

Date.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug 2.	71 3	69 2	13 8	38 7	38 3	4 10	27 3	27 0	6 3	47 8	44 6	3 6	41 8	40 5	9 6	40 9	40 9	9 6
9.	70 0	69 10	13 8	37 10	38 2	4 10	26 9	27 1	6 3	48 4	45 4	2 0	42 3	40 10	9 6	40 11	40 10	9 6
16.	72 3	70 6	10 8	38 1	38 2	4 10	26 11	27 0	6 3	46 2	45 2	2 0	41 6	41 2	9 6	40 10	40 11	9 6
23.	71 11	70 11	10 8	38 4	38 4	4 10	25 11	26 9	7 9	47 6	46 9	1 0	39 8	41 1	8 0	41 10	41 1	8 0
30.	71 10	71 4	6 8	37 11	38 1	4 10	26 8	26 9	7 9	47 6	46 2	1 0	40 7	41 11	8 0	42 7	41 4	8 0
Sep. 6.	71 9	71 8	6 8	39 0	38 4	4 10	26 10	26 9	7 9	41 9	45 6	2 0	42 3	41 4	8 0	42 6	41 7	8 0
13.	70 9	71 6	6 8	39 6	38 6	4 10	26 9	26 8	7 9	38 10	44 0	3 6	42 6	41 6	8 0	43 10	42 1	6 6
20.	69 8	71 3	6 8	39 7	38 9	4 10	26 11	26 8	7 9	39 0	42 5	6 6	42 1	41 5	8 0	43 3	42 5	6 6
27.	70 1	70 10	10 8	40 4	39 1	3 4	28 10	27 3	6 3	38 3	41 2	8 0	43 5	41 9	8 0	44 7	43 1	5 0
Oct 4.	70 4	70 9	10 8	40 8	39 6	3 4	26 9	27 2	6 3	38 1	39 7	11 0	44 2	42 6	6 6	46 0	43 9	5 0
11	67 2	70 0	10 8	41 2	40 1	1 10	25 9	27 0	6 3	37 9	38 11	12 6	44 11	43 3	5 0	46 1	44 4	3 6
18.	65 6	68 11	16 8	41 0	40 5	1 10	25 5	26 9	7 9	38 7	38 5	12 6	45 0	43 8	5 0	45 6	44 10	3 6
25.	66 5	68 2	16 8	41 3	40 8	1 10	25 4	26 6	7 9	38 5	38 4	12 6	46 1	44 3	3 6	45 5	45 2	2 0

PRICES of BUTCHER-MEAT.

	SMITHFIELD. *Per Stone of* 14 lb.		MORPETH. *Per Stone of* 14 lb.		EDINBURGH. *Per Stone of* 14 lb.		GLASGOW. *Per Stone of* 14 lb.	
Date.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1839.								
Aug.	7/3 to 8/	7/6 to 8/6	7/ to 7/9	7/3 to 7/9	7/ to 7/6	7/ to 7/6	7/3 to 8/	7/ to 7/6
Sep.	7/6 8/6	7/6 8/6	7/3 8/	7/6 8/	7/3 8/	7/6 8/3	7/6 8/	7/3 7/9
Oct.	7/9 8/9	7/9 8/6	7/6 8/6	7/6 8/6	7/6 8/6	7/6 8/6	7/6 8/6	7/6 8/

PRICES of English and Scotch WOOL.

English, per 14 lb.

Merino,	22/6 to	25/6
In Grease,	20/	24/6
South Down,	22/	24/6
Leicester, Hogg,	17/	20/
Ewe and Hogg,	15/	18/
Locks,	8/6	10/6
Moor,	7/6	9/6

Scotch, per 14 lb.

Leicester, Hogg,	15/6 to	19/6
Ewe and Hogg.	14/	16/6
Cheviot, white,	13/6	16/
Laid, washed,	10/6	12/6
Unwashed,	5/6	9/6
Moor, white,	6/6	8/
Laid, washed,	5/6	7/3
Unwashed	4/6	5/

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the* 10*th of Oct.* 1838, *and* 10*th of Oct.* 1839,*—shewing the Increase and Decrease on each head thereof.*

	Quarters ended Oct. 10.		Increase.	Decrease.	Years ended Oct. 10.		Increase.	Decrease.
	1838.	1839.			1838.	1839.		
	£	£	£	£	£	£	£	£
Customs,	5,469,271	5,778,006	308,735	. .	18,823,619	19,915,296	1,091,677	. .
Excise,	4,098,959	4,118,159	19,200	. .	11,837,788	12,162,171	324,318	. .
Stamps,	1,751,476	1,699,724	. .	51,752	6,636,204	6,508,523	. .	127,681
Taxes,	328,045	311,283	. .	16,762	3,647,157	3,713,784	66,627	. .
Post-Office,	410,000	407,000	. .	3,000	1,536,000	1,533,000	. .	3,000
Miscellaneous,	8,376	17,654	9,278	. .	44,781	103,907	59,126	. .
	12,069,127	12,326,826	337,213	71,514	42,525,549	43,926,681	1,541,743	130,681
	Deduct Decrease,		71,514		Deduct Decrease,		130,681	
	Increase on the Qr.		265,699		Increase on Year,		1,411,062	

THE

QUARTERLY

JOURNAL OF AGRICULTURE.

ON TRIGONOMETRICAL SURVEYING.

By W. Galbraith, A. M., Edinburgh.

The importance and utility of accurate surveys of countries, and of their minor subdivisions, have been acknowledged from the earliest ages. They are represented as having laid the foundation of geometry itself, from which, indeed, that term is derived. The military expeditions of the ancients, such as those of Alexander, &c., extended and improved geography, because their commanders kept engineers who made regular surveys of all their marches. When Hannibal, at the commencement of the second Punic War, was planning the invasion of Rome, through Spain and France, the Romans caused a general survey of those countries to be made, to enable them to select the most advantageous points for the purposes of fortification and defence. Afterwards, on a much grander scale, a survey of the whole Roman Empire was ordered by Julius Cæsar, who, from experience during his conquests, was fully prepared, in a civil, as well as military point of view, to appreciate its paramount importance. He appointed, for this purpose, some of the most eminent men of science in Rome, who, with numerous assistants, were employed during a period of twenty-five years in completing it. The results of the labours of this wonderful people are conspicuous to this day in Britain, from their roads, bridges, and lines of military defence, as those of Agricola, Adrian, and Antoninus.

In more modern times, Cassini executed a Trigonometrical Survey of France, and though the operations were performed with inferior instruments, and imperfect modes of calculation, still in its time it possessed considerable merit. The inaccuracies of Cassini's chart have led to a new trigonometrical survey of France, by the corps of Military Geographical Engineers, having for its foundation the arc of the meridian of Dunkirk, measured by Mechain and Delambre. All the calculations in the new survey are performed according to the formulæ originally investigated by Delambre, which have been developed by Puissant and Francœur, and the computations simplified by the aid of auxiliary tables. In short, all the reductions are now performed in a manner so accurate as to leave nothing farther, on that point, to be desired.

The idea of a geometrical survey of Scotland, was first started at the close of the Rebellion in 1745, and, with inferior instruments, a large map of the country was formed in manuscript by the late General Roy. At the conclusion of the peace in 1763, a plan was submitted to Government to construct a map of the British Isles, from actual survey, but circumstances prevented any progress in this being made till the peace of 1783, when a memoir of Cassini de Thury, was presented by the French ambassador to the British Government, shewing the advantages which would result to geography and astronomy, from connecting trigonometrically the observatories of Greenwich and Paris. To this proposition our Government assented, and General Roy measured a fundamental base on Hounslow Heath, near London, in 1784. In the summer of 1787, the angles of the connecting series of triangles, measured with Ramsden's theodolite, were extended from Greenwich to Dunkirk, to which those of the French, by Borda's repeating circle, had also been carried from Paris. The result of Roy's calculations gives for the difference of longitude in time, $9^m\ 19^s.4$, and that of Legendre is $9^m\ 21^s$, while that lately found by a mean of a new survey by Captain Kater, by fire signals by Sir John Herschel, and by twelve of Dent's chronometers, is $9^m\ 21^s.3$,—a result not likely to be sensibly altered by any new determination. It is, therefore, to be remarked, that Roy's result is less than Legendre's by $1^s.6$, and than the truth probably, by $1^s.9$, which is likely owing to the slight errors of the elements assumed, and the somewhat insufficient formulæ and rules of calculation used at that comparatively early period of trigonometrical surveying. They were introduced by Dalby, the superintendant of the mathematical department of the survey, to which the attainments of General Roy, the conductor, were inadequate. It is perhaps worthy of remark, that Roy calls Dalby * his assistant, he himself being the commander-in-chief, and that without the aid of the *assistant* the chief could not have advanced a single step—so far, in general, does interest exceed talent and qualification for office !

The French survey was conducted by the most eminent mathematicians in France, and this will perhaps account for the greater accuracy of the French result than the English at that period. Even now, the data employed in the calculations of the survey at present in progress, were fixed by a commission of the most learned men in France, while the investigation of the necessary formulæ are intrusted to M. Puissant, whose scientific attainments well qualify him for such a duty. These are put into the hands of the French geographical engineer officers to be employed in all their deductions, and this appears to me to be a better plan than to commit the whole to an influential officer, with powers to select a mathematical assistant to perform the duty to which the superior is inadequate, as in the case of General Roy.†

After the termination of this survey, undertaken chiefly for the purpose of connecting the observatories of Greenwich and Paris, some years elapsed before a survey of the whole kingdom was undertaken. This commenced in 1791, when His Grace the Duke of Richmond, with the approbation of the King, purchased for the Ordnance, of which he was then Master-General, another and more perfect theodolite, by

* "Mr Dalby, who has been recommended to me as an *assistant*, has acquitted himself throughout the whole perfectly to my satisfaction."—Trig. Survey, vol. i. p. 94.

† It was alleged that the base of verification on Romney Marsh was not so accurately measured as that on Hounslow Heath, especially as the directly measured length, and that found by Roy by computation from the base on Hounslow Heath, differed by 28 inches. Delambre, however, having recomputed all Roy's triangles by a more accurate method, finds a difference of *six* inches only !—Base du Systeme de Metrique Decimal, t. iii. p. 186.

Ramsden, than the former belonging to the Royal Society that had been used by Roy, together with a hundred feet steel chain. With the latter, the base on Hounslow Heath was remeasured, and with the former somewhat improved, all the angles of the great triangles have, up to the present time, been chiefly observed. The horizontal circle is three feet in diameter, and its microscopes read to single seconds. It is provided with a powerful telescope, and was altogether one of the most perfect instruments, previous to that time, ever employed in any kind of surveying. The French used Borda's repeating circle of about half the dimensions of Ramsden's theodolite, but, by their mode of using it, the accuracy of the final results may be put nearly in competition with those of the former. Indeed, the French mathematicians affirm, that a twelve-inch repeating circle, or repeating theodolite, is fully sufficient for all the most refined purposes of geodesy, and their opinion is confirmed by the astronomers of Germany, who employ the twelve-inch circles of Reichenbach and Ertel, for all the purposes of trigonometrical surveying, very successfully. This is important, because these smaller classes of circles are much more portable and convenient than those of the larger size. I am inclined to confide in these opinions of the French and German mathematicians, from my own experience in the accuracy of results by my six-inch altitude and azimuth circle, made by Robinson, after the ideas of Captain Kater, somewhat improved at my suggestion. The circles are divided to every ten minutes, and these ten-minute spaces are again subdivided to ten seconds, by three verniers applied to both the horizontal and vertical circles. The level is very sensible, and has a scale divided so as to shew three seconds, which may be estimated to single seconds by the eye.* With four single observations, or rather two double ones, by reversing the telescope and level each time, thus giving twelve readings by the three verniers, I have generally found the final result in zenith distance, within five seconds of the truth.

* Indeed, if a fine scale, such as that marked 50, used by land-surveyors, had been applied, each division would shew single seconds, but, in so small a circle, this was considered unnecessary accuracy.

Of course, by continuing the operations a sufficient length of time, the error may be constantly diminished, and finally, almost entirely eliminated by judicious arrangement.

In the early stages of the trigonometrical survey, the rules and formulæ given by Dalby, though approximative, were considered sufficiently accurate, and accordingly, all the final results in the first three volumes of the survey, were obtained by their means. Some mathematicians having started doubts of the accuracy of Dalby's formulæ, Kater adopted those of Oriani in the new survey, which are known to be correct. He proposed, however, to observe the direction of the meridian at several places, in order to determine the difference of longitude of these places by those observations independent of any assumed ellipticity, but the attempt proved a failure; and it is now generally admitted, that the ellipticity necessarily forms one of the elements required to determine latitudes, longitudes, and azimuths geodetically. Many of the deductions of Dalby, therefore, though commonly attributed to Roy, &c., are erroneous, and from the theoretical investigations of Mr Ivory, and the chronometrical observations of Dr Tiarks, it is generally admitted that almost all the deductions in the first three volumes of our survey, are slightly erroneous. In fact, the longitudes of the points in the southern coast of England are all too small by about 12″ in each degree.. Hence, the longitude of St Agnes light in the Scilly Isles, is too small by about one minute, that is, the position of the light is one minute of a degree farther west than that stated in the trigonometrical survey. These facts became early known to Colonel Colby, the present conductor of the survey, and, accordingly, I understand he has since changed the methods of computation, latterly, I believe, though I have not the information directly from himself, that the methods now generally followed in deducing latitudes and longitudes, are analogous to those of M. Puissant, with perhaps some slight modifications. With regard to the method of computing the azimuths, I have no direct knowledge, and to infer any thing from surmise is inadmissible. It may here be proper to observe, that all the formulæ usually employed, are only approximations to the truth; but these can be carried as close as may be thought necessary, while the computations, by that means, become much more manageable. The investigations of such formulæ do not accord very well with the pages of this Journal; but I shall here give the results at which I have arrived, with two small tables to facilitate the practice to those who may be inclined to follow such pursuits when they have an opportunity. I shall then add a few results by way of example, and point out, as I have more than once done previously, the great necessity there is for the immediate resumption and active prosecution of the trigonometrical survey of Scotland, that has been so often promised, while so little has been done, notwithstanding the frequent assurances we have received of the powerful support of the noblemen and gentlemen connected with Scotland. Nothing, however, is easier and cheaper, than high sounding compliments without meaning.

Formulæ for finding Latitudes, Longitudes, and Azimuths, geodetically.

1. Let A = the measured arc in feet on the surface of the terrestrial spheroid.

R'' = an arc equal to the radius in seconds.

a = the radius of the equator in feet.

l = the given latitude farthest from the equator.

l' = the required latitude nearest the equator.

z = the given azimuth.

z' = the required azimuth.

ι = the compression.

Δl = the difference of latitude.

Δp = the difference of longitude.

Δz = the difference of azimuth; then,

$$\text{(A).}\quad \Delta l = \frac{A R''}{a}\left(1 + 2\iota - 3\iota \sin^2 l\right)\cos z - \frac{A^2 R''^2}{a^2} \cdot \tfrac{1}{2}\sin 1'' \tan l \sin^2 z.$$

$$\text{(B).}\quad \Delta p = \frac{A R''}{a}\left(1 - \iota \sin^2 l\right)\sin z \sec l - \frac{A^2 R''^2}{a^2} \cdot \tfrac{1}{2}\sin 1'' \sin 2z \tan l \sec l.$$

$$\text{(C).}\quad \Delta z = \frac{A R''}{a}\left(1 - \iota \sin^2 l\right)\sin z \tan l - \frac{A^2 R''^2}{a^2} \cdot \tfrac{1}{4}\sin 1'' \sin 2z\left(1 + 2\tan^2 l\right).$$

When $a = 20922642$ feet, and $\iota = \frac{1}{300}$; then,

$$\text{Log}\ \frac{R''}{a} = 7.9938086;\quad 1 + 2\iota = 1.006666.$$

$$\text{Log}\ \frac{R''^2}{a^2} \cdot \tfrac{1}{2}\sin 1'' = 0.3722;\quad \text{log.}\ \frac{R''^2}{a^2} \cdot \tfrac{1}{4}\sin 1'' = 0.0711.$$

2. Let $\frac{R''}{a}\left(1+2\iota-3\iota\sin^2 l\right)=M$;

And $\frac{R''}{a}\left(1-\iota\sin^2 l\right)=P$, the preceding formulæ become,

(A′) $\Delta l=AM\cos z-A^2M^2\tfrac{1}{2}\sin 1''\tan l\sin^2 z$.

(B′) $\Delta p=AP\sin z\sec l-\ AP^2\tfrac{1}{2}\sin 1''\sin 2z\tan l\sec l$.

(C′) $\Delta z=AP\sin z\tan l-A^2P^2\tfrac{1}{4}\sin 1''\sin 2z\,(1+2\tan^2 l)$.

Log $\tfrac{1}{2}\sin 1''=4.3485$, log $\tfrac{1}{4}\sin 1''=4.0835$, and the logarithmic values of M and P may be taken from the following table (I.) at the end of this article.

If l', the latitude from formula (A) or (A′) be employed, in which the quantity corresponding to the last term, may be either computed, or taken by inspection from a small table drawn up for this purpose, denominated the reduction r'', of λ to l', in which λ represents the foot of the perpendicular from the given point upon the meridian, passing through that required. Then, by the solution of a spherical triangle, after having found l', we have,

$$(a)\ \Delta l=AM\cos z-r''.$$

$$(b)\ \Delta p=AP\sin z\sec l'.$$

$$(c)\ \Delta z=Ap\sin\tfrac{1}{2}(l+l')\sec\tfrac{1}{2}(l-l').$$

Or, since half the difference of the latitudes must always be a very small quantity, secant $\tfrac{1}{2}(l-l')$ will generally be nearly equal to the radius; and hence,

$$(c')\ \Delta z=\Delta p\sin\tfrac{1}{2}(l+l').$$

These simple formulæ might have been easily converted into rules expressed in words at length, but want of room will not admit of it.

It must be kept in mind, that, in north latitudes, the azimuth z is reckoned from the south towards the east or west, and is the supplement of m, or that reckoned from the north.

I shall shortly apply these to practice, and shall, after the example of Messrs Puissant and Moynet, who surveyed the Island of Elba in this manner in 1803, omit the very small spherical excess in the reductions of the stations to the meridian, and to the perpendicular to the meridian,—a method which I believe is also frequently followed by our surveyors, because the introduction of it embarrasses the calculations, while the omission of it does not, in all ordinary cases, sensibly affect the accuracy of the result.

Having occasionally visited, during my leisure time, in the months of August and September, several points on the west coast of Scotland; and for the sake of amusement, recreation, and the banishment of the *ennui* frequently attending the lounger at a watering place, who has no particular object in view, I generally carried a few mathematical and astronomical instruments along with me, to fill up, if possible, my vacant hours, at least in an interesting, and perhaps useful manner. In the course of these excursions, I found that, in the maps of the country commonly reckoned the best, there were great errors. In the year 1836, I found that Pladda Lighthouse, and, indeed, the whole southern shore of the Island of Arran, was about *five* geographical miles or minutes of latitude too far to the *north*, and three minutes of longitude too far to the east. Again, in 1837, I found that the county town of Ayr was placed too far to the *south* by about *three* miles or minutes of latitude, and too far to the east by about eight minutes of longitude. Hence these maps of this part of the country were distorted no less than about eight minutes of both latitude and longitude! These errors also prevailed in the tables of latitudes and longitudes given in our best books and charts for the purposes of navigation. They are, therefore, very dangerous to the shipping trade of the Clyde; but they will, I am happy to say, be speedily corrected by the joint-labours of Captain A. Henderson of the Royal Engineers, and Captain Charles G. Robinson of the Royal Navy, who have been for some time engaged in a survey of the Firth of Clyde and the adjacent lochs.

The remaining part of this paper will shew that their labours are still required farther north,—as far, I believe, as Cape Wrath. Indeed, it appears probable that almost all the Hebrides imperatively call for a new survey, not only for the benefit of vessels navigating amongst them, and connected with them, but for all other vessels which, from foreign places, make the land among them, not when they are bound for the ports on the west coast of Scotland only, but also for those on the east, when they come, as it is commonly called, north about.

Why should the maps and charts of our own coasts remain in this state of inaccuracy, whatever may be the position of the inhabitants, when the funds of the country are largely expended in surveying the Straits of La Maire, of Magellan, and the shores of Patagonia, inhabited by savages at the southern extremity of the continent of America? Even at this moment, a survey of the southern extremity of Africa is agreed upon for the general interests of astronomical and geographical science; while the accurate position of St Kilda is, generally speaking, unknown, insomuch that the master of a vessel from a foreign port, bound for one on the east coast of Scotland, told me, when he made that land first, and expected to check his longitude by chronometer, he found great fault with its performance, because it deviated so far from the truth, he innocently enough believing that he could trust the position of St Kilda, so laid down in his charts and nautical tables!! Let us see what justice there is in this opinion.

If we turn to our books of piloting directions and charts of the Hebrides, we shall find that the longitude of St Kilda is

stated by one authority, at	8° 26′ W.
by a second, at	8° 32′
by a third, at	8° 36′
and by a fourth, at	8° 40′

The difference of the extremes of these is no less than 14 minutes of longitude, or 56 seconds of time! This is certainly far from affording a check upon a good chronometer which has been properly managed during a voyage, of which the rate had been accurately given at the commencement of that voyage, and carefully checked at each point in the course of it, which was known to be well determined. Though many of the small isles among the Hebrides, and others generally round our shores, are of themselves far from being valuable, yet, on account of our extensive shipping trade frequently by these islets put in danger, when near the termination of a voyage, they certainly ought to be immediately surveyed, and their geographical positions accurately determined. Certainly, their claims are far stronger than those of the foreign distant lands to which I have just alluded. It may be alleged, that there are few vessels traversing among these islands, and, consequently, the necessity for accurate surveys of them is, on this account, less important. It is well known, however, that ten or fifteen vessels may be observed passing in one day the southern shores of Tiree near the Skerryvore rocks, on which the Commissioners of Northern Light-Houses have very properly commenced the erection of a new light-house, under the superintendence of their able engineer Mr Robert Stevenson, which, for the safety of many lives and much valuable property, it is to be hoped, notwithstanding considerable difficulties, will be speedily completed.

Before proceeding to the operations in which I have this year been engaged, it may be proper to remark, that the instrument which I employed in all my astronomical observations, and some of my geodetical, was the six-inch circle previously alluded to. For the ordinary purposes of surveying, I used a five-inch theodolite of the best construction, combined with a hundred-feet chain. I also occasionally employed a pocket reflecting circle, Schmalcalder's surveying compass, with a measuring tape, a good eight-day chronometer for time, together with several other small instruments in such cases as they were required, or when a better either could not be obtained, or perhaps used, from the unfavourable state of the weather and other circumstances. The special point to which my attention this year was particularly directed, was the interesting island of Iona, of which my friend Mr D. Macvean is minister. From him I received great assistance in my operations, and in his family the most marked attention and hospitality, which I can never forget. Many of the inhabitants of the island rendered me important services, with little or no remuneration, especially the boatmen employed to land the passengers from the steam-boats at Iona* and Staffa. When I visited Staffa by the boat of Mr Macdonald from Iona, whose duty required his attendance at Staffa on certain days, I was, in the most friendly manner, invited to accompany him, without fee or reward, because, as the boatmen told me, it was their duty to attend, independently of me accompanying them. After having visited the caves and natural curiosities of that extraordinary island, and remained six hours in expectation of the steam-boat in rather heavy rain, I was obliged to leave it

* At Iona, a small pier is very much wanted at the landing-place, which might be erected at an inconsiderable expense.

in the boat of Mr Macdonald of Little Colonsay, in the mouth of Loch-na-Keal, on a day so stormy, and the sea running so high, that the steam-boat was obliged to return to Oban by the Sound of Mull, without being able to reach Staffa. Though there might not have been absolutely any great personal danger, yet it was not very agreeable to see an open boat shipping, every now and then, considerable quantities of salt water, drenching above twenty passengers to the skin, amid a storm of Gaelic lamentations from a dozen of Helen Macgregor's female cousins. However, notwithstanding all these perils, we were all landed safely, and, as no boat could then return to Iona, I was compelled to experience Mr Macdonald's hospitality at Colonsay for two nights and a day, without any remuneration, though repeatedly offered.* I cannot, therefore, assent to the general tenor of Dr MacCulloch's description of the avarice of the Highlanders. That extravagant demands are occasionally made in the Highlands, there can be little doubt, because that is the case everywhere. The Deal boatmen, for example, charged a friend of mine *ten* shillings for landing him from a French packet, instead of *five*, which was their due; and a Thames waterman charged another four shillings, for which he was compelled to take one! I believe the Highlanders seldom charge *four* times as much as they are bound in equity to take!

Having obtained the error and rate of the chronometer kindly lent me by Mr R. Bryson, from Professor Henderson at the observatory of Edinburgh, I set out, on the 2d of August, for Glasgow, whence I sailed in a steam-boat for Port Bannatyne, in the Island of Bute, where I staid a few days, waiting to see if the weather would become a little more steady. During this period, I observed, a few times, the latitude by meridian altitudes of the sun, and the longitude by chronometer. The latitude of my position turned out to be 55° 51′ 47″ N., longitude by

* Should any tourist or geological traveller wish to visit this district of Scotland, he might find it advantageous to stay with Mr Macdonald, Colonsay. The house is large and commodious for this part of the Highlands, and a boat is at command to visit the coast of Mull, Inchkenneth, Ulva, Gometra, Staffa, the ruins of Maclean's Castle in the Tresnish Isles, &c.

chronometer 5° 4′ 54″ W., from too few observations, I am afraid, to be confidently trusted. All the important points in this vicinity have been accurately fixed by the operations of my friend Captain Henderson, whose results, in latitude at least, were checked at Brisbane Observatory. Sir Thomas M. Brisbane informed me that he had determined the latitude of his observatory by his astronomical circle, from some hundreds of observations, to be 55° 49′ 6″ N., while Captain Henderson's trigonometrical observations gave 55° 49′ 4.5″ N., less than the preceding by 1.5″ only,—a sufficient proof of the great accuracy of both.*

One great object would be gained, if the publication of this little paper would contribute in any degree to induce Government to continue Captain Henderson's labours still farther northward on the west coast of Scotland, and among the Hebrides, where I have endeavoured, and will continue to attempt to shew, that they are so much wanted. Will he also (as I have been told it is possible), be sent out to this African survey, while so much is required at home? Why do not the Highland proprietors, like the shipowners and merchants on the Clyde, combine to urge Government to survey the Highland coasts and lochs, in preference to Patagonia and Negroland, as they are bound to do for the benefit of agriculture as well as of commerce? Indeed, some appearances indicate the resumption of the trigonometrical survey of Scotland, but since, as I am informed on what I consider unexceptionable authority, there is no act of Parliament for its completion, the little money allotted for this purpose depending entirely upon the Chancellor of the Exchequer for the time being, the representatives and friends of Scotland are in duty bound to press Government for such an act.

On Tuesday the 20th of August, I left Bute for Oban, and

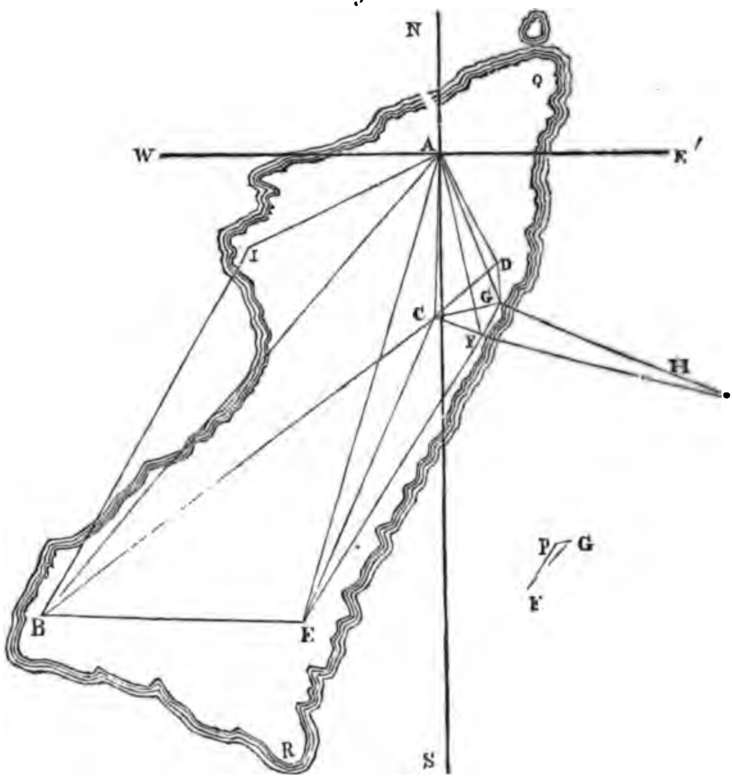
* There are frequently much greater discrepancies than this between the observed and geodetic latitudes, especially in mountainous countries. It often amounts to 5″. M. Puissant, in the supplement to his Traité de Geodesie, p. 89, states, that, on account of local attraction, the geodetic latitude of Milan exceeds the observed by 23″, while, in the Connaissance des Tems for 1838, the difference for another point is 27″.4.

on Wednesday 21st, at about eleven o'clock forenoon, I arrived at Iona. The weather being then good, I commenced in the afternoon my observations at the top of Dunii, the highest point in the island, on the cairn which had been used in some of the great triangles constituting those of the Trigonometrical Survey. Though the pile was considerably dilapidated, Mr Macvean and I succeeded in repairing it tolerably, and placing a flat stone on its centre with sufficient steadiness to receive the three feet-screws of the tripod of my circle. When properly adjusted, I was successful in getting a number of observations for time, for the azimuth of Carn Cul ri Eirn. the south pile, for the depression of the horizon of the sea, and for the elevation of Ben More in Mull. These observations were continued whenever the weather would permit. A base was also measured near the shore at the village, with the hundred-feet chain, and from it observations to some of the more prominent points of the island were extended.

I intended to have taken a circuit of the whole island with the theodolite and chain, but the continued wet weather rendered this impracticable, and I was reluctantly compelled to restrict myself to what I could conveniently overtake. I have endeavoured to fix accurately as many points as I could, filling in around them, with the compass and eye, as accurate an outline of the island as possible. Indeed, on account of the rugged nature of the west coast generally, it is difficult to take, by means of instruments and a chain, correct measurements, except by a sacrifice of more time and trouble than I could spare. I do not therefore guarantee the perfect accuracy of the coasts, but they are only to be considered a tolerable approximation to the truth, which may be corrected at some future opportunity. I fixed astronomically the latitude and longitude of the church as carefully as my time and means would permit, and I believe the positions of the other places connected with it are equally worthy of confidence.

My chief place of observation was about the new church and manse, near the point C in the triangulation, and by means of triangles thrown out by the theodolite from, or connected with, the measured base, all the other points which will be presently mentioned were carefully determined.

Island of Iona.



In the accompanying sketch—

A is Carn Dunii, the highest point in the island, or north pile.
B Carn Cul ri Eirn, or south pile.
C The point of a rock near the nunnery.
D The tower of the cathedral.
E A sharp peak north of marble quarry.
F The southern extremity of the measured base.
G The northern.
H A large boulder-stone, near the ferry-house, on the opposite side of the sound, in the Ross of Mull.

I Dun Bhuirg, fixed roughly by the compass. It is evidently the remains of an ancient fort or watch-tower, on an isolated rock. I did not observe it with the theodolite at the time I was fixing the other points, because I had not then visited it, and had thought it of less importance than it afterwards apparently deserved. The foundations are distinctly visible, as well as the remains of some outworks for protecting the approach, and covering the summit of the rock almost entirely. In addition to these, I was anxious to extend my series of triangles, so as to include the more important points about Q and R, in order to obtain a more correct outline of the whole island, but the limited time, and unfavourable weather, rendered this impossible. The outline here given must remain subject to these and other imperfections till another opportunity.

The base FG consisted originally of two parts, FP = 846.75 feet, PG = 169.5 feet, the contained angle, FPG = 119° 12′ 30″, and the angle PGF = 51° 45′. Hence FG = 941.13 feet. From this base, with the necessary angles, were obtained—

AB = 12840.8 feet.	FE = 6794.2 feet.
AC = 3391.0 ...	CB = 10373.3 ...
AE = 10176.3 ...	CE = 6935.8 ...
AF = 4046.5 ...	CF = 1031.5 ...
AG = 3405.3 ...	CG = 1354.7 ...
AD = 2587.1 ...	CD = 1584.9 ...
GH = 5275.0 ...	GD = 839.5 ...
FH = 5442.0 ...	

From observations made on Dunii Carn, the azimuth of the sun depending on the latitude, altitude, and declination, was	S. 108° 4′ 27″ W.
By time from chronometer, . . .	108 4 23
Mean	S. 108 4 25 W.
Horizontal angle between Carn Cul ri Eirn and the sun by my circle, . . .	68 54 3
Carn Cul ri Eirn bears from Dunii Carn .	S. 39 10 22 W.
The angle BAC was . . .	37 50 0
The angle CAS, or azimuth of C, is . .	S. 1 20 22 W.
Also, from a considerable number of observations, the latitude of the New Church is	56° 20′ 5″.2 N.
The point C is 450 feet south of the place of observation, or	— 4 .4
Latitude of the point C, ...	56 20 0 .8 N.

This may also be considered the latitude of the nunnery.

The point C is also 750 feet west of the place of observation; hence $750 \div 56.35 = 13''.3$, the difference of longitude of C west of the place of observation.

Now, by formulæ (*a*), (*b*), (*c*′), page 495, and the auxiliary tables, pages 507, 508.

$\frac{1}{2}(l+l') = 56° 20' 0''$ log. M. =	7.993698	λ gives log. P =	7.992832
Z = 1 20 22 cos.	9.999881	sine . . .	8.368763
A = 3391.0 feet log.	3.530237	. . . . .	3.530237
$\Delta l = m'' = +0° 0' 33''.4$ log.	1.523816	. . log. p''	9.891832
$l' = 56\ 20\ 0.8$			
$l = 56\ 20\ 34.2$* secant		. . . .	0.256316
	$\Delta p = 1''.4$ log.	. . .	0.148148

* The reduction of λ to l', is here insensible, since m'' is so small.

Hence the latitude of Dunii Carn is 56° 20′ 34″.2 N., and the difference of longitude between the point C and Dunii is . . 1″.4 W.
Place of observation east of C . . . 13 .3

Difference of longitude . . . . 14 .7
between the place of observation and Dunii, or about one second of time to be allowed on the longitude of the place of observation by chronometer, ... h. m. s. 0 0 1.0
Longitude of place of observation, . . 0 25 33.5

Longitude of Carn Dunii in time . . 0 25 34·5 W.
which, converted into arc, is . . 6° 23′ 37″.5 W.

From the position of this point, so determined, the latitudes and longitudes of the others are readily found from their relative bearings and distances; thus, to get the latitude and longitude of Carn Cul ri Eirn, we have

$\frac{1}{2}(l+l')=56°\ 19'\ 45''$ log. M = 7.993697 λ gives log. P = 7.992806
Z=39 10 22 cos. . 9.889439 sine . . . 9.800484
A=12840.8 feet log. . 4.108591 . . . . . 4.108591

$m''=-0°\ 1'\ 38''.1$ log. 1.991727, $p''=1'\ 19''.8$ log. 1.901881
$l=$ 56 20 34 .2

$l'=$ 56 18 56 .1* secant 0.256005

$\Delta p''=+0°\ 2'\ 23''.8$ . . log. 2.157886
Longitude of Dunii . = 6 23 37 .5 $\frac{1}{2}(l+l')$ sine 9.920247

Long. of Carn Cul ri Eirn = 6 26 1 .3 W. $\Delta z=1'\ 59''.7$ log. 2.078133
Bearing of Carn Cul ri Eirn from Dunii S. 39 10 22 .0 W.

Carn Dunii bears from Carn Cul ri Eirn N. 39 8 22 .3 E.

In this manner all the other latitudes and longitudes were determined, of which we here give a recapitulation.

			lat. ° ′ ″		long. ° ′ ″	m. s.
Carn Dunii, point	A,	lat.	56 20 34.2 N.	long.	6 23 37.5	=25 34.5 W.
Carn Cul ri Eirn,	B,	.	56 18 56.1	. .	6 26 1.3	=25 44.1
Middle Peak,	C,	.	56 20 0.8	. .	6 23 36.1	=25 34.4
Cathedral, .	D,	.	56 20 11.1	. .	6 23 18.0	=25 33.2
Southern Peak,	E,	.	56 18 57.4	. .	6 24 25.4	=25 37.7

These results are probably true to 5″ in latitude, and 15″ or 20″ in longitude.

By the astronomical circle, the depression of the horizon of the sea from the top of Carn Dunii, the axis of the circle being about 3.5 feet above the rock, was, by a mean of twelve readings, 17′ 52″.

* The reduction of λ to l', is here insensible since m'' is so small.

Hence, constant logarithm	. . . . .	6.457582
Depression 1072″, log. × 2	. . . . . .	6.060390
Height 329.6 feet log.	. . . . . .	2.517972

The following observations were also made with the astronomical circle.

The zenith distance of Bein More in Mull was 88° 9′ 36″.3, and the angles

Iona S. pile, N. pile, Bein More	. .	150° 47′ 45″
Iona N. pile, S. pile, Bein More	. .	25 24 53
		176 12 38
		180 0 0
Iona N. pile, Bein More, Iona S. pile	. .	3 47 22
As sin. 3° 47′ 22″ (cosec)	. . .	1.179864
Is to sin. 25 24 53	. . .	9.632627
So is 12840.8 feet log.	. . .	4.108591
To 83384.0 feet	. . . .	4.921082

the distance of Bein More from Dunii.

Now by Table II.,

$\frac{1}{2}(l+l')=56°\ 23'$, and $z=68°\ 23'$ log. O.	. .	—7.616176
A=83384 feet log.	. . .	4.921082
Red. Z, D, —0° 5′ 44″.5	. .	2.537258
Obs. Z, D, 88 9 36 .3 log. A	.	4.921082
Cor. Z, D, 88 3 51 .8 cotangent	.	8.528871
Difference of height, 2818.4 feet log.	.	3.449953
Dunii Carn, . 329.6 feet.		

Height of Bein More, 3148.0 feet above the mean level of the sea.

Dr MacCulloch makes Dunii	400 feet,	Bein More	3097 feet.
The above calculations	330	.	3148
MacCulloch differs by	+ 70 feet	.	—51 feet.

It is clear that Dr MacCulloch estimates Dunii far too high, and Bein More too low.

I think the error in my results cannot exceed 10 or 15 feet.

With the preceding results I shall now compare those obtained from some of our best maps, charts, &c. because I have not found, in any publication, the position of Iona expressed in figures. I shall designate the Map of Scotland published by the Society for the Diffusion of Useful Knowledge by simply Society's Map.

South End of the Island of Iona.

1. Society's Map,	Latitude	56° 20′ N.	Longitude	6° 27′ W.
2. Arrowsmith's Map,	...	56 20	...	6 26
3. Norie's Chart,	...	56 18	...	6 22
4. Blachford's Chart,	...	56 19	...	6 42
5. Thomson's Atlas,	...	56 19	...	6 26
6. Galbraith's results,	...	56 18 56″	...	6 26 1″

North End of the Island of Iona.

1. Society's Map,	.	Latitude 56° 22′ N.	Longitude	6° 23′ W.
2. J. Arrowsmith's (Anderson's Guide),		56 22	...	6 25
3. Norie's Chart,	. . .	56 20	...	6 20
4. Blachford's Chart,	. .	56 22	...	6 41
5. Thomson's Atlas,	. .	56 21	...	6 25
6. Galbraith's results,	. .	56 20 34″	...	6 23 38″

The discrepancies of these results are sufficiently palpable to shew the absolute necessity of an immediate new survey, and it is not a little singular that the Society's map, which professes to be founded on points fixed by the trigonometrical survey, should give a latitude of the south end equal to that of the north, thus shifting the whole island north of its true position by a space equal to its own length !

Now I know with certainty that the Society's map of Scotland at this island is not adapted to the points fixed by the trigonometrical survey of the Board of Ordnance, because I have been informed on good authority, that its results differ from mine by a few seconds only. Of what use, then, is a committee of great names, including those of Lord Brougham and Lord John Russell, guaranteeing the accuracy of maps which are so notoriously inaccurate ?

As another proof of the ignorance of authors of the relative positions of places here, it is stated in Lumsden's Steamboat Companion, that the distance of Staffa from Iona is 12 miles, in McPhunn's Steam-boat Guide as 10 miles, in the Scottish Tourist at 9 miles, while the true distance from the cairn on Dunii to that on Staffa, is only 6½ miles, and scarcely a distance of 6 miles from shore to shore !

Do not all these glaring cases call upon Government for an immediate survey of Scotland, when there is a very complete survey of Ireland far advanced, and no less than *three* surveys of England now in progress, all carried on at the expense of the country.

The three surveys of England are the Trigonometrical Survey by Colonel Colby, the Tithe Commissioners Survey, under Captain Dawson, and the Geological Survey by Mr Delabeche. With what pretensions to equal justice to all parts of the United Kingdom are these important favours so unequally distributed?

I intended originally to have added a few historical, statistical, and geological remarks here, but my present limits will not admit of it. I shall therefore terminate the present paper with the two small tables required in the geodetical calculations in the foregoing part of this paper, reserving the other matters to some future opportunity. The first table is required in fixing latitudes, longitudes, and azimuths, the second in determining heights, in which the effect of terrestrial refraction is assumed as 0.08 of the intercepted arc. They are given in rather an abridged form, but as extended as this paper will admit, and quite sufficient by interpolation for almost all purposes that usually occur. Their use will readily be understood from consulting the calculations in pages 503, 504, and 505 of this paper.

Table I. *To convert feet on the surface of the Terrestrial Spheriod into seconds of arc.*

Lat.	Log. M.		Azimuth from the Meridan *z*. Log. O.								Log. P.		Colat.
	0°	Diff. Lat.	10°	20°	30°	40°	50°	60°	70°	80°	90°	Diff. Lat.	
0°	7.996709	131	6622	6371	5986	5513	5009	4535	4149	3896	3809	44	90°
10	6578	377	6494	6250	5877	5418	4930	4470	4096	3850	3765	126	80
20	6201	577	6124	5902	5562	5145	4700	4281	3940	3717	3639	192	70
30	5624	709	5558	5365	5082	4726	4348	3992	3701	3513	3447	236	60
40	4915	755	4864	4715	4489	4212	3916	3637	3410	3265	3211	252	50
50	4160	711	4123	4019	3860	3664	3456	3259	3099	2995	2959	237	40
60	3449	580	3427	3364	3267	3149	3022	2904	2807	2744	2722	193	30
70	2869	379	2859	2829	2783	2728	2669	2614	2568	2539	2529	127	20
80	2490	132	2489	2480	2468	2454	2439	2424	2413	2405	2402	44	10
90	2358		2358	2358	2358	2358	2358	2358	2358	2358	2358		0
Lat.	180°		170°	160°	150°	140°	130°	120°	110°	100°	90°		Colat.

TABLE II. *To find the seconds in the interceptial arc reduced for the effect of refraction as used in the computation of heights.*

Lat.	Log. M'		Azimuth from the Meridian, z, Log. O'								Log. P'		Colat.
	0°	Diff. Lat.	10°	20°	30°	40°	50°	60°	70°	80°	90°	Diff. Lat.	
0°	7.619958	131	9871	9620	9235	8762	8258	7784	7398	7145	7058	44	90°
10	9827	377	9743	9499	9126	8667	8179	7719	7345	7099	7014	126	80
20	9450	577	9373	9151	8811	8394	7949	7530	7189	6966	6888	192	70
30	8873	709	8807	8614	8331	7975	7597	7241	6950	6762	6696	236	60
40	8164	755	8113	7964	7738	7461	7165	6886	6659	6514	6460	252	50
50	7409	711	7372	7268	7109	6913	6705	6508	6348	6244	6208	237	40
60	6698	580	6676	6613	6516	6398	6271	6153	6056	5993	5971	193	30
70	6118	379	6108	6078	6032	5977	5918	5863	5817	5788	5778	127	20
80	5739	132	5738	5729	5717	5703	5688	5673	5662	5654	5651	44	10
90	5607		5607	5607	5607	5607	5607	5607	5607	5607	5607		0
Lat.	180°		170°	160°	150°	140°	130°	120°	110°	100°	90°		Colat.
	Diff. Az.		Diff.	Diff.	Diff.	Diff.	Diff.	Diff.	Diff.	Diff.			
0°	87		251	385	473	504	474	386	253	87			90°
10	84		244	373	459	488	460	374	246	85			80
20	77		222	340	417	445	419	347	223	78			70
30	66		193	283	356	378	356	291	188	66			60
40	51		149	226	277	296	279	227	145	54			50
50	37		104	159	196	208	197	160	104	36			40
60	22		63	97	118	127	118	97	63	22			30
70	10		30	46	55	59	55	46	29	10			20
80	1		9	12	14	15	15	11	8	3			0

In Tables I. and II., Diff. Lat. means the difference for every 10° of latitude in columns in Log. M, Log. P.; and Diff. Az. means the difference to every 10° of azimuth in Table II. for competing proportional parts readily.

ON THE AGRICULTURE OF THE COUNTY OF CORK. PART II.

(Continued from page 172.)

East Carbery.—It has been already stated that the great district of the County of Cork which bears the general denomination of Carbery, is not less than forty miles from east to west.

The principal town in this division is Clonakilty, part of the estate of the Earl of Shannon. It owes its origin and prosperity to the ancestors of this peer—the noble family of Boyle—one of whom, Sir Richard Boyle, obtained from James the First, a charter by which it was constituted a parliamentary borough, with the usual municipal officers. The lord of the soil exercised the privilege of sending two members to the senate until the act of Union, by which the close boroughs were disfranchised by Government, who paid to the owners an average sum of L.15,000 each, as compensation for their loss of political influence. Clonakilty contains about 4000 inhabitants, and has improved considerably in its appearance and real condition. During a long period, the coarse linen manufacture has been conducted here with remarkable industry. Before the introduction of cotton weaving, the annual amount of sales of linen and yarn, for the purchase of which the Bandon linen manufacturers attended a weekly market, averaged L.700 per week. There are now about 400 linen and 40 cotton-looms employed, giving occupation to 1000 individuals. A bleach-green is within a mile of the town, on the river Arigadeen.

Though the harbour is within a mile of the quays, to which the tide flows, Clonakilty will never be a port of much importance, as the accumulation of sand at the harbour's mouth renders navigation dangerous and difficult, and no vessels above 100 tons can come up except at high spring-tides. The bar at other times opposes the entrance of any vessels but the small craft engaged in the corn, potato, and coal trade: for this class of boats, notwithstanding the narrowness of the channel and the other natural impediments, it is a good safety harbour.

There are several lighters, of 15 or 16 tons burden, constantly employed in raising and bringing up to the quays the sea-sand, so efficacious in the fertilization of the populous and cultivated country around.

The value of this manure will appear from the following analysis, by the late Dr William Meade of Cork:—

	Carbonate of Lime.	Argill and Iron.	Silex.
Coal-sand of Bantry,	100		
Red sand,	69	2½	28½
Oyster-haven sand, near Kinsale,	67	2	31
Ringe sand, near Clonakilty,	64½	6½	29
Sand of Courtmasherry Point,	56	4	40
Ringabella sand, near Cork Harbour,	27	5	68
Common blue sand from Courtmasherry Strand,	29	4	67
Island sand from the hill,	24	2	74
Sea-mud, Courtmasherry,	24	2	72

The Clonakilty sand has shades of red, that on other parts of the coast is light coloured, and blue, and some of these sands contain the shells little altered in their form, while others have them in such a state of fine powder as to be hardly perceptible without a microscope. The quantity annually drawn from the narrow beach called the red strand (on the east side of the Galleyhead) into the interior is prodigious; and where the distance from the coast is not so great as to render the cartage of this manure expensive and difficult, the farmers are more comfortably circumstanced than those nearer to the coast, from the better quality of the soil, the lesser amount of rent, and the advantage of peat-fuel, which abounds in the interior. If coves and estuaries communicate with their vicinity, the sand is of course easily supplied, and in such localities land is truly valuable. The red sand, when taken far into the interior, is actually sprinkled like salt over the land from the hand, and on fresh land this stimulating application operates powerfully. The peasantry throughout this part of the county have been always remarkable for a quiet, courteous, and peaceable demeanour, and were induced with difficulty to take any part in the conflict of 1798 against the laws and government.

They did, however, on one solitary occasion assemble in battle array against the royal troops, at a place called Ballinascarthy, where there is a bleach-green. Fortunately for the welfare of the protestant and well-affected, but comparatively small part of the community, the Caithness legion came into the field at the moment when the only force nominally opposed to the rebels—an Irish militia regiment—were about (as it is said) to desert their officers and unite with the opposite party, and overawed their military brethren into steadiness. There was a little fighting, and of course much excitement for a long time subsequently, which caused the whole county to be placed under martial law.

During this state of things an incident arose, which having, as the result will testify, some natural connection with the practical details of husbandry, may please the reader.

Two of the volunteer cavalry, under the command of ——, had been ordered at night, in the month of August 1799, and after the affray at Ballinascarthy, to take despatches to the head-quarters at Bandon. Both these troopers had probably taken a little more punch than was particularly conducive to the cool and deliberate execution of their orders, which were, to ride fast and with as little ostentatious appearance as possible, until they reached the garrison town.

On passing the neighbourhood of the late scene of action, one of these volunteers observed a very commanding figure, wrapped in the long national blue frieze great coat, with a green ribbon round his hat—the unequivocal badge of rebellion—standing in a field not far from a high furze fence which separated him from the road on which our troopers were travelling, and waving his right hand to and fro, as if making signals to some rebels in ambuscade. The trooper who was most or least mystified by the punch—we forget which—reined up his horse and pointed to the enemy; his comrade boldly challenged the supposed rebel sentry, and commanded him to surrender his arms—if he had any—and march as prisoner before them, or ride *en croupe* safely pinioned behind one of them, in order that he might be regularly hanged in Bandon. This the rebel—who still occupied his position within the fence and dyke, seemed obstinately indisposed to do, while he persevered in waving his right arm, and from the low grumbling sound which proceeded from him, once or twice, at this critical moment, it might have been imagined that he had been piously ejaculating to himself, "hanging be d——d!" But he uttered no intelligible or articulate words, which led one of the troopers to suppose was the effect of the man's ignorance of English. He accordingly roared to him, and swore at him, in very plain Irish—which is the vernacular language of all the natives of this district—but without producing any apparent respect.

The circumstances under which the dragoons were placed were alarming, and might have embarrassed them exceedingly, or induced them to dash off at full gallop for the chance of escape from their surrounding enemies, but the invigorating influence of the punch which they had taken at Clonakilty, prevented a hasty retreat. They were in the heart of an enemy's country, in a retired and narrow road, hemmed in by high furze bushes, without any probable assistance, and objects of peculiar hatred and revenge to the peasantry, who had so recently suffered a defeat from the royal army, and lost many captive friends, destined to military execution in Bandon. In short, they stood a fair chance of being piked to death on the very spot where they now were.

But the troopers had no dread of consequences. The elder of the two, Mr James Sullivan, very gallantly made an effort to leap the fence, but his horse chested it, jerking the rider clear over it, and laying him on his back in the ditch at the enemy's side; the other, whose name was Ned M'Carthy, hearing his comrade swear that he was a dead man, drew his pistol from the holster, and taking true aim at the man with the cloak, hit him in the breast, as plainly appeared from the quivering motion of the coat over his bosom, and the tendency which he evidently had, in consequence, to fall. But the fellow did not fall nor quit his ground in the least, which so amazed M'Carthy, that he roared out to the other to cut him down with his sabre, while he himself forced his horse over the fence, and ran at the unfortunate victim. "Oh, war, war, what hast thou not to answer for?" Sullivan by this time was mounted, and both of these bold men charged at the commanding form before them; one of them cut off the offensive member, the waving right arm, with a stroke of his sword, and the other stabbed him through the breast, precisely where the ball had entered and passed through. Down fell the— What? It was only a "tatie doolie,"—Norna of the Fitful Head in breeches—which had been exceedingly well dressed and put up together, for the purpose of saving the corn crop, where it was stationed, from hedge-birds. What report our heroes made to the General we have had no means of ascertaining. The *moral*, however, should not be neglected;— never deliberately to discharge a gun or a pistol at any figure, however it may apparently bear the impress of humanity, nor lop off a limb, *unless* you have first ascertained from the mouth of your antagonist, or some other unquestionable evidence, that the object of your benevolent intention is not a tatie doolie, but a real man, or woman, as the case may be.

Glandore, in the western division of East Carbery is a very neat and improving village, belonging to James Redmond Barry, Esq. on the east side of the safe, deep, and picturesque harbour of the same name, which is navigable for several miles into the interior.

The proprietor has judiciously expended considerable capital in rendering the vicinity a desirable place of residence for many respectable families, particularly in summer, when it is the resort of bathers. Schools for both sexes have been established here in a manner very creditable to the proprietor, who has connected a model farm and its appendages with the boys' school. There are slate quarries in the vicinity which will gradually conduce to the substitution of a slate covering for all the farmers' houses in place of straw, which, however cheap at first, is in the end an expensive covering, as it requires such frequent renewal, and consumes so much of what would be more profitable if converted into manure.

Ross Carbery, a poor decayed town of great antiquity, once a celebrated seat of monastic lore, and now possessing the cathedral church of the diocese, on the ruins of the monastery of the early ages, though ill adapted for commerce—the estate of Lord Carbery—is in low circumstances, though on an elevated rocky site. It is sufficiently near the strand, and consequently within reach of fish, principally haddocks and bream, which constitutes no inconsiderable part of the food of the pauper population (principally weavers) within its limits. There is a species of silver-coloured eel or smelt, from six to twelve inches in length, which is caught on the strands here at low water; they are taken with small and closely meshed nets. "In the beginning of summer they make their appearance on the coast, and are then taken with small nets of very close mesh. In the months of September and October, they come higher up upon the sand, for the purpose of spawning. The velocity with which they pierce through the sand, by means of their slender bodies and pointed noses, is surprising; for unless immediately secured, they work down and are out of sight. When the tide has retired, the peasants collect them in great numbers on the strand with shovels and baskets, and seldom fail to return with a full load, the men turning up the sand, and the women and boys collecting the fish. Night, as well as day, is employed in this operation. I think I am within bounds in saying, that I have this season, in which they have appeared in unusual abundance, seen a thousand persons at one time engaged in this work, exhibiting a most curious and entertaining scene. Sometimes they stand up to the middle in water, and scraping through the sand, with an old reaping-hook fastened to the end of a stick, throw them on the shore."*

From the obstruction offered by a ridge of sand-hills, the harbour is, except for small fishing boats in moderate weather, useless. This natural barrier admits only of an entrance of a few yards in breadth where the tide flows rapidly. The bay inside, which is about a mile in length, half a mile in breadth, and across which a mail-road causeway has been carried, with a bridge at one end, might be reclaimed without much difficulty. School education is much regarded here, and there is ample provision on this head.

On no part of the coast is there more subject of interest to the lover of the strange and marvellous than on the adjacent coast. In the vicinity of Lord Carbery's fine demesne, at Castle Freke, and on the far humbler one of Mr Smith of Downeen, whose plain but abundant hospitality is proverbial, there are "caves and cliffs in wild confusion torn," of gigantic dimensions and terrific grandeur. The sea in one remarkable instance has forced its way through a small opening to a great length under one of the cliffs and excavated a passage, gradually working its way into the rock, until it has formed a cavern of great size. At high water the opening is closed, but at low tide, it can be entered by a boat, and if the weather be mild and there be not too much time lost in exploring recesses, which probably have never been fully traced, the adventurer, by means of torch-light, can indulge his curiosity. In our boyish days, we partly ventured into one of these awful passages when visiting our venerable and accomplished acquaintance, the late Rev. Horace Townsend, whose house and well-improved demesne at Derry, in the neighbourhood of Ross Carbery, was not the least interesting point of attraction to the visitor, friend or stranger, from the well known talents and amiability of its possessor. It may not be misplaced to remark here an observation of that practised and intelligent writer, which appears in his survey, where he describes the circumstances of Ross Carbery, regarding the barberry bush as a supposed cause of the blight in wheat.

* Townsend's Statistical Survey.

We notice this the more particularly from having observed in the 44th Number of this Journal, p. 595, that a gentleman of Leeds attributes the prevalence of mildew in his neighbourhood to the barberry, and, in consequence, destroyed all the barberry bushes on his land. He states that "his example was followed in the adjoining villages, attended with the same success, nor has mildew been since heard of, except as a matter of surprise."

Mr Townsend observes, after alluding to the absurdity of hastily stating things almost incredible as fact, without considering that the effects imputed to one cause might have originated from another,—"I must certainly be excused from joining in condemnation of the poor barberry. One instance of its innocence falls within my own knowledge. In the neighbourhood of Ross, I lately took notice of a few barberries growing in a hedge, on the south side of a small field. The situation, of course, was such as to favour any influence they could have on the crop, the wind blowing so frequently from that point. The field has been for years under a continual rotation of potatoes and wheat. To my question respecting the general quality of the latter, it was answered that the crops were uniformly good. Last summer, it was under wheat; and as it often came in my view, I had an opportunity of being fully satisfied that these barberries at least had done no harm. Blights are here observed to attend particular situations. Wheat is the only grain that appears to suffer much, and we are accustomed to attribute the cause not to the mysterious influence of poisonous plants, but to the more obvious and probable operation of chilling winds and an unfriendly soil."

The theory of mildew from the proximity of the barberry is of very old date, and was probably first suggested by some old woman whose organ of causality was either in a state of excessive activity, attempting to explain every thing without the support of data, or so deficient as to render the intellect superficial and unfit for forming comprehensive views.*

Surely the deduction of extended and general effects from such a particular and trifling cause as the neighbourhood of the barberry bush, is unworthy of a man's brain, however it may suit the calibre of an old woman's intellect, and should be scouted as contrary to common sense, and in direct contradiction to fact.

* See Hand-book of Phrenology.

Except with a few individuals of the higher order, tillage is ill conducted here, yet the land, though light, is fertile. In many parts the sea manure is still carried on horses' or mules' backs; but some of the gentlemen farmers drain and irrigate, cultivate clover and grasses carefully, and use good implements. Lord Carbery himself has considerable zeal in promoting the interests of husbandry. Wheat and barley are much sown, but the average produce of the former grain is very low. There are excellent slate quarries opened, and copper and manganese are said to abound here. On the eastern coast, Kilbritain, the seat of the Stowell family, is strikingly fine; the glens which separate the eminence upon which the house stands from the hills on the east and west sides, display a great deal of timber, and the house commands a view of Courtmasherry bay.

Dunmanway, on the northern limit, and considerably in the interior, surrounded on three sides by bogs and mountains, small lakes, and three or four hundred acres of oak wood, is the only remaining town within East Carbery. The excellent mail-coach road to Bantry passes through it, and has conduced much to the local improvement of the very long street which constitutes the town, which was founded by Sir Richard Cox, Lord Chancellor of Ireland (in the reign of William III.), who built an excellent mansion-house, of which the melancholy remains—a solitary room, the original kitchen—are still in existence, and in the occupation of a poor weaver.

The linen manufacture has wofully declined here, but the breweries, corn-mills, tan-yards, and general agriculture, afford reasonable employment. The abundance of water and of peat fuel rendered it originally a very desirable site for a manufacturing town, but various causes occasioned its decline. The founder himself was drowned in an adjoining lake. The family of Cox still possess the property, which, with an adequate expenditure of money, is, doubtless, very improvable.

Following the course of the river Bandon, there are fine arable and pasture plains of light soil incumbent on gravel —not calcareous—which are excellent for all crops not requiring clay or loam, and particularly kind for pasturage. The river itself is clear and rapid, and, on the left bank from Inniskean to the boundary of this great barony, beautifully wooded in many places, and with some gentlemen's seats of great respectability of appearance. Of these two contiguous ones, now melancholy exhibitions of delapidation and neglect —Fort Robert, and Connorville—are remarkable from being the property of the O'Connor family, of whom Fergus, or *Feargus* (lucus a non lucendo, for the man appears to fear nothing), is rather a noted individual in the records of modern radicalism. We remember the period when Connorville was occupied by Mr Roger O'Connor, who took so prominent a part among the rebel leaders of 1798, and had no community of interests or affections with his eldest brother of Fort Robert, who was as enthusiastically zealous in loyalty, as the other, unfortunately for himself, was hostile to the established order of government. Robert (or Bob, as he was always called), as if ashamed of his family name, spelled it in a different way from his patriot brothers Arthur and Roger—and discarded the O, to which he invariably said the family had no claim. Be this as it may, these individuals were certainly most respectable as to birth and connexion. The brothers—there were several—were nephews of Lord Longueville, and Arthur the eldest, so long a resident in France, who sat in the Irish House of Commons, would have been the titled heir of Lord Longueville, if he had maintained his uncle's course of politics; so far we must do *his* patriotism justice. The less, however, that is said upon the subject the better.

Passing on through two very indifferent villages along the course of the river, there is a good deal of oak-wood at Palace Anne, the mansion-house of Arthur Beamish Bernard, Esq., who farms much of his own estate, and rents considerable farms from the Duke of Devonshire. This gentleman has a large flour-mill about an English mile from his own house, and gives considerable employment. He is the most spirited and extensive farmer in that part of the country, and has improved the condition of the land considerably. The want of calcareous matter in the soil, which is either gravelly or schistose, renders it most desirable that turnip husbandry should prevail; and this has been introduced with great success by Mr Bernard, who has raised Swedish turnips of extraordinary weight. Towards the northern boundary of the barony, and near Palace Anne, there is a very ill cultivated and wild tract, for a long period in possession of a set of under-tenants of very turbulent character, whom the proprietor, the Earl of Bandon, has been labouring to clear out, with a view of substituting an orderly and improving tenantry, such as this very amiable nobleman would wish to establish every where on his extensive estates.

Yet, even in the wildest parts of this district, many picturesque localities abound, which, if embellished with timber, neat cottages, and all their proper adjuncts, would rival many places which at present, by contrast, have a very striking superiority.

We have often had occasion to lament the result of the old middleman system, which led to such land-jobbing, and while it gave to the immediate landlord a high rent without much trouble, and yielded a great profit to the speculating middleman (whose term of tenure was usually three lives, or thirty-one years), entailed much inconvenience on the successors of that proprietor, and grievously affected the unfortunate individuals who rented at rackrents for the middleman's advantage. In one point particularly the effects of the former proprietors' culpable indolence or selfishness have embarrassed the present generation of landlords,—namely, by preventing them from introducing improving British farmers with skill and large capital, who would settle in Ireland, from the superior fertility, and comparative cheapness of its soil, in place of the present pauper peasantry, who will neither improve the land themselves, nor allow others to do it. The farms are so dovetailed into each other, and occupied by so *many* tenants, that however desirable it may be to *purchase* out the occupiers (for we do not advocate forcible ejection where the moral conduct is good), it would be found too expensive a preliminary to the establishment of the more valuable British husbandman. We are acquainted with some Scotsmen of great wealth and experience who have been vainly looking out for large tracts of land in Ireland. They have given up the pursuit in despair of success.

Ibawne and Barryroe. This is a very small barony, but possessing peculiar fertility, though it contains much coarse land, and a range of hills intersects it. Sheep are pastured here a good deal, but without any care or protection from the winter storm except what the lee-side of a furze bank affords. With the small farmers these poor animals are invariably fettered with straw ropes to keep them within bounds, and it is surprising that they thrive under such circumstances, but they at least *live*, and supply wool and milk to the owners, many of whom, though in the rank of farmers, are not owners of a cow. Courtmasherry, which has beautiful plantations and woods, especially interesting in such a maritime locality, is on the confines of this barony. Lord Shannon possessed a bathing lodge (now we believe in the occupancy of John Leslie, Esq.) among the woods, with a demesne of considerable extent of slightly cultivated land, projecting towards the sea, which forms, on one side, the boundary of the harbour of Courtmasherry, from which the tide flows up to the village of Timoleague.

The want of turf is experienced, from the extent of the population, and the consequent consumption of the local supply, which is now scanty; but as there are several coal vessels trading with Newport, the natural deficiency of fuel is sufficiently supplied. Fishing affords much employment and considerable profit here, as on the other parts of the coast of this county. There is a small but commodious pier, which affords protection to all the fishing trading vessels, of which there are a considerable number.

The village contains about 150 houses, many of which on one side of it are neat, and respectably fitted up for bathers, who frequent this interesting spot; but it must be confessed, that a great proportion of the houses on the eastern side is very Irish.

The town of Timoleague—the only one in the barony—in the neighbourhood of which there is much natural wood, has been greatly improved by the present proprietor Colonel Travers, who has introduced green crops and the improved plough, instead of the former wooden one. Though the population are principally employed in agriculture, many of them derive the means of subsistence from weaving coarse linen and cotton cords.

The land in this neighbourhood is rather light and stony, but produces wheat, as well as the more ordinary productions, potatoes and oats.

The Franciscan Abbey, founded early in the fourteenth century, forms a very interesting ruin, much of which is still in good preservation. Many of the windows elegantly formed, with their mullions, are still perfect, as well as the high arch supporting a tower sixty-eight feet high, dividing the nave and the choir, beneath which is a narrow and curious passage.

The demesne of Lord Carbery, though adjacent to Carbery, is in this barony. The appearance of much wood in a situation so completely exposed to the ocean, is truly astonishing. This has been effected by planting alders and *broom* hedges on the weather side as nurses. These have been more or less sacrificed to the blast; but the trees flourish within the nursery screens, and in every part of the demesne where elevations of land have defended them in their earlier years. His Lordship has, of course, raised forest trees and shrubs in nurseries on the spot; and these being here acclimated, withstand the rigours of the Atlantic blast, though trees not reared in such a locality would vainly struggle for existence. Within the demesne at Castlefreke, some coins of the age of Athelstan, and Edmund his son, have been found by Lord Carbery.

This nobleman communicated to the Cork Institution some years ago, the details of an experiment on sheep fattening in the house with potatoes, which had been first practised in that country by the Rev. Mr Kenney.

"December 26. Twenty common Irish wethers, of the mountain breed, three years old, in very low condition, and worth about 14s. each, were put into house at Castlefreke to feed on potatoes. The process used was as follows:

"The house was spread over with sea-sand, which was changed twice a-week, and produced a considerable quantity of most valuable manure. The potatoes were cleanly washed, and cut in troughs, allowing a weight of twenty-one pounds for four sheep per day. They were given in equal quantities, morning and evening. A few small bundles of hay were hung up in the house, which they usually consumed after eating the potatoes. They were turned out every dry day on a bare pasture near the house, and particular care was taken to have them brought in on the approach of rain, wet weather being at all times injurious to sheep, but, particularly when they are to be housed, turning them in with wet fleeces is a bad practice.

" On the 23d of January one of them was killed, weighing fourteen pounds per quarter, and producing nine pounds of suet. Others have since been killed, equally good, though some weighing less, and those that remain are all fit for market. Though all were not fat as soon as the first that was killed, they may be averaged as all fit for market in twelve weeks.—The estimate of the expenses, and the value when fat, rated by the price of the neighbouring market, is as follows :—

A score at 14s., . .	L.14	0	0	Value of one sheep killed, weight 52 lb., or 13 lb. per quarter, being the average weight of those killed, at 6d. per lb.,	L.1	6	0
120 weights of white potatoes, at 3d. per weight, the wholesale price at which they were bought,	5	5	0	Suet 8 lb., being the average produce of those killed, at 1s. per lb., .	0	8	0
12 cwt. of hay at 3s. per cwt., . . .	1	16	0	Wool and skin, . .	0	4	0
12 weeks' bare pasture, .	3	0	0		L. 1	18	0
12 weeks' labour of a man and boy, who could have attended two score, at 1s. 4d. per day, . .	5	12	0				20
The drawing of sand amply paid by the manure it produced, . .	0	0	0		L.38	0	0
					29	13	0
	L.29	13	0		L.8	7	0

His Lordship still continues to indulge in his predilections for agricultural experiments, and to keep up the spirit of emulation among the gentry and common farmers of his country. At a recent exhibition of the Bandon and Clonakilty Farming Society, Lord Carbery obtained prizes for the best turnips and mangel wurzel. There were also some fine cattle exhibited by Lord Bernard, who was a successful competitor.

Potatoes and corn, for a very long period, used to alternate here ; but the utility of clover, as an intermediate crop occasionally, is now understood. The sheep, in consequence, have better fare, and improve accordingly ; and the beasts of burden now partake of a luxury unknown to their ancestors.

Dry sea-sand is used very much as bedding for cattle ; and the compound mass of animal and mineral manure becomes invaluable, when clover is cut and used for soiling in the sheds and open yards. The fertilizing mixture is the certain forerunner of an abundant crop of potatoes.

But the poorer farmers, who possess few animals for the accumulation of manure, resort to the ruder practice, so frequent with their miserable class, of collecting earth and sods from the margins and dykes of roads and lanes, and the headlands of fields, and putting the substances thus obtained (when pulverized with the spade, and mixed with a little dung or some sand) on the land for potatoes or wheat.

Until roads became general to and from the sea-beach, sand and sea-weed were carried, as in West Carbery, on the backs of horses and mules, in sacks or small panniers. For taking sheaves of corn, the natives employed (and in some places use them to this day) wooden frames shaped like a W, and described by Mr Marshall, in his account of farming in Devonshire, during his own time.* The similarity of practice observable in the west of England and the east coast of the county of Cork, and the terms employed by the natives of the two countries, are shewn in parallel columns by Mr Townsend. The similarity is curious, but not attributable, in Mr Townsend's opinion, to colonization from one country to the other, but (allowing for some local varieties) to general practice, in similarity of situation and circumstances, at a period when a general simplicity of practice prevailed. Yet, both coasts being exposed to nearly the same part of the continent, they might have derived their customs from the same source. Among the similarities in Mr Marshall's days, were the general use of back-loads for carrying hay, corn, dung, &c., in crooks, dung-pots, and sacks. This peculiarity, though it has ceased to be characteristic of the south-west of England, is by no means obsolete on the opposite coast of Ireland. "Paring and burning, provincially called *burning beat*, the sod sometimes raised with the plough, sometimes with a sort of hoe or adze," critically applies, in terms and practice, to Irish agriculture in Munster. The adze or hoe of Marshall is the Cork *graffaun*. The similarity of climate causes an accordance, also, in the seasons of sowing and harvesting.

The Barony of Courcy.—This, the smallest barony in the county (containing only two parishes) is nearly insulated. On its southern termination, at the point of a rocky promontory of stupendous elevation, stands in sublime and awful majesty, the old head of Kinsale, with a lighthouse instead of a crown

* See Townsend's Survey.

on its bold and frowning front; near this are the ruins of a castle, a place of impregnable strength, and great importance during the occupation of Kinsale by the Spaniards in 1600. It belongs to the premier baron of Ireland, Lord Kinsale, whose ancestor, John de Courcy, obtained from King John his rank and special privilege of keeping his head covered in the royal presence. The land estate of this noble family, is rather contracted in its limits; but the right of wearing his hat, without restriction as to the dimensions of its rim, under the eye of the sovereign, must amply compensate each successive Baron of Kinsale, for the narrowness of his territorial domains.

There are several good slate quarries on this part of the coast. Though the quality of some of the low lands on the margin of the Kinsale river (the lower portion of the Bandon) is good, the more elevated parts, which are of schistose formation, or of poor argillaceous and shallow earth, are very unproductive. The power of procuring sea-ware in the vicinity tends to counterbalance the natural deficiencies of the soil.

Near the thriving little village of Ballinspittle, there is some fine old timber (and noble gardens) at Garretstown, the property and residence of —— Rochefort, Esq. On the margin of the River Bandon, where it passes through this barony, there are some very comfortable farm houses. Among the residences of the few gentry who inhabit this district, Coolmain, the seat of E. Stowell, Esq., though without the advantage of what can properly be called timber (from the exposure of the demesne to the sea winds), is the principal seat in the barony, and evidences the exceeding care and skill of the proprietor, who has long been conspicuous as an agriculturist. The general system of culture is so similar to that pursued in the baronies already noticed, that it is unnecessary to allude to it.

Kinalmeaky.—This is also a small division of the county; it once constituted part of Carbery, which it adjoins on the north-east. It appears from the researches of Mr Townsend, that this barony was so incumbered with woods and bogs at the commencement of the 17th century, as to afford shelter and security only to wolves and robbers. It is now thickly peopled, in many parts highly improved, dotted with the seats of the gentry, and it still retains some of those oak woods and coppices, which justified Spencer in describing the fine river which meanders through parts of it, as

"The pleasant Bandon crowned with many a wood."

Among the extensive woods and forests which fringe the river, are, —the park which bounds the demesne of Castle Bernard,* and through which the river, as if disdaining the uniformity of a single channel, and willing to prolong its stay in so favourite an abode, divides its course; the numerous woods of Inoshannon, a pre-eminently picturesque village, principally in the barony of Kinalea; and those which belong to Captain Herrick, R.N. in the vicinity of Shippool, which is deservedly one of the most admired spots in the county. Mr Herrick, not satisfied with the great extent of oak wood which had descended to him from his forefathers, has himself planted very extensively—and thus rendered valuable and productive—a poor shingly tract of land which otherwise would have been of little value. This gentleman has for many years pursued his rural avocations with great zeal and perseverance, and proved himself a very successful cultivator of lucerne in particular, which he has sown in wide drills. The woods on the opposite banks of the river, belonging to Lord Bandon and other proprietors, combine in rendering the vicinity of Shippool a scene of great sylvan beauty. The remains of ancient forests are seen in many parts of this barony, both above and under ground. In the bogs, oak is constantly found, and in a surprising state of preservation. Several years ago, a farmer, when scouring a ditch, perceived the end of a piece of timber, which he cleared, and on examination, ascertained to be part of a tank 72 feet square, the bottom of which was paved, the sides being lined with pieces of oak plank each 24 feet long, and 16 inches broad, rudely joined together. On one side there was an opening, as if for a sluice. It was conjectured that this was a cistern for tanning hides, and of no great antiquity. Possibly it might have been for malting corn. The chief contents of the bogs are fir, but oak seems to have occupied the hilly situations. The hills, which constitute a large part of the barony of Kinalmeaky, are generally poor and stony, but capable of being rendered much more productive of herbage by irrigation; for

* Belonging to the Earl of Bandon.

which the various rills descending along their sides, afford sufficient facilities. Among many of these hills, bogs with an opening generally at one side, abound ; so that the comfort of a good fire is always procurable by the poorest inhabitant, and coal is easily landed at a place called Collier's Quay, between Shippool and Inoshannon, whence the inhabitants of Bandon, as well as those residing on each side of the river lower down, can supply themselves with it (from Newport or the north of England), and, in many respects, it is more desirable than the indigenous fuel.

Continual top-dressing with town manure, renders the naturally poor soil on the north side of the town of Bandon, sufficiently rich in herbage, for the support of milch cows or other stock ; potatoes and corn are of course occasionally, under such favourable circumstances, grown ; but nothing pays the inhabitants of a town so well, as a grass field, which affords the luxury of pure milk and fresh butter.

In the southern parts of this barony, the favourite sea-sand is largely used and brought hither from Courtmasherry or the neighbourhood of Kinsale, by lighters, to the depot at Collier's Quay, nearly opposite Shippool, and within three or four miles of Bandon, to which a canal was at one time contemplated. In the northern parts of the barony, lime from Muskerry is the usual manure. This is delivered by the lime-burners at a very reasonable rate, considering the distance to which it is often conveyed. The mode of burning it in rude kilns will be noticed in the ensuing number, which will conclude our sketch of this great county.

The total absence of all natural calcareous substance from the soil of Kinalmeaky (and the same remark applies to the vast proportion of the county), and its loose texture, renders it totally unfit for the production of wheat, except in a very few instances, where peculiar local causes may warrant a departure from what ought to be the general rule, of substituting barley or oats. There are many good dairies in this barony, the Honourable William Bernard, whose house and farm adjoin the demesne of his brother the Earl of Bandon, and Thomas Poole, Esq., in the same neighbourhood, have been distinguished improvers. The father of Mr Poole reclaimed much of his land by irrigation, and rendered a considerable tract of bog-land very productive by judicious treatment. The general mode of culture here does not essentially differ from that pursued in the inland parts of Carbery. The town of Bandon owes its origin to the *great* Earl of Cork (as he was usually styled), in the reign of James I., when it was incorporated. "The difficulties indeed were such as no ordinary mind would venture to contend with or indulge any prospect of surmounting; they vanished, however, before his genius and enterprise."* The state of the country led him to "adopt a policy apparently illiberal, but enforced by necessity, and justified by the event. Protestants alone were admitted, to the exclusion of all other religious sects, whose jarring passions and animosities, forbidding at that time any hope of harmonious co-operation, would soon have brought ruin upon his infant establishment. The force of deep and early impression long prevailed, and to this day the inhabitants of the old town are of the same description."†

The old town on the north side is the property of the Duke of Devonshire. The Earls of Shannon, Cork, and Bandon possess the remainder. The religious institutions in connection with the Church of England and Protestant Dissenters are numerous, and altogether Bandon (its population being about 10,000) holds a high rank among provincial towns. The woollen manufacture was the first branch of industry introduced by the founder, then the linen, camblet, corduroy, and cotton manufactures successively followed. The latter prospered for some time, but at length declined. Five years ago Mr Scott introduced the manufacture of fine stuffs; this continues to exist, but affords very scanty employment in proportion to the extent of population. The distillation of the liquid poison, which is producing such incalculable misery in Ireland, is now carried on by some of those gentlemen who had been largely engaged in the cotton trade, and there are now two rival distilleries, capable of producing between two and three hundred thousand gallons in the year. There are two large flour-mills in Bandon.‡ How different the sensations with

* Townsend's Survey. † Selden.

‡ There are some leviathan flour-mills in Ireland. Perhaps the noblest

which these different species of manufactories are viewed by the philanthropist. In the one, is an exhibition of the most useful and healthful industry, providing the "staff of life" for thousands, while the other deals forth the elements of sorrow and suffering, the waters of strife and bitterness; the most powerful of the many engines of sin which Satan is permitted to afflict the land.

The late Earl of Bandon constantly resided at Castle Bernard, and being very liberal in his disbursements, and employing a great number of labourers, was a benefactor to the town and neighbourhood. The present proprietor is occasionally resident, and his Lordship's eldest son will probably pass much of his time at the family seat.

Kinsale, properly speaking, is a barony in itself, but of no peculiarities of soil or husbandry, and so combined with the barony of Kinalmeaky, as to render it needless to notice its agricultural condition.

The town of the same name, however, deserves a passing observation or two, both from its antiquity and the extent of its population, which is little short of 7000. During the wars of the early part of the seventeenth century, between the English and the natives, supported by Spanish troops, Kinsale was a frequent theatre of invasion and bloodshed; in 1649 (the Irish having been expelled in 1641) Prince Rupert and Prince Maurice entered the bay with a fleet, in order to make preparations for the landing of Charles II., but being blocked up by the Parliamentarian leaders, they were obliged to sail for Lisbon, and on Cromwell's approach the town declared for the Parliament. At different periods of our history, long before, and subsequently to, the memorable years just stated, Kinsale was a place of note and importance. The streets, like those of all our old fortified towns, are very narrow; the principal one is very long also, running at the base of a steep and abrupt hill, on the higher parts of which are streets and houses, built on the bare rock, or on sites excavated through

establishment of this kind, as regards beauty of locality, combined with extensiveness of operation, is that of Milford, in the county of Carlow, belonging to John Alexander, Esq. It has eighteen pair of stones, worked by a powerful iron water-wheel.

it, inaccessible by carriages. The haven at the town, which is landlocked and remarkably secure, is the mouth of the river Bandon, and entered from the ocean at the south extremity by a long and deep passage, defended by a fort. The superior capaciousness, and other general advantages possessed by the harbour of Cork, tend to render that of Kinsale of comparative insignificance. Except in the coal and timber trades there is little commercial intercourse. The fishing-hookers, long celebrated as sea-boats, have the staple trade, and with a considerable aggregate tonnage, are constantly occupied in moderate weather. Sprats and herrings are taken in their season with seines within the bay and harbour, and haddock, hake, ling, cod, turbot, soles, plaice, mackerel, gurnet, lobsters, crabs, oysters, and salmon (in every part of the river), afford food and luxuries to the inhabitants. The annual value of the fishery is very great. The advantage of sea-bathing (hot and cold baths are provided), and the cheapness of some of the most essential articles of food in Kinsale, render it, especially in summer, a favourite residence with those of the gentry, who have no particular business to occupy them, and whose incomes are too limited to permit the expenditure which would be requisite for the enjoyments of social life in the more fashionable and crowded resorts of British society.

We conclude for the present with Spencer's eulogy of the southern parts of this county.

"And sure it is yet a most beautiful and sweet country as any is under heaven, being stored throughout with many goodly rivers, replenished with all sorts of fish, most abundantly sprinkled with many sweet islands and goodly lakes, like little inland seas, which will carry even ships on their waters, adorned with goodly woods,* even fit for the building of houses and ships, so commodiously, as that if some Princes of the world had them, they would soon hope to be lords of all the seas, and ere long of all the world, and also full of very good ports and havens opening upon England, as inviting us to come to them, to see what excellent commodities that country can afford; besides the soil itself most fertile, fit to yield all kinds of fruits that shall be committed thereunto. And, lastly, the heavens most mild and temperate, though somewhat too moist in the parts towards the west."

D.

* Alas! these have been too much cleared away, in the true North American fashion.

ON INSECTS MOST INJURIOUS TO VEGETABLES AND ANIMALS, AND THE MEANS BEST CALCULATED TO COUNTERACT THEIR RAVAGES.—NO. VI.

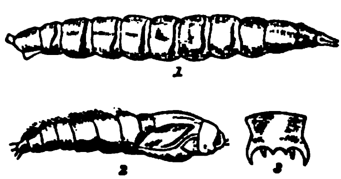
By JAMES DUNCAN, M. W. S.

Tabanidæ, or Horse-flies.—The insects of the preceding order, to which our attention has been hitherto chiefly directed, occasion so little direct injury to animals in this country, that they may be considered, in a general view, as almost enjoying an immunity from their attacks. Such, however (as already intimated), is far from being the case with the Dipterous, or two-winged order, which contains many kinds, which, in some instances, prove a great annoyance to our domesticated animals, while, in others, they are the frequent cause of serious diseases. Of the former sort are the Tabanidæ, or horse-flies, of which we are now to give some account. Besides being known as horse-flies, they are occasionally called the *Breeze;* but that name, to prevent confusion, had better be confined to the Œstri or gad-flies, afterwards to be described. It may be inferred from the English name that the horse is the principal object of their persecution, but several of them attack indiscriminately many different kinds of the larger quadrupeds, especially the ruminants, and even man himself is occasionally assailed. The object of these attacks is to gratify their thirst for blood, which they extract from the body of their victims, by means of a proboscis, so constructed that it serves at the same time as a lancet to pierce the skin, and as a tube for the passage of the fluid.

The Tabani have been thought by some to be the insects called Œstrus by the Greeks, and Asilus by the Romans, and they are frequently alluded to under these names by the ancient poets, on account of the terror they occasioned among cattle. They are of strong and robust forms, generally somewhat above the middle size, one of the species (*T. bovinus*) being among the most bulky of the European Diptera. The prevailing colours are somewhat obscure, with the exception of the eyes, which are of great brilliancy, and often ornamented with rays and spots of crimson and purple. They first appear in the month of June, but are seldom in full force till the middle of autumn. They are much more plentiful in the southern than in the northern parts of the country. They delight in warm and sultry weather; are most active on the wing during the heat of the day, and are, therefore, most troublesome to cattle and beasts of burden when they stand most in need of repose. They are particularly excited and eager for blood when the atmosphere is in a warm and humid state, such as it usually is after a thunder shower. It is invariably observed to be the females that attack animals, the males being commonly found on flowers from which they extract the juices; an analogous fact has been observed in relation to various gnats (*culices*) and some other sanguisugous species. The quantity of blood which they can gorge is much more considerable than might be supposed from the size of the body, as the latter, after a full meal, becomes dilated beyond its usual dimensions. Some species, like Œstri, attach themselves chiefly to one kind of animal; thus the reindeer has a winged parasite appropriated almost exclusively to itself; and it is not improbable that a more extensive knowledge of the history of these flies would make us acquainted with others equally restricted in the choice of their victims.

We are not very fully acquainted with the early stages of these insects, nor their metamorphoses. The eggs are said by a distinguished observer to be deposited in the earth. The larva of one of them (*T. bovinus*) he describes as long and cylindrical, narrowing at the head into an elongated cone. The body is divided into twelve rings, the anal one being very minute, and resembling a tubercle, (Cut No. 1. fig. 1.) The head is provided with two short antennæ and several minute organs, among which the most conspicuous are two scaly hooks, which it employs in opening a passage for itself in the earth, and aiding its motions. The latter, however, are chiefly accomplished by means of numerous retractile tubercles placed on a dark-coloured band encircling most of the segments, which, by their pressure against the plane of position, preserve the space gained by the

No. 1.

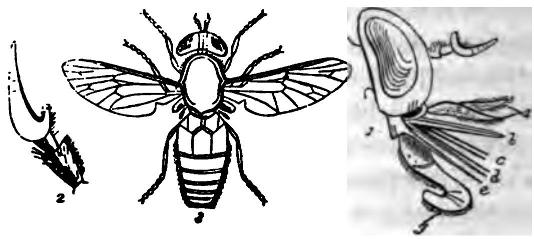


elongation of the rings. With the exception of the band just mentioned, the colour is dirty white, the head brown and shining. The pupa is nearly cylindrical, of a greyish-brown colour, the segments fringed on the posterior margins with grey hairs (fig. 2.) The anal segment is small and armed with six sharp scaly points (fig. 3.), which seem to enable the pupa to push its head above the surface of the soil, as it is always observed to do, while the lower portion remains imbedded.

No direct detriment to the health of our cattle is likely to result from the phlebotomy of the Tabanidæ; but the annoyance they suffer is so great, that it would be well if some plan could be suggested to save them from it. In some seasons, and in certain localities, they can scarcely derive any benefit from their pasture during the heat of the day; they commonly desert it, and either scamper about in a state of agitation, or seek some place of shelter. While travelling along the west coast of Wales last summer, I was somewhat surprised to observe the cattle so frequently at mid-day, lying upon the sands at the sea-shore, which are often in that country of great extent and beauty. Upon inquiring into the cause, I found they had withdrawn so far from their pasture, solely for the purpose of avoiding the attacks of Tabani and Œstri, which do not pursue them to this cool and airy retreat, insects of this description disliking the sea-air. Here they were exempted from the buzzing impertinence even of common flies, and seemed to have such enjoyment in their repose, that I have seen the approaching waves wetting their sides before they shifted their position. These flies also are frequently the cause of considerable danger to travellers, for when they are numerous and biting hard, a spirited horse is apt to become unmanageable under the infliction. When their proboscis is fixed in the skin and employed in pumping the blood, the insect can in general be easily got at, and killed with a stroke of the hand; but all that can be done in that way will, of course, have but little effect in diminishing their numbers.

The instrument by which the skin is pierced and the blood extracted, is of curious and complicated structure. Although so unlike the oral organs of the coleoptera, this implement is formed of pieces analogous in number and situation. The palpi, fig. 1, *a*, Cut No. 2. are two-jointed, long, hairy, and pointed;

No. 2.



labrum long, lanceolate, acute, fig. 1, *b*; mandibles and maxillæ lanceolate and slender, fig. 1, *c* and *d*; tongue narrow and pointed, fig. 1, *e*; labium large, fleshy, and cylindrical, terminating in two large hollow lobes, fig. 1, *g*. In order to form a tube, these various pieces are nicely adjusted to each other, and the fluid ascends principally by capillary attraction, for it can hardly be supposed that insects *suck*, in the ordinary sense of that word, as they never breathe by the mouth, and it is not probable, therefore, that they form a vacuum by inhaling the air in the same manner as an animal provided with lungs. The concave lobes of the lip probably enable the insect to attach itself firmly, and render the apparatus steady; while the palpi are useful in dividing the hair, and form a kind of protecting sheath to the other parts when they are unemployed. In substance, the pieces are so stiff and horny, that they easily make their way through the hardest and coarsest hide.

The family may be known by having the antennæ projecting forwards, approximating at the base, three-jointed, the third joint ringed, without any seta or slender bristle at the extremity, No. 2, fig. 2, Nos. 3 and 4, fig. 1: proboscis standing out from the head; abdomen consisting of seven segments; halteres half covered by large scales; wings, when at rest, extended horizontally on each side of the body; tarsi with three distinct spongy cushions.

Only three genera occur in Britain, and they may be easily distinguished by the following brief characters:—

Two lowest joints of the antennæ somewhat cup-shaped and unequal; third joint, . . . { Five-ringed—TABANUS. / Four-ringed—HÆMATOPOTA.

Two lowest joints of antennæ cylindrical and equal,—CHRYSOPS.

These genera include eighteen or twenty species, many of which are not common, and others are far from being determined in a satisfactory manner: the Tabani are greatly the most numerous, amounting to thirteen or fourteen species. It is foreign to our present purpose to give a minute description of all these; all that our limits will permit, is briefly to indicate the specific distinctions of two or three of the most common.* *T. bovinus*, brownish-black; antennæ ferruginous at the base and dusky at the tip; greater part of the head greyish-yellow; thorax thinly clothed with yellowish-grey hairs; hinder edge of the segments of the abdomen, and a triangular spot in the middle of each segment, reddish-yellow or whitish; thighs and tarsi blackish, the rest of the leg yellowish-white. This species is about an inch in length, being the most bulky of our native Diptera. It occurs not unfrequently among the Highland moors, but is scarce in the Lowlands of Scotland. It is far from being rare in England.

T. tropicus.—Head grey, forehead yellow in the female, with a black callosity at the base, a narrow black line in the middle, and a shining point of the same colour on the crown; eyes green, with three cross lines of purple; thorax shining dark brown, with indistinct grey lines along the back; abdomen black, the first four segments tawny-yellow at the sides, and the centre with a dark stripe of variable breadth; belly tawny-yellow; thighs dark brown; tibiæ ferruginous, dusky at the apex; tarsi black; wings pale brownish-grey, the anterior margin and nervures yellowish-brown. Length from seven to eight lines: found occasionally throughout Britain.

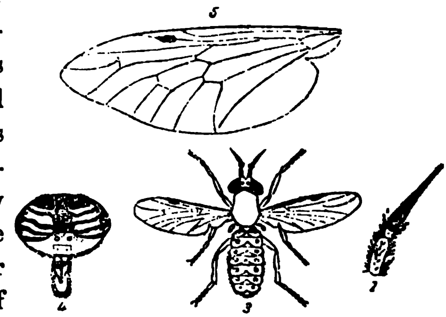
T. rusticus.—Blackish, covered with yellowish-grey hairs; eyes of a uniform pale green; thorax and abdomen densely clothed with whitish-grey hairs, sometimes inclining to yellow; thighs grey; tibiæ yellow, anterior tarsi black, the hinder pair yellow with the apex black; wings clear and transparent, the exterior border tinged with yellow. The female is yellowish-grey on the forehead, with two shining black spots; the eyes

* The British species are described at length in the Magazine of Zoology and Botany, vol. i. p. 359. They will likewise be found in the general work of Meigen, entitled "Systematische beschreibung der bekaunten Europ. Zweiflügeligen Insecten;" and in Macquart's "Diptères," forming part of the "Suites à Buffon."

having an indistinct arched band near the inner side, and the abdomen is marked with four series of dark brown spots; thighs entirely grey. Length five to seven lines: one of the most common species inhabiting this country; but rather scarce in Scotland. *T. fulvus*, represented in the woodcut (No. 2. fig. 3), bears considerable resemblance to the two last species, but it is of comparatively rare occurrence.

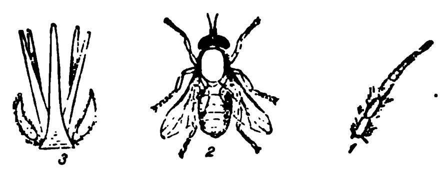
Hæmatopota pluvialis.*—This is the common horse-fly of this country, known in Scotland by the name of *Cleg* or *Gleg*, a term derived from the Danish word *Klaeg*. It is by far the most troublesome of the Tabanidæ, both on account of its numbers and its persevering and incesant attacks. It is more than usually blood-thirsty in warm showery weather, a circumstance which has obtained for it the specific name of *pluvialis*. The males are seldom seen, and their numbers seem to be remarkably few in proportion to those of the other sex. They appear to subsist entirely on the juices of flowers, and in conformity with their innoxious habits, the oral organs are found to be much less developed than in the female. The speckled wings, green eyes with transverse undulating purple-brown bands (No. 3. fig. 4.), dark brown abdomen, with the hinder margin of the segments, a dorsal line, and a series of faint spots on each side, of a light grey colour, sufficiently mark this well-known insect.

No. 3.



The genus *Chrysops* contains a few species of brighter colours than the two preceding, and remarkable for the dark colouring of their wings, relieved by a few transparent pale-coloured patches. But although one of the species (*C. cæcutiens*, No. 4, fig. 2.),

No. 4.



* From αἷμα *blood*, and πότης *a drinker*.

is pretty frequent in some parts of England, it never becomes sufficiently formidable in this country (although it is a great pest to horses on the Continent), to deserve further notice in this place.

Another family, named Stomoxydæ (from στομα, the mouth; and οξυς, sharp), is nearly of the same habits as the preceding; attacking various animals, and even man himself. The most common species (*S. calcitrans*) abounds in many parts of the country. In size and markings, it is not unlike the common house-fly (*Musca domestica*), but may easily be distinguished by the greater length of the proboscis, which is geniculated or suddenly bent at the base; thorax cinereous, with a black line along the back; abdomen rounded, covered with short hairs, cinereous, with shining black spots. This insect, we believe, frequently becomes very troublesome in certain localities. It generally attacks the legs, and its punctures are attended with great pain. But it is not of sufficient importance, as an enemy to plants or animals, to deserve a more detailed notice in this place. The same thing may be said of gnats (*Culicidæ*), and other allied tribes of blood-sucking propensities, which, however formidable in foreign lands, never, in this country, occasion more than a casual and temporary inconvenience.

Œstridæ, Bot-flies, Breeze, or Gad-flies.—The economy of the tribe of Diptera which next claims our notice, is perhaps as remarkable as that exhibited by any other race in the whole circle of insect life. It evinces a singular combination of instinct, nice mechanical adjustments, and prospective care for attaining the end in view under very peculiar and difficult circumstances. Even a brief and imperfect account of the structure and proceedings of these insects, cannot, we think, be perused without interest and wonder, although pertaining to a department of natural science in which similar examples are abundant and familiar.

The Œstridæ are by no means numerous in this country, neither do they seem to exist in great abundance anywhere. Even such as we do possess, very seldom fall under our observation, for they are very short-lived in their perfect form, speedily perishing after the continuance of the species has been secured. The nidus which they select for rearing their offspring, is either the stomach, interior sinuses of the skull, or the skin, of ruminating animals; and three of our most valuable domesticated quadrupeds, the horse, the sheep, and the ox, are respectively made the subjects of their operations. We shall first advert to the species which chiefly attach themselves to the horse.

*Gasterophilus** *Equi*, Leach. Great Spotted Horse Bot. *Œstrus Equi*, Linn. Trans. (Clark) iii. pl. 23. f. 7, 9. Clark's Essay on the Bots of Horses, pl. 1, fig. 1–16. *Œstrus Bovis*, Linn.—(*See wood-cut* No. 5, *fig.* 1.)—One of the largest of these flies, the length being about seven lines. The general colour is clear yellowish-brown, the surface with few hairs. Head broad and obtuse, the forehead covered with a soft whitish membrane, the vertex ferruginous and hairy. Thorax inclining to grey, the back more or less obscure. Abdomen rust-brown, with a tinge of yellow, a series of dorsal spots, and a row of points along the hinder margin of the segments (most observable in the male) black. Wings whitish, having a black undulated transverse fascia behind the middle, two spots of the same colour at the apex, and a minute one near the costa toward the base. Legs yellowish. The abdomen of the male is obtuse at the extremity, that of the female elongated into a narrow tube.

The genus Gasterophilus contains five British species. They were separated from the Œstri, properly so called, by Dr Leach, both on account of their different habits, and some peculiarities in structure. The antennæ are inserted in a cavity of the face (fig. 3.), the second joint large and kidney-shaped, the remaining three forming a naked bristle (fig. 2.); eyes equally distant in both sexes; mouth either entirely wanting, or consisting merely of an indistinct linear opening, without any of the usual appendages, except, perhaps, a pair of palpi, if they may be called such:† posterior margin of the wings without transverse nervures.

The great spotted horse bot, above described, is by far the most common. We have often observed it in many different parts both of Scotland and England, flying about moorlands

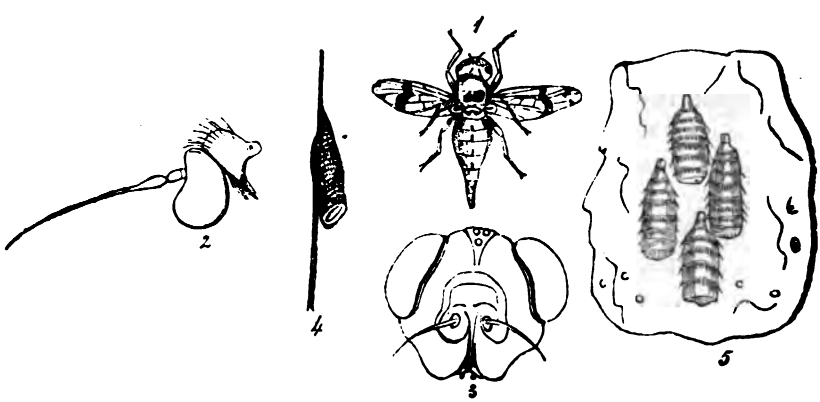
* From γαστηρ, the belly, and φιλος, a lover.

† This insect takes no nourishment of any kind; in fact, the alimentary canal has no opening at its anterior extremity.

and elevated pastures, a considerable number usually in company, and producing a humming sound by the motion of their wings. It is probable that any member of the genus *Equus* would serve almost equally well as a receptacle for the larvæ —they have been actually found in the stomach of the ass— but the fly in general prefers the horse. Having selected the individual to which her treasure is to be entrusted, she continues to hover about for a short time till the egg be propelled through the oviduct, and placed in the pincers at the extremity of the anal tube. Thus prepared, she makes a sudden descent upon the horse—her body carried nearly in a perpendicular direction, and the ovipositor curved forwards—and deposits the egg upon a hair, to which it instantly adheres by means of a glutinous matter secreted along with it. This process, which is performed with such expedition that the fly can scarcely be said to alight on the horse, is repeated at intervals till the whole of the mature eggs are discharged.

These eggs, which are very numerous, four or five hundred being sometimes placed on a single horse, are somewhat pouch-shaped, narrow at the end attached to the hair, and widening at the other, which is closed by a kind of operculum or lid of an oval shape, surrounded by a prominent margin. When magnified, the surface is found to be shagreened, or reticulated with transverse and longitudinal striæ. (Cut 5, fig. 4.)

No. 5.



Under the guidance of an instinct which cannot be sufficiently admired, the fly almost invariably attaches her eggs to some part of the fore-quarter of the horse (the inside of the knee and the shoulder are the spots commonly selected), so as to be within reach of his mouth—for he is himself to be made the unconscious instrument of conveying them into his stomach, where alone they can come to maturity. Before this fact was ascertained, many conjectures were formed as to the manner in which they were transported to a receptacle of such difficult access, and the most plausible explanation that could be devised was, that the fly entered the intestinal canal and deposited them there. This improbable notion was believed even in the days of Linnæus, who says of one of the species, "Habitat in equorum intestino recto, *mirè per anum intrans*." It is now well known that the eggs are left wholly to the chance of being conveyed into the animal's mouth by adhering to the tongue and lips while he is licking himself; and this he does so frequently when grazing, urged by the bites and titillation of various flies, &c. that no inconsiderable number may be presumed to arrive at their destination, especially since they are purposely placed in situations where they can scarcely be avoided. Even when beyond reach of the mouth, the eggs are not necessarily lost, for horses are in the habit of licking each other, and a horse free from bots may thus receive them from another. When the eggs are mature, it would seem that the larva makes its appearance very soon after they are touched by the tongue, the warmth and the moisture both contributing to their immediate development, and the lid being usually rubbed off by the contact of the rough surface. Indeed, if the larva were not disclosed before reaching the stomach or very shortly after, the eggs would very soon pass into the alimentary canal, as they are without the means of fixing themselves to the coats of the stomach. But the larvæ are amply provided against such a contingency; and immediately upon reaching the stomach fix themselves to its inner tissue, where they remain in security, uninjured by the powerful action of the gastric juices, and enjoying the warmth of a tropical climate.*

A small group of these larvæ, adhering to the lining membrane of the stomach, is represented in the preceding wood-

* The temperature of a horse's stomach is about 102 degrees of Fahrenheit

cut, fig. 5. They hang in dense clusters, attached by the head, for which purpose it is provided with a pair of sharp hooks, which effectually serve the ends of an anchor. When the head is first applied to the membrane, these hooks are drawn in. The head is then pressed forwards, and one of them is protruded on each side, nearly at right angles with the body, till it include a sufficient portion of the membrane, when it is curved downwards, and permanently maintains its hold. The mouth lies just between these hooks, and appears like a longitudinal fissure. In their general shape these larvæ are not unlike some kind of flask, the head narrowing rather suddenly into the resemblance of a neck, and the shoulders being rounded off. They are surrounded by several rings of spines and projècting points, by means of which they are able to move about a little before they have fixed their hooks, or when they have accidentally lost their hold. The colour is pale reddish-yellow. Their only food seems to be the humour secreted by the internal membrane of the stomach, or it may be the chyme, the latter undergoing a further elaboration, to adapt it to their system.

These parasites have been sometimes accused of penetrating the coats of the stomach, and lacerating them to a dangerous extent; but this, there is every reason to believe, could in no instance take place. A small circular hole appears in the white membranous tissue, in the place where they fix themselves; but this never penetrates farther, the thicker and more rigid coats remaining untouched. Indeed, it is obvious, from the structure of their mouth, formed only for imbibing fluids, that it could be of little avail in penetrating the fibres of a firm texture; and they are destitute of any other instruments which could be employed in its stead.

These *bots*, as the larvæ are called, take up their quarters in the stomach about the end of summer or in autumn, and they are in no haste to leave their dwelling, for they pass the remainder of the autumn, the whole of winter, and the spring months, without undergoing any change, save that they are gradually enlarging, and advancing to maturity. When that is complete, they cease to retain their hold on the stomach, become mingled with its contents, pass into the intestinal tube, and are ejected at the anus. As soon as they have found a convenient place of retreat they change into a chrysalis, which is somewhat like the larva in shape, but more contracted and rigid, and of a chestnut or reddish-brown colour. A few weeks suffice to mature the fly, when it makes its escape by the narrow end of the pupa-case, and is soon ready to take wing, and go in search of a mate.

"It is fortunate," says Mr Clark, "for the animals infested by these insects, or rather most beautifully ordained, that their numbers are much reduced, and kept within due limits, by the hazards they are exposed to in the singular round of their propagation. I should suspect, that near an hundred at least are lost for one that arrives at the perfect state of a fly. In the first place, in depositing the eggs, not a little interruption is given to the female by the movements of the horse. The eggs, when deposited, may remain on the hairs untouched by the animal, unless some casualty makes him lick those parts to which they adhere; and when ripe, or if hatched and opened by rain or other moisture, the larvæ may come forth, and crawl about till they die. In the mouth of the animal they have the dreadful ordeal of the teeth and mastication to pass through. On their arrival at the stomach they may pass, mixed with the mass of food, into the intestines; and when full grown, on dropping from the anus to the ground, a dirty road or water may receive them. If on the commons, they are in danger of being crushed to death, or of being picked up by the birds, who so frequently for food attend the footsteps of the cattle. By such contingencies as these, Providence has wisely prevented their too great increase, and the total destruction of the animals they feed on." *

G. hæmorrhoidalis. Red-tailed horse-bot. Œstrus Equi, Var. Fabr. Clark's Essay, pl. 1. fig. 21, 22. Nearly one-half less than the preceding. Forehead white; eyes brown, those of the female marked with a black longitudinal line; thorax black in the centre, brownish on the sides, and thinly pubescent; scutellum pale yellow; abdomen white at the base black in the middle, and reddish-yellow at the extremity; under side ash-grey; legs pale, wings unspotted.

As this species differs somewhat in its mode of procedure

* Essay on the Bots of Horses and other Animals, by Bracy Clark, F. L. S., London, 1815. This writer is probably known to many of our readers by his publications on various veterinary subjects. Of the merits of these we are unable to form an estimate; but he has made a most valuable contribution to entomological science in the dissertation referred to. It is characterized by patient and persevering research, considerable powers of observation, sound induction, and accurate description, insomuch, that it has left not much to be desired regarding a subject very difficult to investigate, and which, before his time, was most imperfectly understood.

from *G. Equi*, it is necessary to give a short account of it. The eggs, which are shaped nearly like those already described, only they have a much longer neck, which makes them appear petiolated or placed on a footstalk, are, in the first instance, deposited by the parent fly on the *lips* of the horse. This operation is attended with great annoyance to the animal, for he is no sooner aware of the presence of the fly, than he tosses his head in the air, gallops off to a different part of the field, or, if he have the opportunity, betakes himself to the water, where his tormentor generally leaves him, having a peculiar dislike to that element. When the fly succeeds in fixing an egg, he rubs his mouth against the ground, or upon his fore-legs, in great agitation, frequently striking out with his fore-foot, which occasionally comes in contact with the jaw, and by no means tends to allay his irritation. The larvæ are taken into the stomach, and fix themselves there, exactly like those of *G. Equi.* They are smaller than the latter, proportionally longer, and more rounded. After leaving the stomach and passing into the intestines, they are in no haste to make a final exit, but again cast anchor near the extremity of the rectum, where they continue to hang often for a considerable time. In this situation they create great uneasiness to the animal, causing it to kick frequently, and even rendering its movements awkward. In other respects the history of this fly corresponds to that of the preceding.

It may be useful briefly to state the distinctive characters of the other three British species, which are rarer than either of the two preceding, which will enable any one to determine the name of such kinds of these curious flies as he may happen to meet with.

G. nasalis, Linn. *Œ. veterinus*, Clark. Head, thorax, and abdomen clothed with ferruginous hairs, the latter with white hairs at the base, and the second segment rendered somewhat gibbous by two tubercles ; wings unspotted. A variety of the female occurs with the abdomen nearly black.

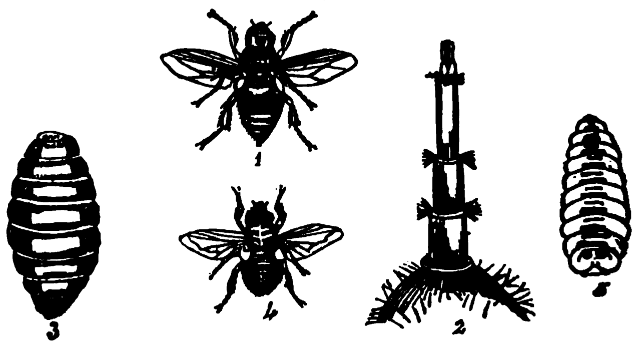
G. salutiferus, *Curtis' Brit. Ent.* vol. iii. pl. 146. *Œ. salutaris*, *Clark*, pl. 1, f. 35. and 36. Black, and very pubescent; head, thorax, and scutellum covered with bright ochre-coloured hair ; abdomen with straw-coloured pubescence, except on the second segment, where it is black ; wings unspotted, the costa and base yellowish-brown. Male with the thorax, and likewise the apex of the abdomen orange.

G. Clarkii, Leach, *Trans. of Wern. Soc.* vol. ii. p. 568. Head, thorax, and legs clothed with fulvous hairs; abdomen black, a band across, and the base with white hairs. This rare species was found by Dr Leach in Devonshire, and named after the individual who has so successfully investigated the history of these insects.

The essential distinction between the genus Gasterophilus and Œstrus is, that, in the latter, there are transverse nervures towards the apex of the wings closing the cells, and the wing-scales or winglets are very large, covering the whole of the halteres. Very slight modifications of form can likewise be traced in a few other parts of structure, and the entire amount of these, in connection with a difference of economy, suffices to constitute a separate generic group, according to the modern principles of classification.

Œ. Bovis, Clark, pl. 2. figs. 8, 9. About the size of *G. Equi* or somewhat larger; forehead white, densely clothed with hair ; thorax yellow anteriorly, black in the middle, with several abbreviated longitudinal lines free from pubescence, hinder part cinereous ; abdomen likewise cinereous at the base, a black fascia in the middle, and the apex with fulvous or tawny-yellow hairs; wing-scales very large, white; legs black, tarsi pale. The female has the abdomen attenuated behind, and terminating in a black-coloured style, composed of cylinders which slide into each other like the tubes of a telescope (wood-cut, No. 6, fig. 1. the fly ; fig. 2. the anal tube greatly magnified). The male is smaller, and the extremity of the abdomen obtuse.

No. 6.



As the specific name intimates, this species is appropriated to the common ox; instances have occurred of its attacking the horse, but these are rare, and must be looked upon as anomalous deviations from the general habit. This is what has been called a cuticular insect, the eggs being deposited externally on the skin of cattle, and the larva inhabiting a tumour or abscess formed around it, in a manner exactly analogous to the galls on the leaves of willows and other trees, produced by the *Cynipsidæ*. These tumours are generally found on the back of the animal, along the sides of the spine, and occasionally on the loins; when full grown, they are often larger than a pigeon's egg. It is not well ascertained whether the eggs are merely laid on the hair or skin, and the larva, when disclosed, left to force its own way beneath it, or a perforation is made by the fly, and the egg deposited within it. That the latter is the case seems rather most probable; the ovipositor seems constructed for the express purpose, and it is contrary to the usual ordination that the larva, on its exclusion from the egg, should not be placed among the substance which is to supply it with food. Unless the ovipositor pierce the skin, and produce, in so doing, considerable pain, it is difficult to account for the extreme agitation and alarm of the cattle when assailed by this fly. They often become quite furious; run off bellowing at their utmost speed, with the tail extended behind them in a straight line, and the head and neck stretched to the utmost. If attacked when yoked to the plough, they become so unmanageable, that, as Mr Clark informs us, many ploughs are provided with a contrivance for setting them at liberty immediately. He also states, that he has seen one of the flies meet a herd when almost driven home, and such was their dread of this apparently puny foe, that they immediately turned back, regardless of the stones, sticks, and noise, of their drivers; nor could they be stopped till they reached their accustomed retreat in the water. All this is likely to be produced by the apprehension of immediate pain. At all events, (for this is a point on which the best authorities differ), the young larva is found to occupy a small cyst or cell within the substance of the skin, which gradually enlarges with its growth, while the pus which is abundantly secreted by the irritation, serves for its sustenance. The tumours thus produced are called *Warbles*, *Wormals*, or *Wornils*, but these names are sometimes also applied to the larvæ.

The latter have very little resemblance to the gastric larvæ formerly described. They are of an oblong-oval shape, the body divided into eleven segments by transverse bands, which are again crossed at the sides by longitudinal lines; and on each side of all the segments there is a distinct spiracle, or breathing-hole. (Wood-cut, No. 6, fig. 3.) The rows of spinous projections are wanting in this case, as the larva requires no means of locomotion in such a contracted dwelling; and, for a like reason, it is not supplied with suspensory hooks. The tumour is never entirely closed around it; there is always a small aperture on the upper side, to which the anus of the larva are usually applied, and in this way it receives the necessary supply of air, the principal air-tubes opening at this extremity. On attaining its full growth, the larva makes its exit by the aperture just mentioned, and the wound speedily closes up and is healed, but the hide never recovers its original strength, as afterwards appears when it comes under the operations of the tanner. The chrysalis is furnished with a lid resembling that of a snuff-box; a necessary provision, to enable the prisoner to escape, for the texture is too rigid for him to force a passage otherwise. It is remarked by Reaumur, as a singular circumstance, that the larva commonly issues from the tumour to assume the pupa state, at a very early hour in the morning, and thereby avoids many of the dangers to which it would be otherwise exposed.

The only other member of this family which it will be necessary to describe, infests the sheep, and its habits, in many respects, are different from any yet detailed. It is named *Œ. Ovis*, or *Sheep-bot.*—Donovan's *Brit. Ins.* vol. xvi. pl. 550; Clark, pl. 2. figs. 19, 20. Less than any of the species formerly noticed, scarcely attaining the length of five lines; forehead dusky red, with a blackish depression; antennæ black; thorax ash-grey, with numerous small black warts, each of which has a hair in centre; abdomen variegated in a similar manner, the ground colour silky white, with a yellowish play of colour in some places; legs pale red; wings clear and unspotted; wing-scales large and white. (Wood-cut, No. 6, fig. 4.)

It is thought that this insect deposits its eggs on the nostrils of the sheep; but this is partly conjecture, for the animal is so much disturbed by the presence of the fly, and so unwilling to allow a person to approach near enough for the purposes of observation, that it is no easy matter to witness the actual operation. The modes of defence adopted are various; but recourse to water, which seems to be the most easy and effectual, is seldom one of them, the quadruped, in this instance, sharing in the antipathies of its tormentor. The common plan is to get into the roads in dry hot weather, and lie down among the dusty ruts, holding their heads close to the ground; or to continue standing, with the head held downward, and the nose turned in between the fore-legs, almost in contact with the earth. When in an open field, they assemble close together, and form a dense phalanx, with their noses pushed against each other, or held to the ground, so that the fly can scarcely accomplish its object unless with those on the outskirts of the body.* These methods of defence, in connection with other considerations, leave little doubt that the egg is placed on the margin of the nostril. It probably soon occasions pain, by producing a certain degree of inflammation, which is augmented by frequent rubbing of the nose on the ground, and this, along with the instinctive dread which is always strongly exhibited by animals for these flies, sufficiently accounts for the agitation of the sheep when about to be attacked. The warmth and humidity of the nostrils very soon bring the eggs to maturity, and the larvæ have little difficulty to find their way into the frontal maxillary, and other sinuses or cavities of the face, which are the situations they are destined to occupy. Like those of *G. Equi*, they are furnished with two tentacula, by which they adhere to the white membrane covering the interior of these cavities, the secretions of which constitute their food. A considerable degree of inflammation is usually caused by their presence.

The larvæ are flat on the under side, and convex above, of a delicate white colour, without spines of any kind, save the terminal hooks already mentioned. Their motions are effected by fixing these hooks, and drawing the body forwards, after the manner of geometer caterpillars. A series of black transverse spots are visible on the under side, covered with rough points,

* Clark's Essay, p. 59.

which no doubt are employed in aiding their movements, and perhaps also in irritating the smooth surface of the membrane to which they adhere, so as to cause a more profuse exudation of the pus on which they feed. (Wood-cut, No. 6, fig. 5.) The transformations take place in the usual manner. The larva, when full grown, permits itself to drop through the nostrils, wriggles itself into some loose soil, or adheres to a blade of grass, and is there converted into a chrysalis, in which dormant condition it continues for nearly two months.

These are the only species of *Œstri* found in Britain, except one described and figured by Mr Curtis, *Œ. pictus* (Brit. Ent. vol. iii. pl. 106), which appears to be of very rare occurrence. Another is noticed by Dr Leach, under the name of *Œ. ericetorum*, but that is now affirmed by the best authorities to be merely a variety of *Œ. pictus*. Various other kinds occur in different countries, but it forms no part of our plan to enter into their history. It may merely be mentioned that there is one appropriated to the antelope, another to the stag, another to the rein-deer, one to the camel, and one to the hare. Humboldt states, that, in South America, he has seen Indians whose abdomen was covered with small tumours, which he supposed to be produced by the larva of an *Œstrus*. This opinion subsequent observation has tended to confirm, and there is a species actually called *Œ. hominis*. The fly which Bruce speaks of in his Travels, under the name of *tsaltsalya*, the attacks of which were so formidable, that it was an object of alarm even to the lion, has been conjectured by some to belong to this tribe of flies, but it is much more likely that it is one of the Tabanidæ, the family noticed at the commencement of this article.

It will probably be supposed, that the various animals mentioned cannot be inhabited by their respective parasites without sustaining considerable injury; and that, in certain cases, must be admitted to be the fact. Of one of the gastric species, Linnæus says, "habitat in ventriculo Equorum, sæpe ipsis lethalis," and this opinion seems to have been entertained long after his time. Several years ago, certain kinds of Œstridæ became very plentiful in some parts of France, and, in consequence of the irritation caused to the cattle by numerous tumours, fevers, inflammation, and death frequently ensued. We are assured also, that, in Lapland, many rein-deer annually fall a sacrifice to the gad-fly, the ulceration (ther called *Kurbma*) often proving so extensive as to carry then off, particularly the young fawns. Even the full grown rein deer become so much deteriorated under the persecution o these insects, that, at a certain season of the year, Linnæu asserts that they are not in a fit condition to be slain for eat ing. It cannot be alleged, however, that such results eve ensue in this country, the only evil being the annoyance t which cattle are subjected, the loss they sustain in being pre vented settling at their pasture, and the damage frequentl done to the hide.

The last mentioned of these evils it seems no difficult mat ter to check, or altogether prevent. The cuticular larvæ ar so conspicuous on the backs of horned cattle, that if searche for, scarcely any could be overlooked, and they may be kille with the utmost ease either by simple pressure with the finge and thumb, or by pouriug some corrosive liquid into the aper ture of the tumour. They are seldom so numerous but tha a short time would suffice to inspect a whole herd, and if thi were done simultaneously at several different places, a whol district might, in a short time, be nearly or altogether free from this pest. Should the gastric larvæ be considered hurt ful, it will be a matter of much greater difficulty to destro them after they have secured a lodgment in the stomach. N poison can reach them but what is first swallowed by th horse, and even then it does not follow that they are to swa low it, but the very reverse, for they are already supplied wit their natural food, and are unlikely to receive what is unusu or disagreeable to them. Opium and tobacco have, accord ingly, been administered for several days together without an effect; and even oil, which was thought likely to be fatal b closing up the respiratory pores, has been found not to inju them. Neither are they dislodged, at least to any extent, b drastic medicines. In these circumstances, the best metho is to look for the eggs at the proper season about the knee mane, and shoulders of the horse, and they can be readily re moved either by a brush and warm water, or, what is sti more effectual, by cutting off the hairs to which they adher The larvæ of *G. hæmorrhoidalis* should be occasionally looke for, in horses that have been much out at grass the *precedin* *year*, in the place to which (as already described) they prefer fixing themselves, and their removal is evidently a great relief to the animals.

But nearly all these remedies and precautions will be unnecessary, if we adopt Mr Clark's opinion, urged with considerable plausibility, that bots, instead of being pernicious, are positively beneficial to these animals. He regards them as natural stimuli, which promote digestion, and, by local irritation, prevent the inroads, or promote the cure, of various disorders. This view corresponds with that taken by Linnæus and other naturalists of that era, regarding the utility of parasitical animals, which is still in many parts of the country a popular belief, and must be admitted, to a certain extent, to be founded on sound physiological principles. "Rodendo caput" says the Swede, in relation to one of the best known of these parasites, "exciat achores apud puerulos voraces incarceratos indeque strumosos et sicque preservat a coryza, tussi, cæcitate, epilepsia, &c." In a similar way, Mr Clark thinks, the gastric *Œstri*, by gently stimulating the stomach, tend to prevent the cholic, gripes, and other indigestions which ultimately affect the head of the horse, and produce staggers, a disease to which that animal is peculiarly subject. "The appearance of exanthematous eruptions on the skin, and the formation of local abscesses, from the same cause of partial irritation, often relieve a general disorder of the system. The mucous membranes of the skin possess this power when irritated in the most eminent degree, and to these the larvæ of the *Œstri* are applied. Irritating the membranes of the stomach in other animals would excite nausea and vomiting; but the horse not possessing this power, his stomach is peculiarly fitted for the stimulus of such inhabitants."*

Acting on this view, Mr Clark administered a few dozen larvæ to his own horse, and he afterwards grew fatter and in better condition than he had ever been before. Our author has therefore included them among the materia medica of veterinary practice. We are not sanguine that many of our readers will be anxious to avail themselves of the prescription, but should it be otherwise, they may be referred to Clark's *Pharmacopœia equina* (p. 25), where further information regarding it will be obtained.

* Clark's Essay, p. 40.

ON PARING AND BURNING.

By Mr John Pearson.

We are told, that the first attempts of vegetation to cover the steril rocks of our globe must have been a kind of moss of the most minute description, and, in course of time, the decomposition of the first gave birth, as it were, to a second vegetable of larger dimensions, and the second to a third, and so on, till those incessant operations of vegetable life and decay, combined most probably with the remains of graminivorous insects, formed, in course of time, a crust of earthy materials, sufficiently thick for the establishment of those plants which now constitute the natural order Gramineæ, and which form one of the broadest features in vegetable life. There are other causes, no doubt, which have assisted in forming the crust of the earth; but, as I have no intention of attempting to elucidate the wonderful beginnings in vegetable or in animal life, suffice it to say for the present, that when once a good *turf* is obtained, whether by natural or artificial means, it ought not to be destroyed by the fashionable incendiary, as, even at the present day, a good thick turf is not got by magic, though I am sorry to say, that the magical influence of fashionable manure-making has done infinitely more injury to the land, generally speaking, than did the incendiary who burned the stacks of straw,—I mean that of paring and burning turf to make manure, as we hear it termed. When the incendiary has burned a grain rick, the *turf*-burner says that the grain is not the only loss, as there is the loss of the straw to the land in shape of manure, but never thinks of accusing himself for the loss which the land must have sustained from his burning the *turf*. There are all kinds of excuses brought forward for the destruction of this ever-to-be-cared-for property, such as a foul turf, a sour turf, a strong turf, a mossy turf, a squitchy turf, &c.; but I feel confident, that all those excuses are visionary when compared with the loss of the turf. Ever since I began to practise and think, I have hated the idea of burning turf to make manure; consequently, I have searched the chemical scriptures of Sir H. Davy and others, to try to find out my error in this respect; but the more I have examined those wonderful productions of the laboratory, and the more I have practised, the more I am convinced of the stand which I have made being nearly correct. Not only myself, but gardeners generally, prefer a chopped *turf*, or a preparation of *turf*, to grow pine-apples in. Now, though gardeners are very well aware that the pine-apple is a coarse feeder, that is, will grow in what is called a rich soil, yet they are also well aware, that it produces the best flavoured fruit when grown in a chopped *turf* that can possibly be sent to a gentleman's table. The fruit will be smaller, of course, than if the plant had been growing in a well-prepared manure mixed with the turf; but the connoisseurs prefer the flavour of the pine-apple when grown in chopped *turf*. The melon is a fruit that formerly was grown in a highly manured soil, but I prefer a *turf* with four inches of earth attached to it. The vine, which every man knows produces the generous wine, though a coarse feeder, will grow remarkably well in a soil that has been prepared from *turf;* and a vegetable of much less pretensions than any of the former (the cabbage) will grow to an immense size in nothing else but the decomposing weeds of the garden, the very thing which the agriculturist destroys when he burns his squitchy *turf*. These simple facts ought to be sufficient to convince the indiscriminate *turf*-burner, that he must be doing the reverse of good practice, when he is burning any kind of green *turf*. Yet they will have it, that some one has told them, that to burn a good *turf* makes manure, and that they can see it in the crop, and more particularly where each heap was burned, and so I believe they can the first year, as I have frequently noticed, but as those places where the heaps were burned cannot be pointed out in the second crop, I consider that it is no more than giving the land a saline draught, afforded from its own laboratory by robbery, and, when the bubbles have burst, all is air. On the contrary, when a good *turf* has been ploughed over, it affords, by its gradual decomposition, food for the cereal grasses and other plants for several years to come. As facts always have their sterling influence, I may here be allowed to mention, that an extensive farmer in my neighbourhood was going to pare and burn a field of *turf* last year. I told him to order his dairymaid to burn the cream instead of churning it, and then request her to make the residue into butter, as I was quite sure that the turf might be termed the cream of the earth, and there would be just as much sense in his dairymaid burning the cream as a preparatory step to making butter, as there would be in lime burning the turf to make manure. The above, to me at least, sufficiently correct comparison, kept the fire from his *turf*, for he ploughed it in and took a crop of oats. Last autumn he sowed it with wheat, without a particle of manure of any kind, and, to all present appearances,* he may challenge any field of fallowed wheat in the neighbourhood, growing on the same kind of land, in the same aspect, and on the same elevation. The scientific agriculturists say, that, by paring and burning, we obtain carbon, carbonate of potassium, carbonate of lime, gypsum, muriate of magnesia, &c. These high-sounding new names for manure, proceeding from the laboratory, and given in a manner as though paring and burning was to act as a panacea for all the poor land in the kingdom, have, in my opinion, done great injury, generally speaking. Though the parer and burner may have read Sir H. Davy's 8th Lecture on Agricultural Chemistry, yet he had not a Sir H. Davy with him to point out which should, or which should not, be burned, nor could he have it impressed on his mind what Sir H. Davy says in his concluding remarks on paring and burning, which are, "All poor, siliceous sands must be injured by it, and here practice is found to agree with theory. Mr Young, in his Essay on Manures, states, that he found burning injure sand, and the operation is never performed by good agriculturists upon siliceous, sandy soils. An intelligent farmer in Mount's Bay told me that he had pared and burned a small field several years ago, which he had not been able to bring again into good condition. I examined the spot: the grass was very poor and scanty, and the soil an arid, siliceous sand."† Here it is evident, that it was not because the land

* August 1839.

† The above quotation ought to be at the head of every agricultural and country newspaper in the kingdom, with "caution to turf-burners," printed in large capitals, for its title.

was siliceous sand, but also because it was so poor in vegetable matter, that it could not afford to part with its turf for so trifling a return as a little charcoal, &c. My practice in the use of turf for various purposes convinces me, that all lands must be injured by paring and burning, save those lands, which are few and far between, that possess too much inert vegetable matter; or, in other words, lands that grow their crops to such a state of luxuriance as to prevent the desired intent of the cultivator. Those lands which possess too much inert vegetable matter might also be improved, by having part of their subsoils burned, but not to burn the turf even here, for that is the only thing that can be commanded on the spot that will cause fermentation in the soil when it is ploughed in, and thus, according to Lord Meadowbank, assist in breaking down some of the inert vegetable matter and produce food for the intended crop. We frequently see, that when commons and wastes are being brought into a state of cultivation, as it is termed, no matter whether the land be siliceous sand or thin-skinned clay, fire must go first, and, like a swarm of locusts, clear the ground of the slightest trace of vegetable existence, and thus render the land more barren than it was before the operations commenced. As to the carbon which is obtained by paring and burning, and which is stated by Sir H. Davy to be gradually converted into carbonic acid,—a mainstay of vegetable existence, the cottagers in the neighbourhood of Bewdley Forest, who put charcoal-dust into their onion-beds, say, that there "bin nothin' in it;" which is as much as to say, that there is neither acid nor alkali in their ground that will dissolve it; and I will venture to stake my word, that, were there anything in it, there would not be a charcoal hearth in the whole Forest that would not be divested of its blackness. The great wonders which have been stated to have been effected by paring and burning seem to me to have been altogether a mistake; for, instead of the paring and burning having effected it, it was the extra ploughings and harrowings to get the burned stuff properly incorporated, which brought the land into a better state of pulverization and commixture of parts, by which means every particle of earth gets, as it were, possessed of life; a slight fermentation takes place in the well stirred mass; atmospheric influences become more regular; evaporation is condensed in dry weather; and the internal heat of the solid ground below is, in a great measure, prevented from escaping during cold weather. Hence the wonders that the great Tull effected, and hence what he would have effected, if he could but have seen what was daily before his eyes, that the well-being of vegetation is indebted to previously organized matter, and that the best laboratory for its conversion is the stomachs of animals. Practical turf-burners have frequently declared to me, that pease never do well after paring and burning, nor where burned soil has been applied. May it therefore not be taken for granted, that the whole of that useful natural order of plants, Leguminosæ, is similarly affected by it? Should this be proved to be the case, it speaks loudly for the preservation of the *turf*, for to burn which, in my humble opinion, is merely to destroy the diamond for the sake of the charcoal. I compare the mucilage of a turf, or other green vegetable, to the brilliancy of the diamond, which may be seen in both of them before the one is burnt and the other pounded. Therefore, as pounding or friction never takes place without heat being evolved, it is heat that destroys the brilliancy of the diamond, as well as the greatest part of the usefulness of the turf. In Sir H. Davy's eighth Lecture on Agricultural Chemistry, he says, on burning stiff soils, that "the process of burning renders the land less compact, less tenacious and retentive of moisture, and, when properly applied, *may* convert a matter that was stiff, damp, and, in consequence, cold, into one powdery, dry, and warm, and much more proper as a bed for vegetable life." This having been written in the laboratory, is only in part correct; and it is certainly not to be wondered at, that a man of such extensive acquirements, and always having so much professional business on hand, should have passed over such a thing as a lump of burned earth or clay, without giving it a more thorough consideration. Burning certainly renders land less compact and less tenacious, but not less retentive of moisture, when it is only just burned to redness, which is only the first stage towards rendering it analogous to sands, flints, or quartz. It must undergo vitrefaction before it can perform the office that sands and flints do when mixed with the soil, and to do which would require a degree of heat that is not very cheaply obtained.

If burned and unburned loam be considered separately, the fact is obvious enough, that the former will hold less water than the latter, because the latter is capable of being held in solution or puddle, while the former is not. But, as there is no puddle in a state of nature, and as we have nothing to do with burned soil apart from that which has not been burned, it is the two combined that we have to deal with, and which we have next to consider. When a third part of loam, or stiff soil, has been burned to redness only, and mixed thoroughly with the other two parts, the whole, as a body, will receive and retain more water in wet weather, than the same land would have done previously to burning. This fact must have been clearly seen by every one that considers for a moment, that, as the soil is mixed with bits of petrified sponge, as it were, the absorbing power of which is very great, it gives the land a more open surface, and renders it much more pervious to water, and the absorbing power of the burned soil or clay is kept in action until every pore is gorged, which renders the parts that were not burned much wetter by contact with the burned stuff. Whereas a stiff soil that has not been burned, when laid in a good position, will, when rain falls, form a kind of coating of elastic plaster, as it were, on its surface, and throw off perhaps two-thirds of a day's rain; and it is elastic, because of the air in the soil, and the capability of the soil for capillary attraction. But when it is mixed with the burned parts, it takes in water, and lets heat and air out more freely than it did when not burned. Hence, I take it, that stiff land that has been part burned to redness, is colder and wetter in wet cold weather, and drier in dry weather, than the same land would have been previously to burning,—points which, when applied to the cultivation of the soil, are opposed to good practice; as the only time that burned soil can be said to be drier and warmer than the other soil, is, while it is giving off its latent heat, which only lasts till it gets its fill of water, and this is most probably the reason why burned stuff has been said to do so much good in the early part of the first season after its application. The weight that soils lose in burning vary according to their kind, and to the degree of heat they have been subjected to; the specimen which I tried had lost about one-seventeenth of its weight. The quantity of water they absorb after burning varies accordingly; the specimens which I tried absorbed from one-eleventh to one-fifteenth of their weight. From the above statement, it will be seen that burned stuff, as it is termed, holds a greater quantity of water during winter, at a time, too, when we have almost always too much rain from the clouds, at least much more than can be made use of in the growth of vegetables, and it retains the water, even in spite of that most wholesome cultivator, the drain, because, although the burned stuff should be laid over the drain, it being always uppermost drinks first, and then allows the drain to take the remainder; and, from this circumstance, I think it is more than probable that there is no little blame attachable to the burned stuff where the wheat crop has failed on the thin skinned clays during our late severe winters. The superabundant moisture, which naturally prevails in such soils during winter, combined with the extra and unnecessary quantity retained by the burned soil or clay, causes the frost to bite deeper than it otherwise would have done, and thus the burned stuff becomes an agent to the casting of the young plant out of the ground, which is just the reverse of what is wanted. It is very natural to fancy that when clay is burned as hard as brick, and mixed with stiff soil, that the whole soil must be drier, and to all superficial appearances it is, but in reality it is not so; and though the burned clay may be burned so hard that the frost cannot at first pulverise it, yet it has a much worse effect on the soil it is mixed with than if it was able to do it—for this law of nature cannot be put a stop to, that the frost draws the water out that may have gained access into the interior of the burned suff, and therewith corrugates the surface of each burned particle. Hence, why every little stone on the roads is incased in ice in a frosty night, when the day previous has been wet, and hence also that clayey land that has been partially burned is in a more rotten state after a frost than the same land would have been had part of it not undergone torrefaction. Clayey *rotch*, as it is termed, is chiefly composed of clay mixed with sand and lumps of sandstone. It is those lumps of sandstone that hold so much water that when frost attacks them immediately after rain, that become incased in ice, not from the wet clay that surrounds them, but from the frost not being able to pulverise them, drawing the water out of them, and freezing it on the exterior in the same manner as it does with the burned clay as above stated, and hence the injurious effects to the wheat crop on such lands, after sudden and severe frosts, the sandstone not expanding with the frost, the other part of the soil swells irregularly. A well-drained stiff loam in a good climate is invaluable property when frost attacks it. It expands regularly like water, and, from so doing, the wheat crop seldom or never gets kicked out of its cradle ; but should you burn part of such a soil, you would then be taking steps towards rendering it analogous to rotch, or at least to have the same effect on the whole crop. Had the money which has been expended in burning clayey soils been devoted to draining the same in a proper manner, the landlord and tenant, as well as the country at large, would have been benefited by it ; but it is my firm opinion that it is next to a dead loss to all parties. The doctrine of the excrementitious matter of plants, though not fully established, seems to be progressing, and burning the soil to sweeten it has been recommended by writers of the present day ; but as the spongioles, or the mouths of plants, are placed in the ground to supply the plant therefrom with certain nutriment, it is very unnatural to suppose that the excrementitious pores are placed there also. I suppose them to be placed on the under side of the leaves of plants, for the simple reason that in dry weather, when the leaves of plants crowd each other, take the strawberry or turnip for instance, the surfaces of the under leaves will be found to be covered with black excrement. This cannot arise from condensed matter given off by the surfaces of the leaves, because the upper leaves are not so affected, therefore it must be deposited from the under side of the leaf above. Be that as it may, it is quite certain that from these plants, when rain ls, it is washed on to, and turns the ground black. I will leave the above theory with the vegetable physiologist; and let the excrementitious matter of plants come from whence it may, I certainly shall not set fire to it to sweeten the soil, but will choose the opposite power, which is frost, and which is known to be a most powerful sweetener.

During the time that the surface of the earth is held in the jaws of frost, the internal heat of the earth is prevented from escaping, and after the frost departs and warmer weather commences, a leavening takes place, and if dung has been mixed with the soil, so much the better, as the little leaven added will of course increase the leaven, and thus the excrementitious matter of both plants and animals will be completely changed and lost sight of for ever. Hence the necessity of draining, trenching, mixing, and stirring the earth to as great a depth as you conveniently can, as that which is not stirred gets sour for want of leavening. When burned clay is applied as a top-dressing, it acts the reverse of draining, and it is from this property that its beneficial effects when applied to dry sandy plains or hillocks arises, and it is on those soils alone that the application of burned clay ever effects any permanent improvement; for though even on those soils it holds too much water during winter, yet it more than compensates by retaining it during summer at a time when water is most in demand; for as sand can only hold water by capillary attraction, evaporation goes on very rapidly during fine weather, while the burned clay, being a powerful absorbent, acts as a condenser. Though burned clay is also a powerful evaporator during fine weather, yet sands are more so, in consequence of which the burned stuff never parts with its moisture until the sand that surrounds it becomes the drier body. There are lands that lie flat and moist during winter, which the application of burned clay would have the same effect on the wheat crop after severe frosts as it has on the thin-skinned clays, where of course it never ought to be applied. When burning and pulverising have been executed in the most judicious manner, and plants have indicated afterwards, from their sickly appearance, that there is something in the soil that is poisonous to them, then let chemistry step in and declare if fire will either drive it off, or render it sweeter, before such violent measures are adopted.

As burning clay cannot be said to be destroying much of anything but valuable labour, so far as the commodity itself is concerned, and allowing every advantage which has been conferred on agriculture by geology and chemistry, and having the greatest respect for the labourers in those sciences as well as for the sciences themselves, I remain yet to be convinced that to burn *turf* as a general practice, as is done in some places, is not a *burning* shame.

ON IRRIGATION.

By Cuthbert William Johnson, Esq. Corresponding Member of the Maryland Horticultural Society.

Irrigation, or the artificial watering of the earth, chiefly to produce increased crops of grass, has been in use from a very early period. In oriental countries, in fact, the heat of the climate is such, that, in many situations, the now productive soil would be absolutely sterile, were it not that the cultivator enriched his ground with a copious supply of water. The simile employed by Isaiah, ch. i. v. 30, to indicate barrenness and desolation, is " a garden that hath no water." And that, in patriarchal times, they laboured hard to supply their grounds with water, by means of various hydraulic machines, some of which resembled the water-wheels of the fen districts of England, and were worked by the feet of men, something after the style of the modern tread-mill, is certain. Moses alluded to this practice when he reminded the Israelites of their sowing their corn in Egypt, and watering it with their feet,* and in the sandy soils of Arabia the same system is still continued.† According to Dr Shaw, the following is the modern mode of raising and using the water of the Nile for the purpose of irrigation in Egypt. Such vegetable productions as require more moisture than what is occasioned by the annual inundation of the Nile, are refreshed by water that is drawn at certain times out of the river, and lodged in large cisterns made for that purpose. The screw of Archimedes seems to have been the instrument formerly made use of for that purpose, though at

* Deut. xi. 10. 2 Kings, xix. 24. † Niebuhr, vol. i. p. 121.

present the inhabitants either supply themselves with various kinds of leathern buckets, or else with a *sakiah*, as they call the Persian wheel, which is the most useful and generally employed machine. Engines and contrivances of both these kinds, are placed all along the banks of the Nile, from the sea to the cataracts, their situations being higher, and consequently the difficulty of raising the water being greater, as we advance up the river. When their pulse, saffron, melons, sugar-canes, &c. (all of which are commonly planted in rills), require to be refreshed, they take out a plug from the bottom of the cistern, and then the water gushing out, is conducted from one rill to another by the gardener, who is always ready as occasion requires to stop and divert the current. In Egypt, at the present day, according to Dr Clarke, the water is sometimes raised for the purposes of irrigation by means of a wicker basket lined with leather; this is held by cords between two men, who by this laborious means swing it over the banks of the Nile into the canal which conveys it to the lands intended to be irrigated. A machine similar to the Persian wheel is still employed in China by the cultivators, for the purposes of irrigation. This use of machinery for the purposes of watering, might, in fact, in many situations be advantageously employed in England, to a much greater extent than is commonly believed. It is well known how many thousand acres of valuable land are profitably drained by means of the steam-engine. At this very period a public company is proposing to enclose and drain an arm of the sea in Lincolnshire, by the assistance of its gigantic aid. Yet how rarely, if ever, is that power employed to irrigate the thirsty lands of England, lands of all others the most profitable, the best adapted for the formation of water meadows. The tracts to which I allude are those on a slope, as on the side of a hill, but these are rarely found in situations where a sufficiently copious supply of water can be constantly obtained for the purposes of irrigation. Yet the quantity thus required is not so large as to be beyond the power of the steam-engine to supply; thus, to sufficiently saturate a square yard of a calcareous sand soil with water to the depth of one foot, as in irrigation, requires about 30 gallons of water, equal to about 145,000 gallons per imperial acre. Now, that the steam-engine could readily and profitably supply this quantity of water, may be concluded from several facts; thus, the two engines, one of eighty, the other of sixty horses' power, which keep Deeping Fen, near Spalding, completely drained, when working, in 1835, only ninety-six days, of twelve hours each, raised more than 14,000,000 *tons* of water several feet. The district drained by them contains about 25,000* acres, which would otherwise be a complete swamp. And it has been proved that, by a common condensing steam-engine, one bushel of coals will raise more than 50,000,000 lb. of water one foot. In many situations, therefore, where, for the purposes of irrigation, good river water can be copiously obtained, and fuel is at a moderate price, I am confident that great results are yet to be obtained by the aid of mechanical power. For, by the steam-engine, the soils of all others the best adapted for irrigation, may be successfully brought into cultivation; for instance, the poor sands and gravels on the sloping banks of many of the English and Scottish rivers, many of whose waters, from being charged with organic matter, the carbonate and sulphate of lime, and various earthy substances, are excellent for the use of water meadows. The early employment of irrigation by the Egyptians and Chinese, was most likely the result of the good effects which were observed to be produced by the overflowings of the Nile, and the Chinese rivers, for, in the "Celestial" Empire, irrigation has, it seems, been employed, according to their veracious historians, for a period long before that assigned to the flood. In Italy, especially on the banks of the Po, the cultivators of the earth have certainly employed this process for a period previous to the days of Virgil,† and it is still carried on with a zeal and care worthy of the art they practise. M. P. Cato, the earliest of the Roman writers upon agriculture (150 years before Christ), in his ninth chapter, told the Italian farmers, to "make water-meadows if you have water, and if you have no water, have dry meadows." The

* Brit. Farm. Mag. N. S. vol. iii. p. 300.

† Georg. Lib. i. v. 106-9—

"Deinde satis fluvium inducit, rivorque sequentes."

directions of Columella seem to have all the freshness of a modern age about them. He was the first who noticed the inferior nutrition afforded by the hay from water-meadows. "Land," says he, "that is naturally rich and is in good heart, does not need to have water set over it; and it is better hay which nature of its own accord produces in a juicy soil, than what water draws from a soil that is overflowed. This, however, is a necessary practice when the poverty of the soil requires it, and a meadow may be formed either upon a stiff or free soil, though poor when water may be set over it, neither a low field with hollows, nor a field broken with steep rising ground are proper; the first, because it contains too long the water collected in the hollows; the last, because it makes the water run too quickly over it. A field, however, that has a moderate descent may be made a meadow, whether it be rich, or so situated as to be watered, but the best situation is where the surface is smooth, and the descent so gentle, as to prevent either showers or the rivers that overflow it remaining too long; and, on the other hand, to allow the water that comes over it quietly to glide off; therefore, if in any part of the field intended for a meadow, a pool of water should stand, it must be let off by drains, for the loss is equal either from too much water or too little grass."* Pliny tells us that "meadows ought to be watered immediately after the spring equinox, and the waters restrained whenever the grass shoots up into stalk."† When, after the fall of the Roman Empire, agriculture, in common with all other sciences, rapidly declined, a very remarkable exception to this melancholy result of slavery and despotism was presented in the case of irrigation, which was carried on and extended through the long period of the dark ages, with equal zeal and success. This was more especially the case in Lombardy, where it was certainly prosecuted on a very bold and profitable scale long before 1037. The Princes of Lombardy patronised and followed the example of the various religious establishments, which then monopolized all the wealth and learning of the land, in extending the employment of water in all possible directions. The monks of Chiazevalle, in particular, were so celebrated for their knowledge of this branch of agriculture and of hydraulics in general, that the Emperor Frederick the First, in the thirteenth century, very gladly sought their advice and assistance. This system has ever since been zealously and carefully extended and improved, in every possible way. The waters of the chief rivers of the north of Italy, such as the Po,

* Col. Lib. ii. c. 16.

† Nat. Hist. Lib. xviii. c. 27.

the Adige, the Tagliamento, and of all the minor streams, are employed in irrigation. There is no other country which possesses an extent of rich water meadows equal to that of the Lombards. The entire country from Venice to Turin may be said to be formed into one great water-meadow: yet the irrigating system is not confined to grass lands; the water is conveyed into the hollows between the ridges in corn-lands, into the low lands where rice is cultivated, and around the roots of vines. From Italy the practice extended into the south of France, into Spain, and then into Britain. In the States of Lombardy, the water of all the rivers belongs to the State; in those of Venice, the Government extends its claims to that of the smallest springs, and even to collections of rain water, so highly, for the use of the cultivator, is water of every kind valued in the north of Italy. It is necessary, therefore, in Lombardy, to purchase from the State the water taken from the river; this may be taken by means of a canal through any person's grounds, the Government merely requiring the payment of the value of the land to the proprietor, and restraining him from carrying his channel through a garden, or within a certain distance of a mansion. The water is sold by the Government at a certain rate, which is regulated by the size of the sluice, and the time the run of water is used; this is either by the hour, half-hour, or quarter, or by so many days at certain periods of the year; the right to these runs of water is regularly sold like other property. Arthur Young gives an account of the sale of an hour's run of water through a sluice near Turin, which produced, in 1778, 1500 livres. The rent of the irrigated lands in the north of Italy is, upon an average, more than one-third greater than the same description of land not watered.

In Bengal, wells are dug in the highest part of their fields, and from this, by means of bullocks and a rope over a pulley, water is raised in buckets, and conveyed in little channels to every part of the field. No attempts at cultivation are here made without the assistance of water, obtained by some mode or other. The art of irrigation was not confined to the Old World. The Mexicans practised it long before the days of Columbus; they collected the mountain torrents, and conducted their waters to their lands in proper channels, with much care and address. It was only towards the termination of the seventeenth century that water-meadows were constructed in Britain upon any thing like a regular system. Of these, those in Wiltshire, which are amongst the most celebrated in England, especially those in the Wyley Bourn, were made between 1700 and 1705. Those of Hampshire and Berkshire were constructed about the same period, but they were at first formed very inferior to the modern noble water-meadow lands of those counties. Great improvements were made towards the conclusion of the eighteenth century, through the publications of G. Boswell on Meadow Watering in 1780, and of the Rev. T. Wright of Auld, in Northamptonshire, whose writings appeared at intervals from 1789 to 1810. It is noticeable that the water employed for these celebrated southern meads is perhaps the most clear and swift flowing of all the English rivers,—issuing from the chalk-formation, it is equally copious and transparent. Some of the chief advantages, therefore, of irrigation may evidently be derived from almost any description of water; for it is proved by the good effects produced by the brilliant chalk-waters of the south of England, and the still greater fertilizing effect of those surcharged with organic matter, as in the Craigintinny meadows, near Edinburgh, that there is no water too bright or too full of impurities, to be useless for the purposes of irrigation.

I propose in this paper to investigate the chemical properties of river water, and of the effects produced by it in irrigation, adding a few remarks upon the practice of the best and most skilful cultivators of the water-meadows of the south of England.

1*st*, With regard to the composition of river water, there have been several chemical examinations; that of the Thames was analyzed by Dr Bostock, who found, in 10,000 parts after most of its mechanically suspended matters had subsided, about $1\frac{3}{4}$ parts of foreign substances, viz.—

Organic matters, ...	0.07 parts.
Carbonate of lime, ...	1.53
Sulphate of lime, ...	0.15
Muriate of soda, ...	0.02

In an equal quantity of the waters of the Clyde, Dr Thomson found $1\frac{1}{6}$ part of solid substances, namely,

Common salt,	0.369 parts.
Muriate of magnesia,	0.305 —
Sulphate of soda,	0.114 —
Carbonate of lime,	0.394 —
Silica,	0.118 —

The water of the Itchen in Hampshire is one of the most celebrated of all the southern streams, for the use of the irrigator. I found, in 10,000 parts of its water, about 2¼ parts of solid matter, viz. :—

Organic matter,	0.02 parts.
Carbonate of lime,	1.89 —
Sulphate of lime,	0.72 —
Muriate of soda,	0.01 —

From an examination of the substances found in these streams (and they afford a pretty correct view of the contents of most others), the farmer will see that they all yield ingredients which are the food or natural constituents of the grasses. Thus, sulphate and carbonate of lime are found in most of them, and there is no river-water which does not contain, in some proportion or other, organic matter. To ascertain, therefore, whether pure water was alone able to effect all the magic effects of irrigation, it was necessary to employ other water than that of rivers, lakes, or even springs. Pure water, as obtained by distillation, therefore, has been tried as a supporter of vegetation, but it was found totally inadequate to the support of plants,—they merely vegetated for a time, but they could not, by any means, be made to perfect their seeds. In this conclusion, the experiments of Dr Thomson, and of MM. Saussure and Hassenfratz, entirely agree. Pure water, therefore, notwithstanding the dreams of the Greek philosophers, and the celebrated deceptive experiments of Van Helmont with his willow tree, is not able to support the growth of the grasses.* And yet, it has been shewn, that impure water,

* Van Helmont's tree, when he planted it in an earthen pot, weighed five pounds; the earth, previously dried in an oven, weighed 200 pounds; after five years, it weighed 164 lb., although it had been watered during that time with only rain and distilled water, and the earth had lost only two ounces of weight. Hence, said Van Helmont and his disciples, water is the sole food of plants. Bergman, in 1773, first pointed out the source of error. He shewed, from the experiments of Margraff, that the rain-water contained a

such as that from a sewer or from a dunghill, is alone sufficient to sustain vegetation. This was clearly evidenced in the experiments of M. Lampadius; for he found, that plants placed in a pure earth, such as silica or alumina, although they would not grow when watered with pure water only; yet, that when they were watered with the liquid drainage of a dunghill, they flourished very luxuriantly, and this fact has been also proved in another way. It has been shewn by chemical analysis, that the quantity of solid or earthy matters absorbed by plants, is in exact proportion to the impurity of the water with which they are nourished. Thus, equal quantities of some plants of beans, fed by distilled water, yielded, of solid matters or ashes, ... 3.9 parts.

Those fed by rain-water, . . . 7.5 —

These grown in garden mould, . . 12. —

These facts strongly confirm the conclusions of some of the most sagacious cultivators, that the chief advantages of irrigation are attributable to the foreign substances with which the water is charged, although, as I have elsewhere observed, almost every farmer has a mode of accounting for the highly fertilizing effects of irrigation,—one thinks it *cools* the land, another that it keeps the grass *warm* in winter. And this was Davy's opinion. He thought that a winter flooding protected the grass from the injurious effects of frost. He says, "Water is of greater specific gravity at 42° than at 32°—the freezing point; and hence, in a meadow irrigated in winter, the water immediately in contact with the grass is rarely below 40°, a degree of temperature not at all prejudicial to the living organs of plants. In 1804, in the month of March, I examined the temperature in a water-meadow near Hungerford in Berkshire, by a very delicate thermometer. The temperature of the air, at 7 in the morning, was 43°. In general, those waters which breed the best fish are the best fitted for watering meadows, but most of the benefits of irrigation may be derived from any kind of water."

Such were the opinions of Davy as to the fertilizing properties of water. It is to be regretted that the opportunities for agricultural observations of this great chemical philosopher

sufficient quantity of earth to account for the increased weight in the willow, every pint of rain-water containing one grain of earth. Then, again, the earthen vessel (which was sunk in the earth) would, in this experiment, transmit its moisture impregnated with all kinds of soluble substances.

were so few, for his valuable remarks were always cautiously made. He appears, however, as I have remarked elsewhere, never to have steadily investigated the chemical composition of river-water with regard to its uses in irrigation, and, in consequence, knew little of the value of some of its impurities to vegetation. Thus, if the river-water contains gypsum, sulphate of lime, which it certainly does; if the water is *hard*, it must, under ordinary circumstances, on this account alone be highly fertilizing to meadows, since all grasses contain this salt in very sensible proportions; for, calculating that one part of sulphate of lime is contained in every two thousand parts of river water, and that every square yard of dry meadow soil absorbs only eight gallons of water (and this is a very moderate allowance, for many soils will absorb three or four times that quantity), then it will be found that, by every flooding, more than one hundredweight and a half of gypsum per acre is diffused through the soil in the water, a quantity equal to that generally adopted by those who spread gypsum on their clover crops, lucerne, and sainfoin, as a manure, either in the state of powder, or as it exists in ashes. And if we apply the same calculation to the organic substances ever more or less contained in flood waters, and allow only twenty parts of animal and vegetable remains to be present in a thousand parts of river water, then we shall find, taking the same data, that every soaking with such water will add to the meadow nearly two tons per acre of animal and vegetable matters, which, allowing, in the case of water meadows, five floodings per annum, is equal to a yearly application of ten tons of organic matter.

The quantity of foreign substances present in river water, although commonly less, yet very often exceeds what I have thus calculated to exist in it. I have found it impossible, however, to give, from analysis, the amount which, under ordinary circumstances, is present in river waters, with any tolerable accuracy, since the proportion not only varies at different seasons of the year, but a considerable proportion of the merely mechanically suspended matters subside, when the specimen water is suffered to rest. In my conclusions with regard to the theory of irrigation, I have found many excellent practical farmers concur. Thus, Mr Simmons of St Croix, near Winchester, considers that the great benefit of winter flooding for meadows is derived, in the *first* place, from the deposites made by the muddy waters on the grass; and, *secondly*, from the winter covering with water preventing the ill effects to the grass of sudden transitions in the temperature of the atmosphere. This gentleman is perfectly aware of the value of the addition of the city drainage of Winchester to the fertilizing qualities of the Itchen river water, and of its superiority for irrigation after it has flowed past the city, having water meadows both above and below the town; and he finds that, if the water has been once used for irrigation, that then its fertilizing properties are so materially reduced, that it is of little value for again passing over the meadows; and so convinced is he of this fact by long experience, that, having in this way long enjoyed the exclusive and valuable use of a branch of the waters of the Itchen for some grass land, a neighbour higher up the stream followed his example, constructing some water-meadows, and using the water before it arrived at those of my informant, who, in consequence, found the water so deteriorated in quality (though not sensibly diminished in quantity), that he had once thought of disputing the right with his more upland neighbour. The experience of other irrigators tends to the same conclusion. In the best managed water-meadows of Hampshire, the farmer does not procure annually more than three crops of grass; yet in situations where a richer water is employed, as near Edinburgh, four or five are readily obtained. It is evident, therefore, that the chemical properties of water have a much greater influence in irrigation than is commonly believed. The *quality* of the water, therefore, employed for the purposes of irrigation, is of the first importance to be well understood by the farmer; and although many more modern discussions have taken place upon the subject, yet the definition which the great Lord Bacon gave, in his natural history of the advantages of "Meadow Watering," has never been excelled,—"that it acts not only by supplying useful moisture to the grass, but likewise by carrying nourishment dissolved in the water."* This nourishment is, generally speaking, composed almost entirely of the animal and vegetable matters mechanically suspended or chemically dissolved in the water—the fouler the water the more fertilizing are its effects. It is very erroneous the objection which has been sometimes urged to this explanation, by instancing the prejudicial effects of some *very* thick muddy waters (as those of the Humber), on meadow lands; for, in those cases, the mud deposited on the grass did not consist of animal or vegetable matters, but of fine *earthy particles*, such as clay or chalk, substances of which the alluvial soil, on which the same flood waters had for ages occasionally deposited their earths, was in fact entirely composed, and to which, in consequence, any farther supply was almost useless, the earthy slime merely covering the grass with mud, without adding a single fertilizing ingredient not already abounding in the soil. If, however, the soil is naturally deficient in any of the earthy ingredients contained in the water, then even such flood waters are ever found most fertilizing.

It by no means, however, follows, as a necessary result of any contemplated improvement in irrigation, that the water should previously undergo a chemical examination. There are many other modes by which the farmer can form a pretty correct conclusion, as to the fertilizing properties of the water he proposes to employ.

The surest proofs, says Mr Exter, of the good quality of

* "The agency of water in the process of vegetation," says Mr Stephens, "has not till of late been distinctly perceived. Dr Hales has shewn that, in the summer months, a sunflower, weighing three pounds avoirdupoise, and regularly watered every day, passed through it or perspired twenty-two ounces each day, that is, half its weight. Dr Woodward found that, in the space of seventy-seven days, a plant of common spearmint increased seventeen grains in weight, and yet had no other food than pure rain water; but then he found that it increased more in weight when it lived in spring water, and still more when its food was Thames water."—*Practical Irrigator*, p. 2. And when speaking of the fact, that some irrigators think clear spring water equal to any, he adds (p. 24), "I would recommend to those who are of the same opinion, to inspect the irrigated meadows which are watered by the washings of the city of Edinburgh, where, I trust, they will find the superiority of muddy water to that of clear spring water most strikingly manifested."

water (and the observations of this gentleman will be readily confirmed by the irrigators of the southern counties), as a manure, are the verdure of the margin of its streams, and the growth of strong cresses in the stream itself; and wherever these appearances are found, though the water be perfectly transparent, the occupier of the soil through which it flows may depend, in general, on having a treasure, if he is attentive to it; but that this is not invariably the case, and that there are instances where a good water will not improve the herbage of certain soils, is proved by the following account (and there are several other cases with which I am acquainted) of the meadows of Mr Orchard of Stoke Abbey, Devon. These two meadows are situated on the side of a hill, their aspect nearly south,—the superstratum a fine rich loam, from eight to ten inches deep, on a substratum of strong yellow clay. No difference whatever can be seen by the naked eye, in either the upper mould or the substratum, or in the herbage growing on the surface of them; except that, in the lower part of one, a few rushes appear, in consequence of some small springs which rise near them, but the water from them is not sufficient to render any part of the land poachy. At the head of the two meadows is a large pond, formed by the collecting of some small runs of spring water rising near it, and which is also improved by the wash of a small farm-yard adjoining, which, of course, must add to its efficacy as a manure. When this water is thrown over one of the meadows, it produces the richest herbage in abundance, and this field is regularly mowed for hay; on the other meadow, though repeatedly tried, it produces no good whatever.*

This result is attributable to the superior tenacious, retentive quality of the substratum of the lower field, or of some chemical difference in the composition of the soil; and although almost any description of soil is adapted to the formation of water-meadows, those of a heavy clay description are generally the most unsuitable, those of a light or peaty kind are better, and those with a sandy or very absorbent gravel substratum still more so. There are some of the most cele-

* Ann. of Agric. vol. xxx. p. 206.

brated water-meadows on the banks of the Kennet of this description, and many of the best on the banks of the Wiltshire Avon have a mass of broken, porous flints for a subsoil. Those near Edinburgh, irrigated by the city drainage, rest upon the sands thrown up by the sea.

It is evident, therefore, that it is as important an object in the construction of these meadows to secure a ready and rapid exit for the flood-waters, as to procure, in the first instance, a copious and fertilizing supply.

The farmer is generally well aware of the injurious effects to his meadows of suffering the water to remain too long on them. He watches, therefore, with much care, for the first indications of fermentation having commenced, which is evinced by the rising of a mass of scum to the surface of the water—putrefaction is now beginning in the turf, and he knows very well that if the water is not speedily removed, that his grass will be either materially injured, or entirely destroyed; he hastens, therefore, to open his water-courses. There are some soils in the vicinity of Standen in Berkshire, however, of so porous a quality, that they need not any drains to empty the water-courses; and, in fact, in many instances, the farmer does not even require them: after a few hours all the water is absorbed by the soil; and yet these lands, with hardly six inches of mould above the gravel, are amongst the richest of water-meadows; the roots of the grasses penetrate readily into the *grasses*, and the earliest and sweetest grasses is produced on them.

Almost any description of grass will flourish under proper management in water-meadows. Those whose soils consist of peat resting on sand or on sandy loam, with a substratum of chalk or gravel, generally produce the meadow foxtail (*Alopecurus pratensis*), the brome-grass (*Bromus arvensis*), and the meadow-fescue (*Festuca pratensis*), on the tops and sides of the ridges. The furrows and sides of the drains are usually planted by the creeping-bent, the hard-fescue, the rough-stalked meadow-grass, and the woolly soft-grass. In those water-meadows whose soil consists of a sandy loam on a clay subsoil, the chief grasses are commonly the creeping-rooted soft-grass, the crested dog's-tail, the meadow barley, and the sweet-scented vernal grass. But some grasses change their appearance in a very remarkable degree, when exposed under favourable circumstances to the influence of the flood-waters. This fact is strikingly exemplified in the case of two small meadows situated at Orcheston, six miles from Amesbury in Wiltshire, denominated from their great produce, "the long grass meads." These, says Davis, "contain together only two acres and a half, and the crop they produce is so immense, that the tithe hay of them was once sold for five guineas." Much discussion took place amongst the Wiltshire farmers as to the nature of the crop of these meads, before it was at last shewn that the greatest part of their herbage consisted of nothing else than the black couch, or couchy-bent, the *Agrostis stolonifera*, one of the worst of the grasses or weeds which haunt the poor ill cultivated arable soils.*

It is a very general, as well as correct conclusion of the English farmers, that the grass and hay of water-meadows is not so nutritious as that of the permanent pasture lands. The difference, however, is not so great as is commonly supposed. The late Mr George Sinclair determined this experimentally, and he is no mean authority with regard to all that relates to the grasses.

He obtained from the rye-grass (*Lolium perenne*), at the time of flowering, taken from a water-meadow that had been fed off with sheep till the end of April, of nutritive matter, 72 grains; and from the same weight of this grass, taken from a rich old pasture, which had been shut up for hay about the same time, 92 grains.

From the same grass from the meadow, that had not been depastured in the spring, 100 grains. And from the same grass, from the pasture which had not been fed off, 120 grains.

All the grasses, in fact, where their growth is forced by the application of either liquid or solid manures, are found to contain nutritive matter in diminished quantities:—this, too, was determined by Sinclair.

From four ounces of a very rankly luxuriant patch of rye-

* We have seen immense crops of hay, said to amount to 600 stones per Irish acre, obtained from this weed, on the peat-earthy soil along the margins of the Grand Canal in King's County, Ireland, and both cattle and horses were exceedingly fond of this hay.—EDITOR.

grass, on which a large portion of cow-dung had been deposited, he obtained, of nutritive matter, 72 grains.

From the same quantity of the same grass, growing on the soil which surrounded this luxuriant patch, he obtained 122 grains.

And, in a second trial, the same species of grass, on a soil entirely destitute of manure, afforded, of nutritive matter, 95 grains.

On the same soil, excessively manured, the grass afforded only 50 grains.

In these experiments, the plants were of the same age, and were examined at the same stage of their growth.*

With regard to the construction and management of water-meadows, there are many practical works of the highest authority† to which the farmer has ready access, and, in the following observations, therefore, I shall merely very briefly paraphrase the accounts given by Mr Davis and others of the practice of irrigation in the southern counties. In this, however, even since the time that Davis wrote, there has been a great and steady improvement. The land is better levelled, the slopes more evenly preserved, the water-way, aqueducts, and hatches, better constructed, and in many of the more recent improvements, in the valley of the Itchen in Hampshire, the sliding-water doors are regulated by a cogged wheel turned with a movable winch, so as to render them safe from alteration during the absence of the meadow-keeper.

The management of the Wiltshire and Hampshire water-meadows, as well as it can be briefly described, is as follows:—In the autumn, the after-grass is eaten off quite bare, when the manager of the mead (provincially the *drowner*), begins to clean out the main drain, and the main carriage, and to "right up the works," that is, to make good all the carriages and drains which the cattle have trodden in, so as to have one tier or pitch of work ready for drowning. This is immediately put under water, whilst the drowner is preparing the next pitch.

In the flowing meadows, this work ought to be done if possible early enough in the autumn to have the whole meadow

* Hortus. Gram. 384.

† Stephens's Practical Irrigator. Brown's Rural Affairs, p. 263. Sinclair's [illegible] p. 382. Davis's Wiltshire. Driver's Hampshire.

ready to catch the first floods after Michaelmas; the water, being the first washing of the arable lands on the sides of the chalk hills, as well as of the dirt from roads, is then thick and good; and this remark as to the superior richness of the flood waters, is one that is commonly made in Berkshire and other parts of England. The length of the autumnal watering cannot be precisely stated, as much depends upon situations and circumstances; but if water can be commanded in abundance, the custom is to give meadows a "thorough good soaking at first," perhaps for a fortnight or three weeks, with an intermission of two or three days during that period; and continues for the space of two fortnights, allowing an interval of a week between them. The works are then made as dry as possible, to encourage the growth of the grass. This first soaking is to make the land sink and pitch close together, a circumstance of great consequence, not only to the quantity, but to the quality of the grass, and particularly to encourage the shooting of new roots, which the grass is continually forming, to support the forced growth above.

While the grass grows freely a fresh watering is not wanted, but as soon as it flags, the water must be repeated for a few days at a time, always keeping this fundamental rule in view, "to make the meadows as dry as possible after every watering, and to take off the water the moment any scum appears upon the land, which shews that it has already had water enough."

Some meadows that will require the water for three weeks in October, and the two following months, will not, perhaps, bear it a week in February or March, and sometimes scarcely two days in April and May.

In the catch-meadows, which are watered by springs, the great object is, to keep the works of them very dry between the intervals of watering; and as such situations are seldom affected by floods, and generally have too little water, it is necessary to make the most of the water, by catching and rousing it as often as possible; and as the upper works of every pitch will be liable to get more water than those lower down, a longer time should be given to the latter, so as to make them as equal as possible.*

* Davis's Agriculture of Wiltshire, p. 125-7.

In Berkshire they first flood their water-meadows about Michaelmas; these are situated principally on the banks of the Kennet. The first flooding they deem the richest in quality: this they keep on the land for about four days, then they dry them for about a fortnight, and then the water is let on for three or four days more; those meadows which are the most readily dried are the most productive. There are none more so, in fact, than those which have a porous, gravelly, or broken flint bottom, from which the flood-water readily escapes, almost without drains. They begin to feed their meadows with sheep about the 6th of April, and continue feeding till about the 21st of May, when the meadows are again flooded for a crop of hay; the land is then flooded and dried alternately for three days until hay-time.

The number of acres of land in Wiltshire under this kind of management has been computed, and with a tolerable degree of accuracy, to be between 15,000 and 20,000 acres. Some considerable additions, however, have been made to the water-meadows of the district since this calculation was made.* About the same number of acres are formed into water-meadows in Berkshire, and a still larger number in Hampshire. No one has attended more carefully to his water-meadows than Lord Western; on some of those situated on the London clay-formation in the Blackwater Valley in Essex, a soil of all others, perhaps, from its tenacity, the least adapted to their successful formation, and his testimony is very important: "There is an old adage," says his Lordship, "that water is the best servant in agriculture, and the worst master. Water has in itself intrinsic value,—distilled through chalks, lime, or marl, it acquires a portion of their qualities, though preserving the most perfect transparency, and coming down in torrents and floods, it carries along the finer particles of earth and manure from the mountains, or higher grounds, into the valleys; hence, of course, it is that the valleys derive their fertility, and the value of the meadow has been originally created by an accumulation of wealth from the hills."†

In descending the Jura mountains, which divide France

* [illegible] Vol. VIII. p. 122.

† [illegible] Improvement of Grass-land, pp. 14, 23.

from Switzerland, the very first pasture you find on the descent evinces the value placed on the mountain floods by the inhabitants of those districts; and, accordingly, every stream is sedulously directed and conducted over the pastures in a most skilful manner. The very washing of the roads in hasty rains, is also attended to and applied to the same purposes." This system of catching the uncertain flood-waters, is known amongst farmers by the name of *catch*-work, and though highly valuable, yet they deem it infinitely less important to them than irrigation, which is watering (generally five or six times a-year) from a certain and ever-accessible head of water, as a river, &c. And yet Lord Western's testimony is decisive in favour of even one *catch*-flooding, for he observes, when speaking of the expense of constructing the requisite little channels to disperse the flood-waters over the grass—"In many cases it will be trifling, in some cases considerable, but when the farmer reflects that one winter's flooding will do more in *many*, I say in most cases, than thirty loads an acre of the best rotten dung manure, that can be laid upon his grass lands, he can hardly shrink from some considerable expenditure." If, then, the effects even of a *catch*-flooding with water are so great, how infinitely superior are the advantages capable of being derived from a regular constant supply of the enriching foul waters, like those issuing from the drains of a large city, and which is even now most successfully employed near Edinburgh, and utterly worse than wasted in the case of London! Whatever may be the value, in an agricultural point of view, of the solid contents of the London sewers, yet, to me, the absolutely liquid portion, for the purposes of irrigation, appear at least equally important.

There is no agricultural question, therefore, more important in a national point of view, than that of the improvement of the soil by the practice of irrigation; for, in its prosecution, all the rich organic and other matters diffused through the rivers, are saved to agriculture, which would otherwise be carried into the sea. This is not, therefore, a question like that attending most other modes of fertilizing the soil, merely one of transposing the manure from one field or district to another; but it is the absolute recovery, as it were, from the ocean, of a mass of finely divided enriching subst stantly draining from the land. It is the effectua of a stream which is ever steadily impoverishing all soils, and which unnoticed, and in too many instar ed worthless, gliding into the ocean, is almost the back to the steadily increasing fertility of our coun

---

ON AGRICULTURAL IMPROVEMENTS.

Upon the subject of agricultural improvements, s already been written, that it would seem almost In the following observations, therefore, I do not bring out any thing new: my object is rather to the impression of its importance; and, more espec rect attention to the intimate connection existir landlord and tenant, in all operations of the kind.

The agricultural community seem now to be av importance of the subject. Thorough-draining, trench ploughing, are becoming more extensivel every year, and in those places where they have duced, the result has proved, that no investment gives a greater or more immediate return. Still of which any one may be convinced who will tr the country, that these very profitable operations means proceeding with that rapidity which the m ments held out would lead us to expect; nor is t all cases executed in such a manner as to insure a improvement of the land. In every district of S see large tracts of fine land destroyed by wet, and there are no symptoms of improvement. Inquire mers, why they are not improving? One will te know it would pay to drain, but my lease is nearl Another, "That he has not sufficient capital." "That the expense is too great for a tenant." various answers all tend to prove, that the chief c provements not being general, is the want of co-op tween landlord and tenant. Were the former alwa neither the duration of leases, nor the expense, wc neral, have the slightest effect. Improvements would proceed with equal rapidity at the termination as at the commencement of leases; and the execution of the work would always be of the most efficient kind. Now, this want of co-operation may frequently be traced to the difficulty of fixing the share each ought to bear of the expense. Both parties are probably disposed to take rather a partial view of the relation in which they stand towards each other, and to overlook this important fact, that in almost all improvements their interests are inseparably united, and that the greatest benefit can result only from the parties uniting, and each bearing a share of the expense proportionate to their interest in the concern. In order to induce co-operation, a line of distinction has sometimes been drawn between that species of improvement, which may be termed *temporary*, and which will generally be executed by the tenant, amd that which is permanent, and to the proper execution of which the assistance of the proprietor is essential. It may, however, be proper to notice, that these terms, *permanent* and *temporary*, as applied to agricultural improvements, have no definite signification; and it may be necessary, therefore, before proceeding farther, to give a short explanation of them.

These terms bear evidently a *relative*, as well as a *positive* signification. They are *positive* only in the case of a proprietor who farms his own land. To him having a perpetual interest in the property, it is evident that the permanency of all improvements is in exact proportion to their duration. In the connection, however, of landlord and tenant, they bear strictly a *relative* signification, becoming *permanent* or *temporary*, not in proportion to the duration of *improvements*, but to the duration of *leases*.

Improvements may be said to be of a *temporary* kind, when the tenant has time and opportunity to reap the whole benefit of them during the existence of his lease; and *permanent*, when he cannot reap the whole, but must leave to his successor a part of the benefit. Hence, what is permanent to a tenant on a lease of ten years, may be temporary to one on a lease of nineteen. And, in like manner, what constitutes permanency to one of five, may be temporary to one of ten, and so on. Or, in other words, on a lease of the shorter duration, it may be for the interest of a proprietor to bear a part of the expense upon certain improvements; when he would be throwing away his money by joining in the case of the longer period. For example, to a tenant for one year, every thing may be said to be permanent but *seed* and *labour*. Dung, the least durable of ameliorators, in such a case, is permanent, because the tenant has not the power to reap the full benefit; and his successor, being interested in the quality of the manure, and the manner in which it is applied, if he look to his real interest, ought to bear a part of the expense, rather than allow this operation to be insufficiently executed. But dung, to a tenant on a lease of five years, becomes temporary, and his successor would not be justified in paying any part of it, because its duration is not supposed to exceed that time. In the case of lime, too, it may become the interest of a proprietor to assist his tenant upon a short lease, by which the latter might be enabled to pay a much higher rent. Hence the practice in many counties of England, when land is let either from year to year, or upon very short leases, of having a fixed valuation for different improvements, estimated according to their duration; so that a tenant may, with confidence, execute the most permanent improvements, because he is assured of repayment, either by retaining his possession, or by receiving their value, should he be obliged to quit.

Having thus given an explanation of these terms, we can easily understand that every improvement, so far as a tenant is concerned, may be either permanent or temporary. And by applying it to leases of—say from fifteen to twenty years' duration, it at once points out what strictly may be denominated permanent improvements; and to the proper execution of which, the assistance of the proprietor is essential. It is evident that, in leases of such duration, no manures, whether vegetable, animal, or mineral, nor any partial draining, ought to be classed under the head of permanent improvements; and it must be peculiar, not general cases, in which a proprietor would be justified in giving any assistance to his tenant. Those only should be considered such, whose duration far exceeds the endurance of an ordinary lease, and of these the chief are, *building*, *planting*, *enclosing*, *roads*, and *thorough-draining*, which, if well executed, may be supposed to extend over a period of almost a century; and hence, over the execution of which, the proprietor ought invariably to have a control.

At present, however, we shall confine our observations to the last, viz. thorough-draining, and inquire how far a proprietor is interested in this operation. The question is not whether draining gives an adequate return for the outlay of capital; of this there can be no doubt. Upon wet land, no sheep-stock can with safety pasture, nor can almost any benefit be derived from eating turnips upon the ground. The expense of culture too, as well as that of manure, is much greater upon wet than upon dry ground. And I may add another important fact,—that of dry and wet ground *naturally alike* in quality, the latter, when made dry, becomes superior to the former, requiring for many years less manure, and being by no means so liable to suffer from long continued droughts. There can, therefore, be no doubt, that upon a lease of an ordinary duration, even a tenant, defraying the whole expense himself, will be amply repaid by thorough draining.

By the mode of executing the work, however, this may be made either a permanent or temporary improvement; and as the interest of a farmer is only temporary, the work, if executed at his expense, will, in all probability, be of the most superficial kind. It becomes, therefore, an important subject of inquiry, whether both landlord and tenant would not be more benefited by joining and each bearing a share of the expense, in proportion to their relative interests, and thus effecting an improvement which might extend over a period of almost a century.

Draining, though the first and most important improvement, is, over a large extent of land in Scotland, only one step towards further improvement by means of deep ploughing, whether with the subsoil or trench plough, and without which, the land cannot be brought into its utmost state of fertility. If, therefore, by the mode of executing the first, all ulterior improvement be stopped, the present occupier is no doubt benefited ; but, then, the property itself will be permanently injured, and such will be found, in very many cases, to be the effect of draining, as executed to serve merely the temporary purpose of a tenant.

Separating, therefore, in idea, what ought never to be done in reality,—the interest of landlord and tenant,—I would say, to drain for a landlord, nothing should be withheld that can add to the durability of the work, and secure the ultimate improvement of the land, by means of deep ploughing : to drain for a tenant, only as much should be done as will dry the ground, and make the drains effective until the expiry of his lease.

In order to give a practical view of the subject, I shall describe the two modes of executing the work, with the probable expense of each. *First*, then, we shall describe the method and expense of executing tile-draining. According to the best practice,—or that which should be adopted by a proprietor,—the depth ought to be thirty inches, soles ought always to be used, and over the tiles should be put from ten to twelve inches of gravel or stones of a similar size, thus leaving a sufficient depth for the operation of the subsoil or trench plough. When the soil is retentive clay, it may be necessary to fill the space above the gravel with porous earth, to within a few inches of the surface of the ground, to admit the free filtration of water into the drain. The expense of this will, of course, vary a little according to circumstances. I shall, however, assume the following to be a fair average rate. Supposing, by the frequent drain system, that the drains are twenty-four feet apart, which is at the rate of 600 yards per English acre, the charge will be—

For cutting, ...	L.1	17	6
[illegible]00 tiles, at 3s. 6d. per 100, . .	2	12	6
Carriage 10 miles, . . .	0	18	0
1500 soles, at 1s. 9d. per 100, . .	1	6	3
[illegible]riage 10 miles, . . .	0	12	0
[illegible]ing, ...	0	4	0
[illegible] cubic yards of gravel, quarry rubbish, or broken stones, including carriage, at 11d.,	1	3	10
[illegible]lling in [illegible], .	0	4	0
	L.8	18	[illegible]

Again, according to the worst practice, or that which may be adopted by a tenant merely to serve his own purpose, the depth may be from eighteen to twenty-four inches, and neither soles nor gravel used. The expense of this will be—

For cutting, ...	L.1 5 0
1500 tiles, at 3s. 6d. per 100, . .	2 12 6
Carriage 10 miles, . . .	0 18 0
Laying, ...	0 4 0
Filling in earth, ...	0 4 0
	L.5 3 6

We shall next describe the mode and expense of executing stone-draining. Adopting the best practice, the depth of drain ought to be from thirty-three to thirty-six inches, the width at bottom seven inches, and filled with stones to within eighteen or twenty inches of the surface of the ground. At least twelve inches of these stones ought to be of nearly a uniform size, none exceeding four inches in diameter, and the remaining three or four inches of small gravel, or stones of a similar size, properly levelled and beat down, so as to form a close and compact surface through which no earth can pass. The expense of this must, of course, vary considerably in different situations; but when quarries are not beyond an average distance of half a mile, the following may be assumed as a fair price for 600 yards.

Cutting, ...	L.2 10 0
55 cubic yards of stones, quarried, broken, and filled into the carts, at 9d. per yard, .	2 1 3
Carriage and disloading per yard, 9d. . .	2 1 3
Levelling, filling in earth, &c., . . .	0 16 0
	L.7 8 6

Again, according to the worst practice, the depth may be from twenty-four to twenty-eight inches, the former for clay soils, the latter for soils of a more porous nature, and filled to the height of twelve inches with stones broken as above, and properly levelled on the surface. The expense of this may be—

For cutting, ...	L.1 10 0
30 cubic yards of stones, quarried, broken, and filled into the carts, at 9d. per yard, .	1 2 6
Carriage and disloading at 9d. per yard, .	1 2 6
Levelling, filling earth, &c., . .	0 11 0
	L.4 6 0

In regard to these two methods, I may remark, that, having practised both, I have found the *immediate* result to be much the same. In both cases, the ground has been dried and I have no doubt, to secure merely the temporary purposes of a tenant, that the one will prove as effective as the other.

Supposing, again, that, in the expensive case, the proprietor bears the whole expense, the tenant paying interest at the rate of 6 per cent. per annum, and in the other, that the tenant, bearing the whole expense himself, ought to receive at least 10 per cent., to be repaid before the expiry of his lease, the annual charge against the farm will be found, in both cases, to be nearly the same; and to a tenant possessing sufficient capital, it will be a matter of indifference which is adopted. In either case, he will be amply repaid. To a proprietor, however, it is by no means a matter of indifference. In the former case, he receives not only a large return for his capital during the existing lease, but the most important step is taken towards a thorough and permanent improvement of the ground. In the latter, admitting that the tenant possesses the requisite capital, he cannot, with any hope of being repaid, effect a thorough drainage of a large extent of wet land, and, at the same time, apply the trench or subsoil plough. He, therefore, very properly adopts the cheapest mode of drying his ground, by making the drains no deeper, and using no more materials, than merely to serve his purpose during his temporary possession; knowing that, even independently of occasional failures, he will receive an immediate and large return.

We now come to the important inquiry,—I should say, to a proprietor the only important inquiry,—What will be the condition of the farm, in both cases, at the termination of the existing lease, or when again in the market? The answer [illegible] the improvements have been executed at the expense of the tenant, admitting that the drains are still operating, no future tenant, knowing the manner in which the work had been executed, would take the farm for another lease trusting that they would continue effective during that time; and further improvement, moreover, by means of trench or subsoil ploughing, is completely stopped. In the other case, it is guaranteed as a farm, not only perfectly dry, but prepared to undergo any improvement, which a tenant of skill, enterprise, and capital, may think proper to exercise upon it. In the former case, it is certain that a very small, if any, increase of rent could safely be given for the farm; in the latter, we have no reason to doubt that the statements which have been made on the subject of thorough draining would be fully realized, and that the rent of much of the land in Scotland would be doubled, and, in some instances, quadrupled.

A very proper question may now be asked, How are proprietors to effect this much-to-be-desired object—the thorough improvement of their estates? Themselves unacquainted with the subject, who are to be entrusted with the management of the work?

In answer to these questions, I may remark, that when a proprietor who is not a practical agriculturist resolves to improve his estate, the work should be entered upon with the greatest caution. By hastily and imprudently commencing extensive operations, or by giving assistance to tenants without having previously fixed upon proper plans of improvement, and then discovering that their properties are not permanently benefited, many proprietors have resolved not again to engage in works of the kind. Such resolutions, I know, have followed the outlay of considerable sums. But the failure is owing to the *practice*, not the *principle*, being wrong.

As land may be deemed an article of commerce, both the proprietor and the cultivator of the soil expect to receive an adequate return for capital invested. Hence, every proprietor is as well entitled to receive a fair rate of interest for capital invested in improvements, by which the land is increased in its annual value, as he is for that which was invested in the purchase of the land itself. It should, therefore, be adopted as an invariable rule, never to lay out money upon improvements without being certain (that is, as certain as the nature of the speculation will admit of) of receiving a fair return, either immediate or prospective. And, in order that he may not blindly enter into the speculation, he ought, if not a competent judge himself, to appoint one in whom he has confidence, to report as to the plan of improvement; but, even with all the information he can obtain in this way, in order fully to satisfy himself, it would be advisable that he undertake an operation of the kind upon a small scale, and lay out say L.50 or L.100 in effecting a thorough improvement of a piece of ground, and the result will, in one season, prove whether the speculation is likely to be a paying one or not.

This naturally leads to another question. Assuming that land will give an adequate return for capital invested in improvements when let on lease, what portion of the outlay ought the tenant to bear? To this no precise answer can be given. Of the various plans of dividing the expense which have been suggested, that of the proprietor laying out the money, and the tenant paying a certain rate of interest, has not only the advantage of simplicity, but gives to the proprietor, whose chief benefit is to be derived from the permanency of the improvement, the power of executing the work in any way he thinks proper. And in regard to the rate of interest, six per cent. has been stated as a fair return; and, no doubt, taken as an average rate, it may be perfectly fair. But it is quite evident that, in practice, this must be varied by many collateral circumstances; such as the length of lease—and the nature of the land upon which the improvement is proposed to be effected. Upon land of naturally good quality requiring nothing more than draining, by which an immediate return would be obtained, a tenant may, with [illegible] the highest rate of interest; and on the [illegible] tenant to apply the trench-[illegible] [illegible] stones, and execute other expensive [illegible] bring the land into a proper state of cultivation, [illegible] the return to the tenant as well as to the pro-[illegible] be prospective, and hence in justice, a very small, [illegible] interest should be paid for several years. I may, however, remark, that upon this subject some very erroneous opinions have been formed. It is alleged by many, that, as this species of improvement yields a large return, therefore the proprietor, who does the whole at his own expense, ought to receive a rate of interest in proportion to the probable return. Now, this would be correct reasoning if the tenant had no choice, but either to accept of the proprietor's money or allow his land to remain unimproved. But, as the tenant has the power of doing the work himself, it is evident that the rate of interest ought to depend altogether upon the *amount of outlay and the number of years he has to be repaid.* We shall, by way of illustration, take an example :—Suppose that I take a farm on a lease of nineteen years, and that it can be drained in either way at the expense which I have formerly stated; suppose, also, that during eight years I can complete the drainage of the farm, I have thus a period of fifteen years to be repaid. Now, according to the estimate already given for the draining of it to serve my purpose, the cost might be, in round numbers, L.4, 10s. per acre, or L.450 per 100 acres. The question, therefore, with me would be, what sum should I receive annually during the fifteen years, to be repaid the sum of L.450 at five per cent. compound interest? Without entering minutely into the calculation, we shall take it at ten per cent. or L.45 per annum. Now, if the proprietor, instead of allowing me to execute the work in a superficial manner, chooses to do it himself at the outlay of L.7, 10s. per acre, or L.750 per 100 acres, on condition that I pay a certain rate of interest, it is quite evident that the rate which I should pay, does not depend either upon the sum laid out by the proprietor, or upon the increase of produce resulting from the improvement, but upon the sum it would have cost me had I done it myself; hence I would ascertain the rate of interest thus :—

As L.750 : L.45 : : L.100 : L.6

the per-centage I ought in justice to pay.

In regard to the last question. Who is to be intrusted with the management of the work? Viewing it as a general question, the answer would be, to appoint a strictly neutral person. But when a landlord and tenant understand each other, the latter can evidently do it most advantageously, and as a further security to the proprietor, a mutually paid superintendent may be appointed who would see that no part of the work was insufficiently done.

AGRICULTURAL CHEMISTRY.—NO. VII.

By Henry R. Madden, Esq., M.D., Edinburgh.

According to the order laid down in our last number, we shall now proceed to the consideration of *Ashes*. The various kinds of ashes used as manure may be comprehended under the two following divisions; viz. 1. Ashes derived from recent vegetables; 2. Ashes derived from vegetables which have undergone considerable alteration, dependent upon time, pressure, &c., and have by these means been converted into the well known, and extremely useful substance, *Coal*.

I. *Ashes derived from recent vegetables*. These result from the burning of weeds, dry leaves, hedge-clippings, and, in fact, all kinds of vegetable rubbish which the farmer cannot conveniently form into compost. Their constitution will, of course, vary with the nature of the substances from which they are derived, but, notwithstanding this, they possess many *constant* properties which render them of considerable importance to the agriculturist. When any vegetable substance is burned, the whole of the oxygen, hydrogen, and nitrogen which it contains is dissipated, together with a greater or less proportion of the carbon, according to its more or less complete exposure to air during combustion. The existence of carbon in the ashes depends upon the fact, that plants require a considerably greater quantity of oxygen gas to convert *all* their carbon into carbonic acid, than they contain naturally; as, therefore, this extra quantity must be derived from the atmosphere, it is evident that the proportion left undissolved will depend inversely upon the quantity of the air brought in contact with the burning mass. Ashes are consequently composed of all the fixed saline ingredients of the plants from which they are derived, together with more or less carbon. In addition to which, when produced by burning heaps of vegetable rubbish, they frequently contain humic acid, derived from the *partial* decomposition of those portions of the heap which are least exposed to the flames. On account of their possessing the above constitution, it is evident that their utility as manure will depend upon the following circumstances :—1. Since they contain saline matter derived from plants, it is evident that they can in their turn supply other plants with these valuable ingredients ; but since all vegetables do not possess precisely the same saline constituents, and as the ashes used for manure are seldom, if ever, derived from the same species as those to which they are applied, but, on the contrary, from weeds, hedge-clipping, &c., it follows that they will not be capable of supplying those salts which are *specific* to the various cultivated crops : On the contrary, however, all those saline substances, which are common to most plants, and which constitute by far the greatest proportion of the whole earthy matter that they possess, are contained in, and hence can be supplied by, ashes from whatever vegetables they may have been derived ; and, moreover, having been already absorbed by plants, it may be supposed that they will be in a sufficiently minute state of division to admit of their reabsorption. 2. Another circumstance which renders ashes peculiarly useful as manure is, that they always contain a considerable quantity of *vegetable alkali* (*carbonate of potass*), derived from the decomposition of various combinations of potass with vegetable acids, which exist in nearly all plants. This alkali will serve a double purpose. It will, in the first place (when mixed with the soil), act upon, and combine with, a certain portion of insoluble organic matter, and thus render it capable of absorption ; and, in the second place, when taken up by the roots of the plants in combination with organic matter, will be *retained* by them in order to form those various combinations with vegetable acids already alluded to, as existing in the majority, if not in all vegetables.

As we have had occasion to refer to the use of both *mineral* and *vegetable alkali* (the *carbonates of soda* and *potass*) as manure, it will be interesting to point out an important difference which exists between the two in their mode of action, not so much from its being of any great practical importance, as from its pointing out some of those very intricate changes which are constantly occurring in nature, and a thorough knowledge of which may, as science advances, be of the utmost consequence in rendering certain those all-important circumstances which are at present involved in such great obscurity. If we examine carefully the constitution of the earthy particles of plants, we shall find that, whereas potass is of almost constant occurrence, soda, on the other hand, is but rarely met with, and, when it does exist, it is almost always in the form of muriate of soda (common salt). For this reason, therefore, carbonate of soda, which, as we have already seen, is denominated *mineral alkali*, on account of its occurring much more frequently and abundantly there than in the organic kingdom, whether vegetable or animal, can of itself be of no direct value to any plants, except to those few which contain common salt. Its sole action is, therefore, confined to the preparation of food *in the soil.* Potass, again, not only performs this office, but is itself so constant an ingredient of plants, that it supplies them, in addition to *organic* food, with a very valuable part of their *mineral* constituents. Were we to content ourselves with the above fact alone, we should, of course, conclude that carbonate of potass was a far more valuable substance to the farmer than the same salt of soda. Unfortunately, however, few of the operations of nature are so unconnected as to admit of so simple an explanation; for if we look more carefully into the subject, we shall find that, all things considered, carbonate of soda is in fact the most valuable to the agriculturist for the following reasons :—*First,* As soil always contains a considerable quantity of decaying vegetable matter, it must at the same time be always supplied with potass in some form or other. *Secondly,* As by far the most important office (as regards extent at least) which is performed by either of these substances, is its chemical action upon the organic matter of the soil, it follows that the one which is most efficacious in this respect will be the most valuable as manure. The result of examination here is decidedly in favour of carbonate of soda; 1. Because it is more efficacious, in the proportion of 32 to 48, in dissolving organic matter: and 2. From the fact of soda being of little or no value to the plants themselves, all that is absorbed in combination with the food will be returned to the soil by the process of excretion, and will consequently be capable of performing again the same office, viz. rendering soluble the undecomposed portions of the organic contents of the surrounding soil.

Before leaving the subject of vegetable ashes, I must refer to one point more, namely, that, as the ashes used for manure are frequently derived from burning weeds, if these weeds happen to possess any *specific saline* constituent of uncommon occurrence, the employment of their ashes as manure will tend to increase their quantity, and, consequently, render the land fouler. I am not aware that this circumstance has ever been remarked, but, should it have been so, I should feel particularly obliged by any of my practical readers letting me know the fact, at the same time specifying the particular weeds which are thus produced; for, if we discover the *cause* of any thing of this kind, it is rarely that we have much difficulty in suggesting a remedy.

II. *Coal Ashes.* These are seldom used alone, but are much more frequently applied in combination with various other refuse matters obtained from towns, and will, consequently, be more conveniently examined under the head of composts.

I may, however, mention here, one serious objection which applies to all manures that contain any considerable portion of coal-ashes, namely, their very inconvenient form. When coal is burned, those portions which are strongly impregnated with iron and other metallic ores are converted into hard *porous* masses, which possess the power of absorbing a considerable quantity of fluid, and consequently, when they are mixed with the soil, become, in time, saturated with *soluble organic matter*, which is thus, for a time at least, rendered completely useless to the crop, as the tender fibrils of the roots are easily turned aside by any resisting medium, and, consequently, are not at all likely to push themselves through the pores of a cinder. It is true that, during wet weather, the soluble organic matter will be washed out into the soil below: but, nevertheless, there can be no doubt that few substances possess a more inconvenient form for manure than that now under consideration, and if used in large quantities for a series of years, would undoubtedly alter completely the texture of the soil. This last-mentioned fact should lead us to conclude that manures containing coal-ashes would, upon the whole, be far less objectionable upon strong clays than on lighter soils, as they would tend to make the texture more open. Unfortunately, however, the manure which contains them in greatest quantity, viz. *Police manure*, will be found most suitable to those crops which thrive best upon sandy soils.

Soot. All farmers seem agreed in considering this substance in the light of a valuable manure; it is, however, one of those whose action is as yet involved in great obscurity. It is composed of the various volatile saline matters derived from the burning of coal, together with a considerable quantity of carbon and other substances, mechanically carried off in the form of smoke. From several experiments which have been made with this substance, it would appear that soot owes its fertilizing properties to its soluble matter chiefly, that is to say, that the carbon and other undissolvable matters are of little or no consequence. Those portions which are capable of solution are chiefly saline, and consist of the carbonate and sulphate of ammonia, together with a small quantity of a substance described as *bituminous matter*, but which will, most probably, consist chiefly of humic acid, or some analogous compound. Sir Humphrey Davy has proved practically the fact that carbonate of ammonia is useful as a manure; and the sulphate will also be of value, most probably after having undergone decomposition, and by this means having produced an additional supply of its carbonate. It is extremely difficult, however, to explain the manner in which this salt acts, but the most probable conjecture is undoubtedly that it performs a similar office to saltpetre, viz. *stimulating the roots*, and thus rendering them more active in the performance of their important functions. It is curious enough that both these substances, viz. nitre and soot, possess the property of making the blades of the various cereal grasses assume a dark green [illegible]ur, which we know is generally considered as a proof of [illegible] vigour; this fact, therefore, evidently favours the idea of the[illegible]ing the part of stimuli. [illegible] not be denied, [illegible] that the action of soot, nitr[illegible] similar manures, are still wrapt in the greatest obscurity, and it is to be hoped that some well qualified individual may be tempted to examine carefully into the subject, as I feel convinced that its investigation would, in all probability, be rewarded by the discovery of many interesting particulars regarding some points in the economy of vegetable life, which are as yet but very imperfectly understood.

III. *Composts.* Under this head I shall make a few observations upon three different composts. 1*st*, The compost of coal-ashes with the various refuse matters obtained from towns, and which in this neighbourhood is denominated police-manure. 2*d*, Upon the composts formed by the collecting together of all the useless matters occurring in farms, and rotting them by means of lime. 3*d*, Upon the compost of peat with lime, or farm-yard-dung, or both.

1. With regard to *police-manure*, or that consisting of all the varied refuse matters of large towns. To give any thing approaching to an accurate analysis of this substance would be obviously impossible, as, from its very nature, it is evident that no two specimens can possess precisely the same constitution. It is, however, by no means difficult to point out the substances to which it owes its fertilizing powers; there are, first and foremost, the *human ordure*, which it contains as a constant ingredient; and secondly, the carbonate and sulphate of lime, derived from the coal-ashes. It is the former of these ingredients which gives to police-manure its chief value; and from the highly azotised nature of this *ordure*, it results that the effects produced by the manure will depend directly upon the proportion of this substance; unfortunately, however, it exists in but a very small proportion, a few per cent. only in general. As to the sulphate and carbonate of lime, they are of course useful, as we have already shewn, but still are not of themselves sufficiently valuable, to render a manure eligible merely because it contains them; besides the above substances, sulphur occurs in pretty considerable quantity, and thus renders this manure much more useful for turnips than it otherwise would have been. On the other hand, police-manure contains iron in large quantities, a considerable proportion of which is in a state very liable to become soluble, in which state I have already repeatedly shewn that it acts as a power-

ful poison to plants. Taking all these circumstances into consideration, therefore, in conjunction with its inconvenient form, and the great quantity of useless matter which it contains, I think we may conclude that its chief recommendation is the facility of obtaining large supplies, without incurring any great expense.

2. Composts produced by adding lime to the various refuse matters of the farm. These consist chiefly of weeds, hedge-clippings, dry leaves, &c., in fact, the same substances which I before mentioned as furnishing ashes. When any vegetable matter is mixed with lime, the same series of decomposition take place, as those mentioned in No. V. of this series when speaking of the action of lime as manure,—by this means soluble manure is formed, the original texture of the vegetables is destroyed, and there results a mass of putrid organic matter in a condition capable of being absorbed by the spongioles of the roots. Composts of this sort must, therefore, be only useful as manure, from the following circumstances:—(1.) It will contain all the saline matters possessed by the plants themselves, and will therefore, in this respect, be equally valuable with ashes. (2.) It will, in addition, contain most of the organic matter which existed in the various substances composing the heap, and will, consequently, in this respect, be *superior* to the ashes before mentioned. We may hence conclude that, in point of fact, this compost will contain more manure than the ash es. It certainly will be inferior to them in one respect, namely, that it will contain no *carbonate of potass*, but still it always contains an excess of lime which, as far as *chemical* action is concerned, will be equally valuable. So many collateral circumstances, however, must constantly occur, which will influence greatly the farmer in his choice between the two methods of using his refuse vegetable matter, namely, burning them for ashes, or forming lime compost, that it is impossible to lay down any rules as to which ought to be preferred. Probably the most advantageous plan, when it can be readily accomplished, would be, to separate the harder and more woody parts from the rest for the purpose of burning for ashes, and making lime compost with the more green and succulent portions, and again mixing them before they are applied, by which means we may combine the ad-

vantages possessed by each. I need hardly say, that, should any refuse animal matter occur, it ought to be added to the lime compost, as, by this means, it is possible to add greatly to the beneficial effects of the mixture. Before leaving the subject of refuse matters, let me add a suggestion to those who keep orchards, or any place in which fruit-trees are cultivated, namely, that they should collect and burn all the clippings, leaves, &c. of the trees in question, and either mix the ashes which result with the manure when applied, or spread them on the ground round the roots of the trees, in order that their soluble matters may be washed into the soil; as, in this way, the fruit-trees will be capable of growing for a much greater length of time without deterioration than they otherwise could do, on account of the soil being, by this means, replenished from time to time with the various saline matters peculiar to the trees themselves.

3. Composts produced by rotting peat, by means of lime or farm-yard dung, or by both together. This compound has excited considerable interest at various times in the agricultural world, both on account of the large quantities in which the substance producing it occurs, and also, because, were it to become an article of great consumption, its formation would afford employment to many individuals who are at present in a state of the greatest destitution. Unfortunately, however, although cases do now and then occur, in which this compost may be turned to a profitable account, still its applicability is too limited to admit of its ever commanding an extended sale; besides, as it is only the pure peat which could be the vendible article—for the compost must be made on the spot where it is to be employed—the very means required to render it portable would increase greatly the difficulty of turning it into good manure.

When the compost is to be made, the best kind of peat for the purpose is that known by the name of "*water-born peat,*" or "*water-slain moss,*" as it is likewise called. This species, as its name denotes, has been deposited by water which previously held it in suspension; and its superior value as manure, depends upon the fact of its being in a far more decomposed condition, and reduced to a much more minute state of division, than any of the other kinds.

Peat, in its natural condition, is the greatest enemy which the farmer can meet with. In places where it occurs, it is constantly on the increase, and, when once fully formed, no useful plant will grow upon it; for not only is it useless of itself on account of its insolubility, but, in addition, it possesses such powerfully antiseptic properties, that it prevents all other substances from acting beneficially, which, under more favourable circumstances, would have constituted excellent manure. When, however, peat is decomposed by means of lime or farm-yard-dung, it loses its bad qualities, and is converted into a manure of considerable utility. As I have already explained the action both of lime and farm-yard-dung in converting inert vegetable fibre into useful manure; and, as the changes in the case of peat are precisely similar, I shall not occupy any space by recapitulating the various steps of the decomposition, but shall confine my remarks to the advantages possessed by the compost when fully prepared.

The advantages are for the most part *local*, as there can be no doubt that many of the manures in common use are far more valuable than the one under our notice at present. I by no means, however, wish to disparage its use in the neighbourhood of the spots where it exists, because, if lime, for example, can be readily procured, and the peat mixed with it when *first dug up*, it can be readily formed into a very good compost heap, which will be applicable to most of the purposes for which the compost last spoken of is fitted; and again, if a limited supply of farm-yard-dung can be obtained, this may be made to go much farther by being made into peat-compost in the manner recommended by Lord Meadowbank, in the second volume of the Highland Society's Transactions, published in 1803, where he shows that seven cart-loads of dung are [illegible] -one loads of peat into compost, [illegible] will be ready for the spring [illegible] n, can be prepared in eight [illegible] his compost will undoubtedly [illegible] to good farm-yard-dung, [illegible] exceeds the *decrease* in [illegible] must be evidently of advantage to the [illegible] however, if it would succeed to carry [illegible] distance in order to form this compost, as the expense would, of course, by this means, be considerably increased. In place of using lime for compost when required on a spot where peat exists, I think that it would be far better to employ the lime to render the peat useful "*in situ*," and thus increase the quantity of productive soil.

The disadvantages which occur in the peat-compost depends upon the origin of the substance itself. All persons are now agreed that peat is produced by the gradual decay of various trees, herbs, grasses, mosses, &c. which have grown in succession on the spot where the deposite occurs. Now, I have already had occasion to point out, when treating of the action of lime upon moorland pasture, the manner in which the herbage of such places gradually becomes of a worse nature by the failure of good nutriment. Precisely the same occurs on all peaty soils, and, consequently, the peat which is commonly used for the purpose of making compost, being for the most part taken from some of the higher or most recent strata, it follows that it will have been produced by the decay of the very poorest kind of herbage, such as the diminutive grasses, various mosses, &c.

But the question will be asked, Why should such an origin be considered a disadvantage? Two answers can be given to this question. (1.) Because the compost will contain the peculiar saline compounds which naturally exist in these plants, and, consequently, its employment as manure will tend to reproduce these useless weeds, especially in soil at all predisposed to infection. Lest any of my practical readers should imagine that this objection is purely theoretical, I would just call their attention to the following *practical fact*. All persons who are acquainted with the herbage of peaty soils must have noticed the great quantities of sorrel (*Rumex acetosella*) which grow wherever the soil is at all dry. Now, in a paper upon the "Properties and Uses of Peat," by John Nasmith, Esq., which may be found in the Highland Society's Transactions, vol. iii. published in 1807, he expressly states, that peat-manure should not be used for "*light blowing sands*" (the kind of soil most prone to infection), "as it would *increase* the distemper of the soil, and promote the growth of *Rumex acetosella*." And again, in an excellent paper upon the use of lime, published some time ago in America, the author mentions, that one of many benefits derived from the use of this substance is the destruction of the *Rumex acetosella*, and other *acid plants* which grow so abundantly on the poorer soils in his neighbourhood; but we have already seen that lime and peat are so far incompatible, that the former always destroys the characteristic properties of the latter. I may here remark, that this last observation proves that peat-compost with lime is less objectionable in *this respect* than that formed with farm-yard-dung. (2.) But another answer may be given to the question, which again refers more to the lime-compost, namely, that, as the quantity of *azote* (nitrogen) contained in plants gradually increases as we go up the scale of vegetables, and as the utility of manures for the higher orders of plants—as, for example, our cultivated crops—depends directly upon the quantity of azote which they contain, it follows that a manure derived from the *lowest species* of plants must be but ill fitted for the purposes of the farm; although, in the case of the compost with farm-yard-dung, this objection will be less valid, on account of the large proportion of azote existing in that substance, which, of course, will add to the quantity contained in the compost. We thus perceive that whatever method is adopted to convert peat into manure, the compound formed has certain defects which, under peculiar circumstances of by no means unfrequent occurrence, would render its employment dangerous. It is doubtful, therefore, whether it would be advisable to recommend a more extended use of this manure, although I by no means deny that there are circumstances and situations in which it will form a valuable addition to the other manures on the farm.

We have thus at length completed the second division of the extensive subject of manure, namely, the account of the composition and mode of action of the more valuable manures; and we shall, therefore, now take a survey of the ground we have gone over, for the purpose of discovering the exact position in which the science stands in reference to this important subject; or, in other words, to ascertain what we *have learned*, and what we have *yet to learn*, with regard to the cultivation of plants. Before doing so, however, I shall give, for the purpose of future reference, a tabular view of the manures described, arranged according to their several modes of action.

TABLE of MANURES, arranged according to their Action.

	Manures which act by yielding *Organic* Matter to the Plants.	Manures which act by yielding *Earthy* and *Saline* Matter to the Plants.	Manures which act upon the Organic Matter of the *Soil*.		Manures which act by altering the *Texture* of the Soil.	Manures which act *specifically* upon certain Crops.		Manures which act as Stimulants?
			By Fermentation.	As Chemical Solvents.		From containing peculiar *Saline* Matter.	From peculiarity of *Organic* Matter.	
VEGETABLE.	Rape Cake, Malt Dust, Steepings of Flax & Hemp, Green Plants, Straw, Woody fibre, Tanner's spent Bark,	All more or less,	All slightly.					
	Farm-yard Dung.	Farm-yard Dung.	Farm-yard Dung.					
ANIMAL.	Dead Animals, Fish, Blubber, Excrements, Urines, Horn, Hair, Woollen Rags, Feathers,	All in some degree,	All more or less.			Horn.	Rape Cake. Malt Dust? Horn.	
MINERAL.		Chalk. Gypsum. Marl. Saltpetre. Common Salt. Kelp.		Kelp. Lime, (hot).	Marl. Chalk. Lime, (mild).	Gypsum. Chalk. Kelp. Common Salt. Saltpetre.		Saltpetre. Common Salt.
MIXED.	Bones. Composts.	Bones. Ashes. Soot. Composts.	Bones. Composts.	Ashes. Composts.		Bones. Ashes. Soot. Composts.	Bones.	Soot.

An examination of this table shews us, that there are no less than eight distinct ways in which a manure can act, seven of which have a direct reference to the plants themselves. We may also observe, that two of the eight modes of action are of such a nature, as to produce deterioration of the soil. I refer to the actions upon the *organic matters of the soil*, whether by fermentation or as chemical solvents ; for it is evident, that crops raised by manures which act in this manner, are in fact procured at the expense of the *soil*, in place of the *manure*. The practical deduction from this fact of course is, that those manures which owe their chief value to this mode of action, must be repeated with caution. The method by fermentation, however, is much less objectionable than that by chemical solution : in fact, on looking at the table, we shall find that all our most valuable manures possess this action, and consequently, we might be apt hastily to conclude, that all manures are, more or less, exhausting, which is manifestly absurd. On the contrary, no manure can *exhaust* by producing fermentation in the organic matter of the soil, unless they cause it in a great degree, and at the same time possess comparatively but little organic matter themselves ; this we have already shewn to be the case with bones, and it will probably be found to apply equally well to rape-cake, and to *all other manures which produce great effects when used in small quantities.*

On reviewing what we have had occasion to remark upon, —the more important individual manures,—we cannot help thinking, that, however superficial our knowledge of vegetable economy at present is, still, were farmers merely to make themselves masters of what is already known in regard to this subject, we should not so constantly hear such various and contradictory opinions broached with reference to the respective values of certain modes of culture, nor should we have occasion to regret the time, trouble, and expense, annually wasted by many in performing experiments which are evidently useless. What could be more absurd, for example, than trying the effects of *arsenic* as a manure ? Yet, in a published account of some experiments with turnips, arsenic was one of the substances used, and these experiments were published with a view to persuade others to follow out the same plan !

Now the fact is, that the report alluded to, contains many very valuable hints in reference to the mode of performing experiments with different manures; but is it not most probable, that if the account had fallen into the hands of any intelligent farmer, however anxious he might be to lend his aid to the advancement of science, when he found *arsenic* among the manures for *turnips*, he would quit the subject with disgust, and be prejudiced against all investigations of the sort, from the fear of meeting with some other equally ridiculous proposition?

In the foregoing pages we have exemplified certain laws connected with the subject of manures, which all experimentalists would do well to keep in mind, one of the more important of which is the self-evident fact, that *manures cannot yield that which they do not contain.* Yet, strange as it may appear, no fact is more universally neglected by some of the very men who cry out for the application of scientific principles to agriculture. For example, I would ask the question, Is there *arsenic in turnips?* Need I reply in the negative? Yet we have seen that arsenic was employed as a *manure for turnips!* The ignorant might retort with the question, Are there *bones in turnips?* No! but bones contain *carbon, oxygen, hydrogen, nitrogen, sulphur, carbonate of lime, &c., all* of which are contained in turnips; whereas arsenic being a simple chemical compound, contains nothing which could be of any value whatever either to the turnip or any other crop.

Another general law is, that, although plants *can* obtain carbon, oxygen, hydrogen, and nitrogen from the air, still all cultivated crops, when growing in *soil,* obtain at any rate a *large* proportion of all these four elements from the manure contained therein. Yet, notwithstanding these, we find an experimentalist declaring, that "because manures containing *nitrogen* are always the best, it would appear that plants draw their supply of this element from the *soil,* whereas they obtain their carbon, oxygen, and hydrogen from the surrounding air!" the fallacy of which conclusion must be evident to all who have paid any attention to the subject of manure.

A third general law, which I think we have sufficient grounds for establishing, is, that, all other things being equal, that manure will be found most economical *which is derived from sources nearest in the scale of organization to the plant for which it is employed.* Having frequently had occasion to speak of the *scale of organization*, I may take this opportunity of explaining the exact meaning of the term in the sense in which I have employed it. It has always appeared to me that the simplest way of instituting a comparison between plants and animals, *chemically considered*, would be by making reference to the proportion of azote (nitrogen) which they contain. This element has always been considered as a characteristic of animal matter, but still we have seen that it exists in many vegetables also: Moreover, M. Boussingault, Theodore de Saussure, and many other distinguished continental philosophers, have proved that the relative value of different plants, as food for man and animals, is *in direct proportion* to the quantity of azote which they contain. These are the plants, therefore, namely, those richest in azote, that I would place highest in the scale of vegetable organization; or, in other words, these plants, when considered in reference to their *chemical constitution*, will be found to approach nearest to the animal kingdom. When, therefore, I speak of plants *high* in the *scale of organization*, I refer to those *rich in azote*. Those which are altogether devoid of this substance constitute, of course, the lowest portion of the scale. Thus to paraphrase the law above laid down—*that manure will be found the most economical which approaches nearest in chemical constitution to the plant for which it is employed.*

Thus far have we proceeded in our knowledge of that por- [illegible] vegetable economy which relates to manure—let us now, by instituting a comparison between the feeding of plants and of animals, discover, if possible, the exact position in [illegible] at present stands, and then endeavour to [illegible] by which we may advance. Let us suppose [illegible] *analysis* were alone to [illegible] animals, What would [illegible] example, let us suppose that [illegible] omitted to analysis, we should [illegible] elements necessary [illegible] should conclude that they would be suitable for his nourishment. Well, but if we were to proceed farther in our analytical researches, we shall find that the same chemical elements existed in the new born infant, in birds, reptiles, and fishes, and consequently had we no other means to guide us, we might be led to conclude that beaf-steaks and porter was the best food for the whole animal creation, than which nothing could well be more absurd. Still this must not lead us to suppose that chemical analysis, as applied to this subject, is altogether useless; for, on the contrary, we shall always discover by its means an evident relation between the substance fed upon, and the animal which is nourished thereby, although undoubtedly *elementary* analysis will not enable us to choose the food best suited to the wants of each particular species. Nor is this necessary, because, as animals are gifted with the powers of locomotion, and are, moreover, endowed with instinct and discrimination, they are capable of selecting for themselves such articles as are most suited to their wants, and consequently by observing their habits when in a state of nature, we are enabled to learn what to supply them with when we preserve them in a domesticated condition.

Far otherwise is it with plants; they are compelled to remain on the spot where they were first called into existence, and unless the surrounding soil contain all that is required for their preservation, they must of necessity perish. How important, therefore, must it be, that, in cultivating plants, we should endeavour, as far as possible, to counteract these evils by a judicious application of that species of manure which is best suited to each crop! But it will naturally be inquired how it happens that plants are not much more frequently destroyed from improper food, if each species requires a different kind of nourishment, and yet are not capable of choosing for themselves? Two things, however, require to be remembered before we come to any such conclusion, namely, *first*, that Nature has not left plants to be thus the sport of chance, but here, as elsewhere, has admirably adapted the means to the end in view. For we have already seen that the *soil* is the *stomach*, in which the food of plants is prepared, and consequently as the first steps of digestion take place *exterior to* *the plant itself*, it is evident that it is thus freed from the danger of injury by the introduction of indigestible food. And *secondly*, as the process of putrefaction is that by which the food of plants is prepared, and as during this change substances bearing a considerable similarity to each other are formed, whatever may be the nature of the putrefying mass, it follows that every plant will, out of the same mass, be able to find more or less food of the nature most fitted to its own purposes. Still, however, it must be evident, that unless the manure is placed under circumstances most favourable for the formation of a considerable quantity of that substance most needful for the plants which grow in its neighbourhood, and moreover is capable of keeping up a continual supply of the proper food, the plants themselves cannot be in a thriving condition, and consequently will not yield a remunerating harvest.

The proper object of inquiry, therefore, would be to ascertain, 1. How the process of putrefaction is modified; 2. What are the peculiar circumstances under which each particular substance is formed in greater abundance? and lastly, What particular substance constitutes the proper food of each plant?

As far as the science has yet advanced, we have merely learned what circumstances are necessary in order that putrefaction may proceed; these we have before stated are the presence of *heat*, *air*, and *moisture*; and the various modifications which these undergo as regards quantity, both absolutely and relatively considered, may in all probability be capable of producing an equal number of modifications in the nature of the resulting compounds. Unless this is the case, how can we explain the reason of some plants inhabiting wet soils, and others dry; some growing best in clay, and others in sand, and so forth; for it is clear from what we have already said, that plants cannot require a clayey soil, for instance, on account of the clay which it contains, but the necessity of this condition must depend upon some modification which is in this manner produced upon the compounds resulting from putrefaction. Again, plants which inhabit wet soils cannot do so on account of the direct action of the water upon *themselves*, because were th[illegible] plants would be succulent, which is far from being the case; it must therefore be owing to the modifications produced in the *food* by the existence of a large proportion of water.

If we consider this fact as proved, the following important results will be deducible from it:—1. That upon it depends the necessity of adapting the crops cultivated to the nature of the soil. 2. That upon this principle we can explain the necessity of the different depths of tillage required for different crops. 3. As the changes occurring during putrefaction, as produced in each particular condition, will in all probability proceed in a certain order, it will follow that upon this circumstance will depend the various modifications requisite in the *rotations of crops*, according to the nature and situation of the soil.

How important, therefore, would it be, if it were possible to reduce all these suggestions to the certainty of experimental facts! That it is possible, I have not the slightest hesitation to affirm; but at the same time, its accomplishment would be attended with considerable labour and expense, such as could be given by no one who had not resolved to devote his whole time to the pursuit. But who will attempt to dispute the value of the inquiry, or doubt the important results which would accrue to *practice* as well as *science* by its successful accomplishment? To conclude, therefore, we may observe, that we have learned already, in reference to *organic food*, what a manure *must* contain in order to make it useful to *every* crop, but have yet to learn what it *ought* to contain to fit it for *each particular* crop. The method by which we might hope to succeed in advancing the science in this respect, would be by examining carefully into all the results of putrefaction, and endeavouring, by chemical tests, to learn to distinguish every slight shade of difference which occurs, according to the various modifications resulting from differences in the supply of *heat*, *air*, and *moisture*, and having done so, we must next endeavour, by careful experiment, to ascertain what changes in manure are most favourable for the production of the *best food* for each cultivated plant.

The next subject we shall have to treat of, is the choice of manure for each particular crop; which, although it would require a knowledge of all the facts referred to above, in order to make the research perfect, still we shall find that a considerable degree of instruction may be gained, even as the science already stands, by comparing carefully together the results of the various modes of culture recommended by different practical agriculturists, and ascertaining in what circumstances they all agree, and in this manner obtaining some standard points by which to guide ourselves in our selection. In order to do this effectually, it will be necessary to collect as much practical information as possible, and to weigh thoroughly all the statements obtained, for fear of arriving at an unjust conclusion. As these circumstances will render my future communications of a much more original character, I trust my practical readers will deal leniently with me, should I appear to be stating any thing which may not altogether accord with "*old customs*," especially as all that is new must be considered in the light of suggestions only, as it is quite out of *my* power to put them to the test of extensive *practice*.

DISEASE OR FAILURES OF THE POTATO.

By Mr Towers, C.M.H.S.

Some years have elapsed since the public were made acquainted, through the medium of agricultural periodicals, and of the provincial journals, with a partial failure of the potato crop. The disease, if such it could with propriety be considered, appeared to abate; being very partial in its operation, no general alarm was excited, and the local epidemic having either subsided, or for a time passed away, we were led to hope that no just cause of anxiety remained.

The tocsin is, however, again sounded, and if we are to place implicit confidence in the assertion, that *the potato crop is in a state of progressive failure*, "with the prospect of an annual decrease in the quantity, to meet the demand of a rapidly increasing population,"—it is indeed high time that every farmer throughout the empire should devote his most serious consideration to *the cause* of this apprehended calamity.

Mr Aitken, the author of the paper which takes the lead in the last number (47, p. 311) of this Journal, refers it to a certain TAINT in the tubers themselves, and not to any agency of the soil or atmosphere during the course of growth. His title runs thus,—"*The Taint in the Potato explained,*" and by assuming it, he takes new ground, on which I propose to follow him, not by any means with a view to find fault—for I admire the writer's zeal, and the general construction of an article, which is clever in itself, and based upon sound philosophical facts—but to elicit truth, and to promote Mr Aitken's laudable and avowed object, namely, the introduction of "an improved system of cultivation, more in accordance with the nature of the plant."

In a former article I entered into the detail of a mode of culture of several most excellent varieties, which have never deceived me: I need not recapitulate, it being perhaps quite sufficient to refer to No. 43, page 337 of this Journal, anno 1838. That method I have subsequently practised with undeviating success, and it will not perhaps be out of place, after paying attention to some of the leading passages of Mr Aitken's article, to produce the results of the last year's crop of my favourite semi-early kidney potato, and of a long-keeping round red, which, for solidity, figure, and colour, might be appropriately styled the *Cricket-ball.*

The first paragraph which claims particular notice alludes to the *peculiar* properties of the potato, wherein it is said that "it differs materially from every other plant of the farm." If *ignorance* of its nature be the direct cause of taint or disease, the knowledge of its physical and botanical organization, and its habits of growth and development, may act remedially, and lead to a truly scientific method of cultivation.

The potato is a genus of the natural order *Solanaceæ*—CXLIII. of the Prodromus of the renowned philosopher of Geneva, De Candolle, Class I. Dicotyledones—Subclass III. *Corolliflore.* The order comprises three tribes, the first of which consists of the true *Solaneæ*, or the night-shade tribe. The potato is therefore a *Solanum* or night-shade, and its Latin name is *Solanum tuberosum.* Its congeners are described as being "eminently narcotic and exciting, and many of them

dangerous as poisons, which qualities, however, va
gree in different individuals; thus, what exists in t
is dissipated by heat, and the tubers are rendered qu
some." The potato-blossom is not so lurid and *somb*
of several of its allies—on the contrary, if minutel
gated, is found eminently beautiful; but its alliances
traced with *Solanum dulcamara*, the bitter-sweet; *
tum*, the egg-plant; *Atropa belladonna*, deadly nig
and more remotely with *Datura stramonium; Hy*
henbane; and *Nicotiana*, tobacco. With the last
in the odour which both diffuse when the sun shin
fully on the plants. If any one pass amidst a stron
plot of potatoes, and along a row of the pink-flow
ginian tobacco-plants, he will be struck with the i
the powerful odour, which is decidedly that of very
fragrant tobacco.

Perhaps there are few persons who have taken so
interest in the improvement and successful cultu
vegetable, as did the late Thomas Andrew Knight:
was in the work. Of this I cannot adduce more sa
evidence than by quoting these two lines from a le
first of a great number with which I was favoured
correspondence that closed only in 1837. "*Of the
the potato to supply us with animal food, no perso
formed any thing approaching to a fair estimate.*"
more of this great physiologist's letters refer to the c
of this plant, and I received from him fourteen late
entirely new, produced from seeds by crossings, acc
his scientific method. It will, therefore, be apparen
Knight is an authority to which any one may saf
who is desirous (to borrow the language of Mr Aitk
quiring "a thorough knowledge of every particular
with the nature and cultivation of the potato."

The plant is familiarly known to be a native of a v
climate; in *its herbage* it is strictly an annual, but i
of extension to an almost indefinite period, by the
processes of its roots. The chief points, therefore, to
will be proper to direct the reader's attention are
nection which exists between the productive power

dical processes and *that* of the floral organs (for the plant bears seed very profusely), and the *influence which the one exerts upon the other.*

Mr Knight was of opinion that the production of tubers was considerably lessened by the copious development of blossoms, and he published, many years ago, the fact, that, by pinching off the blossoms, an ounce weight might on an average be added to each plant, the increase amounting to a ton or more in the acre. Subsequently, however, he made a strong effort to remove the tendency to produce blossoms; and in a letter, dated February 4. 1831, he thus expresses himself to me:—" I do not despair of getting 800 bushels of potatoes from an acre of ground, if I live long enough to see the produce of some new varieties which I have formed, and which are of very vigorous growth, *whilst they do not expend any thing in blossom. The blossoms* take away a good deal of sap, which would be better employed in forming potatoes; and *whenever a potato affords seeds freely, I think it almost an insuperable objection to it.*" The converse of this hypothesis led to an experiment by which the new-*early* Downton varieties were obtained. Every one knows that the esteemed and far-famed *ash-leaved kidney* seldom produces flowers, it is therefore termed in some districts the "*no-blowing* kidney."

I copy the following statement from the *Encyclopædia of Gardening*, to which will be added a few lines from a letter written by Mr Knight, to *complete* the detail of his process.

" I suspected the cause of the constant failure of the early potatoes to produce seeds, to be the preternaturally early formation of the tuberous root, which draws off for its support that portion of the sap which, in other plants of the same species, affords nutriment to the blossoms and seeds; and experiment soon satisfied me that my conjectures were perfectly well founded.

" I took several methods of placing the plants to grow in such a situation as enabled me readily to prevent the formation of tuberous roots; but the following appearing the best, it is unnecessary to trouble the Society with an account of any other. Having fixed strong stakes in the ground, I raised the mould in a heap round the bases of them, and in contact with the stakes. On the south sides I planted the potatoes from which I wished to obtain seeds. When the young plants were about four inches high they were secured to the stakes with shreds and nails, and the mould was then washed away by a strong current of water from the bases of the stems, so that the fibrous roots only of the plants entered into the soil."

It is at this point that I would invite the reader, who is solicitous to acquire a knowledge of the structure and functions of the radical processes, first, attentively to digest the remarks which next follow, and then, to compare them with the developments of the growing tuber. One investigation will not suffice. A row of at least a dozen sets, or entire potatoes, should be planted in soft friable earth, and one should be taken up occasionally during the course of growth, till the period of maturation; thus, a fair idea may be formed of the correctness of the theory, or, on the other hand, of its want of accordance with observed facts. Mr Knight continues,

"The *fibrous roots* of this plant *are perfectly distinct organs* from *runners*, which give existence, and convey nutriment to *the tuberous roots*; and as the runners spring only from the stems of the plants, which are, in the mode of culture I have described, placed wholly out of the soil, the formation of tuberous roots is easily prevented; and whenever this is done, numerous blossoms will soon appear, and almost every blossom will afford fruit and seed." (So far extracted from "*Hort. Trans.* vol. i. 188.—Encyc. of Gardening, edit. 1826, p. 625.)

Acting upon this partial quotation, I experimented in 1831, but found myself hampered by an unforeseen result; for the plant developed copiously a number of *cauline* processes at the angles of the leaves with the stem; and these acting the part of the subterranean tubers, diverted the fluids from the extremities of the growing stems, and thus no fruit (proper) was perfected. I communicated the circumstance; and, in consequence, received a letter from Downton, per date September 22. 1831, from which I learned that, in order to obtain seeds from early potato plants, it would be necessary to obliterate, at its first appearance, every tuberous process which might arise from the sides of the stems. This condition had been stated in the *original* communication to the society, but was omitted in the extract. Mr Knight added also, "I have occasioned a heavy crop of potatoes to be formed at the extremities of lateral branches, and there *only*. If you will repeat the experiment, and *wholly prevent the formation of tubers*, you will obtain seeds from every early variety of potato." I [illegible] that I did not subsequently prosecute this inquiry to its full disclosure ; but I had enough to do with trials of the character and produce of the many Downton varieties, in different sites and soils. One certain fact was established :—Of the five early varieties, not one opened a flower ; of the many *late* varieties, some formed the stalk and flower-buds ; but these turned yellow and fell off. Thus Mr Knight had succeeded in his endeavours to produce barren herbage ; and his plants remained true to their character during the four years that I continued to cultivate them.

From what has been adduced, it will appear that the potato developes proliferous organs of three distinct kinds, two of which may co-exist ; namely, the true seed-vessels, and the underground tubers. These, to a certain extent, influence each other ; but yet I have proved, that, in some varieties, one of which is the kidney potato, hereafter to be noticed, a very prolific underground crop is perfectly compatible with great fertility of the seminal system. A third means of perpetuation is found in the *cauline* tubers before mentioned ; but whether it frequently occurs in common culture, I am not prepared to decide, as I have rarely witnessed it in my plots.* The potato plant, in its capability to develop these stem-bulbs, resembles the tiger-lily and the begonia. These processes generally produce, when sown, small, but complete plants in the first season ; those raised from the true seeds would be mere miniature productions. But the underground bulbs of the lily, the tubers of the potato, and the torpid roots

* We have frequently observed these cauline processes on the stems of potatoes cultivated in the fields, but never more so than on an occasion of our own experience. We had drained and trenched with the spade, 14 inches in depth, about two acres of rather light land, resting on retentive subsoil, the site of an old plantation of birch, and having got those operations finished by the end of April, determined on planting the ground with potatoes. There was no time to ferment the dung, so it was led directly out from the court-yard to the field. Whether it was from the unprepared state of the manure, or the natural poverty of the soil, the crop was scanty, though the stems were luxuriant, and these were found to be very abundantly furnished with those processes, a great proportion of which appeared so ripe as to fall from the stems in the act of taking up the crop with the plough. The potato was the small white American, a delightful vegetable for the table at all seasons, off light land.—EDITOR.

of the begonia, greatly surpass their competito duce, when duly excited, plants at once perfect and luxuriant in a degree corresponding with t they receive.

Of the nature of the *tuber* something remai The word *tuber* is apt to mislead those who att its sound, and are not conversant with the bota clature. It is strictly a Latin word, and means a ki or excrescence : in a restricted sense it is applied and *morel*. It is not properly a *root*, though Mr K be observed, has conformed with the customary a the term, and considered the potato as " a tuber

The tuber is a mass of cellular and fibrous tiss by external coverings, and in which lie imbedd number of germs, the embryos of perfect plants. are situated one at each *eye* of the tuber, and c perfectly detached by a careful dissection, and du would exhibit a miniature potato plant comple organs. Sir J. Edward Smith describes " *Rad* which we *now* simplify by substituting " tuber" sisting of fleshy knobs. " These knobs are reser rishment, moisture, and vital energy, connected stalks or fibres, as in the potato and Jerusalem The *tuber* is described—by Dr Lindley (I believe derground *stem*, to which opinion I cannot sul although a stem may, and does, contain embryo expand into branches or shoots, yet *there* the an A *tuber* is a reservoir of watery sap and of prep or starch ; and as the germs or buds which it con vealed, and protrude herbage, so, in proportic tuber itself become exhausted.

The observations which I now extract from a tise are, however, extremely interesting, and as s intended to elucidate still farther its natural char

" The *tuber* is a short, fleshy, underground stem, produ of slender subterranean branches. Its surface is marked covered with scales, from within which buds appear, by cies is to be multiplied. In the potato, the underground first as slender as the roots among which they burrow, an be known from them by having scales upon their surface. But, in time, such a branch ceases to lengthen; its end then becomes swollen by the matter impelled into it, from the main stem" (runner) "not being able to proceed any further; it gradually increases in diameter, becomes more and more succulent, till at last a perfect tuber is formed."——"When fully formed, a tuber is a fleshy body, on the surface of which are numerous depressions, each containing what a gardener calls an *eye*, which is, in reality, a bud that, under favourable circumstances, will become a *new plant*." "It generally happens that such eyes, like the buds on the branches of trees, do not develop the same year as they are formed, but pass the first season of their existence in gaining strength for their growth in the succeeding season. But if any circumstance should call them into action in the same season in which they are created, a tuber will branch, and then assume an appearance very unlike its common state. This often happens to the potato in long dry summers, when what are called clustered potatoes are generally produced. Such productions are excellent illustrations of the plan upon which tubers finally grow, and of the analogy that exists between them and branches."

I have extracted the above essential paragraph on the *tuber*, which appears at page 12 of the treatise on *Botany* of the Library of Useful Knowledge, omitting only those passages which would not materially elucidate the nature of the organ. It will be very useful to compare this extract with the description furnished by Mr Knight in his paper before referred to; for the comparison, assisted by a few well conducted experiments, can hardly fail to throw much light upon a subject heretofore very little inquired into, and still less understood.

It will be seen that the writer just quoted, styles the development of the tubers, a *creation*,—and speaks of the first season of *their existence*. Let us compare this view of the phenomenon with that which is taken of it by Mr Aitken, and that indeed which constitutes the foundation-stone of his hypothesis. At page 317, when writing of plants raised exclusively from seeds, he says,—"Their health cannot be influenced in such a degree by the treatment the parent crop receives the previous seasons, as the potato can, *which is only a continuation of the same plant*, not a *renewal* by generation. Here, then, is where the potato differs from other plants; it is a *new plant* only when it is raised from seed."

But upon what ground does the author of the "Treatise on Botany" believe the tuber to be a fresh creation, and why should

Mr Aitken conceive that *seed* alone *renews* a generation? Are they not both alike developments, that is to say, merely revealments of parts preorganized and pre-existent in the vegetating plant?

Let us suppose the case of new seed, one which never before had been seen by man. Does it not contain within itself the rudiments of a perfect future plant, of one which will and must, by the law of its organization, produce in due time, all the parts that constitute its individuality, and which, of course, comprise these of reproduction for extension? If the tuber just becomes visible as a scale seated upon an extending runner, is not that scale a development of a preorganized germ which will assuredly enlarge, and finally discover the germs of plants imbedded within a mass of nutritive pulp? And what, more or less, can we say of a perfected seed? If Dr Lindley's view of the organs of fructification be correct, a flower is nothing less than a leaf, and the *entire fructification* only *newly modified foliage*. A seed is first revealed as an *ovule*, which, being impregnated by the pollen of its own stamens, or by that of some other congenerous plant, enlarges, ripens, and finally becomes a seed; but, during the course of these processes, it remains fixed by its string of attachment (the *funis*) to its medium of nutrition (the *placenta*), through the vascular or cellular tissue of which, it receives its fluid aliment till its growth be completed.

Every physiological fact that the closest inspection by our most refined instruments can reveal, seems to prove that the floral and seminal organs are as purely developments as are any other parts of the vegetable body whatever, and nothing more. The only point wherein a seed differs from a bud ap[illegible] this, that its pointal (pistillum) is capable of re[illegible] the *pollen of another plant* to the ovary, [illegible] agency of which pollen the ovule is impregnated [illegible] rendered capable of producing *varieties* of [illegible] seeds are essential parts of *buds*, [illegible] superficial) or subterranean. All reproductive organs are alike parts and portions of plants [illegible] formed and consequently *pre-existent;* and thus *seeds* [illegible] are germs or tubers [illegible]

Having thus adduced evidence in proof of a very important law of vegetable perpetuation, the question which next presents itself refers to the duration and extinction of life.

Mr Aitken cites a passage from a paper by Mr Johnson, to shew that "every organized creature has its limits of existence, that of all things the days are numbered;" consequently, that, from the moment a seed germinates, it progresses onwards to maturity, to old age, decay, and death; and, viewing the *tuber* of a potato as part and portion of a plant forming one stage or era of its existence, he conceives that each successive tuber is one year *older*, that is, *more aged*, than its precursor in a former crop; thus, speaking of seedlings (of the presumed *new creations*), he says, page 317, "It is evident that the *new* plant will progress through the successive stages of *youth*, *maturity*, and *decline*. In youth the plant will shew most vigour in stems, flower, and fruit (seed); in maturity, higher perfection as to quality; and in decline, deterioration."

Let us view one or two facts. In the late season, I had saved a number of seedling tubers, about the size of kidney-beans, procured from the fruit of my fine kidney potatoes, which had fallen in 1837, and become self-sown seedlings. I planted about half a pint of these tubers in a small trench of rich adhesive loam that had been under asparagus; the edges of the trench were four inches above the level of the earth, which covered the little tubers to the depth of one, or one inch and a half; over this earth a two-inch layer of reduced tree leaves, with stable-dung that had been used as the lining of a pit, was placed; this was all the manuring the trench received. The date of planting was March 4. 1839; the aspect shady, being to the north-west of a vinery wall; the weight sown was not more than half a pound. As soon as the first green tips broke through the manure (which was a considerable time after setting, owing to the cold weather of the spring, and the little excitable condition of the potatoes), some rough hay was laid in the trench to ward off the frost of six degrees on the 16th May. When frost passed away, and the weather became more genial, earth was gradually drawn against the advancing stems, till it rose full five inches above the tubers; thus preserving the herbage effectually, and affording ample scope for the fibrous roots, and tuber-bearing runners.

The plants grew during a long period, and slowly; some were very strong; others less so; but not *one flower* or *fruit* was developed. At length, early in November, the stems of most being still rather green, the crop was digged and it weighed 11½ lb. Some tubers weighed two or three ounces; and of these three were boiled. They proved more watery than the parent stock, but gave promise of future excellence; the smaller are reserved as seed-store.

Here, then, we find that *no blossoms were produced upon plants* (some of which were three feet high) *the progeny of a variety extremely prolific of fruit.*

2. Again, all Mr Knight's strong young varieties, whether *early* or *late*, brought no blossoms to perfection!

3. The *Ash-leaved Kidney* stands firm and in vigour without renewal by seed; and who ever thought of disease or degeneracy in that universal favourite?

4. I have now cultivated my medium kidney during at least five successive seasons, yet have experienced no loss; my *rotation* consists of a simple alternation with cabbage, broccoli, or savoys; the *manuring*, that of a sprinkling of vegetable ashes in the autumn after potatoes, and a two-inch covering of linings-manure over the sets at the time of planting. But I enrich for the *brassicas*, by digging into the trenches a spade of the same lining's dung to every three or four spits of the turned earth. The soil is generally an adhesive hazel loam, that contains, perhaps, 15 per cent. of alumina; 4 or 5 per cent. of peroxide of iron; as much or more of chalk; and 70 to 75 per cent. of coarse and fine siliceous sand.

These four practical facts, obtained by my own connected experiments, to shew that the presence or absence, the abundance or paucity, the power or debility of the floral organs, [illegible] nothing whatever to do with the age, strength, or debi- [illegible] now, therefore, I refer the reader to that portion of Mr Aitken's article contained in the pages 317-318, and in the eleven first lines of 319. Therein we find [illegible] of [illegible] theory of "the taint" and of the remedy which it indicates. This theory implies that, *by age*, the tubers become debilitated, then dry and mealy; that such tubers, however fit for the table, are liable, after hot summers, to be tainted with the dry-rot; but, on the contrary, that *young juicy* tubers, and, indeed, any potatoes which are *immature*, are never liable to this contingency, and will produce a healthy and abundant crop.

I will not follow the writer, or trace the chain of his *evidence* through the six following pages; *that* is complete, provided we can bring ourselves to admit that *the disease* has really *existed* to the reported extent, and has had its origin in the cause assigned. We are all too apt to "beg the question" on some leading point; and thereby arrive at conclusions, either through mental ignorance or want of sufficient investigation, which the real facts will not bear out!

We are told, that "the *parent disease of the taint*" (*i. e.* the arid mealy condition of tubers produced year after year from *the same stock*), "by *the dry-rot* of the *cut sets*, appeared about seven years ago" (1831). Now, if this statement be correct in the abstract, how came it to pass that any tendency to, or preparation for, the disease never manifested itself throughout the millions of acres which had been planted with potatoes during the thirty preceding years of the present century?

Potatoes were not generally cultivated fifty years prior to that period; yet there is no one now alive who recollects the tremendously wet year of 1799, who can entertain a doubt that they were *then the chief* vegetable of the table. Be it remembered also, that, little as the *physiology* of the tuber might be understood by the planter, the subject of potato culture had subsequently received all the aids which the luminous papers of Mr Knight could impart. The public journals borrowed and communicated fact after fact; and if the *rationale* of his directions were little inquired into, the order of culture derived infinite benefit from the unselfish communications of that most zealous investigator.

During this time, potatoes must have progressed yearly towards that state of *age and decay*, which, in 1831 or 1832, spread universal alarm by "*extending over the greater part* *of the three kingdoms*, and proving most fatal on all the *best soils*."

One of two things must now be admitted, 1*st*, Either the potatoes had not fallen into that state of age, decrepitude and aridity, which precedes decay, during the long period that had intervened between their first introduction and the year 1831 (nearly 300 years); or, 2*d*, Age has nothing whatever to do with the taint.

Fortunately for our hopes, Mr Aitken, in announcing his "effectual remedy," has made the following distinct and positive averment (p. 39):—"Where the potato is never over-ripened or over-grown, it *never* shews disease, and will live in the enjoyment of good health to a very great age."

This is refreshing; it is like the "day-spring from on high," and affords a good hope that our successors, even to a thousand generations, may continue to enjoy the fruit of their labours upon the *root*-progeny of those very tubers which are now in our own stores.

But it appears that the conditions of health and disease vary or intermits; for we are told, that "three times during the last nine years" (say seven) "have *healthy* crops succeeded *wet* seasons" (p. 322). The first year of revealed disease was 1832; the second was 1834; for 1832 being showery, produced juicy tubers, and a healthy crop in 1833. In 1834, the newspapers of the North repeated the alarm cry; and again, 1835 was everywhere fine, almost beyond precedent. According to Mr Aitken, the summer of 1836 *was wet*; that is to say, the thunder-storm of 6th July broke up the summer in *Scotland*; but with us of the South, that terrific storm was *dry*—no rain fell; and, though the heavens blazed with lightning from nine o'clock of the evening to the dawn of day, yet there were no dense masses of clouds: a pale "cirrus" suffusion formed the upper stratum; under which floated numbers of fleecy, grey cumuli. They who witnessed the tremendous [illegible]y of that night, will not speedily forget it. The autumn proved ungenial (so had that of 1835); but the hot, dry summer weather continued till the corn was completely housed.

Thus we perceive that the potato *can* be rescued from disease, and that it may be carried through every period and season in perfect safety, provided the husbandman do his duty, and act in conformity with the habits and structure of the plants.

To return from this digression, we shall see that 1832, 1834, 1835, 1836, and 1838, were years of disease *in the North;* but that 1836 " restored the potato, and led, as a consequence, to the healthy crop of 1837. The wet weather of 1838 operated in a like manner, and secured the healthy condition of the potatoes of 1839" (see page 321) ; but as all these results are only collected from the details in print, it becomes an affair of moment to inquire what was, *de facto*, the scene of mischief, and whether, or to what extent, England partook of the infliction ?

In 1834, the newspapers, as I before observed, gave the alarm ; but they stated no definite and tangible facts. As I had not observed one instance of failure or disease in any of my potatoes, with the single exception of that black variety, the total destruction of which I communicated in my former article (see No. 43, p. 348), I made every inquiry of parties in my own neighbourhood,—wrote a letter to Mr Knight, and another to a person in Wiltshire, whom I knew to be a keen and accurate observer. *Not one individual*, of whose crop I could obtain information, knew a solitary instance of disease ; and I can testify, that, though dried sets had been planted in soil, rich and in good heart as corn-land could be, yet, great crops—fine crops—were produced, year after year, from old tubers ;—no one thinking of renewal by seedlings, or of securing the result by selecting green and immature tubers.

Mr Knight replied to my inquiry in the following terms :—

" I have not witnessed any particular disease in the potato, with the exception of *the curl;* and that is never, I believe, seen in plants which spring from immature fibres. I have seen cases in which frost has destroyed the power in the buds of the tuber to germinate properly; and it is, as you suppose, not improbable that it may have produced such effects in the cases to which you allude. I planted whole tubers of moderate size, and my plants came up regularly, and were perfectly healthy. They, however, suffered much from drought; and the tubers of the early and moderately early kinds were very small. I, however, obtained from the variety No. 2., a yellow potato of not very early habits, 750 bushels and 16 lb. per acre; and nearly as great a crop from No. 8, which is very early."

I need hardly observe, that Mr Knight was, of late years, in the constant habit of planting entire tubers; therefore, his evidence may be objected to, or, at least, considered inapplicable by those who cut the sets. Thus, Mr Aitken, observes, in page 314,—"When any kind of potato is in youth, and in full possession of all its natural vigour, it may with safety be cut down to every eye, and they will all produce healthy plants; *but as the kind becomes old*, it loses its vegetative vigour, and will not grow at all if cut small. It then *requires the combined strength of the tuber to produce a healthy plant.*"

The entire potato, whether it be young or old, gives assurance of a plant. Of that fact, there can be no doubt: thus, in the ash-leaved and other early varieties furnished with few eyes, it is a prudent practice to plant entire tubers. But they deceive themselves who suppose that *all* the eyes break, and produce shoots. One or two only push first; and *these* progress, employing and consuming the nutritive matter contained in the pulp. Let any one try the experiment of leaving a few tubers on the ground throughout the winter,—duly protecting the surface by a mass of friable earth, or a covering of litter. These undisturbed tubers will remain a long time torpid; but they at length will sprout, and then, if carefully digged up, will afford incontestible proof that two or three of the most excitable eyes only advance, the rest remaining quiescent. But, in the event of destruction by sudden frosts, other eyes will push, and supply the place of those which were cut off. Trees and shrubs yield analogical evidence in support of the fact. A bud (to say nothing of latent germs) is at the base of every leaf. At the season of growth, those at the extremities will, in nine cases out of ten, take the lead, and push into shoots, leaving the lower buds in a state of quiescence. If the young shoot of a vine be pruned back to three eyes, the strongest will break—two perhaps will push; but one [illegible] will take the lead, and consume most of the sap. Thus, entire tubers provide against contingencies, and secure a crop,—and this is the sole philosophy of the practice, for, with all the late or strong varieties, it is wasteful; and the product does not compensate in proportion, for the extra expenditure of seed

It is always dangerous to confide in single-eyed *sets*; two, or, at most, three eyes, afford sufficient security, and Mr Aitken's directions for the preparation of the sets at page 334, are practically excellent; but I think he cannot sustain his position, that "*age* requires the combined vigour of the entire tuber."

In my former article upon "*The Culture of the Potato*," No. 43, p. 340, I endeavoured to present a comparative view of the average product of the land generally, with that to which it could be brought by scientific culture; in this I was justified by the great produce from entire tubers. It was also my object to prove, that the mismanagement of the "sets," in rejecting the rose or crown-ends, and permitting the poor weak fragments that were selected to lose all their sap, perhaps to suffer decomposition by long exposure to the air, must conduce to failure, if not to disease.

Mr Aitken's remarks, founded upon experience, have more than confirmed all that I stated, and he has proved beyond doubt, that the old drying treatment was founded in ignorance, and led to mischief: that a tuber cannot be too vigorous and juicy, consequently, that the sets can never incur danger from being planted in duly prepared soil *as soon as they are cut*. I, for instance, never lost a crop or witnessed disease, yet I have invariably cut every potato within the hour before it was planted.

I agree with him upon all the points that he has advanced concerning the superior excellence of green tubers; and hope it will not be long ere our planters adopt one or other of his modes of procuring them. One remark, however, I must make on this subject, founded upon my own experience. Whatever be the advantage of using *green* and rather *unripe* tubers, cut or entire, certain it is, that more failures and blanks in the rows have been, and will be, caused by planting comparatively *new* sets that have become *dry and flaccid* from exposure after being cut, than by employing the tubers of a hundred generations, provided they have been placed in the drills *fresh from the knife*.

It is a remarkable fact, but one, the truth of which is of easy proof, that "a *succulent*" is less affected and injured by exposure to moisture than the most dry and hard-wooded plant. Persons have supposed that a cut potato might rot in the ground, in consequence of its juicy condition; experience shews the fallacy of the idea: and this, in the instance under consideration, ought to be held satisfactory. Yet, in order to obtain additional evidence, let a shoot of a melon or cucumber plant, both very juicy and tender, be cut at a joint, and inserted in a phial of water to the depth of an inch or two,—or let cuttings of the balsam, or of almost any of the varieties of *Mesembrianthemum*, or of the *Cactaceæ*, be similarly treated, and retained in a pit or moist stove, at the heat of 70° to 80°, and it will speedily be seen that, so far from decaying, they will rarely fail to send forth strong and delicately white roots, generally in a very short time; but if otherwise, the water will remain sweet, and acquire no taint, provided the cutting live and tend eventually to protrude roots. In the autumn, owing to declining solar stimulus, I have retained a cutting of a very succulent *Geranium zonale* (the "horse-shoe," so called), during two months before the first root appeared; and yet neither softness nor solution of texture was in any degree produced. Under similar circumstances, woody cuttings have too often been entirely decomposed.

The vegetable *vital principle* is most energetic, and resists *electrolytic* decomposition till it becomes extinct; then, indeed, putrescent fermentation takes place, and separates the constituent elements of the inert vegetable matter.

I have thus endeavoured to collect many of the data, physiological, botanical, and practical, which more than a nine years' course of observed experiments have furnished. I beg leave also to refer to the former article in No. 43, as therein are other facts which it would be an intrusion now to repeat; and I hope that a careful comparison of these data, with those [illegible] in Mr Aitken's estimable paper, will throw much [illegible] the habits of the potato plant, and particularly in [illegible] with the [illegible] which it affects. We may remain [illegible] of disease, prolificity, or the reverse, depend more upon rotation than on the composition or texture of the native earths which constitute the staple of the land. [illegible] experiment confirmatory of this remark cannot be overlooked:—I had always found that the ashes produced by the combustion of the haulm contained a considerable portion of chalk (*carbonate of lime*) and some mild alkali. Wishing to ascertain whether the plant derived these substances from the soil alone, I placed one entire four-ounce tuber, of a very fine Downton variety, about five inches below the surface of a heap of black heath soil from Bagshot in Surrey, which was deposited on the hard-beaten surface of a gravelled yard. This heath-mould consisted of little more than white siliceous sand 90 per cent., and of black vegetable matter 10 per cent.; a very faint trace of iron was discoverable by the prussic test.

The tuber was planted late in April, or in beginning of May, 1838; it produced a powerful haulm and rich foliage that nearly covered the heap, and did not lose its verdure till it was suddenly destroyed by one of the sharp frosts of October. Some short time after, I removed the light black earth from around the stems, and discovered a vast progeny lying closely huddled together, in very small compass, and almost as if the tubers had been turned into a cavity made to receive them.

I took up at once at least twenty-six potatoes, most of them larger than the one sown, three or four of still greater size, and as many less, or about 2 oz. each; the total weight exceeded 7½ lb., and in turning the heap more carefully some months after, others were discovered making the weight fully eight pounds.

This result proves two important facts; it shews, *first*, that the simplest light sandy soil will support ONE *heavy* and *beautiful* crop, at the least; and, *secondly*, that the destruction of the herbage by *frost* entirely arrests the ripening of the *tubers*. Thus Mr Aitken's view of the effect of *cutting off* the stems, in order to *obtain green tubers* for seed, receives corroboration; for, beautiful as was the appearance of potatoes, the flavour was far inferior to that of the ripened tubers of the same variety.

I cannot speak decisively of the effects of *cutting down* the stems, though I recollect to have heard a farmer say that he had made one of his people cut off with a hook the straggling stems of an entire plot, and he made no complaint subsequently of the crop. But I have frequently taken off the extremities of all the shoots in the rows, in order to obliterate the flowers; repeating the operation if required, and have seen no reason to believe that the crop was injured in any degree.

As the object, in this case, is to increase the yield of the potato, the amputation should never be severe; and the stems ought to be suffered to become ripe, and thus insure the ripening of all the tubers intended to be used as food. But for *seed stock*, "green potatoes," that is, *those* which retain the full compliment of vegetable juice *at that precise period when the leaves begin to become flaccid*, are beyond question to be preferred.

It is the duty of every farmer who wishes to elevate his art to the dignity of a science, to try the experiments suggested by Mr Aitken in pages 328–9; nothing can be more simple, and the truth of the positions assumed would soon be ascertained, and thus the means of security would remain no longer hypothetical.

From all that we read in page 319, it is quite evident that the taint has been local, even in Scotland, for "*no taint has ever appeared* on the whole line of road from Leadhills to Edinburgh, with the exception of a little about Biggar in 1836." Leadhills is stated to be 2000 feet above the level of the sea, consequently "cold and late." On such land, which cannot produce mature potatoes fit for the use of man, it ought to be the sole object to grow the seed stock; for it is admitted that *superior quality* is not consistent with the implied condition which insures the safety of the next crop.

The summer of 1838 produced, we are told, a tainted crop; if *it did*, the disease was not seen in our best agricultural districts of England, and this I again assert, not so much to discredit Mr Aitken's opinion, for he evidently alludes to Scotland, but to caution the reader against attaching credence to the reports of the newspapers.

The nation was told of the frightful condition of the potato-crop about midsummer last;—"whole rows had disappeared," "the lots had rotted in the ground," "a total failure was to be anticipated." Yet what is the truth? Let "the reports (in England at least) decide."

Verily, "the schoolmaster is abroad" to some purpose, if those "best of all possible instructors" are to be taken in proof! *We* are forcibly reminded of the following severe remark of a very observant friend,—"There is nothing true in a newspaper, but what contradicts something that has preceded it."

The *nature* of the soil must, in a certain degree, govern the crop; *sets*, which would fail in rank-land, frequently produce fine foliage and healthy tubers in light sandy loam; this leads to the consideration of that result which Mr Aitken has stamped with the importance it deserves, by his observation on the "*Over-growth*" of the tubers, pp. 323–4.

He is correct in viewing it as a new topic, for, although it is in the mouth of every cultivator, that very large potatoes are generally defective in flavour, if not hollow and discoloured, yet few have thought of a preventive remedy, and but too many write *in favour of fine large* tubers, weighing from one to two pounds each.

I committed an error in my first experiments with Mr Knight's new varieties, and by planting his "Dowton Yam" and others in very rich adhesive loam, obtained a heavy crop of distorted, bulky potatoes, the largest of which were hollow and of very inferior quality. The progeny, however, when differently treated, recovered, and yielded, in every successive season, improved crops. My land was found ultimately to be too strong for those varieties which had their origin in a soil widely different from mine. This I ascertained by comparing my practice with the data furnished in the course of correspondence with Mr Knight.

It is certain that potatoes affect different soils and climates, and thus we have every reason to believe that the fine varieties for which Lancashire is so far and justly famed, fail to support their character when transported to the southern counties.

The process of *cutting down the stems* as modified at p. 329, par. 2, "allowing the tubers to mature in the drills until the ordinary season of taking up the crop," must be effectual to check the growth, because it is evident that the potato is nourished by the vessels of the stem, and, therefore, it can rarely fail to provide healthy and *succulent* tubers for the planter; but what its effect may be on those intended for food is at present undetermined. At all events, the result must be more satisfactory than that of diseased over-growth, and the suggestion should, on every account, be followed up, as it must conduce to practical knowledge.

A middle course may be safely tried thus;—the stems of some potatoes grow very luxuriantly four or five feet high; these might be cut back to *half* their height, and *they would then present more breadth of foliage to the sun*, than were they permitted to fall over, intermingling stem with stem till the entire plot become an entangled mass.

It only remains to state the produce of the two varieties grown by me this year. One of these I described in No. 43 as a *medium-early potato*, a variety of kidney which assumes curious twists and curvings. It is delicious in flavour, early or late; rarely breaks an eye before the season, and remains good till July.

I planted these potatoes in rows so widely asunder, as to permit rows of broccoli between them with ample space for both. The tubers were prepared in several ways, and the crops vary accordingly, as will now be seen.

Small 1 oz. to 2 oz. tubers in the poorest soil, where a large apple-tree had grown.

Row	1.	April 20.	2 lb.	digged,	Sept. 27.	17 lb.
	2.	21.	2.10	do. in a trench,	30.	30
	3.	—	2.12	halves do.	—	27
	4.	22.	3	small halves,	Oct.	43
	[illegible]	24.	5	large halves,	—	44½
	[illegible]	27.	4.12	do.	—	35
	[illegible]	29.	3	small entire,	—	35
	[illegible]		3.8	do.	—	38
	[illegible]	[illegible]	.12	small sets, 3 eyes,	—	30
	[illegible]	[illegible]	.12	do.	—	25
	[illegible]	[illegible]	[illegible]	medium halves,	—	35
	[illegible]	[illegible]	[illegible]	do.	[illegible]	24½
			[illegible]			384

[illegible] and there are many small [illegible] the four last shorter rows [illegible] dwarf standard. No manure, but as a covering, was used, and all the rows were in shallow trenches excepting No. 1. In the *garden*, five rows of entire small tubers yielded a crop comparatively much larger, but the results were not weighed. The earth of the garden plot is of a much more adhesive quality than that wherein the twelve rows were grown.

The Cornish rough red, or cricket-ball variety, I had grown some years since, but parted with the seed tubers in order to stock an agricultural neighbour. Thus I lost the variety till the late spring, when that person supplied me with 11 lb.; these I cut into two and three eyed sets, and from them obtained 87 lb.

The quantity is not sufficient to render it worthy of notice, but the quality claims a few remarks. Since the wet summer 1829, we have, in England, witnessed no season which could in any degree be compared with it. But the autumn also, and to this day (Dec. 21.), has been surpassing wet. With the exception of about sixteen days in August, there have been no dry intervals of three successive days. Of late dense fogs and haze have kept vegetation in a constantly wet and dripping condition, even in the absence of rain; thus the land is saturated, and all upon it is in contact with water.

Yet, strange to say, my kidney potatoes are perfect, mealy, and fine in flavour as I ever knew them to be: nothing of greenness, or of watery insipidity, can be discovered.

The rough reds were in a clinging unctuous loam; so much so, that the four rows were not digged in the course of three weeks; the work was done by snatches, and even then the tubers were coated with mud.

The only inference I would deduce is this: All varieties are not affected alike; there is a just balance between the soil and the crop, and this requires study and observation. Every fact that we meet with tells us of our ignorance, and yet furnishes the encouraging assurance, that, by patient investigation, we shall attain to a knowledge of rotations, and the adaptation of crops to soils, which will perhaps double the productiveness of the land.

ON DRENCHING HORSES.

By Mr JOHN STEWART, Veterinary Surgeon and Professor of Veterinary Medicine in the Andersonian University, Glasgow.

The operation by which fluids are administered to a horse against his will is termed drenching, and the fluid is termed a drench, a draught, or a drink. It is an operation very often performed both in town and country, and as often by the owner or groom as by the veterinarian.

MODES OF DRENCHING.

1. *Ordinary mode.* Turn the horse in his stall, tail in, head out; place a loop of rope or leather in his mouth; pass one prong of the stable fork into this loop, and elevate the head by it, so as to suspend it by the upper jaw, the loop pressing the roof of the mouth close to the front teeth; raise the head till the muzzle be about one inch, and not more than two inches higher than the throat; let the head be straight with the neck, not bent to one side; let not the loop press th cheeks into the mouth; make him who holds the fork direct its point right upward, and keep it so; he stands on the horse's left side; the drench is given from the right side by another person.

In quantity the drench seldom exceeds a quart, and it is given from a wide-mouthed, strong, smooth-necked bottle, either of glass or of metal; to an expert operator one is as good as another. A horn is sometimes used, but a bottle is more manageable, though not so safe in the hands of an awkward operator.

Standing on the right side, the operator puts the neck of the bottle into the horse's mouth, between the tusks and the first cheek tooth, taking care to avoid both, lest they catch the bottle and crush it, and cut the mouth. Pour the fluid in by degrees, and let one mouthful be swallowed before more is given.

When the horse is unwilling to swallow, it is good to let [illegible] his head after he has got one-half of the drench, and [illegible] two seconds before giving the other half. After all, wash out the mouth with half a bottle of clean cold water, which he may swallow or not, as he likes.

Caution.—Whenever the horse makes the least effort to cough, let his head down instantly; never tie his head up to a beam; never pull out his tongue; never press or finger his throat or neck to make him swallow, for it may make him cough; never put a twitch upon him; and never attempt to give a draught by the nostrils. These are the tricks of ignorance, and they are very dangerous.

2. *Extraordinary mode.* When the horse is lying on his side, a draught can be given with more ease, and with less danger, than when he is standing. Let a man keep down the head, by placing his knee upon the neck, and grasping the collar with one hand, and an ear with the other. Let the top of the horse's head rest on the ground; put your hand into the mouth, take a firm hold of the cheek; raise the muzzle till it forms with the ground an angle of about forty-five degrees; let the angle of the throat be such as it would be when the horse would stand at ease; if too acute, he cannot swallow, if too obtuse, he may choke. Having got his head fast, and in proper position, pour in the fluid slowly as in the other mode, and wash out the mouth after it is all swallowed.

3. *The Danger of Drenches.*—Very few suppose that there is any danger in drenching. In books and in stables, no mention is made of the danger. They are recommended and given without caution, and without fear. Now I know that many a good horse has been killed by a drench, while both owner and groom were quite ignorant, quite unsuspicious of the cause. The mischief is produced by some portion of the draught entering the windpipe, and going to the lungs, where it produces inflammation. When much of the draught enters the windpipe, there are immediate symptoms, which tell pretty plainly what has happened. The breathing becomes very quick; sometimes the horse coughs violently whenever his head is free, and sometimes a little of the draught runs from the nostrils. Upon applying the ear to the horse's breast, a gurgling sound is heard, which is produced by the air and fluid in the lungs. After a few hours, the pulse gets hard and quick, the breathing sometimes gets a little slower than at

first, but in general it becomes quicker as the pulse rises. The horse eats nothing; he never lies down, by night nor by day; he stands with his four legs wide apart; and if at liberty, he will seek fresh air, always standing with his nostrils to the open door or window. These symptoms continue till the horse either recovers, which is rare, or till he dies, which may be in six hours, or not till after sixteen days. He never lies down till perhaps an hour or two before death. The symptoms vary a little in every case according to the quantity of fluid which enters and remains in the lungs; much operates more quickly and more violently than little. One may shew the symptoms immediately after the drench, another not till after twenty-four hours. One may die in a few minutes from suffocation, and others may live to a period varying, as I have said, from six hours to sixteen days. Sometimes the horse does not die, but becomes broken-winded, and remains so for the rest of his life. Occasionally so little enters the windpipe, that the horse recovers completely, a slight cough continuing for a few days being the only evidence that any has entered. But a small quantity of a pungent irritating fluid will produce the same effects as a large quantity of another. For example, a little spirits of turpentine will do more mischief than twice as much oil. All fluids, however, are more or less dangerous; water I cannot indeed be sure of, but I have seen death follow from gruel and from oil, neither of which one would expect to find much more irritating than water. The symptoms vary, too, according to the treatment which may be adopted to remedy the mischief. Much can be done to save the horse's life, and if done soon enough, it is generally successful. Of the treatment, however, I cannot speak at present. My principal object is to warn agriculturists and others against an operation which they often perform without suspicion of its danger.

[illegible] experience better than [illegible] than another's; yet this paper will probably be read by some who, having given draughts without [illegible] their danger, will hesitate little to conclude that, [illegible] not, I *can* not. The best judges, however, [illegible] veterinary surgeons; and to the best judges every [illegible] his discoveries, before he imparts them to the public. It is proper that I should shew how far I have complied with this rule.

On the danger of draughts, I addressed my professional brethren eighteen months ago in a periodical entitled the Veterinarian.* I submitted to their consideration the following propositions:—

"1. That draughts, particularly when pungent or disagreeable, are dangerous. 2. That by no care can the danger be altogether avoided. 3. That no draught should be given, unless the horse be in danger of dying without it. 4. That the safest way of administering draughts, is to give them when the horse is lying. 5. That a draught is seldom or never absolutely necessary, but in diseases which make the horse lie. 6. That a bottle is a better drenching instrument than a horn."

To illustrate the danger of drenches, I gave twelve examples. Of these, one became broken-winded; four recovered completely; and seven died. A warm discussion followed; four, one after another, offered objections, but they were very easily answered. After publication of my last reply, Messrs Pottie, Spooner, and Horsburgh, came forward to describe similar cases, and to confirm what I had advanced. The matter seems now to be settled beyond further disputation. I have had two or three cases since, but all have recovered.

Let it not be supposed that I would prohibit draughts altogether. Horses, especially farm and other slow-working horses, are very liable to a disease which is fatal to great numbers of them, and which cannot in all, nor in the majority of cases, be cured by any medicine given in a solid form. In these cases, a draught must be employed, or the horse must die. Though the draught is dangerous, the disease is still more so.

In my own practice, I have, for several years, abandoned the use of draughts in every disease except the one I allude to. I give no bottles of oil, no solution of salts or aloes, no gruel-draughts, no fluid medicines, which can be given with nearly as much effect in a solid state. In some cases, a draught might operate sooner or more effectually; but that is no reason why it should be given. Will the horse die without it? that is the question. If he will, give the draught; if not, give a ball.

* See Veterinarian, vol. xi. pp. 476, 574, 576, and 649. Also, vol. xii. pp. 106, 167, 229, 235, 327, and 526. This work is published monthly.

THE AGRICULTURIST'S NOTE-BOOK.—NO. X.

*Management of the Poor in Scotland.**—Many and diverse opinions have of late years been laid before the public with regard to the best method of preventing the increase of pauperism, and of managing that portion of it which now exists, and which revelation and experience alike convince us must always continue to exist, more or less, in the present constitution of society. Several of these views seem to be legitimately deduced from authentic statistical details, others of them cannot be looked upon as otherwise than theoretical and speculative, and these epithets, we fear, are not altogether inapplicable even to some of the most distinguished writers on the civic economy of large towns. Dr Alison has entered upon the subject with an intimate acquaintance with all the facts calculated to lead to accurate views of it; and he has discussed it with a degree of earnestness, candour, good feeling, and sound discrimination which cannot be too highly appreciated. The value of the work must, of course, be estimated by its intrinsic merits; but it is impossible for those to whom Dr Alison's character is in the least degree known, not to feel with what emphatic propriety and force any statement on such a subject comes from one who has been led to investigate it by feelings of the most ardent sympathy and unwearied philanthropy, and whose convictions are founded on a long-continued and extensive personal experience.

Although a work of such a high character, and on a subject of such deep interest to all classes of the community, must necessarily be extensively circulated, and may already have fallen into the hands of some of our readers, as we hope it ultimately will into those of them all, yet we cannot but persuade ourselves that we are aiding the cause of humanity, which it so powerfully pleads, by presenting a brief abstract of some of its most important statements. The destitution and suffering among the lower orders in Edinburgh and Glas-

* Observations on the Management of the Poor in Scotland, and its effects on the health of great towns. By W. Pulteney Alison, M.D., F.R.S.E., &c. [illegible] Son. Edinburgh, [illegible]

gow, always great, are now *very much on the increase*, approaching to the wretched condition of the poorest classes in Ireland. This is incontestibly proved from the records of public institutions, which are not liable to the fallacies which might be suspected in the statements of any individual. The degree of this destitution is shewn by numerous details. In the closes of Edinburgh, into whose gloomy recesses the light of day scarcely penetrates, several families often lodge together in one apartment, of the most filthy description, without furniture or cooking utensils of any kind, most of them sleeping in the same clothes they wear during the day; old men of eighty often lying on the boards; and few better accommodated than with a litter of straw. In Glasgow "scenes of wholesale human degradation and misery" exist to a still greater extent. The wynds comprise a fluctuating population of from 15,000 to 30,000 persons. In some of the lodging-rooms in these lanes (visited at night), "We found a whole lair of human beings littered along the floor, sometimes fifteen and twenty, some clothed and some naked; men, women, and children huddled promiscuously together. Their bed consisted of a layer of musty straw intermixed with rags. Thieving and prostitution constitute the main sources of the revenue of this population."

The consequences of this lamentable state of things may be foreseen. For many years past contagious fever has never been absent from Edinburgh, and there have been three great epidemics of that disease in the last twenty-two years, each lasting nearly *three years*, and each of the two last affecting, Dr Alison believes, nearly *ten thousand persons;* in other words, of the last twenty-two years, nine may be said to have been fever-years, during which probably from 25,000 to 30,000 of the population have been affected! The rate of mortality in Glasgow is truly frightful. Since 1830, the average mortality there has been 1 in 30; in 1832, it was 1 in 21.67; and in 1837, 1 in 24.63. The average mortality of London—the fact is particularly deserving of notice—being 1 in 41, and over England 1 in 51.

This repeated recurrence of extensive epidemic fever Dr Alison regards as a clear indication of great previous suffering among the poor; and, while he admits that contagious fever may exist (of which every one has seen instances) where there is no destitution, he is certain that destitution is a peculiarly powerful and efficacious cause of its *rapid diffusion*. This he shews from a variety of considerations, and, among others, from this, that most of the great towns in England are comparatively exempt from fever, a difference distinctly to be ascribed to the more comfortable condition of the English poor. Not only are the destitution and sufferings of the poor in Scotland greater than in England, but they are much greater than in any other well-regulated countries. Although the medical charities in Edinburgh are well supported, that is, although institutions for the relief of poverty, *combined with disease*, have been augmented to meet the increasing demand for them, yet there has been a falling off in those designed for the relief of *indigence alone*, of persons out of employment, of widows and orphans, &c. The relief of poverty, therefore, as a *prevention* of disease, is greatly neglected, a circumstance to be ascribed to the impression which has prevailed, that charity, intended merely for the relief of indigence, independently of disease, is of doubtful public advantage, inasmuch as it tends to "break down the spirit of independence among the poor," and thereby multiply the objects of charity. This opinion Dr Alison maintains to be the very reverse of the truth. He shews that it is chiefly founded on fallacies connected with the statements as to the English poor. The proportion of paupers in England is not really increasing on the whole, as alleged; nor does increase of pauperism in England infer increase of destitution, or suffering, or deterioration of the *condition* of the poor, as often supposed. If this were the case the poor of the English towns, where poor-laws have been in full operation for 250 years, would be *more* redundant and more liable to contagious fever than those of the Scotch and Irish, instead of being remarkably *less* so. Dr Alison then enters at considerable length into an examination of the various arguments urged against poor-laws, and having answered all objections, concludes by giving his most decided and conscientious preference of a legal provision for the poor to every kind of voluntary charity. Its advantages are, 1*st*, that it is much more effectual for the permanent relief of misery in the lower orders; *2d*, much more just towards the higher orders; *3d*, acts much more uniformly,—its amount being much more easily adapted to the real wants of the poor, and its kind, in each case, to their character and circumstances; *4th*, it secures an interest in the concerns of the poor throughout the whole community. The facts and reasonings by which these propositions are supported and enforced are too numerous and lengthy to be adduced here; but they imperatively claim the attention, as well as every other part of Dr Alison's work, of all who feel an interest in the welfare of their species.

*Macgillivray's British Birds.**—We have already introduced the first volume of the above work to the notice of our readers, and now propose to make a few remarks on the second, which has been for some time before the public. It amply sustains the high character merited by the former for original observation, patient and persevering research, a just appreciation of character and habit, combined with detailed and lucid descriptions. Numerous works on British birds have lately appeared—Jenyn's, Wood's, Mudie's, Selby's, Jardine's, Yarrel's—all possessed of separate excellences, and the three last in particular of pre-eminent merit. Of these some will be preferred to others, according to the taste and attainments of different students; but it may be safely affirmed that none of them form a more faithful guide than Mr Macgillivray's in acquiring a knowledge of our native birds, while to some it will probably appear to possess an interest in which the others may be thought deficient.

Certainly no one has entered upon his task with greater enthusiasm, or at least has allowed so much of the *con amore* spirit to transpire in the execution of it. Our author seems altogether in his kindred and congenial element when descanting on the properties, ways, and instincts of his feathered

* A History of British Birds, Indigenous and Migratory, &c. By William Macgillivray, A.M., F.R.S.E. Vol. II. London: Scott, Webster, and Geary.

favourites; and his mind is so filled with the subject, that he is often led into minute and collateral details, which, we fear, will be thought by many to be somewhat discursive and diffuse. Different opinions also will be formed, and have already been expressed, with regard to the judiciousness of the method at times adopted for conveying his instructions, as well as in relation to the matter occasionally introduced. A high degree of dramatic talent is requisite to render a didactic dialogue at all tolerable; it is at best an awkward and circuitous mode of communicating knowledge; and if written in the quaint and involved style of a bygone age, it becomes still more objectionable. We perfectly agree with our author, that there is no necessity, in treating of such subjects, for maintaining a uniform precision and stateliness of style and manner. Many recent naturalists have, we think, impaired the interest of their subjects by being too particular in this respect,—never moving but in a stately processional march, and with as much stiffness as if they were clothed in sheets of lead. But we must beware, at the same time, of going too far in the opposite direction. We must not mix up our disquisitions on the sublime and beautiful in nature with a detail of the petty incidents of every day life,—not remark in one sentence on the philosophy of the subject, and in the next on the most ordinary occurrences that may befal us in the prosecution of our labours. We must have respect to the "majesty of nature." We should endeavour to conform to the Shaksperian advice (although with many it is difficult to do so), and endeavour to be familiar without being vulgar. We need not be so ascetic as never to indulge in a joke, or endeavour to excite a smile; but this should be done with caution, for, judging from the attempts of the kind which we have seen in works on Natural History, it is generally done at the expense of good taste, and not unfrequently of good feeling.

Although these latter remarks have been suggested by the perusal of Mr Macgillivray's book, they are by no means strictly applicable to it; but are made in the apprehension that others, especially young naturalists, who may adopt his plan, without being gifted with the same powers for executing it, may fall into the error to which we have pointed. The method he has followed seemed to him best adapted to accomplish the highly laudable purpose of recommending this branch of natural history to more general attention than it has yet received, by investing it with all the interesting accessories of which it was susceptible. "My aim," he says, "has been to amuse as well as to instruct, to engage the affections as well as to enlighten the understanding, to induce the traveller on the road to science to make occasional excursions tending to raise his spirits, and to shew the public that ornithology is not necessarily so repulsive as some of its votaries represent it."* We cannot help regretting that, in his praise-worthy attempts to surround the objects of his study with all agreeable influences, our author has omitted, in almost every instance, to quote any of the poetry in which their praises have been celebrated. Most of them, as he well knows, have been "married to immortal verse," and why should they be thus unceremoniously divorced therefrom? Even that "daughter of love-lorn poets, Philomel," appears without the usual tribute from her votaries.

The present volume contains the history of what, in Mr Macgillivray's not at all times very euphonious nomenclature, are called *cantatores*, or songsters, a section including a great portion of the insessorial order of other ornithologists. An interesting account is here given of most of the ordinary birds which frequent our fields and gardens, cheering us with their song, and enlivening our walks by their unceasing activity and sprightly motions. Thrushes, larks, wagtails, nightingales, tits, and numerous allied tribes, are treated of, and many original observations made on their habits. The descriptions (in every instance original) are of very great length, and include the most minute details. Indeed, we are inclined to think, that their particularity is carried at times rather too far. A *species* can only be properly described in somewhat general terms, for perhaps no two individuals are in every respect alike. It is a very common error with modern naturalists to describe an *individual*, when they should describe a species.

* Preface to vol. ii., page 2.

We congratulate Mr Macgillivray on not having become a convert to the quinarian or circular system. To use his own words, he has not been *deceived* by it. The expression is strong, but it is perhaps warranted by the occasion. When we first studied that system in the *Horæ Entomologicæ*, the sagacity, extensive knowledge, extreme caution, and logical reasoning of Mr Macleay, made us favourably disposed towards it, and we really thought that a key had been discovered to some of the designs of nature. The attempts made by Mr Swainson to extend and apply this system, in a series of works which, for inaccurate statement of matters of fact, false notions of analogy, and illogical reasoning, have certainly no parallel among modern publications on natural history, first convinced us of its fallacy; and, even in the hands of Mr Macleay himself, the "parens atque princeps" of the discovery, when he applies it to the arrangement of subordinate groups, it appears to us to involve in inextricable confusion and obscurity the very subject it was devised to illustrate.*

There is much in Mr Macgillivray's book to afford subject of remark, but the space to which we should restrict ourselves has been already exceeded. In return for so much agreeable reading and useful information, it may seem ungrateful and hypercritical to advert to a few matters of inferior importance which we could wish had been otherwise than they are. A part of the title does not appear happily expressed. A History of British Birds, *indigenous* and *migratory*: the terms are not distinctive. A swallow, nightingale, or corncraik, are migratory; but they are surely as strictly indigenous—that is, natives of this country, *born* in this country—as a sparrow or a blackbird; *resident* or *stationary* would have been preferable terms. Cotemporary authors are occasionally alluded to in a somewhat detractive and acrimonious spirit, to which a mind like that of our author's should be superior. A perfect galaxy of modern ornithologists, who have been the means of raising the science to its present state of advancement, are slightingly spoken of as mere compilers (see page 59). Full just[illegible] done to *one* of these (page

* [illegible] forming pa[illegible] Smith's Disco-
[illegible] Afri[illegible]

412). Mr Macgillivray's residence being in Edinburgh, and most of his correspondents also being in that neighbourhood, certain parts of his work are, from that circumstance, insensibly contracting a somewhat too local character for a general British Ornithologia. It is much to be regretted, that he has no correspondents in the south of England, and south of Ireland, to afford the same service for him there that Mr Weir performs so zealously and successfully in the Lothians. Some effort should be made to remedy this evil. Our species of native birds amount to upwards of three hundred (the fullest catalogue we have seen contains three hundred and twenty-three). Proceeding on the plan he has adopted, our author describes about fifty in each volume; to complete the work, four other volumes will therefore be required, making in all six goodly tomes. This is not too much for the subject; but we are apprehensive that it may prove too much for the purse of many into whose possession we should wish the work to come. We strongly recommend Mr Macgillivray to publish a synopsis, containing merely the specific character, a few words on the distribution, and the woodcut at the side: nearly all the wood-cuts are admirably executed. This would form a valuable manual, and would by no means supersede, but rather promote, the circulation of the larger work.

Domestic Gardener's Manual. *—The name of Mr Towers is now pretty familiar to the readers of this Journal, and the contributions with which he has frequently favoured us, abundantly testify how well qualified he is to produce such a work as that whose title we have just transcribed. A long acquaintance with the practical details of gardening has afforded him an opportunity of testing the merits of the various modes of treatment; and those which he recommends in this volume have therefore the sanction of an extensive experience. But the merit of the work does not solely consist in affording ample instructions for the most approved method of cultivat-

* The Domestic Gardener's Manual: being an Introduction to Practical Gardening on Philosophical Principles, &c. By JOHN TOWERS, C.M.H.S., M.E.A.S. New Edition, enlarged and improved. London: Parker, 1839.

ing garden plants of every kind, forcing, laying out gardens, and many other collateral matters in connection with these. The author has aimed at a higher object—he has entered keenly into the science and philosophy of his subject, and given a perspicuous account of the great agents employed by nature in the production of plants, as well as their intimate structure and physiology. The nature of earths, electricity, water, the atmosphere, light, heat, motion of the sap in vegetables, &c. are treated of in a highly interesting and satisfactory manner. In this department not much original matter is, of course, to be expected; but the materials are derived from the best possible sources, and skilfully digested. We know of no work of a similar kind which comprehends, in so small a compass, so much useful information on the philosophy of vegetation, or which is better calculated to excite a spirit of research among young gardeners and amateur cultivators in general, into the secret processes of nature continually going on around them, but of which so many are contented simply to reap the fruits without desiring to obtain any acquaintance with the *rationale* of the wonderful agencies by means of which these are elaborated. Besides other matters, too numerous to be mentioned here, the work contains a Naturalist's Calendar for each month, introduced probably that nothing might be wanting that is usually found in such publications, rather than from any conviction of its utility. Such calendars are in general very sorry affairs, and had better be dispensed with altogether. The error that pervades them is, that they state as general facts what are true only in particular localities. The present work, for example, is generally applicable to the British islands; and we are told, without condition or restriction that the nightingale appears there in the second [illegible] t is very unkind in the nightingal[illegible] and the north of England, [illegible] y much further northwards [illegible] continent [illegible] is known not to exist in the two [illegible]-mentioned [illegible] apprehend that it cannot reasonably be expected to appear there at the time indicated, notwithstanding Mr Tower's assertion to the contrary. Similar objections apply st[illegible] many of the other co[illegible]

[illegible]

Repton's Landscape Gardening. * — "Gardening," says the Editor in the Introduction, "as an art of culture, since the commencement of the present century has made rapid progress; but as an art of taste it has been comparatively stationary." Why is this the case? "One of the principal causes," Mr Loudon justly remarks, "is the abundance of cheap books on subjects belonging to the former department, and the scarcity and high price of those treating on the latter;" and this obvious cause he is using every effort to remove. This he has already partly accomplished, by placing the works of Repton, formerly published in a splendid and expensive style, within the reach of every head gardener, and every economical journeyman gardener, in the land. He proposes, also, to continue his exertions in this way with other works on the subject of taste, as connected with what is called "laying-out grounds."

Landscape gardening, as practised in this country, is evidently very far behind every other department of rural science or art. It is, indeed, difficult to point out any country residence where an outrage on the principles of taste is not at one glance apparent. Not only are books in a cheap form awanting, but masters teaching by example are, or ought to be, in demand. Already landscape gardening has branched into various styles or schools, which may be named after the most eminent masters of each particular style.

"The modern or landscape style, when it first displayed itself in English country residences, was distinctly marked by the absence of every thing having the appearance of a terrace or of architectural forms or lines immediately adjoining the house. The house, in short, rose abruptly from the lawn, and the general surface of the ground was characterized by smoothness and bareness. This may be called the Kent school." The publications which illustrate this style or school are

* Repton's Landscape Gardening and Landscape Architecture, a new edition, with an Historical and Scientific Introduction, a Systematic Analysis, a Biographical Notice, Notes, &c. &c. By J. C. Loudon, F.L.S., &c. &c. Being the entire works of the late Humphrey Repton, Esq. on those subjects, originally published in one folio and three quarto volumes; now compressed in one volume octavo, illustrated by upwards of two hundred and fifty engravings. For the Editor. London.

chiefly those of Shenstone, G. Mason, Whately, and Mason the poet. "The rage for destroying avenues and terraces having subsided," the masterly writings of Uvedale Price paved the way for "what may be called Repton's School, which may be considered as combining all that was excellent in the former schools, and as consisting of the union of an artistical knowledge of the subject with good taste and good sense." These works, as formerly published by Repton, we believe, amounted to L.25. Thanks to Mr Loudon, the price does not now amount to a sixteenth part of that sum.

A biographical notice of the late Humphrey Repton, Esq., appears in the end of the volume, written expressly for the work we are now noticing, and shews how eminently well qualified that amiable gentleman was, by nature and circumstances in life, for writing on matters of taste. A perusal of this, after going over the work itself, will shew the extent of the obligation which gardeners and architects are laid under by Mr Loudon for placing within their reach a work so intimately connected with their every-day pursuits, and so well fitted to direct their ideas, mature their judgment on proper principles, and to enable them, without hesitation, to perceive at once, in every case, what would form real and pleasing improvements, either in building, planting, thinning, or groundworking. And to shew by the pencil the effects these suggested improvements would have to the eye, before the operations are entered on, Mr Repton seems to have possessed a singular facility in thus illustrating the improvements he recommends; and his numerous engravings afford valuable examples of the appearance of the building, lawn, or landscape, before operations for improvement commenced, and shewing *a priori* how they would appear when executed; and no man, who does not possess this qualification, can act with credit to himself or satisfaction to [illegible] landscape gardener—a term first [illegible] Repton and to which it is appa- [illegible] well entitled. Although [illegible] years since he departed this life, yet, [illegible] period, birth has been given to another [illegible] landscape gardening produced by the for- [illegible] botanical collections of trees and shrubs allowed to take their natural forms. To this style or school Mr Loudon has contributed much by his Arboretum Britannicum, and other works, and to which he has given the name of *gardenesque style*, and with which succeeding authors, on such subjects, will likely associate his name.

We shall now lay before our readers a few extracts to shew Repton's style of writing, a specimen of his style of landscape gardening cannot be so easily illustrated without referring to the engravings in the work itself, and his accompanying remarks. In pointing out the distinction between the farm and what relative to a country-seat is called "the Park," Mr Repton says, "The chief beauty of a *park* consists in uniform verdure, undulating lines, contrasting with each other in variety of forms—trees so grouped as to produce light and shade to display the varied surface of the ground, and an undivided range of pasture. The animals fed in such a park appear free from confinement, at liberty to collect their food from the rich herbage of the valley, and to range uncontrolled to the drier soil of the hills. The farm, on the contrary, is for ever changing the colour of its surface in motely and discordant hues; it is subdivided by straight lines or fences. The trees can only be ranged in formal lines along the hedges, and these the farmer claims to cut, prune, and disfigure, instead of cattle enlivening the scene by their peaceful attitudes or sportive gambols. Animals are bending beneath the yoke, or closely confined to fatten within narrow inclosures, objects of profit, not of beauty." (p. 208.)

We are here referred to two wood-cuts, shewing in figures, first, a view of farm lands, then in the second the same lands with the hedge-rows removed, and the whole converted into park scenery.

In nothing connected with landscape gardening does so much want of taste appear as is often displayed in forming the approach or carriage-road to the house. This will appear to every traveller who chooses to read the few following rules offered by Repton—rules which are much oftener violated than observed. They seem to form part of a report on improvements at Tatton:—"The requisites to a good approach may be thus enumerated. 1. An approach is a road to the house, and to that principally. 2. If it is not naturally the nearest road possible, it ought artificially to be made impossible to go nearer. 3. The artificial obstacles which make this road the nearest, ought to appear natural. 4. And to this we would call particular attention, as, though obviously being well calculated to give the lodge and entrance an air of importance, the advantage of bends in public roads are seldom made available. When an approach quits the high-road, it ought not to break from it at right angles, or in such a manner as robs the entrance of importance; but rather at some bend of the public road, from whence a lodge or gate may be more conspicuous, and where the high-road may appear to branch from the approach, rather than the approach from the high-road. 5. After the approach enters the park, it should avoid skirting along its boundary, which betrays the want of extent or unity of property. 6. The house, unless very large and magnificent, should not be seen at so great a distance as to make it appear much less than it really is. 7. The house should be at first presented in a pleasing point of view; and 8. As soon as the house is visible from the approach, there should be no temptation to quit it, which will ever be the case if the road be at all circuitous, unless sufficient obstacles—such as water or inaccessible ground—appear to justify its course." (p. 92.)

We have but given a very faint idea of the merits of this excellent work, nor can these merits be made to appear without a reference to the engravings. We trust, however, that with this cheap and valuable work, which, we doubt not will be extensively and profitably perused, and with the series of other cheap works on the same subject promised by Mr Loudon in the introduction, a knowledge of laying out ground, on acknowledged principles of taste, will soon be seen in the improved appearance of rural scenery where nature may be improved by art. Mr Loudon has merited our thanks for what he has already accomplished, and our wishes for his success in his proposed efforts in spreading a knowledge of an art of which he has been long known as a skilful master.

*Millium effusum.**—" The panicles of this graceful and pretty grass are sometimes found near a foot long, and eight inches wide; the seeds are a favourite of numerous birds, and the abundance which it produces, together with its naturally preferring to grow in the cool and shade of trees, sufficiently recommend it as a grass of great utility in game preserves; and its elegance and soft green colour would form an ornament of [illegible] inconsiderable beauty in the shade of plantations [illegible] where but few other plants will grow."

[illegible]

We have long been of the same opinion with the conductors of the Floragraphia respecting the beauty and utility of this elegant grass, and are surprised that a plant which seems intended by nature to produce food for the songsters of the grove, has so long escaped public attention. The name implies fertility, and few grasses have a panicle so richly stored with seeds which ripen early in July, and come most opportunely for feeding young pheasants. The grass early in spring is broad, has a lively green colour, and resembles young luxuriant wheat. In June, it sends up numerous stems from four to six feet in length, according to the nature of the soil. In the beginning of July, the seeds are ripe,—they are rather larger than seeds of Timothy-grass, resembling millet, but longer, and of a brownish glossy colour,—they begin to fall as soon as ripe, and continue to drop for a considerable period. Every part of the grass is relished by cattle, but when allowed to ripen its seeds and afterwards dried, it has more the appearance of wheat straw than hay. The aftermath comes away freely if the plant is cut over for the purpose of saving the seed, and in the autumnal months would afford an excellent and clean bite for young cattle turned into woods or plantations. In cutting for the purpose of saving the seeds, much care is necessary to prevent the seeds from shaking out, the panicles becoming so enlarged with each other, that the least jerk in the attempt of separation, is followed by the fall of a copious shower of seed. When this grass shall have become the predominant plant in our woodlands, it will by its closeness keep down many of the most noxious weeds, and, what is of much importance to the agricultural interest, farmers will have no longer cause to complain of depredations by pheasants in their corn-fields. We know, from close observation, that pheasants will leave any other food for this seed, of which they seem exceedingly fond; and where there is plenty of plants, the seeds that drop from time to time, and that are not devoured by birds, continue on the surface without *vegetating* till the following spring, affording an ample supply of food, and also cover for game, where the plant is neither cut or subjected to pasture, during the autumn and part of the winter months.

The culture of the millium, or Scotch Millet, in woodlands, is exceedingly simple and easy, and as the plants do not require to stand close, three or four pounds of seed will be quite sufficient to sow an acre. In larch plantations, the seed should be sown just immediately before the fall of the leaf, and the leaves falling will cover the seeds and complete the process. In old and natural woods where the ground is already occupied by sylvan plants, a pound or two more should be sown, say at the rate of six pound per acre, to allow for part being picked up by birds; the plants will soon establish themselves, and displace the more useless natural plants. Where the ground is bare, bush-raking may be necessary to cover the seeds, which should all be sown in autumn, or very early in spring.

Were the many thousands of acres of the forests and natural woods of Great Britain sown with this grass, their value as pastures would be exceedingly enhanced, and game laws, as far as pheasants are concerned, would no more be complained of. At present seeds may not be easily obtained, but a demand will soon ensure a supply, and any proprietor may soon satisfy himself as to the value of this grass, by either procuring a few plants to be inserted in some corner of his woodlands in autumn, which will yield seed the following summer, and, being in habit strictly perennial, will improve for several succeeding seasons; or a small patch may be sown in autumn, and the plants will appear the following spring, and will acquire strength throughout the summer to enable them to produce a fine crop of seed the year after. By these simple means the proprietor will be able to proceed in safety to cultivate this hitherto too long neglected, useful, and elegant plant, more extensively.

*Köllar's Treatise on Insects.**—The students of no department of natural history have been so much taunted with the practical inutility of their pursuits as entomologists. The time is not long past when scarcely any one ventured to draw at-

* A Treatise on Insects injurious to Gardeners, Foresters, and Farmers. By Vincent Kollar. Translated from the German, and illustrated by engravings, by J. and M. Loudon. With notes by J. O. Westwood, Esq. F.L.S. London. 1840.

tention to the subject without previously making some apologetical defence of it as one falling within the limits of legitimate inquiry. Now the tide has set in with an opposite current, and there is scarcely any branch of zoology which finds greater favour in the eyes of naturalists. It may still, however, be thought by the uninitiated that there is a deficiency of practical and useful results, and we are therefore pleased to find that so much is now doing, both here and on the continent, to take this objection out of the mouth of those who are either unable or unwilling to appreciate any higher motives for engaging in the study than the *cui bono* objects of a mere economist.

In shewing the benefits that may be expected to result to the farmer and horticulturist from investigating the habits of insects, the Entomological Society of London have taken a prominent part; and the essays which it has called forth, by the offer of premiums, are of the highest value. Similar inducements to attend to the subject have likewise been held out by the Highland and Agricultural Society of Scotland; but these, probably owing to the small number of entomologists in the northern quarter of the island, have not hitherto elicited any thing of consequence. A series of papers on noxious insects from the able pen of Mr Westwood, illustrated by his admirable pencil, has appeared at intervals in a well-known London periodical; and the readers of this journal need not be told that another series, having similar objects in view, exists elsewhere. While all this has been doing here, our continental friends have not been idle. Nay, so important has the subject been deemed by them, that a series of public lectures have been delivered on it in Paris by the professor of entomology in that city; and several elaborate works have been published in different countries.

For the pleasure of perusing one of the latter in an English dress, we are indebted to the Misses Loudon, sisters of the author whose name is familiar to almost every one who has seen a modern book on rural economy. They have executed their task with great care, and seem to have done full justice to M. Köllar. The original work was suggested and patronised by the Royal and Imperial Agricultural Society of

Vienna, who commissioned three of their members, along with M. Köllar, to engage in the execution of it. The contributions of these individuals are accordingly included, although the principal task of authorship devolved on the gentleman under whose name the work appears. It includes a detailed and very useful history of many of the insects from which the agriculturists of this country sustain injury; several of the species described, however, happily do not occur here. Even in reference to the vicinity of Vienna, to which it chiefly applies, the work is very far from being complete, and considered in reference to this country, it is both redundant and defective. It is of the former character, by including many species not indigenous to Britain, while multitudes are omitted from which we have most reason to apprehend injury. M. Köllar has very successfully investigated the history of certain species, but the mistakes he often commits prove him to be not a very skilful entomologist. His errors, however, are in general corrected in Mr Westwood's useful notes, which are a valuable addition to the volume. We may be excused for adding, that we wish the gentleman just named had made the drawings for the wood-cuts which ornament the work; in order to figure insects well, one must not only be a skilful draughtsman, but also a skilful entomologist. This remark, however, has reference chiefly to the Dipterous species near the commencement; nearly all the rest are extremely well, many of them very beautifully, executed.

Draught of Ploughs.—We were anxious to have made some remarks on the comparative draughts required by different forms of ploughs, and especially in reference to the statements made by Mr Handley in a paper on that subject which appeared in the second part of the Journal of the English Society; but, as we observe by the advertisement in the newspapers, that an article on the same subject by Mr Pusey appears in the lately published part of that Journal, it is proper we should peruse it before making our remarks. The newly published part, however, has not yet made its appearance in Edinburgh.

Corn-Law Agitation.—The corn-law agitation goes on apace, and more clamorously and virulently than at this time last year. Why it should be so, we do not know, except it be that the price of wheat is 10s. per quarter lower, and the potato a more abundant crop now than then, thereby plainly indicating the existence of more food in the country at this period than at that. But this we do know, that a more unreasonable clamour never was raised, even by manufacturers, against any existing law. The operatives of large towns, for whose sole benefit the manufacturers for the foreign markets profess to make the clamour, are beginning to see its unreasonableness: they are getting truer views of the actually miserable condition of the continental operatives who have always cheap bread, and they are beginning to suspect that their *friends*, the manufacturers for the foreign markets, are desirous of reducing them to as low a condition, in order that they may profit by the low wages of their labourers. This agitation, instead of ultimately benefiting the manufacturers themselves, will only tend to convince their own labourers of the fallacies of their own assertions; and, believing this will be the effect of their present and past conduct, we are under no apprehensions that the protective duties on our own agriculture will ever be *repealed*.

But although we are fully assured, in our own minds, that even no alteration will be effected in the corn-laws this session of Parliament, yet we think this a very favourable opportunity for the Central Society of London to make a strong appeal for support to the agriculturists of the kingdom generally. That society has not stood well with the public for the last few years. They have allowed the English Society to invade them, and snatch the palm out of their hands with too much of an air of triumph. But they need not care for that. The English Society has now left them free, and taken up a position which none else in England can now occupy. Let the Central Society take up what ought to be their own position; and they may take undisputed possession of it. Let them explicitly declare, that their sole object is to bestow undivided attention on the political economy of agriculture, to study its statistics, and protect the interests of all agriculturists, from the landlord to the hind. Let them request subscribers for these purposes; and, that they may accomplish these, let them establish a corn-law circular, for the purpose of writing down the anti-corn-law circular by sound argument and incontestible truths. Let them engage men of talent and fame to deliver lectures, in the manufacturing towns and districts, on the propriety, safety, and necessity to the nation, of protective duties on agricultural produce against foreign competition. Let them send men abroad, in whom confidence can be placed, to ascertain the actual condition of labourers of all classes, in reference to the prices of food. Let them investigate the actual condition of the labourers of all classes of this country. Let them, by these and many other means that could be devised, collect and disseminate a great mass of statistical facts and arguments, that may serve to guide future legislation in reference to agricultural matters. Let them shew the country, that these are the great and important objects they desire to pursue, and there will be no want of support from the landed interest.

*Doyle's Practical Husbandry.**—Some years have elapsed since Martin Doyle was introduced to the notice of our readers, as an author on agricultural matters bearing special reference to the state of agriculture in Ireland. It may have been remarked, that of late years the press of Ireland has been teeming with works on agricultural subjects, and we have no doubt, that the popular tone and easy style of Mr Doyle's works, have been one great means of giving an impulse to the agricultural literature of that country. And in this busy race of authorship, Mr Doyle has not been an idle spectator. Many works have issued from his pen since his introduction to our readers [illegible] length he appears before them with a regu[illegible] practical husbandry.

[illegible] are of the form of a cyclopædia, [illegible] alphabetical order; but the mat[illegible] he himself [illegible] in the preface, is not original, but [illegible] on agriculture extant, both

* [illegible] and Rural Affairs in general. [illegible]

oral and printed compilations, from a mass of heterogeneous and irrelevant matter,—"to refuse the evil and to choose the good,"—to arrange and select carefully, and to condense essential points, so as to avoid prolixity and meagre conciseness, is no easy task; but, in all these respects, we think that Martin has displayed, in the work before us, much sound judgment and discrimination; so that his own words may here be very aptly quoted, inasmuch as "he has studiously avoided the insertion of unnecessary, or mere expletive matter; and when he has hazarded his own suggestions, though sanctioned by a long course of habitual observation, grafted on actual experience, he has done so without dogmatizing or arrogating to himself hints which exclusively belong to others."

Premiums on Scientific Agriculture.—It may have been generally observed, that the Highland and Agricultural Society of Scotland have, for the two last years, offered premiums for the investigation of certain points, which science, it is supposed, could elucidate more clearly than practice. For this purpose, they have appropriated the sum of fifty pounds annually. No important effects have as yet accrued from the announcement of these premiums, nor perhaps can they be expected to be realized in so short a period as two years. No doubt, the time would be much precipitated were scientific investigators well acquainted with the practice of agriculture, for then their minds would probably be led into more direct and less tedious courses of investigation. Should these premiums have the effect of inducing scientific men to engage in investigations of the rationale of these and other departments of practical agriculture, the object of the Society, of arousing the attention of scientific men to agriculture, would be gained; for let men of science once embark in this pursuit, and there is no fear but they will discover the most proper method of attaining the desired results.

In addition to these premiums, the Society have this year offered one for proofs of cultivated plants excreting matter injurious to their successors, upon which, it is supposed, the true theory of the rotation of crops is founded; and another for the ascertainment of the greatest quantity of saline matter which cultivated plants may contain without injury to their health. The former subject has already attracted much of the attention of M. De Candolle of Geneva, and M. Macaire of that city has pursued the same subject for some time past; but the practical results of their investigations for many years back have not been published, at least in this country. It is hoped that the importance which the Society attaches to this subject will induce these eminent philosophers to communicate the results of their researches to them. The other subject, of the saline ingredients of plants, is also suited to the nature of the studies of scientific men; and it is to be hoped that M. Boussingault and M. Baudremont, two distinguished members of the Institute of France, will direct their attention to both these subjects. The Society, we are assured, would be happy to confer a high mark of honour on those individuals who will bring the investigation of these important matters to a result calculated to be useful to practical husbandry.

*New Mode of Turnip Culture.**—It is unnecessary to remind agriculturists of the annoyances frequently experienced in preparing land for turnips, arising from the season being either over wet or over dry; or to inform them that one or other of these circumstances causes an occasional failure in the crop of that valuable root. To discover a mode of culture that would avoid these annoyances seemed not unworthy of experiment. It was thought that, could the land be prepared to a forward state in autumn, so as to require less labour in the spring, the object would in part be gained. With this view, part of a field intended for turnips was, last November, prepared as if the seed were to be immediately put in. In this prepared state it was allowed to remain until the usual period of sowing, when it was found to be more highly pulverized than the [illegible]ner part of the fi[illegible]d could be rendered by every means used. [illegible] thout disturb[illegible] [illegible]ne drills, a brush harrow was passed over [illegible] [illegible] annual weeds, and a double mould-board [illegible] ploughed between the drills to throw

* [illegible] Lothian, too late [illegible] number.—Editor.

up the soil that might have mouldered down during the winter. The whole field was then sown in succession. The braird on the part prepared in autumn was more healthy than on the other part, and throughout the whole season the crop maintained its superior luxuriance. To ascertain the weight of the crop, a drill was measured, the roots lifted and weighed, and they shew a produce of 37 tons 17 cwt. 2 quarters 20 lb. per imperial acre; or about 44 tons 13 cwt. 2 quarters 16 lb. per Scotch acre of genuine purple-top Swedes. As the proprietor, Sir George Grant Suttie of Balgone, Bart., spares no expense in the management of the farm, it is unnecessary to say that the whole field is in a very high state of cultivation.

QUARTERLY AGRICULTURAL REPORT.

February 1840.

The character of the weather of the last quarter has been rainy and pretty fresh. In December, the rain fell in torrents, the rivers and ditches overflowing their banks. The greater part of January bore the same character, accompanied with high and boisterous westerly gales. This month has been somewhat drier, with occasional glimpses of sunshine, drying breezes, and mildness of temperature. Twice only has the ice borne to be skated on during the quarter, though the hills have continued for some time to be powdered with snow, which was precipitated on the mountains when rain was falling in the valleys. The remainder of the crop of 1839, consisting of beans and oats, was only gathered in in January 1840; the latter crop, of course, of little worth but for manure, but the former, we understand, was in good order. It is astonishing what quantity of bad weather beans will withstand, when the sheaves are kept separately on their ends. Keep away rimy frosts, which shell the pods, and that crop will stand with impunity in the fields all winter.

The excessive rains in autumn prevented the sowing of the usual breadth of autumnal wheat, and they caught many a farmer in the seed-furrowing of his potato and bean land; and it is scarcely a month yet that the red land has been in that consolidated state as to bear the action of the plough. From the natural repugnance of Scotch farmers, except those on the Borders, to sow spring wheat, it is to be apprehended that a limited extent of wheat will now be sown this year,—a circumstance to be regretted in a season following one of acknowledged deficiency and high price.

The young wheat, on all soils, looks well. The young clovers seem to be in the same state, in both cases, as the wheat. But the trying time for both is March, when dry frosty nights and succeeding sunny days generally throw the young plants out of the ground. The turnip land has been too wet for sheep-feeding, except on dry and sheltered situations; and yet the markets are well supplied with good mutton and beef, and at good prices, though bought in stock will leave little profit. Great ewes and young sheep have suffered from the wet. Field operations are far advanced, even with the ploughing of lea, notwithstanding the wet weather, and thorough-draining goes on apace in all quarters. The demand for labour at this kind of work, as well as at railways, gives full employment to spademen at fair wages, and the same demand, no doubt, finds employment to such of the operatives in towns as can wield a spade, who have been thrown idle in winter by the unfortunate stagnation of trade, many of the manufacturers working at present on short time.

The prices of grain have a tendency downwards, notwithstanding the stoppage of foreign supplies for the winter; from which we augur, that the supply continues to overbear the demand. The average price of wheat, on the 15th February 1839, was 74s. 1d. per quarter; on the 14th February of this year, it was 64s. 11d., being 9s. 2d. per quarter less now than then. In barley and oats, and pease and beans, there is not much difference of price betwixt the years. From this, we apprehend there is no actual scarcity of food in the country; for, if prices fall in the face of grain of bad quality, it is clear that the supply must enlarge itself to produce that effect; and we must also keep in remembrance, that an abundant crop of potatoes, which the last crop undoubtedly was, always has a sensible effect in lowering the prices of both wheat and oats.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th *of* Jan. 1839, *and* 5th *of* Jan. 1840,*—shewing the Increase and Decrease on each head thereof.*

	Quarters ended Jan. 5.		Increase.	Decrease.	Years ended Jan. 5.		Increase.	Decrease.
	1839.	1840.			1839.	1840.		
	£	£	£	£	£	£	£	£
Customs, ...	4,854,388	4,779,305	. .	75,083	19,154,729	19,840,213	685,484	. .
Excise, ...	3,627,190	3,427,271	. .	199,919	11,864,114	11,952,252	88,138	. .
Stamps, ...	1,521,123	1,587,061	65,938	. .	6,612,927	6,574,461	. .	38,466
Taxes, ...	1,586,689	1,584,699	. .	1,990	3,654,818	3,711,794	56,976	. .
Post-Office, ..	365,000	351,000	. .	14,000	1,525,000	1,519,000	. .	6,000
Miscellaneous,	76,097	58,800	. .	17,297	250,704	246,610	. .	4,094
	12,030,487	11,788,136	65,938	308,289	43,062,292	43,844,830	830,598	48,559
	Deduct Decrease,		. .	65,938	Deduct Decrease,		48,559	
	Decrease on the Qr.		. .	242,351	Increase on Year,		782,039	

TABLES OF PRICES, &c.

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Nov. 1.	70 1	44 6	25 11	38 6	45 0	43 8
8.	70 6	45 2	26 8	37 9	45 6	45 1
15	73 4	46 2	26 8	38 2	46 2	45 7
22.	74 10	46 1	27 0	37 8	45 8	44 5
29.	71 6	45 0	26 0	37 10	45 6	43 2
Dec. 6.	71 3	43 11	26 6	38 0	44 8	44 5
13.	69 5	44 0	24 8	38 6	44 4	44 0
20.	71 0	44 5	24 4	38 4	43 6	43 3
27.	71 2	44 1	23 6	38 3	43 0	41 2
1840.						
Jan. 3.	70 11	41 6	25 0	38 0	42 7	41 1
10.	70 9	43 4	25 3	38 4	41 9	39 11
17.	70 4	41 9	24 10	38 3	41 6	39 2
24.	69 3	42 8	24 6	38 6	41 8	39 3

DUBLIN.

Date	Wheat per Bar. 20 St.	Barley per Bar. 16 St.	Bear per Bar. 17 St.	Oats per Bar. 14 St.	Flour per Bar. 9 St.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
Nov. 1.	39 11	21 5	16 9	15 10	25 4
8.	41 5	22 7	17 3	16 8	25 6
15.	41 3	21 10	17 1	16 6	25 5
22.	40 10	20 10	16 9	15 8	25 5
29.	40 8	20 5	15 10	15 7	25 7
Dec. 5.	42 8	22 2	15 6	15 6	25 2
12.	40 10	22 8	14 5	15 6	25 1
19.	40 8	22 5	15 6	16 6	25 1
26.	40 6	22 6	15 7	16 1	24 11
1840.					
Jan. 3.	40 10	21 5	15 2	16 0	24 10
10.	39 8	20 6	15 0	15 6	23 8
17.	39 6	20 4	14 10	14 6	22 6
24.	36 7	19 7	14 6	15 6	21 6

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Nov. 1.	62 2	44 5	28 3	40 2	46 6	47 3
8.	69 6	42 7	27 2	40 8	45 6	49 6
15.	67 7	40 11	28 6	40 9	48 4	50 5
22.	70 2	35 6	27 8	39 4	48 6	50 7
29.	64 4	38 3	27 4	38 6	47 4	49 1
Dec. 6.	66 6	41 6	26 8	39 9	46 6	47 6
13.	58 7	39 4	26 8	39 6	45 6	47 8
20.	65 8	44 2	26 10	38 2	44 9	47 0
27.	60 5	47 5	27 3	38 0	44 6	47 0
1840.						
Jan. 3.	63 3	44 10	27 6	36 6	43 8	45 1
10.	60 1	37 4	26 2	36 6	42 6	43 6
17.	65 1	42 1	26 0	39 2	42 4	44 7
24.	58 10	42 9	25 10	38 6	45 6	48 5

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.
Nov. 6.	69 6	35 0	23 9	46 6	47 2
13.	68 9	36 4	25 9	46 9	47 3
20.	66 6	34 8	27 10	47 0	47 6
27.	62 4	34 2	26 10	45 0	45 6
Dec. 4.	61 2	35 0	25 9	43 0	43 6
11.	59 8	35 9	26 0	42 0	42 6
18.	61 4	35 6	27 6	42 6	42 10
25.	60 4	35 0	27 4	42 0	42 8
1840.					
Jan. 1.	60 6	35 2	27 2	42 6	43 0
8.	60 2	35 4	27 1	42 0	42 3
15.	60 1	35 3	27 2	41 6	42 0
22.	60 2	35 1	26 10	42 0	42 2
29.	60 3	35 2	27 0	41 6	41 10

TABLE showing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN; the Duties payable thereon, from November 1839 to January 1840.

Date.	Wheat.			Barley.			Oats.			Rye.			Pease.			Beans.		
	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
1839.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Nov. 1.	66 5	67 8	18 8	41 3	40 11	1 10	25 8	26 4	7 9	37 9	38 1	12 6	46 2	44 11	3 6	45 0	45 5	2 0
8.	67 4	67 2	18 8	41 4	41 1	1 0	26 0	25 10	9 3	36 1	37 9	14 0	45 2	45 3	2 0	45 7	45 7	2 0
15.	68 6	66 11	20 8	42 7	41 5	1 0	26 4	25 9	9 3	39 1	37 11	14 0	46 3	45 8	2 0	44 9	45 4	2 0
22.	69 0	67 2	18 8	43 1	41 9	1 0	26 5	25 10	9 3	37 4	37 10	14 0	45 1	45 4	2 0	46 1	45 8	2 0
29.	67 1	67 5	18 8	41 6	41 10	1 0	25 10	25 11	9 3	38 3	37 10	14 0	43 8	45 2	2 0	45 1	45 7	2 0
Dec. 6.	66 3	67 5	18 8	40 3	41 8	1 0	25 8	26 0	7 9	38 5	37 10	14 0	43 6	44 9	3 0	44 7	45 5	2 0
13.	65 8	67 4	18 8	39 8	41 4	1 0	24 9	25 10	9 3	39 1	38 0	14 0	43 3	44 3	3 6	44 11	45 5	2 0
20.	66 8	67 2	18 8	40 9	41 3	1 0	24 3	25 7	9 3	37 10	38 4	12 6	42 7	43 10	5 0	43 4	45 0	2 0
27.	66 5	66 10	20 8	40 5	40 11	1 10	23 11	25 2	9 3	38 6	38 3	12 6	42 7	43 5	5 0	42 6	44 5	3 6
1840.																		
Jan. 3.	66 1	66 4	20 8	39 3	40 3	1 10	24 2	24 9	10 9	39 7	38 3	12 6	42 6	43 0	5 0	42 0	43 3	5 0
10.	65 10	66 2	20 8	39 6	39 11	3 4	24 1	24 6	10 9	36 9	38 4	12 6	40 11	42 7	6 6	41 2	43 1	5 0
17.	66 0	66 1	20 8	39 8	39 10	3 4	23 10	24 2	10 9	36 6	38 0	12 6	39 9	41 11	8 0	40 8	42 5	6 6
24.	65 4	66 0	20 8	39 7	39 10	3 4	23 6	23 11	10 3	37 10	38 4	12 6	40 11	41 6	8 0	40 8	41 9	8 0

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Qua[illegible] Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Q[illegible] upon which duties have been paid for home-consumption, during the same Month; and th[illegible] tities remaining in Warehouse at the close thereof, from 5th Nov. 1839 *to* 5th Jan. 1840.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WA[illegible] From Foreign Countries.	REMAINING IN WA[illegible] From British Possessions.
Nov. 5. 1839.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.
Wheat, . .	132,565 4	. .	132,565 4	113,503 0	. .	113,503 0	16,049 7	178 4
Barley, . .	47,092 6	. .	47,092 6	46,734 4	. .	46,734 4	9,264 1	. .
Oats, . . .	68,761 2	. .	68,761 2	155,054 2	. .	155,054 2	9,715 0	. .
Rye, ...	2,284 1	. .	2,284 1	1,438 1	. .	1,438 1	791 4	. .
Pease, . . .	10,582 1	. .	10,582 1	11,969 2	. .	11,969 2	31,140 2	0 7
Beans, . .	8,300 5	. .	8,300 5	18,377 6	. .	18,377 6	16,874 5	. .
Totals,	269,586 3	. .	269,586 3	347,076 7	. .	347,076 7	83,535 3	174 3
Dec. 5.								
Wheat, . .	60,893 2	3 0	60,896 2	7,159 0	3 0	7,162 0	69,632 0	178 4
Barley, . .	98,918 5	. .	98,918 5	106,741 5	. .	106,741 5	2,170 5	. .
Oats, . . .	23,395 4	. .	23,395 4	12,928 1	. .	12,928 1	15,649 6	. .
Rye, ...	1,504 7	. .	1,504 7	64 4	. .	64 4	1,444 4	. .
Pease, . . .	28,868 0	89 2	28,957 2	54,798 0	89 2	54,887 2	5,098 3	0 7
Beans, . . .	17,464 3	. .	17,464 3	31,791 0	. .	31,791 0	2,913 5	. .
Totals,	231,014 5	92 2	231,136 7	213,482 2	92 2	213,572 4	96,848 7	174 3
Jan. 5. 1840								
Wheat, . .	72,819 0	1 2	72,820 2	12,400 3	1 2	12,401 5	128,236 1	161 4
Barley, . .	111,231 1	. .	111,231 1	112,453 4	. .	112,453 4	1,037 7	. .
Oats, . . .	10,336 1	. .	10,336 1	7,156 2	. .	7,156 2	14,738 2	. .
Rye, ...	1,491 0	. .	1,491 0	2 3	. .	2 3	2,878 2	. .
Pease, . . .	17,701 7	169 2	17,871 1	18,929 4	170 1	19,099 5	3,360 0	. .
Beans, . .	30,514 7	. .	30,514 7	32,183 5	. .	32,183 5	697 7	. .
Totals,	244,094 0	170 4	244,264 4	183,125 5	171 3	183,297 0	150,948 3	161 4
Nov. 5. 1839.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.
Flour, . . .	44,684 3 4	287 2 21	44,972 1 25	33,712 0 7	199 1 24	33,911 2 3	22,486 2 14	4,734 2 11
Oatmeal, .	. .	. .	. .	. .	. .	. .	19 3 17	. .
Totals,	44,684 3 4	287 2 21	44,972 1 25	33,712 0 7	199 1 24	33,911 2 3	22,506 2 3	4,734 2 11
Dec. 5.								
Flour, . . .	53,897 0 15	1,142 1 10	55,039 1 25	34,927 1 23	1,146 3 26	36,074 1 21	38,348 0 9	4,729 3 22
Oatmeal, .	110 1 27	. .	110 1 27	113 0 15	. .	113 0 15	15 1 8	. .
Totals,	54,007 2 41	1,142 1 10	55,149 3 26	35,040 2 10	1,146 3 26	36,187 2 9	38,363 1 17	4,729 3 22
Jan. 5. 1840.								
Flour, . . .	113,235 1 11	8,924 2 4	122,150 3 15	19,151 0 6	8,919 3 16	28,070 3 22	19,246 3 11	4,734 2 11
Oatmeal, .	30 2 4	. .	30 2 4	. .	. .	. .	15 1 8	. .
Totals,	113,265 3 15	8,924 2 4	122,190 1 19	19,151 0 6	8,919 3 16	28,070 3 22	19,262 0 19	4,734 2 11

PRICES of BUTCHER-MEAT.

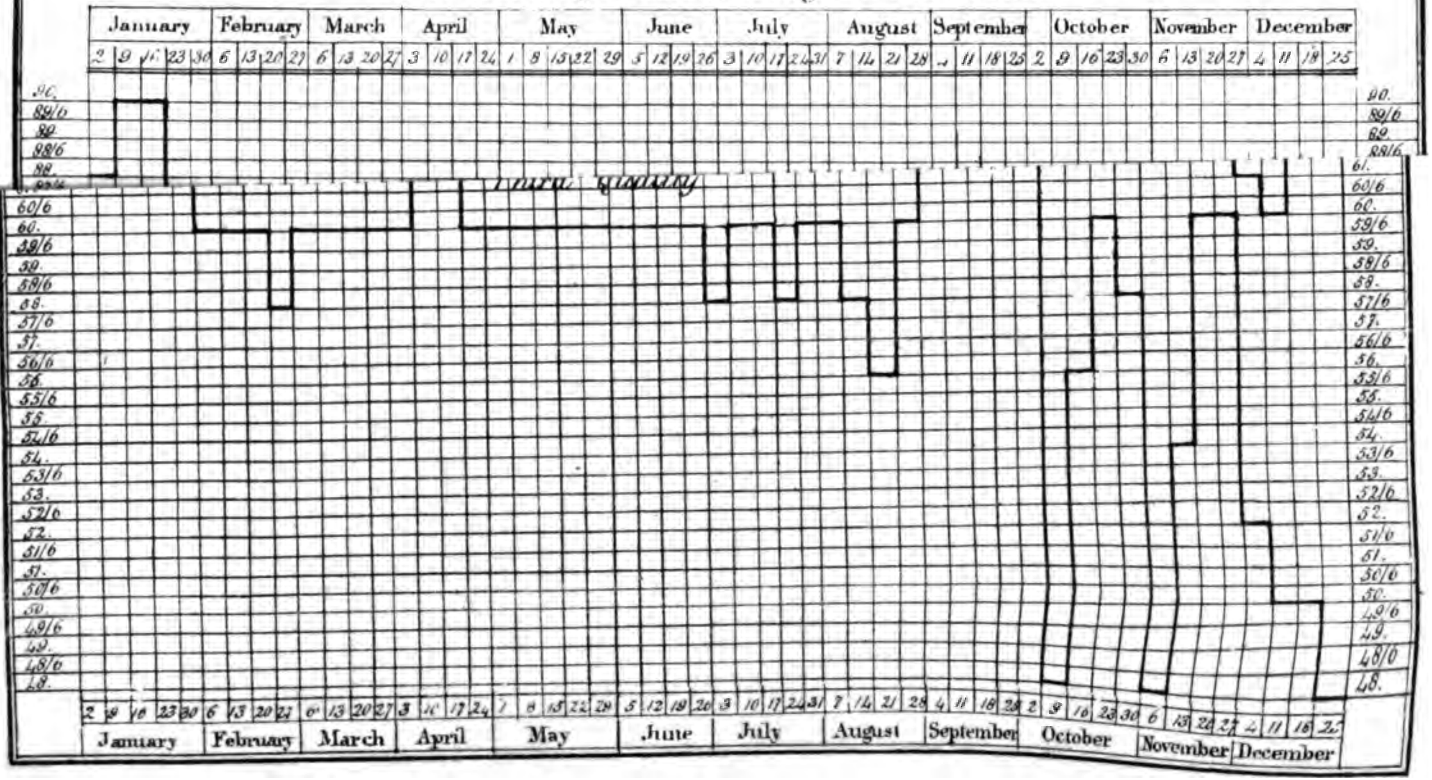
Date.	SMITHFIELD, *Per Stone of* 14 lb. Beef.	SMITHFIELD, Mutton.	MORPETH, *Per Stone of* 14 lb. Beef.	MORPETH, Mutton.	EDINBURGH, *Per Stone of* 14 lb. Beef.	EDINBURGH, Mutton.	GLASGOW, *Per Stone of* 14 lb. Beef.	GLASGOW, Mutton.
1839. Nov.	6/6 to 7/6	6/3 to 7/6	6/ to 7/6	6/6 to 7/6	6/ to 7/3	6/6 to 7/3	6/3 to 7/3	6/3 to 7[illegible]
Dec.	6/ 7/9	6/6 7/9	6/6 7/9	7/0 8/	6/6 7/6	6/6 7/6	6/9 7/6	6/6 7[illegible]
1840. Jan.	6/6 8/6	7/3 8/9	7/3 8/3	7/3 8/6	6/6 8/	7/ 8/	6/9 8/	6/6 7[illegible]

[illegible] *of English and Scotch WOOL.*

SCOTCH, per 14 lb.

[illegible] In G[illegible]	[illegible]	[illegible]	[illegible], Hogg,	16/8 to [illegible]
[illegible]outh Down	[illegible]	[illegible]	Ewe and Hogg, . . .	15/ [illegible]
[illegible]ester, H[illegible]	[illegible]	[illegible]	[illegible]iot, white, . .	13/ [illegible]
[illegible]	4/	6	[illegible]aid, washed, .	10/ [illegible]
[illegible]	[illegible]	[illegible]	Unwashed	6/3 [illegible]
			[illegible]r, white,	[illegible]
			[illegible] washed,	[illegible]
			[illegible] washed	[illegible]

TABLE showing the Price Per Quarter of the First, Second, & Third Qualities of **WHEAT,** *in the Edinburgh Market, during the Year. 1839.*



The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities of Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantities upon which duties have been paid for home-consumption, during the same Month; and the Quantities remaining in Warehouse at the close thereof, from 5th Nov. 1839 *to* 5th Jan. 1840.

Month ending	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOUSE.		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.
Nov. 5. 1839.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, . .	132,565 4	. .	132,565 4	113,508 0	. .	113,508 0	16,049 7	178 4	[illegible]
Barley, . .	47,092 6	. .	47,092 6	46,734 4	. .	46,734 4	9,364 1	. .	[illegible]
Oats, . . .	68,761 2	. .	68,761 2	155,054 2	. .	155,054 2	9,715 0	. .	[illegible]
Rye, ...	2,284 1	. .	2,284 1	1,438 1	. .	1,438 1	791 4	. .	[illegible]
Pease, . . .	10,582 1	. .	10,582 1	11,969 2	. .	11,969 2	31,140 2	0 7	[illegible]
Beans, . .	8,300 5	. .	8,300 5	18,377 6	. .	18,377 6	16,574 5	. .	[illegible]
Totals,	269,586 3	. .	269,586 3	347,076 7	. .	347,076 7	83,535 3	174 3	[illegible]
Dec. 5.									
Wheat, . .	60,893 2	3 0	60,896 2	7,159 0	3 0	7,162 0	69,632 0	178 4	[illegible]
Barley, . .	98,918 5	. .	98,918 5	106,741 5	. .	106,741 5	2,170 5	. .	[illegible]
Oats, . . .	23,395 4	. .	23,395 4	12,928 1	. .	12,926 1	15,649 6	. .	[illegible]
Rye, ...	1,504 7	. .	1,504 7	64 4	. .	64 4	1,444 4	. .	[illegible]
Pease, . . .	28,868 0	89 2	28,957 2	54,798 0	89 2	54,887 2	5,098 3	0 7	[illegible]
Beans, . . .	17,464 3	. .	17,464 3	31,791 0	. .	31,791 0	2,913 5	. .	[illegible]
Totals,	231,044 5	92 2	231,136 7	213,482 2	92 2	213,572 4	96,848 7	174 3	[illegible]
Jan. 5. 1840.									
Wheat, . .	72,819 0	1 2	72,820 2	12,400 3	1 2	12,401 5	128,236 1	161 4	[illegible]
Barley, . .	111,231 1	. .	111,231 1	112,453 4	. .	112,453 4	1,087 7	. .	[illegible]
Oats, . . .	10,336 1	. .	10,336 1	7,156 2	. .	7,156 2	14,738 2	. .	[illegible]
Rye, ...	1,491 0	. .	1,491 0	2 3	. .	2 3	2,878 2	. .	[illegible]
Pease, . . .	17,701 7	169 2	17,871 1	18,929 4	170 1	19,099 5	3,360 0	. .	[illegible]
Beans, . .	30,514 7	. .	30,514 7	32,183 5	. .	32,183 5	697 7	. .	[illegible]
Totals,	244,094 0	170 4	244,264 4	183,125 5	171 3	183,297 0	150,948 3	161 4	[illegible]
Nov. 5. 1839.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr.
Flour, . . .	44,684 3 4	287 2 21	44,972 1 25	33,712 0 7	199 1 24	33,911 2 3	22,486 2 14	4,734 2 11	[illegible]
Oatmeal, .	. .	. .	. .	. .	. .	. .	19 3 17	. .	[illegible]
Totals,	44,684 3 4	287 2 21	44,972 1 25	33,712 0 7	199 1 24	33,911 2 3	22,506 2 3	4,734 2 11	[illegible]
Dec. 5.									
Flour, . . .	53,897 0 13	1,142 1 10	55,039 1 25	34,927 1 23	1,146 3 26	36,074 1 21	38,348 0 9	4,729 3 22	[illegible]
Oatmeal, .	110 1 27	. .	110 1 27	113 0 15	. .	113 0 15	15 1 8	. .	[illegible]
Totals,	54,007 2 41	1,142 1 10	55,149 3 26	35,040 2 10	1,146 3 26	36,187 2 9	38,363 1 17	4,729 3 22	[illegible]
Jan. 5. 1840.									
Flour, . . .	113,235 1 11	8,924 2 4	122,159 3 15	19,151 0 6	8,919 3 16	28,070 3 22	19,246 3 11	4,734 2 11	[illegible]
Oatmeal, .	30 2 4	. .	30 2 4	. .	. .	. .	15 1 8	. .	[illegible]
Totals,	113,265 3 15	8,924 2 4	122,190 1 19	19,151 0 6	8,919 3 16	28,070 3 22	19,262 0 19	4,734 2 11	[illegible]

PRICES of BUTCHER-MEAT.

	SMITHFIELD, *Per Stone of* 14 lb.		MORPETH, *Per Stone of* 14 lb.		EDINBURGH, *Per Stone of* 14 lb.		GLASGOW, *Per Stone of* 14 lb.	
Date.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1839. Nov.	6/6 to 7/6	6/3 to 7/6	6/ to 7/6	6/6 to 7/6	6/ to 7/3	6/6 to 7/3	6/3 to 7/3	6/3 to 7/6
Dec.	6/ 7/9	6/6 7/9	6/6 7/9	7/0 8/	6/6 7/6	6/6 7/6	6/9 7/6	6/6 7/9
1840. Jan.	6/6 8/6	7/3 8/9	7/3 8/3	7/3 8/6	6/6 8/	7/ 8/	6/9 8/	6/6 7/9

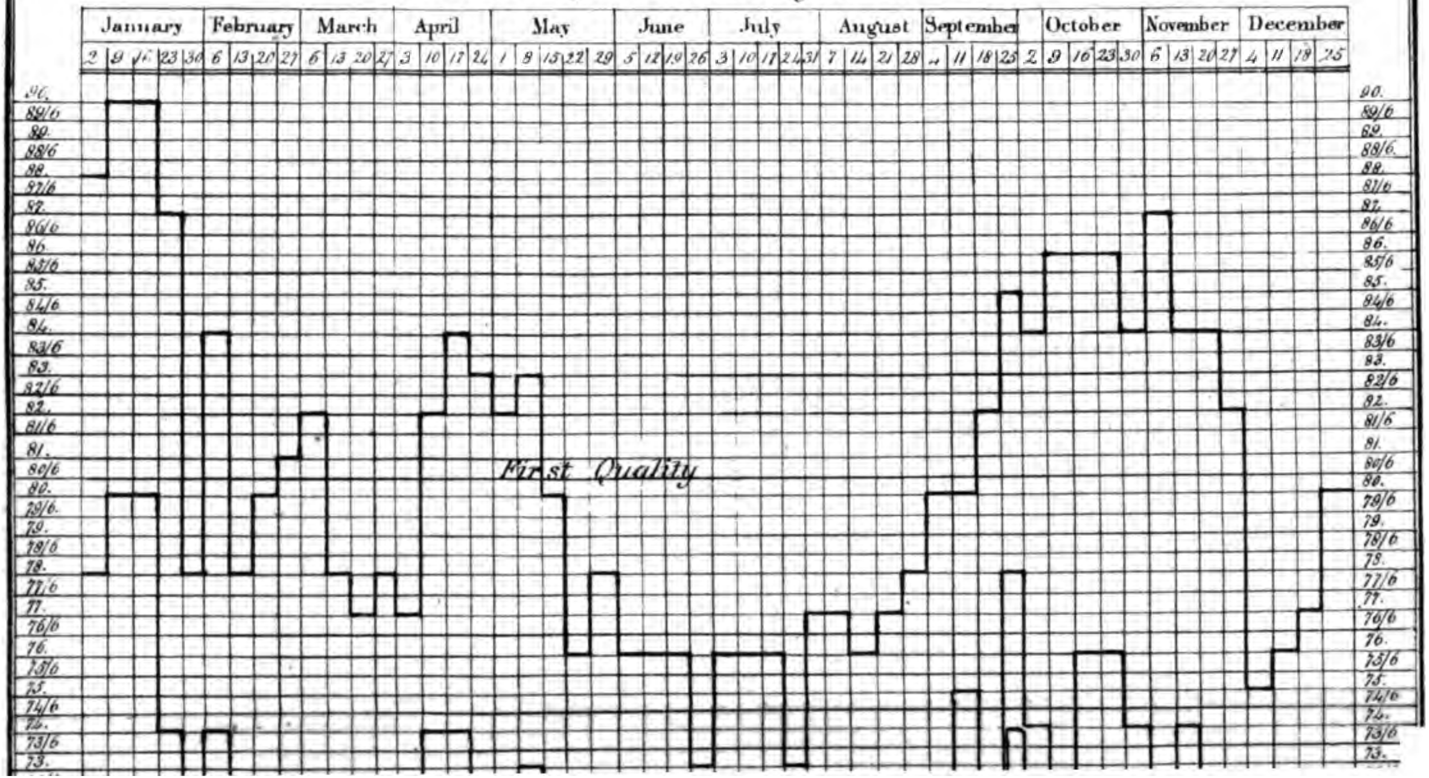
PRICES of English and Scotch WOOL.

SCOTCH, per 14 lb.

...ester, Hogg,	. .	16/6 to	[illegible]
...we and Hogg,	. . .	15/	[illegible]
...iot, white,	. . .	15/	16/
...aid, washed,	. .	10/	13/6
Unwash...	.	6/3	[illegible]
...oor, white,	.	6/	[illegible]
...aid washed,	.	[illegible]	7/
...nwash...		4/6	[illegible]

...n G... ...1 ...5
...h Down ...5 ...6/
...ester, H... ...9 ...0/
... and H... 4/... 6/...
0/

TABLE shewing the Price Per Quarter of the First, Second, & Third Qualities of **WHEAT**, in the Edinburgh Market, during the Year 1839.



INDEX.

PRINTED BY NEILL AND CO., OLD FISHMARKET, EDINBURGH.