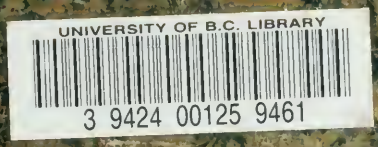

AN

ACCOUNT

OF THE

SYSTEMS OF HUSBANDRY

ADOPTED IN THE MORE IMPROVED DISTRICTS

OF

SCOTLAND.

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SYSTEMS OF HUSBANDRY

ADOPTED IN THE MORE IMPROVED DISTRICTS

OF

SCOTLAND;

WITH

SOME OBSERVATIONS ON THE IMPROVEMENTS OF WHICH THEY ARE SUSCEPTIBLE.

DRAWN UP FOR THE CONSIDERATION OF THE BOARD OF AGRICULTURE, WITH A VIEW OF EXPLAINING HOW FAR THOSE SYSTEMS ARE APPLICABLE TO THE LESS CULTIVATED PARTS IN ENGLAND, AND SCOTLAND.

BY THE RIGHT HONOURABLE

SIR JOHN SINCLAIR, BART.

PRESIDENT OF THE BOARD OF AGRICULTURE.

"*Knowledge is power.*" BACON.

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ADVERTISEMENT.

I HAVE at length the satisfaction of laying before the Public, an Account of the Systems of Husbandry adopted in the more improved districts of Scotland. It was drawn up at the request of a most respectable friend, (Sir Joseph Banks), who thought, that such an investigation, would be beneficial to the agricultural interests of the united kingdom; and he urged, that it was incumbent upon a native of Scotland, while presiding at the Board of Agriculture, and possessing all the means of information which that situation afforded, to undertake the task. Being occupied with many other avocations, nothing but the respect which I entertain for the opinion of so zealous a friend to improvement, could have induced me to engage in so arduous an attempt. Indeed the labour and difficulties attending it, have gone far beyond every idea I could have formed of them. To execute

the task in a satisfactory manner, it seemed to me necessary, personally to examine several of the more improved districts in Scotland, to converse with the farmers in their own fields, to explain to them distinctly, not only the general objects I had in view, but also the particular facts I wished to ascertain; and to obtain from them, not hasty answers, to questions suddenly put, but details, maturely considered, and carefully drawn up. The reader has now an opportunity of examining the result of the whole investigation. The Author claims the merit only of collecting, condensing, and digesting, the important information which was most liberally furnished. The credit of *the knowledge* which this Work may contain, belongs entirely to the intelligent and public-spirited Farmers from whom that information has been derived.

I trust that there are several observations contained in this Work, which will prove of service in those districts of England, where the cultivation of arable land, owing to the attention of the farmer having been principally directed to the management of grass land, to the profits of the dairy, and to the breeding of stock, has hitherto been but a secondary object. At the same time, it has been my wish, to make this Treatise useful also to the far-

mers of Scotland; and for that purpose, I have incorporated a variety of hints, which attention to English Husbandry, and the communications of many respectable correspondents in the southern part of the united kingdom, have enabled me to suggest.

I cannot submit this work to the consideration of the Public, without congratulating my country, on the anxious desire to obtain agricultural knowledge, which now so universally prevails in every part of the united kingdom. Indeed, when I consider that zeal for improvement, and that thirst for useful information, by which the British Isles, are, at this period of time, so peculiarly distinguished, I cannot entertain a doubt, that Agriculture will soon reach a degree of excellence in this country, which it has never hitherto attained in any other; and that the merit of discovering the most effectual means, "*of providing food for man,*" the first of all political objects, will, in future ages, be attributed, to the skill, the abilities, and the enterprise of British Farmers.

JOHN SINCLAIR.

Charlotte Square, Edinburgh,
24th February 1812.

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INTRODUCTION

Of the various circumstances which have contributed to the excellence of Scottish Husbandry, and an explanation of the Plan of the Work.

BEFORE giving any explanation of the plan of the following work, it may not be improper, briefly to point out those causes, which have principally contributed to the excellence of Scottish Husbandry, as practised in its more improved districts, several of which, however, are not to be considered as applicable only to the northern part of the kingdom.

1. Though the climate of Scotland, is in general rather unfavourable to cultivation, (a disadvantage which the Scotch farmers have assiduously, and often successfully endeavoured to counteract), yet the country, on the whole, enjoys several natural advantages of considerable importance. Its maritime situation, and its numerous bays and

arms of the sea, together with the lakes and streams with which it is so amply provided, not only tend to promote its commerce, but are also favourable to its agriculture. It is also largely furnished with those essential requisites for improvement, limestone and marle; and it possesses, in most of its districts, that most important article, fuel, in considerable quantities.

2. Owing to the establishment of parochial schools, the farmers of Scotland had, in general, all the advantages of a good education, and having acquired a taste for reading, were not only fond of perusing works on agriculture, but were anxious to avail themselves of any information they might thus obtain. Hence the culture of artificial grasses, and the best mode of applying them by means of soiling, with various other useful practices, spread rapidly over the whole country. Numbers of Scotch farmers also, were accustomed to travel, with a view of acquiring useful information, and of comparing their own practices with those of other districts *.

3. Many of the proprietors of land in Scotland, who were distinguished by the acquisition of useful, rather than of showy accomplishments, took a delight in rural occupations; and, in various districts, now under a complete system of husbandry, they either improved their estates themselves, or encouraged their tenants to exertion, establishing for that purpose a most liberal system of connexion between the two classes.

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* An intelligent farmer once remarked to me, that he derived more advantage, by travelling about to see the improvements of others, than by attempting to make discoveries of his own. Almost every Scotch farmer has travelled through his own county, and some of the neighbouring ones; many have visited England, and some have even penetrated into Flanders, for the express purpose of obtaining agricultural information.

4. It became a custom in Scotland, at an early period, to grant leases for an adequate term of years, without the possession of which, no material improvement, *on the part of the tenant*, can possibly be expected; and to that circumstance, perhaps more than to any other, is the excellence of Scottish husbandry to be attributed. Indeed, *extensive* improvements, have not taken place in any part of England, but where the same custom has prevailed. In regard to the granting of leases, nothing can be more ill judged, than for a landlord, both to neglect his immediate interests, and to prevent the future improvement of his estate, in order to procure a little political influence, which a generous proprietor can always command, when he may have occasion for it, without keeping his tenants in a state of slavish dependence.

5. In many parts of England, where estates are possessed by tenants for life, or under the fetters of a trust, it is questionable, whether leases of a considerable endurance can be granted, or whether old pastures, though in extent beyond any real advantage to the estate, can be broken up: whereas in Scotland, even when land is under a perpetual and strict entail, leases may be granted for thirty-one years, and upwards, without any unnecessary restrictions against arable cultivation, and the tenant is enabled to do every thing that the proprietor could have done himself, had he retained possession of the land *.

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* The act 10. Geo. III, c. 51, A. D. 1770, introduced by the late Sir James Montgomery, is favourable to the improvement of entailed property. By that statute it is enacted, that every proprietor of an entailed estate, who shall lay out money in inclosing, planting, draining, or in erecting farm-houses and offices for the same, shall be a creditor to the succeeding heirs of entail, for three-fourths of the money laid out, provided that the amount claimed, shall not exceed four years' free rent of the estate, at the first term of Whitsunday, after the demise of the heir who ex-

6. The inferior capitals of the Scotch farmers, when their improved system of husbandry commenced, rendered it necessary for them, to study economy in the management of their farms, to cultivate their lands with fewer horses, with cheaper implements, and with a smaller number of servants; and hence originated a system of management, distinguished by two important advantages, *economy* and *simplicity*.

7. In the more improved districts of Scotland, the farms are in general of a proper size for arable culture. Small lots are beneath the attention of an opulent and intelligent farmer. Much time is lost in the cultivation of small farms, and the comparative expence is much greater, where the servants and cattle have not constant occupation; whereas, with a farm of a proper size, (the extent of which will be the subject of future discussion *), every hour may be advantageously employed.

8. Soon after improvements began, the rents of lands were progressively increased, without the spur of which,

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pended the money. The expence of building or repairing the mansion-house or offices, becomes also a debt against the heir of entail, to the amount of three-fourths of the money expended, if the claim does not exceed two years' free rent. It may, however, be necessary to observe, that certain formalities are required to be attended to, in expending the money, and constituting it a debt against the heirs of entail. By this statute, which is entitled, an act "for encouraging the improvement of land in Scotland, held under settlements of strict entail," it is lawful for the proprietor to let leases for 31 years, or for 14 years and one existing life, or for two existing lives, under certain conditions as to inclosing, if let for longer than 19 years; and proprietors may let building leases, of not more than five acres' extent, under certain conditions, for any period not exceeding 99 years.

* See Dissertation I, Part II, On the Size of Farms.

neither industry in cultivation, nor economy in management, can be generally expected. Oppressive and sudden additions ought certainly to be avoided; but without a fair income for his land, no proprietor ought to part with a control over his estate, more especially for so long a period as nineteen or thirty-one years. A tenant, on the other hand, who obtains a lease of some duration, and on liberal terms in regard to covenants, can well afford a reasonable augmentation, either at once, or at different periods of his lease, on a rent that was previously moderate.

9. It was a circumstance peculiarly favourable to the improvement of Scotland, that the farmers in general, were liable to no material burden, but their rent to the landlord, by whom the land-tax, and the stipend to the clergyman, since 1633, have been generally paid *. Wherever there is any uncertainty in regard to the sums to be exacted, (more especially if the burden increases with the industry exerted), no farmer will attempt any expensive improvement. Hence one of the advantages of a recent law, by which the servitude of *thirlage*, or bondage to any particular mill, may be legally commuted. The personal services also, to which the Scotch peasantry were, at one time, subjected, and which were often indefinite, are now almost entirely exploded.

10. A considerable proportion of the most fertile land in England, until bills of division and inclosure were in-

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* One half of the parochial schoolmaster's salary is paid by the tenantry, together with one-half of the expence of maintaining the poor. This, however, is a trifling object, as the expence of supporting the poor is chiefly defrayed by voluntary collections at church on Sundays. The Scotch farmers are also liable in payment of the property tax, and either to statute labour, or road assessments.

troduced, (which have in some degree alleviated the evil, though not to the extent that could be wished for), was actually debarred from improvement, by the common-field system; whereas in the more improved districts of Scotland, owing to a general Bill of Inclosure passed by the Scotch Parliament in 1695, every farm, for many years past, has been a distinct possession, or been held in severalty.

11. The expence of labour in Scotland, does not differ materially from that of several extensive districts in England; and the day-labourers in that country, certainly execute as much work, within the same period of time, as those in Scotland; *but the servants employed in husbandry* in Scotland, are in general more tractable, are satisfied with homelier fare, have fewer perquisites, are less accustomed to waste their time and their wages unprofitably, are more regular and constant in their hours of labour, have commonly received a better education, and thence are less addicted to debauchery, or to any irregularity of conduct.

12. In Scotland, the laws are favourable to cultivation and improvement, a circumstance to which the excellence of the Scotch husbandry is greatly to be attributed. Regulations exist, which facilitate the division of commons and of common fields; fences erected between two distinct estates, are made at the joint expence of the owners; the value of the tithes of any estate, can be fixed by the decision of the supreme court of justice, and when once fixed by a legal valuation, and converted into what may be called *a corn-rent*, the amount cannot afterwards be increased. The possessor of any estate can, in general, exonerate his property, from all indefinite demands upon it, of a feudal nature; leases are interpreted, by the courts of law, favourably to the tenant; and the occupiers of land,

in general, are not subjected to any arbitrary burdens, under the name of Poor-rates *.

13. The establishment of banks, and the extension of paper money, have certainly materially contributed to the improvement of Scotland †. Enterprising farmers have thus been supplied, when necessary, with aid to carry on their operations, and have obtained a better price, and a readier payment, for their commodities;—no small inducements to exertion. Where the public banks, or their branches, also, are established, the savings of the prudent and economical farmer, have not only been safely deposited, and borne an interest of from 3 to 4 *per cent.*, but were always ready at his command.

14. In the last place, the character of the Scots, industrious, economical, intelligent, and persevering, and their habits of life suited to their national character, would naturally enable them to reach a considerable degree of excellence, in any art or science, to which their attention might be peculiarly directed.

Other causes, as will appear in the course of the following investigation, may have also contributed to the improved state of Scotch Husbandry; but these circumstances combined, will, it is believed, sufficiently explain, why that system should have reached a considerable degree of perfection, and may, in various respects, be accounted a pattern for other districts, similarly situated, in so far as regards *arable cultivation*.

In regard to the plan proposed to be adopted in the

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* I say *in general*, for there are exceptions to this rule in several of the southern counties.

† The celebrated Sir James Steuart, in his Political Economy, (last edit. vol. iii, p. 197), says, "To the banks of Scotland the improvement of that country is *entirely owing*." Without going so far, it may be safely asserted, that to the improvement of Scotland they have *materially contributed*.

prosecution of this important inquiry, it is intended to divide the work into two parts.

Part I. will be purely practical, detailing, *first*, the best practices of the most distinguished Scotch farmers, regarding those points which require attention, previous to the commencement of arable culture; and, *secondly*, those particulars will be discussed, which are connected with the actual cultivation of an arable farm, and the most profitable means of maintaining its stock. It is proposed to conclude this part of the work with, 1. A general view of the improved Systems of Husbandry adopted in Scotland; 2. An account of the improvements of which those systems are susceptible; and, 3. Some observations on the means by which the useful practices of the best Scotch farmers, may be most advantageously disseminated throughout the less improved districts of England and Scotland; together with a general view, of the public and private advantages which may be derived from their more general adoption.

There are some questions, however, connected with the husbandry of Scotland, and with the improvement of that country, which are rather of a more abstruse nature, the explanation of which requires a good deal of research, and much reflection thoroughly to comprehend; in particular, the size of farms, and the establishment of a liberal system of connexion between the landlord and tenant. These are points, therefore, (together with the characters of those who are employed in agricultural labour, in the more improved districts of Scotland), which it is thought more advisable to place in a distinct division of the work, (Part II.), and to discuss in separate dissertations.

In an Appendix will be stated, some particulars connected with the improvement of Waste Lands in Scotland, (a subject to which the public attention cannot be too frequently called), and several other points, respecting which, the author trusted, that the information he had to communicate, would be acceptable to the public.

PART I.

CHAPTER I.

ON THE POINTS WHICH REQUIRE ATTENTION, PREVIOUS TO THE COMMENCEMENT OF ARABLE CULTURE.

BEFORE a farmer commences the actual cultivation of an arable farm, there are several particulars which will require his attention, as, 1. The position of the Farm-House and Offices; 2. Their Construction; 3. The Size of the Fields; 4. The mode of Fencing; 5. The Draining necessary; 6. The Roads on the Farm; 7. The Instruments of Husbandry; 8. The Live Stock; and, 9. The Soil, the elevation and exposure, the climate, and the situation of the farm in regard to markets. It is proposed to discuss each of these points, as briefly as their importance will admit of, in separate sections.

SECT. I.—*Position of the Farm-House and Offices.*

THE first point that any judicious farmer would resolve to ascertain, in regard to any farm he would wish to occupy, (more especially if it were of considerable extent, namely, from 300 to 500, or 1000 acres), would be, whether the farm-house and offices were properly situated,

and erected as nearly as possible in the centre of the farm. In many cases this would make a difference in point of rent of from 1 s. to even 5 s. *per* acre, according to the size of the farm, and various local circumstances therewith connected. The difference is calculated, by some intelligent farmers, at the expence of a plough, or L. 100, and on very extensive farms at nearly L. 200 *per annum**. If the house and offices are placed in the corner of a large farm, a part of the land will often be neglected by the farmer; less manure will be sent to it; the expence of cultivation is materially increased; the horses have their strength uselessly wasted in going backwards and forwards, and the remote part of the farm is left in what in Scotland is called an *outfield* or *afterwall* state, that is to say, in miserable pasturage occasionally broken up.

In the improved districts of Scotland, this is a point as much attended to as the circumstances of the case admit of, more especially when any new buildings are constructed †. How different from that state of feudal barbarism,

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* Mr Walker of Mellendean states, that the old farm-buildings on his farm of Rutherford, before he got possession of it, were placed on the very extremities of the ground, and the acclivity from them being considerable, the upper part of the land of course got a very small share (if any) of the manure. The principal buildings are now nearly central, for 800 acres, and another set of offices equally so for the remainder; by which means the corn is carried a much shorter distance to the barn-yard, and the dung to the fields at much less expence. These, and other conveniences, he calculates are equal to a saving of nearly L. 200 *per annum*.

† It is remarked by an intelligent correspondent, that the farm-buildings in the more improved districts of Scotland are in general much more convenient than those to be met in almost any other country; and that in a large farm there is the difference of at least the labour of one man throughout the year, between a convenient and inconvenient set of offices.

(which may still be found in some districts in England), where all the farm-houses of a parish were collected into a village, originally for the sake of mutual protection and defence, and where all the neighbouring fields were cultivated in common.

There can only be one reason for not having the farm-house and offices in a central position, and that is, when a better command of water, for family use, for the farm stock, or for driving a threshing-mill, can be had elsewhere. Sometimes, also, wind cannot be commanded in the centre for the use of a threshing-mill, by which a great saving in the labour of horses might be obtained. These, however, are only exceptions to the general rule; for it may be laid down as an axiom in agriculture, "*That the farm-house and offices ought to be placed, as nearly as possible, in the centre of a farm.*"

Where the circumstances of the case will admit of it, the farm-house and offices should front the south, should be sheltered from piercing winds, and the fold-yard should enjoy the benefit of the morning sun in winter. The farmstead should be placed *on an elevated situation.* It is not only healthier for the farmer, his family, and his servants, but carts will bring home the corn in harvest time, with least waste, when going up hill, and when empty they can return to the harvest field, in very urgent cases, with a quicker step, which will much expedite the getting home and securing the farm produce. The manure from the farm-yard so situated, will all be conveyed down-hill to the fields in the cheapest and most expeditious manner *.

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* Remark by an intelligent correspondent. It must be observed, that when the house is built on an elevated situation, the farmer will have it in his power to see what is going on all around him.

Sect. II.—*The best Construction of a Farm-House and Offices.*

This is a most material point for the consideration both of the farmer and of the landlord, and the rent to be paid ought certainly in some measure to depend on the goodness of the accommodations with which the occupier is provided. With convenient offices, it is evident that the grain produced on the farm can be better preserved, and more advantageously separated from the straw, and prepared for market. The live-stock also on the farm, can be more easily and regularly fed; and being thus kept in better order, must consequently be fitter for their work, or for the market. The propriety also of having suitable accommodations for the farmer, his family and his servants, need not be dwelt upon. The expence of erecting such buildings must be considerable when first laid out, but no liberal landlord who has the sum requisite at his command, will grudge to lay it out for the comfort and advantage of an industrious tenant, who pays an adequate rent *. Every convenience afforded to the farmer, for

* Even *minutiæ* may be of great consequence to a tenant; for instance, in the erection of barns, more especially if the walls are rough, it is of importance to have a projecting stone or brick at every aperture for the admission of air, to prevent the access of vermin; and in laying the foundation of barns, that material object, the exclusion of vermin, ought always to be kept in view. If the foundation stones were regularly cut like bricks, and jointed, it would prevent the possibility of vermin getting in at that part of the building. But where it is the custom to have barns,

enabling him to carry on his business with as little expence and to as much advantage as possible, must indeed greatly enhance the value of the farm, and will insure to the landlord, should he have occasion to seek for a new tenant, abundance of competitors for a situation in these respects so eligible.

Where convenience and utility are the objects principally attended to, it is recommended by an intelligent agriculturist in Roxburghshire, who has had great experience in the erecting of such buildings, (Mr Walker of Wooden,) to have the farm-house of three stories, the kitchen-story half sunk. This makes the house itself drier, as it is necessary to take such peculiar precautions against dampness in the foundation, and less roofing will furnish the farmer with the accommodations he may require. He adds, that he has made plans of farm-houses, both of that construction, and with only two stories, having the kitchen and dairy behind; but he knows that the house of three stories gives most satisfaction to the occupier. Others object to this plan, maintaining, that though a half-sunk story may tend to make the upper floor drier, yet that it is very apt to be damp itself; that it likewise gives much more trouble to the mistress of the house in superintendence; and that the noise from the kitchen is often disagreeable, more especially when a number of servants assemble together in the evening. Hence a wing or back jamb (or lean-to, as it is called in England), is preferred by many farmers *.

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with floors of board, into which loaded waggons are admitted, the exclusion of vermin is impossible.

* Opinions vary much regarding the proper construction of farm-offices. Mr Stewart of Hillhead is of opinion, that farmers who occupy from 200 to 300 acres, or who have capitals from L. 1000 to L. 2000, ought to be satisfied with a double house of one

In regard to the expence of erecting new farm-steads, it cannot be properly estimated, as the price of building, and the expence of materials, vary in every district. In some publications it is stated at from two and a half to three years' rent of the farm. It is evident, that this can only refer to farms of a small size. In larger occupations, when the landlord receives a considerable rent, the allowance must be higher.

Regarding farm-houses and offices, the following principles ought to be kept in view, when such buildings are to be erected.

1. The house and offices should be on a scale proportionate to the size and produce of the farm, having utility, and not ornament, principally in view; though at the same time, every landlord of taste, in fixing on the site and plan of a new farm-house and offices, will certainly not totally

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story, with garrets for various apartments; which will afford convenient accommodation at a moderate expence. Captain Henderson of Aimster in Caithness, on the other hand, recommends a lean-to back-jamb, or to-fall, as it is called in some parts of Scotland, which furnishes as much accommodation, in the two lower flats, as a double house, and at less expence. But Mr Wight of Ormiston greatly prefers Mr Walker's plan of three stories, as better than a house with a wing and back-jamb, which is neither so neat nor handsome, besides requiring a greater extent of building and roofing in the first erection, and a greater extent of roofing to keep up ever after. In the half sunk story, dampness can certainly be excluded, and the noise of the kitchen can also be shut out, either by proper deafening, or by removing the kitchen to that end of the house least occupied by the family. Mr Walker of Mellendean is decidedly of opinion, that in a dry situation, the same conveniences can be had at much less expence in a house with a sunk story, than in one with wings, and he has accordingly erected of that construction one on his farm at Rutherford.

overlook the embellishment of the country. Not only the original cost, but the very expence of keeping unnecessary buildings in repair, is a heavy burden upon any property, which it is for the interest both of the landlord and of the tenant to avoid. The house and offices should afford ample convenience to the farmer in carrying on his business. On the other hand, all superfluous buildings, and useless decorations, ought to be avoided; for, as Dr Coventry has well observed, durable economy should be preferred to shifting taste *. Nothing can be more absurd than the enormous barns usually attached to all the great farms in England. Grain in the straw keeps infinitely better in the open air than in close barns; it is less apt to be destroyed by vermin, and saves the enormous expence of constructing and repairing great barns. Threshing-mills, when generally introduced, will soon prove the absurdity of erecting such unnecessary buildings.

2. The accommodations necessary for preparing the grain for market ought never to be too scrimp. The threshing-barn, for instance, must be sufficiently spacious to contain one stack of grain in the straw, in case of an unfavourable season. In good weather, it is the common practice to take in the corn when it is threshed, in which case no more room is necessary than to hold the machinery, and the people employed to manage it. The straw-barn, as recommended by Mr Walker of Wooden, should be so large as to pile up the straw of two stacks when threshed, so that a considerable quantity of straw may always be kept in good order for fodder. Indeed, the straw-barn ought to be so contrived, as to keep different kinds of straw separate, at least separately accessible, for fodder, and for litter, as bean or pease haulm, the straw of white corn, &c. Where cattle are fed on straw, (which it would be better to dis-

* See Discourses on Agriculture, p. 5.

pense with, if richer food, as will afterwards be explained, could be provided for them), the farmer would otherwise be obliged to thresh more frequently than he would wish to do. There ought to be a granary adjacent to the barn, in which the grain, when threshed, may be put, the lower part of which will furnish space for a cart-shed, which ought to be large enough to hold two carts for every plough.

3. In regard to the size of the stables, cow-houses, and feeding-sheds, much must depend on the manner in which the farm is occupied; as to the feeding-sheds, in particular, whether it is most advantageous to rear young cattle for the grazier, or to fatten older stock for the butcher; but it is a rule that ought never to be departed from, not to stint them in point of space, but to give the stock ample accommodation *. Where horses are kept in stalls, Mr

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* Mr Shirreff's observations upon this subject are well entitled to attention. He thinks that all horses so heavy and large that two are capable of drawing a plough, ought to have divided stalls, at least five feet wide each, that they may lie at ease; and every horse feed separately, and, if he choose, that he may *feed leisurely*, whatever be his provender. The stalls may slope, say one-eighth of an inch to the foot; from the bottom of the wall, below the manger to the gutter, which may be ten feet from that wall, and two feet from the back part of the division. There ought to be five feet for a thoroughfare between the gutter, and the other side-wall, behind the horses. The length of the stall will admit of a *broad-bottomed* manger, for holding clover and other green herbage for soiling. The racks will not hold enough of this fodder, and its weight compresses it so much, that the horses cannot, without difficulty, draw it out. Green herbage should be divided between the manger and rack, when working horses are foddered up for the night. Stables in which horses are soiled, ought to have openings in the roof, for allowing the heated air to escape

Brown of Markle is of opinion that five feet of room in breadth is required, to give each horse comfortable accommodation, and that the stable ought not to be less than eighteen feet wide, upon the supposition that the horses all stand with their heads to the wall, which is the

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in hot weather, and which can be shut in cold. The width will allow of shelves and pins for the furniture of each pair of horses, immediately behind their stalls.

Cattle in general have by far too little room. Working oxen, large feeding cattle stalled, and milch cows, should have stalls four feet wide, or even more, and as long as those of horses. Were all these animals fed separately, they would no doubt thrive much better than when they are fed in common. Cattle should be foddered at the head, and littered and cleaned from behind. They should stand single, unless they are of the *same age*, and have been *bred together*. Cattle suffer much from being huddled together, and stewed close up in a low-roofed cow-house in winter, particularly milch cows, more especially if sent out to drink cold water in frosty weather when in a heated state. The urine of both cattle and horses should be carefully collected, by means of retentive gutters, into reservoirs, and carried out and regularly sprinkled over the surface of the dunghill. Much valuble manure is lost by neglecting to have these accommodations erected along with the buildings in which the stock is to be kept.

Where economy *must* be attended to, separate stalls may be objected to on account of the expence: in that case a pair of work-horses *may* be accommodated in a space of sixteen feet by eight, leaving room for bringing them their food and litter, and carrying away the dung. Cows require nearly the same room in the breadth of the cow-house, but usually stand much closer together; so that on the average six feet *may* serve two cows for the above purposes, where the breed is not large. In many feeding houses for cattle, for the convenience of feeding at the head, there are holes left in the wall, with shutters, to allow of putting in the food.

custom for farm-horses in all stables recently built. In this way the access is easy in the longest stable, both for removing the dung, and supplying the horses with provender. With respect to cattle, he adds, that it requires three feet eight inches to give due room to a bullock of 45 stone Amsterdam weight; and if the house is fifteen feet in breadth, or at the most sixteen feet, cattle may not only be comfortably accommodated, but full access permitted to supply them with food, and remove their dung. Many cattle houses are not made more than fourteen feet in wideness, some of them even less; but fifteen feet may, on the whole, be considered as a very proper size.

4. It is maintained by some, that the farmer should have a view, from a window in that room where he usually sits, of what is going forward in the farm-yard*, the very idea of which, it is said, keeps the servants in awe, and may often prevent negligence and depredations. It is certainly desirable, that the farmer should be able to command a view of the other parts of the farm from the windows of his house, if a situation sufficiently elevated for that purpose can be obtained.

5. The house should be situated at a moderate distance from the offices, say from twenty to forty yards. When in the line of the square, the farmer and his family are distressed with the unwholesome vapours of the dunghill, which are also extremely unfavourable to the keeping of provisions.

6. It is of great importance to have either a pavement, or a good road, all around the farm-yard and dung-pit. Farmers suffer more than is commonly imagined, by ha-

* It is known that a farmer has on every door a large patch, painted of a different colour, as white upon black, or black upon white, that he may see at a distance when any of them happen to be open.

ving their carts and cattle straggling in farm-yards through piles of straw and dung, where this is neglected.

7. It is highly expedient to raise the party walls above the roofs of the offices, to prevent the communication of fire, more especially where the offices are thatched.

8. It is also desirable to have two reservoirs for urine. As soon as one is full, it should remain in that state till it becomes putrid, previous to its being taken away, and the other in the mean time may be filling. This plan is strongly recommended by Mr Allan of Craigcrook, near Edinburgh. It is likewise proper, in order that the urine may be as strong as possible *, and to prevent an accumulation of wet, that the buildings should not admit water to go inwards from the roof, at least in wet climates, but that where water is likely to be too abundant, it should be taken away by spouts and drains †.

8. It is evident that the access to the house and offices should be as commodious as possible. The road should be

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* It has been remarked, that urine may be too strong, unless it is diluted; and that if it is kept too stale, some of the most valuable parts of it may evaporate. There is certainly no better mode of applying urine, than to mix it, as soon as possible, with peat, or if that cannot be had, with fine earth, or straw, tanners bark, or saw-dust.

† It is said, that where abundance of litter is given in the yards, it hardly ever happens that too much wet gets to them, and that there is sometimes a want of moisture in dry winters. There must, in this respect, be a diversity in practice, between the eastern and the western districts of the kingdom. On the eastern coasts, the water that falls from the roofs may be required for the litter, though it would be much better to saturate it with urine, and to take great pains in collecting it for that purpose. In dry seasons, on the coast, sea-water may be used with great advantage.

kept in good order. The corners of the garden and inclosures to be rounded instead of square, by which, owing to the great facility of turning, many accidents may be prevented, injurious both to the carts and to the cattle.

9. A command of water is essential; it is desirable, therefore, that the house should be situated near some river or stream; but if that cannot be obtained, ponds and wells, and the means of conveying water by troughs to the feeding-houses, both for horses and cattle, and to the dairy, should be constructed. Nothing can be more injurious to stock, than to compel them to drink at ponds, the water of which is not perfectly salubrious. A bore, made according to Elkington's plan, would in general raise water to supply any part of the offices.

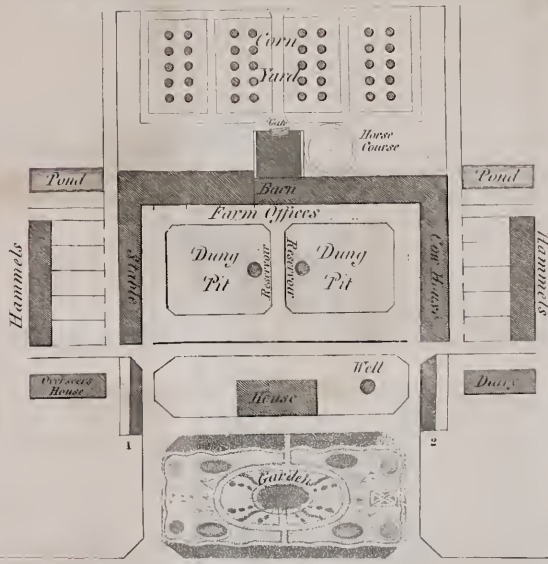
11. As an appendage to farm-houses, a kitchen garden is of infinite importance, and may be more profitable to the occupier, than any part of his farm of the same size. This is certainly less essential, since potatoes, turnips, and other articles have been cultivated in the fields; but still it is expedient for a farmer, to have a garden for other articles; to enable him also to try experiments, with new plants, on a small scale; to train up his rising family to an attention to such objects, and to furnish his table with small domestic luxuries, which no farmer would be willing to purchase, if he can procure them at home.

In conformity to these principles, the annexed sketch has been drawn up, pointing out the proper position of a farm-house and offices, accompanied by the plan of a farm, whether the soil be of a strong or of a light description; and explaining the rotations adopted, according to the most improved systems of Scotch husbandry.

It would be entering into too wide a field to dwell on the various offices necessary for the accommodation of a large farmer, more especially as that subject is very fully detailed in a valuable paper, printed in the Communica-

To face Chapter I. Page 20

FARM HOUSE AND OFFICES.

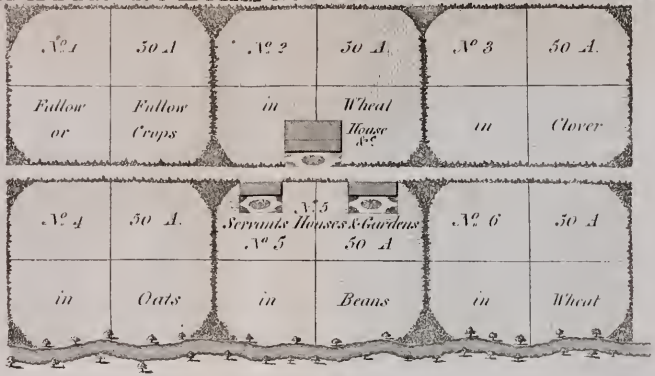


1 *Pig Sties and Yard*
2 *Poultry House and Yard*

Scale as 357 Strand

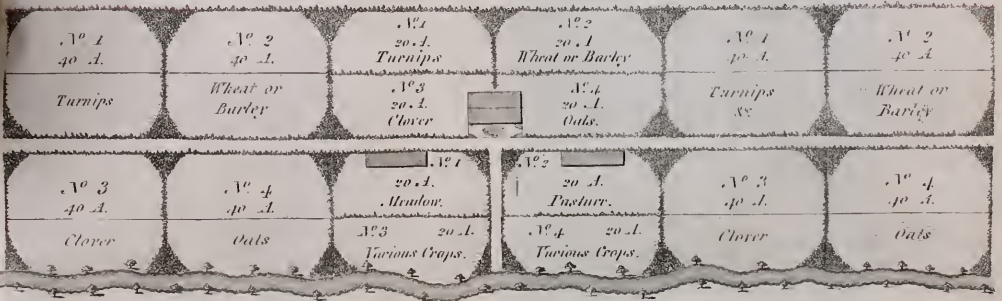
Nº 1

PLAN OF A STRONG LOAM OR A CLAY LAND FARM OF 300 ACRES.



Nº 2

PLAN OF A TURNIP LAND FARM OF 480 ACRES.



The above are the most profitable Systems of rotation either in Strong Land or in Turnip Land Farms, but where the Land is not rich, nor in the immediate neighbourhood of dung, it will be necessary to have one or two years pasture after the Clover to insure an abundant crop of Oats.

tions to the Board of Agriculture *, and will be fully explained in the General Report on the Agricultural State of Scotland, now preparing to be laid by the Board of Agriculture before his Majesty, and both Houses of Parliament. But it may be necessary to dwell on two points: 1. The construction of convenient places for feeding cattle, for the purpose both of consuming the turnips and the straw raised on the farm, and for converting the surplus straw into dung; and, 2. On the best plan of a stack-yard.

In regard to the feeding cattle, three plans have been suggested for that purpose: The first is to feed them in large open yards; the second, in feeding-houses; and the third, in small open sheds, or what, in Berwickshire, are called *Hammels* or *Hemmels*, with separate straw-yards attached to each.

The plan of fold-yards is certainly the cheapest, being in general formed by the offices which afford shelter to the cattle; but where a number of animals, of all sorts and ages, are suffered to mingle together, many accidents must happen, and the cattle must often be injured, by going through a yard full of straw and dung, and often very deep, in which they are apt to sink †, and by master cattle pre-

* See a paper on Farm-buildings in general, by Robert Beatson, Esq. Communications to the Board of Agriculture, v. i. p. 3. But by far the best plan of a farm-house and offices hitherto published, is to be found in Mr Kerr's valuable report of Berwickshire. It is founded on actual experience, and comprehends every convenience essential to the accommodation of a large farmer.

† This is often the case, though in well-regulated farms the dung is never suffered to remain in the court or fold-yard, but is carried out before it becomes so rotten that the cattle can sink in it. This is sometimes done in wet weather, that the dung may have sufficient moisture to make it ferment, but is better done in frosty weather, when more can be carried in each cart, and the fields are less liable to be poached.

venting the others from feeding. Though this plan might answer for young cattle, where divisions are made by walls or hurdles, yet it would never answer for feeding valuable cattle for the butcher.

Feeding-houses are, in some respects, well calculated for fattening cattle, and are less objectionable in the immediate neighbourhood of a market. The animals are kept warm and quiet, and each can have the due portion of food allotted to him; but the animals having no exercise when thus stall-fed, cannot be so healthy, nor the meat so wholesome, as when kept in fold-yards or open sheds. The legs of cattle also, more especially in the case of heavy oxen, when confined to one spot, are so apt to swell *, that they are hardly able to go to any distance. Where a less confined mode of feeding is adopted, the cattle not only thrive better, but the expence is considerably less.

On the whole, the third plan seems to me the best; namely, that of hammels, which I first had the satisfaction of seeing, at Mr Robertson's of Ladykirk, in Berwickshire. An engraving of this excellent plan is annexed, which will give an idea of the form of the construction. The advantages of it are described by Mr Robertson in the following terms: "I have found these hammels or cattle-sheds much "better than any large or open court and yard. Cattle "kept in great numbers waste more straw, they fight, and "hurt one another with their horns. All this is prevented "when they are kept in separate divisions; and, above all, "in these hammels we can give them what meat we choose, "and in what proportion we think proper; and can sepa-"rate those of different ages, which ought not to be asso-"ciated together."

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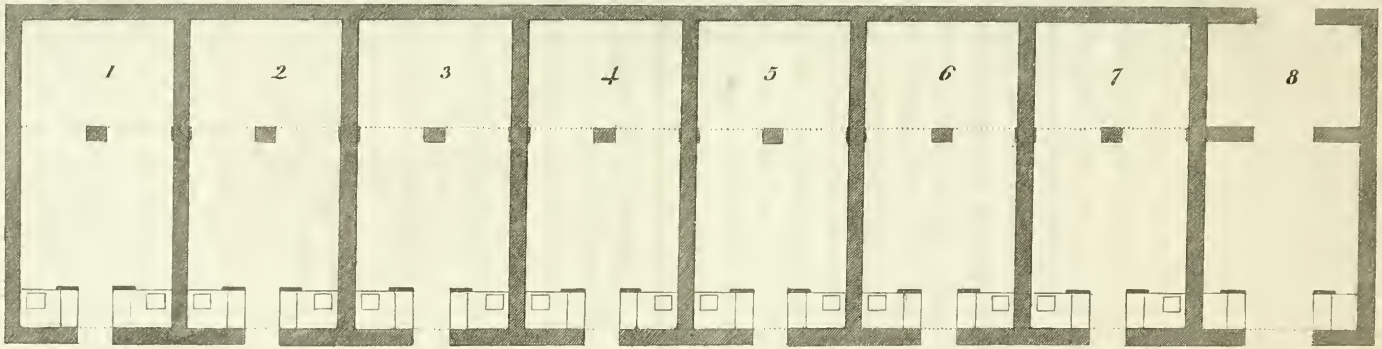
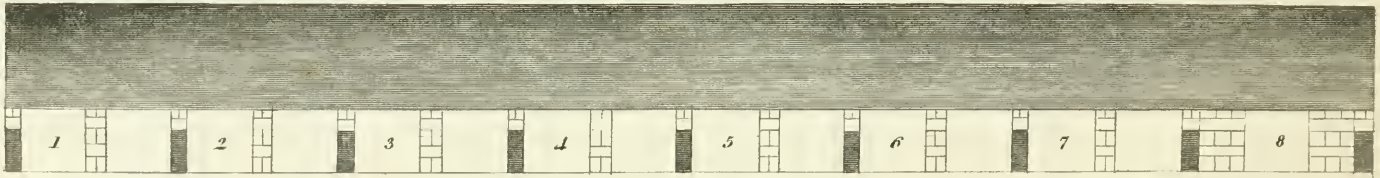
* It is remarked, that the legs of cattle fed in stalls on yams, or exclusively on raw potatoes, are particularly apt to swell.

THE HAMMEL.





THE SHED FOR THE CATTLE.

Scale of 12 Feet to the Inch

This plan, however, is not confined to cattle; a spirited farmer on the estate of Ladykirk, having long used exactly the same buildings for his horses, and with very great success. He had lost none by death for a number of years, and they seldom have colds or any other disease *. His horses lie in these open hammels in winter, and it is remarked, that in frosty weather, when snow is falling, and lying on the ground, the animals do not go under cover, but prefer to lie out, with their backs and sides covered with snow. It is well known, that if a horse is kept out in winter he will have no grease, nor swelled legs, and perhaps no other disease. These hammels seem to have all these advantages, at the same time that they protect the animal from damp, and prevent his back from being kept wet by heavy or long continued rains. Every farmer who keeps a large stock of horses, occasionally loses one by inflammation brought on by coughs and colds; but the horses of the farmer alluded to, become aged, and he has not had occasion to purchase a young horse for several years. It is evident, that horses taken out of a warm stable, perhaps with some degree of perspiration on them, when they stand behind a hedge in a cold day, either to have their corn given them, or when the servants are taking their dinner, must be much more liable to catch cold, than if they had been hardened by being kept in open sheds in the manner above described.

The proper arrangement of a stack-yard is of more consequence than is commonly imagined, and is capable of

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* Mr Kerr fully confirms the advantages of this plan, having repeatedly seen these open-horse hammels at Mr John Herriot's, tenant at Ladykirk farm; each shed holds two horses, with a niche for their harness. To each there is an open small straw yard. Each has a water trough, and each a gate large enough to admit a cart to take out the muck.

much improvement *. It is a common practice to begin building the stacks at the corner opposite to the entering gate from the farm, packing them as close as possible, by which they are deprived of air, and if any of them should shew a tendency to heat, it is extremely difficult to get them turned over, or put into the threshing mill. Mr Mitchell of Balquharn near Alloa, has arranged his stack-yard on principles peculiarly well planned and judicious. His stacks are divided into regular rows, and there is a road on each side of every double row, besides a road round the whole yard †. This plan is attended with the following advantages: 1. By these parallel roads there is a greater degree of ventilation; 2. He can remove any stack he pleases, as necessity or markets may require; 3. In the hurry of harvest, there is no confusion or loss of time whatever may be the number of men or horses employed; and, 4. By having the rows and the stacks regularly numbered, there is no difficulty in ascertaining what each field of the farm produces. This plan was originally suggested by Mr Erskine of Mar.

Two points on the subject of farm-houses and offices in general, remain to be discussed: 1. By whom they ought to be erected; and, 2. By whom they ought to be kept in repair.

In regard to the first point, it is certainly desirable, that the landlord, who has a permanent interest in the soil,

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* In the Berwickshire Report, p. 86, the rick-yard is directed to be ploughed into twice-gathered ridges 21 feet broad. By this means, as the ricks seldom exceed 12 feet diameter, there are 9 feet free between the rows for air and carrying in sheaves. No allowance for heating, as a good farmer has no heated stacks.

† As four rows, if the stacks are pretty large, will in general be sufficient, two roads will be enough, one through the middle of the longitudinal direction, and one round the whole yard.

should, if he can afford it, be at the expence of all substantial improvements *. But how can that be expected in the case of entailed estates, where the proprietor has only a life-interest in the property, and cannot borrow money for expensive erections, notwithstanding the provisions of an act for promoting the improvement of such estates? Frequently, also, the tenant has a greater command of ready money than the landlord, and will lay it out with more economy, and to more advantage. In that case it may be most advisable for both parties to arrange a plan, by which the buildings are to be erected by the tenant, the farm being let proportionally, at a lower rent, and he receiving a certain sum for those buildings, according to their value, at the termination of his lease †. This is particularly necessary in the case of entailed estates.

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* Mr Church of Hitchill in Dumfries-shire, observes, that the farm-house and offices ought to be erected free of expence to the tenant. Many an industrious individual has got the character of a bad farmer by having been unguardedly led to exhaust his capital on buildings, so much so as to disable him from bestowing a proper proportion of it on the cultivation of the soil. Inclosing ought to be done at the expence of the landlord, and the fences reared or maintained at the mutual expence of landlord and tenant. In short, all great permanent improvements on a farm, should be executed by the landlord, and in consideration of these, let the tenant pay a higher rent.

† Mr Milne of Alvah, near Banff, remarks on the subject of farm-buildings, that few farmers have capital sufficient for a farm of 200 acres, the expence of stocking which, at a moderate computation, costs L. 2000 Sterling; and if new houses are required, which very often happens, *a great deal more is necessary*. Any allowance the proprietor gives for building, is seldom or ever paid until the end of the lease; the tenant's capital is thereby very much drained, before the fields can receive much benefit. It also often happens, that the outgoing tenant has a considerable claim

As to repairs, the farm-houses and offices in the more improved districts of Scotland, are usually built in a substantial manner, and it is in general the practice, that the tenant shall keep the house in repair. It is a great addition to the landlord's income, to be exonerated from so heavy a charge, and in Scotland it is rarely found to be attended with any material loss.

On the whole, it can hardly be questioned, that it would make the difference of the labour of one, and in some cases even two farm-servants, that is from L. 50 to L. 100 *per annum*, where the particulars above mentioned, regarding the construction of farm houses and offices, have been properly attended to, or have unfortunately been neglected.

Sect. III.—*Size and Shape of Fields.*

This is a point, which, in so far as regards arable culture, has been brought to a considerable degree of perfection, according to the system of husbandry adopted in the

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for houses, and in many instances they are so ruinous, that the farmer can neither trust himself or cattle with any degree of safety, but he must be at a great expence in repairing them. In such cases, the landlord should certainly give every assistance he can afford. In regard to the plan of valuing *the whole premises* at a tenant's entry, and again when he removes, it is remarked by an intelligent correspondent, that such a system *is rather hazardous*. The price of wood, its workmanship, and other materials, vary so much in the course of a lease of even nineteen years, that he has known a tenant to receive a great surplus sum at his removal, without his having laid out a single shilling, the value of building materials having so much increased.

more improved districts of Scotland. Nothing can be more absurd, with a view to the culture of grain, than to have a number of small inclosures, irregularly shaped, surrounded with high hedges and trees *; and such a system perhaps general in a flat country, where so much shelter is unnecessary. Such a plan is peculiarly reprehensible, where horses and cattle are the principal objects of attention, as soiling, (or giving them cut green food in yards, or houses), is greatly preferable to pasturage: yet so inveterate is the prejudice for small fields, that though the expence of inclosures has now become enormous, they are still persevered in, even in new inclosures, under the authority of acts of Parliament, by which the charges of that important branch of agricultural improvement are greatly increased, to the great detriment of the property inclosed. We shall proceed, therefore, to state, what in Scotland is considered to be the best size of fields, in an improved arable district, and the principles on which the system is founded.

The circumstances on which the size of fields ought to depend, are principally the following:

1. The extent of the farm in which they are situated; 2. The nature of the soil or subsoil; 3. The rotations adopted; 4. The number of ploughs in the farm; 5. The command of water; 6. Access to roads; 7. The elevation of the ground; 8. Its being in pasturage or otherwise; and, 9. The nature of the climate.

1. *Extent of the Farm.*—The size of fields ought certainly, in some measure, to depend, on the extent of the possession. In small farms near towns, from six to twelve acres may be sufficient; but where farms are of a proper size, fields from twenty to even fifty acres, and in some in-

* Fields thus sheltered must be liable to the rust in wheat, as the exclusion of air encourages the growth of *fungi*.

stances as high as sixty, is the size that has been recommended, and that in no case they should be under twenty Scotch or twenty-five English acres, if it can be avoided. One of my correspondents indeed states, that his inclosures are about twenty Scotch, or twenty-five English acres each, and that he would certainly enlarge them, were he not restricted to that size by his lease. Mr Brown of Markle, whose knowledge in every branch of agriculture is so well known, considers a field of thirty Scotch, or thirty-eight English acres, to be a proper medium size, when permitted by local circumstances, for large farms.

2. *The nature of the Soil and Subsoil.*—The best size of fields for arable cultivation, must always depend upon the nature of the soil and subsoil. When the soil is chiefly dry, it is of consequence to have the fields large, as it tends to accelerate the ploughing, harrowing, reaping, &c.; but when it happens to be strong clay, it then becomes a matter of prudence to contract the size of the fields, chiefly for the purpose of keeping them as dry as possible *. In dividing a farm, however, it is proper to separate the light and the heavy soil. They are not only better calculated for different crops and different rotations, but are fit to be wrought at different seasons. It is a fortunate circumstance when a farmer possesses as much ground of each kind as will make a full rotation, so that both may be carried on at the same time. In turnip soils, the following plan has been recommended by Mr Carnegie of Drylaw-hill, in East Lothian. Where the farm would admit of it, he would divide the whole into eight fields of thirty acres each, under a rotation of, 1. Turnip; 2. Wheat and Barley; 3. Grass, and 4. Oats: and he would have two breaks or divisions in each field, one half, (or fifteen acres), of the inclosure in turnips, and

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* Remarks by Mr Rennie of Kinblethmont.

the other in grass; and when ready to consume the turnips, he would strip one half of them, and give them to the sheep on the grass: He would then move back the flakes or hurdles, and would allow the remaining half to be consumed on the ground, with liberty to the sheep to pasture over the whole grass while eating the turnips, taking care never to give the stock more than a certain number of days' turnips at a time. Thus there would be four fields with white crops, after turnip and grass. Others recommend giving the sheep as much fresh turnips each day as they can eat, as the turnips, when not consumed on the day given, are often damaged by the wet and frost, or destroyed by the sheep going over them. Mr Walker of Mellendean concurs in opinion, that on turnip soils, where it is necessary to consume the turnips upon the ground, the fields should never much exceed thirty acres, if the situation will admit them to be made of that size. When they are larger it becomes difficult to give the sheep the quantity necessary at a time, without confining them all round with nets or hurdles, which is always attended with much loss. When one division is done, and a new one taken in, the sheep should always have liberty to fall back, and rest upon the cleared ground, which they naturally do, by which means the turnips are kept much cleaner, and a great deal of meat saved; and he has always found, that a field of the above dimensions will contain as much stock, of any kind, as can be fed together with advantage.

3. *The Rotation adopted.*—It is considered to be a proper rule, that whatever is thought to be the rotation the most suitable to the soil, the field should be neither more nor less than the proper division that the rotation of crops requires, that is to say, a farm with a rotation of eight courses, should be divided into eight fields; six courses into six fields; five courses into five fields, and four courses

into four fields or inclosures *. That rule is laid down by Mr Murray, (Kirkland-hill), with a view of having the whole field under one crop. At the same time, on a farm of 400 acres under a four years' rotation, instead of having four fields of 100 acres each, it would be better to have the farm divided into eight fields of 50 acres each, and having two of these fields under one kind of crop. It is proper, however, to observe, that where the climate is uncertain, and the soil various, the following judicious practice has been adopted, that of having a proportion of every kind of grain cultivated in the strong part of the farm, and another portion in the lighter part. This gives the tenant a fair chance to have an equal crop, whether the seasons are dry or wet, and whether they are favourable to the one species of soil or crop, or to another.

4. *Stock on the Farm.*—It has also been observed, that the size of the fields should be somewhat in proportion to the number of horses and ploughs on the farm; for instance, where six two-horse ploughs are kept, and where it is difficult, from the nature of the soil, to keep fields of a larger extent sufficiently dry, fields of from

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* The size, it is said, should be equal to the fallow-break, or the portion of the farm under fallow. The fields under fallow should be of the average quantity of the farm, and the other crops will become so of course. Every farmer of experience endeavours to have, and knows the comfort of having, the produce of the farm, as equal every year, as the soil and circumstances will admit of. On this subject, Mr Stewart of Hillhead remarks, that though it may answer the farmer *in possession*, to have the farm divided according to the rotation he practises, yet that it will be found generally advantageous *for the proprietor*, to have it divided into double the number of fields that may be required for a four or a five years' rotation, in case any alteration of system should become necessary.

eighteen to twenty-two English acres are considered to be a convenient size: there is less risk, in that case, of being overtaken by bad weather, and prevented from completing the preparation of the land for the intended crop; for with twelve horses in the spring season, a field of that size can always be finished in four days *. In regard to the live stock not employed in the separation of the farm, it is well known, that cattle, and sheep more especially, feed better in small numbers together, than in great herds or flocks.

5. *Water.*—It is is necessary in every field actually to be pastured, to have a supply of water, the command of which is more likely to be obtained in large, than in small inclosures. A correspondent, whose fields are small, complains of their being so ill-watered, that the stock when pastured in some of them cannot get a supply, even in winter.

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* Remarks by Mr Peter Mitchell in Stirlingshire, and Mr James Cuthbertson in East Lothian. On this subject, Dr Young of Stonehaven justly observes, that the fields should be of such a size, as to admit the operations going on upon them to be finished in a short time by the stock on the farm. If the fields are of too great an extent, in proportion to the stock kept, a considerable interval must occur between the sowing of the first and last part, especially of barley and big, where generally the last ploughing and sowing take place together; and it will in general be desirable, to have the whole fields cleared at once, in harvest. There will also be a saving of labour, particularly in the instance of harrowing a crop in seed-time; as, in ordinary sizes of fields, the sowing can be soon accomplished; by which the frequent turnings is avoided, that would otherwise take place, if it were necessary to sow the field in several portions. Whenever rolling is required, whether for grass seeds, for reducing the ground, or any other purpose, much of its benefit may be lost in an extensive field, because, being usually done across, it cannot well be accomplished till the field is completed.

6. *Roads.*—It is essential that each field should have convenient access to the farm-road; so obvious a point need not be dwelt upon.

7. *Elevation of the Ground.*—It is also evident, that the size of the field must in some respects depend on the flatness or elevation of the ground. Even on dry land, if there is a rise on the ground, from fifteen to twenty chains is length sufficient; for where the ridge is longer, the horses are too much fatigued, if compelled to plough a strong furrow, up-hill, farther in one direction.

8. *Pasturage.*—Where the system of grazing and tillage is alternately followed, (more especially where the fields are pastured for two or three years or more), it is convenient to have the fields about twenty-two Scotch, or twenty-seven English acres; because the farmer generally wishes to have his stock divided, which cannot well be done with larger fields, and if they are of a smaller size, too much ground is occupied with fences. Besides, if grass fields are let for pasture, such a size suits graziers best, and consequently they rent considerably higher, than fields would do of a larger, and consequently a more inconvenient description. Unless where there are small fields near the house, it is desirable to have some part of the green-crops near the farm-offices. For if the fields are all large, the whole lot of turnips or clover might be removed to the outward boundary of the farm; whereas if fields are of a moderate size, it is possible to have a part of these crops at a convenient distance *.

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* Remarks by Mr Brown, Cononsyth, by Arbroath. Another correspondent observes, that some extent is desirable for fields in pasture, to attend the stock pasturing over its surface. Fields from ten to twenty acres, however, are large enough for grazing. When few cattle are put together, they remain more quiet, than when there are many, which is very desirable for fattening

9. *Climate.*—The last circumstance to be considered in determining the proper size of fields, is the nature of the climate. In dry and cold climates, small inclosures are desirable, on account of shelter: whereas, in wet countries, the fields under culture cannot be too open and airy, for the purpose of drying the ground, of bringing forward and ripening the grain, and of enabling the farmer more easily to secure it, during any unfavourable harvest, by a free circulation of the air.

We shall now proceed to make some observations on the shape of fields, the form of which should be square, or oblong, and the soil, if possible, uniform.

SQUARE FORM.—It is evident, that it is advantageous to have the fences in straight lines, and that fields when large, should be square *, and when small, of an oblong square, in order that the ploughing may be dispatched with as few turnings as possible. Some people, whose farms are of a waving or uneven surface, and who inclose with hedge and ditch, carry their ditch through the hollows or best soil, with a view of raising a good hedge; thus, often sacrificing, for the sake of the fence, the form of their field. A straight line, however, is preferable, even though it should be necessary to take some particular pains to enrich the soil for the thorns, when it is thin and poor, on any eleva-

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stock. In a wet autumn, much grass is destroyed by treading, and in large fields more grass is destroyed by the feet of the cattle, than consumed by their mouths.

* Mr Kerr justly remarks, that in hanging grounds the ridges and furrows ought always to have so much obliquity, as to reduce the field nearly to the circumstances of one situated on a plain. The operations of ploughing, harrowing, carting, &c. are thus materially facilitated, and the filling up, or sanding of the furrows effectually prevented.

tion *. By means of the square form, an opportunity is afforded, of ploughing in every direction, when necessary, and less time is lost in carrying on all the operations of husbandry in a field of that form, than of any other shape. Where the waving form is necessary to secure proper water-runs, plantations may be so disposed, as to reduce the fields to squares or oblongs, and the fences to straight lines.

Oblong form.—An intelligent correspondent is decidedly of opinion, that all farms are best divided into oblong fields, because, should they ever be converted either into a grazing, or a breeding farm, oblong fields are so easily and simply subdivided, and water can almost in every case be got, by making proper ponds, in the meeting or joining of three or four fields, the gutters or ditches of which fields will convey water to the ponds. This ought more especially to be attended to upon all turnip soils, for the obvious advantage of cutting off, or dividing the turnips with hurdles or flakes, or nets, &c., and for the convenience of feeding them off with sheep, always keeping in mind to take off a certain proportion of drills, for giving to the feeding cattle in the sheds or folds, &c., or to sheep upon the adjoining stubbles or pastures, in proportion to the state the ground is in; land in a rich state having the greater proportion taken off. Nor is it any objection to the oblong shape, that the ridges may be too long, as that can be easily obviated by cross head-lands or head-ridges, which in any soils can be made at any place, according to the length of ridge most agreeable to the taste or opinion of the proprietor or occupier †. If the land has a wet,

* Remark by Mr Church, Hitchell, near Annan.

† On this subject it is remarked, that head-lands are never admissible, except to get rid of wet, or in consequence of deviations

damp or retentive subsoil, the head-ridges can be made in those parts most suitable for taking off the water, as well as to suit the proper length of the ridges, with gutters or gripes where necessary.

Uniformity of soil.—An intelligent farmer laments, that the inclosures on his farm are laid out more with a view to beauty than utility, and that regularity and uniformity of appearance have been chiefly attended to, whilst little regard has been paid to a point infinitely more essential, that of having the several fields of the same sort of soil; hence soils of the nature most heterogeneous are thus unfortunately mingled in the same field. Another farmer complains, that this principle has been so little attended to on his farm, that he has ridges, one half consisting of a strong wet clay, and the other half of a sandy soil, fit for turnips. A spirited correspondent proposes to obviate this objection, by altering the texture of the soil. He observes, that there are fields, partly consisting of strong soils, and partly of light, where probably there are not above one or two acres of the latter, for ten or twenty of the former; and where almost every year the culmiferous crops fail on the light soils from drought. He therefore suggests, that at any slack time, whether in winter or summer, when the field is under fallow, it would be proper to employ two carts and horses, with four fillers, and to cover the acre or two of light soil, with the strong soil contiguous. Draining perhaps would, in the first place, be necessary; but the soil in the field would ever after be uniform. In fields where light soils predominate, the same plan reversed might be adopted. The principal objections to this plan, are, 1. The expence,

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of soil, and hence a difference of culture; and that ridges cannot be too long, where land is inclosed, as it gives occasion to fewer turnings, and is ploughed at less expence of time and labour.

and 2. That the subsoil remains the same; but the idea is certainly excellent wherever it is practicable.

We shall now proceed to state the advantages of attending, as much as the circumstances of the case will admit of, to the principles above laid down.

1. Every intelligent farmer will admit, that it is a material drawback to the cultivation of the farm, if the fields, instead of being regular in size or form, are laid out arbitrarily, without attention to any judicious system; and where the whole farm is divided into fields of various sizes, from 5 to 10, and thence to 20 or 30 acres each, it is extremely difficult to equalize them, so as to suit any judicious rotation of crops; whereas, by having fields of a proper size, the whole strength of the farm, and the whole attention of the farmer, is directed to one point, and there is also an emulation among the ploughmen, when they are assembled together *.

2. It is evident, that small fields are liable to many objections. Besides the original expence of the inclosures, and the injury to grain crops produced by want of circulation of air, and the shelter given to numerous small birds, the very site of numerous hedges, with their attendant ditches, and the uncultivated slips of land on both sides of them, rob the farm of a much greater quantity of arable land, in proportion, than when divided into large fields. Hedges and ditches also, more especially if accompanied with hedge-rows, exhaust the ground near them of its fertility; they nourish weeds, the seeds of

* Rectangular fields of considerable size are advantageous, as it may be thereby known whether the ploughmen have done their duty; that is, if there is one man in the whole who can be depended on. Indeed, in fields of this shape, the work done, is known by the length of the ridges, and number of furrows, of a certain breadth ploughed.

which may be widely disseminated, or exclude the wind and drought after the crop is cut down, keeping it longer from being stacked. Even for meadows, these small inclosures are injurious, by preventing the circulation of air for making or drying the hay. Where fields, on the other hand, are of a proper size, less ground is wasted, there are fewer fences to uphold, and fewer birds to destroy; the crops of grain can be more early harvested, being more exposed to wind, and they are less apt to suffer in dry and clear weather; and though small inclosures are better sheltered in winter, yet the opener they are in summer the better; for in hot weather the cattle and sheep always go to the airiest places *. But the principal argument in favour of large fields is this, that in small fields, much time and labour is wasted by short turnings, &c.; hence an intelligent farmer, (Mr Mitchell of Balquharn), has well observed, *that if fields are of a regular shape, and the ridges of a proper length, five ploughs will do as much work as six ploughs in fields of a small size, and of an irregular shape; and every other part of the business to be performed, as dunging, sowing, harrowing, reaping and leading, will be executed, though not altogether, yet nearly in the same proportion.*

Some general remarks on this important point, (the size and shape of fields), still remain to be stated †.

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* Remarks by Mr Robertson of Almon.

† On this subject the following hints merit consideration:

In regard to the proper size of inclosures for a farm of 200 acres, I think there should be eight of 20 acres, and four of 10; and the best rotation in my opinion is, upon the 20 acre fields, turnips, or a plain fallow, after which any kind of white crop the tenant thinks will pay him most, and to sow along with that crop 8 lb. of white, 6 lb. of red clover-seed, and one bushel of permanent rye-grass seed, to remain in pasture for four years, and when

1. Though fields, on the whole, should be of a large size, yet there is a great convenience in having a few smaller fields near the farm-house; for the family cows; for rams, on farms where sheep are kept; for trying on a small scale, useful experiments; also for raising tares, clover, lucern, sainfoin, &c. and for various other purposes *.

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broken up, to take oats; then to follow the same rotation as at first. The four small inclosures should be made upon the best and strongest part of the farm, and the rotation I would follow, would be a plain fallow, wheat, lb. 12 or 14 lb. of red clover, and two pecks of annual rye-grass *per* acre sown along with it; then to cut green what is necessary for soiling the work horses, and the remainder made into hay for them in the spring; then oats, and the same rotation as at first. If this plan of management is followed upon a soil that will improve itself in pasture, I am certain a good crop may always be depended upon, and with little expence.

For a farm of 300 acres, the same number of fields as the one of 200, only larger, that is to say, eight of 30 acres, and the four small inclosures, 15 acres, and the same rotation followed. For a farm of 700 acres, I would say eight inclosures of 50 acres, and twelve of 25. With those of 50 acres, I would follow the same rotation as what I propose upon the other two farms, and with the twelve inclosures of 25 acres, an eight or four course shift can be adopted; but with the eight-course always to remain four years in grass. This plan of management is only for good soils that will improve by being in pasture, as there are thin clay soils, that the longer they remain in grass, they always get worse, and for which a four-course shift is the best; and the farm should be divided in eight, twelve, sixteen, or twenty inclosures, according to its extent. One or two of the fields could be cut green for soiling the horses, or made hay for them in the spring; but if the tenant chooses, he can take one year's pasture.

* Remarks by Mr Robert Kerr, the intelligent Reporter of Berwickshire; Mr Wilson of Simprin, and others. Mr Stewart

2. Where inclosures are found too large for particular purposes, the field may be effectually subdivided by sheep-flakes, or hurdles, a sort of portable fence, well known to every turnip grower. When carefully set, they have been found a complete fence, at least for sheep. By this means great advantage is derived, from the constant use of the land that would otherwise have been occupied by stationary fences, and the expence of subdivisions, which, on a large farm, would necessarily have been numerous, is thereby avoided *.

Of such importance does it seem to Scotch farmers, to enlarge the size of fields, and to put them into as regular a shape as circumstances will admit of, that it is one of the first circumstances attended to, wherever the Scotch system of husbandry has been introduced into any part of England. A striking instance of this observation will be found in the appendix, where an account is given by Mr Stratton of the origin and progress of the introduction of the Scotch system of husbandry by him into his estate in Oxfordshire. Engravings are given of that estate, according to the English and the Scotch systems, for the

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of Hillside also observes, that it is often found convenient to have some small inclosed fields upon extensive farms, where the general plan of management is calculated for large fields. Besides the purposes mentioned in the text, it may sometimes be necessary to turn out young horses, mares and foals, and old horses, and to have small fields of ruta baga, and other winter and spring vegetables conveniently situated for the farm-offices, and distinct from the large fields. It might not answer the purpose, to have divisions for these in large fields separated by sheep flakes. Besides the expence and inefficacy of that plan, the succeeding crop might not suit that of the large fields.

* Hints from Mr Hunter of Tynefield, and Mr Cuthbertson, near Prestonpans.

purpose of enabling the reader to compare them together. The number of fields, according to the English system, was 201; according to the Scotch, from 95 to 100. By means of which reduction, a considerable extent of ground has been obtained, and the land is rendered better calculated for the production of corn.

I have been led to dwell longer, than otherwise would have been necessary, on the interesting subject of this section, as it is a topic which has not hitherto been so much attended to as its importance deserves.

Sect. IV.—*Of Fences.*

If the fields are of a proper size, it will add greatly to the value of a farm, to have them judiciously fenced. Hedges of a proper construction, with trees regularly planted in the corners of the fields, (see the engraving of the plan of a clay-land, and turnip-land farm), not only beautify a country, and improve the temperature of the atmosphere, but actually increase, perhaps from 2 to 5 shillings *per* acre, the intrinsic value of the land.

In the more improved districts of Scotland, the farmers are not partial to small inclosures. They are of opinion, that the fences take up a great deal of land which might be employed to much better purpose; that they are extremely injurious to the roads along which they may be carried; that hedges furnish a shelter for birds, which do much mischief to the crops of corn, when they are sown or ripening*; that the want of air is extremely prejudicial to

* Others contend, that though sparrows, and other small birds, do harm, yet, on the whole, that they are beneficial, by destroy-

grain, in all the stages of its growth, and in particular that near hedges, its quality is greatly inferior; above all, that when the crops are cut down, the produce of an open field must be ready much sooner for being brought in, than in the case of small inclosures, to which scarcely a breath of air has access. There is certainly much justice in these observations.

It is admitted, that inclosures are of some use to stock, as they require, if pastured in the fields, shelter from heat, as well as from cold; but where the practice of soiling is adopted, sheep is the only species of stock that ought in general to be fed out of doors, and they prefer airy situations. Where there is any old turf, or permanent pasture, on a farm, a high fence is desirable, for the sake of promoting moisture, which is favourable to the growth of grass; and hedges, and hedge-rows, as Mr Kerr well observes, give a rich and sheltered appearance to a country, while the want of that ornament occasions many fertile and highly cultivated districts to appear neglected, cold, and desolate*.

The sort of fences chiefly known in Scotland, are: 1. Open drains; 2. Stone walls; and, 3. Thorn hedges.

1. Open drains sometimes answer the double purpose of dividing fields, and of freeing them from superfluous wa-

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ing caterpillars and the various sorts of moths, butterflies and insects, which attack the ears of corn. Small inclosures, however, first nourish these vermin by the warmth and shelter they afford, and then it is proposed that other vermin should be protected to destroy them!

* Berwickshire Report, p. 132. Others contend, that *a farmer* is not bound to attend to appearances, but to the real advantages of a system; and that where sheep are pastured as stock, moveable fences of hurdles or flakes might supersede hedges on dry soils, in the four-course husbandry.

ter; and they are not liable to several objections, which have been urged against other sorts of fences. Where stock, however, are pastured in fields thus separated, unless accustomed to that sort of fence, as in Carse-lands, they sometimes fall into the ditches, and are killed or materially injured; and if any paling is erected to prevent such accidents, it seldom lasts long.

2. Stone walls are of various descriptions. They have one advantage, that, according to a common saying, "*They are major from their birth;*" or, in other words, are in their greatest perfection as soon as made. They have, however, this disadvantage, that they are getting worse every day. The propriety of erecting such a fence, depends much upon the nature and quality of the stone, the vicinity of the quarry where it is dug, and the possibility of obtaining lime at a moderate expence, by which the construction of the wall can be so much improved, and rendered much more durable. Where all these advantages are combined, stone walls, though not so ornamental as hedges, yet are preferable in point of utility; for the benefit of the inclosure is immediate.

Among the various sorts of stone wall usual in Scotland, there is one, known under the name of the Galloway or snap dike, of which it may be proper to give some account. It was invented in that district, and thence has spread over various other parts of the kingdom. Mr Smith, in his very able survey of Galloway, has given the following description of this species of wall. It is built for the most part two-thirds or three-fourths of their height double, *i. e.* the two sides are formed of two different sets of stones, resting against each other, and connected together by stones, which from time to time are laid across the dike. On the top of this double dike, a set of long stones are laid horizontally across the dike, projecting a little on each side; and above these the remainder is built single, which,

from the irregular figure of the stones, leaves apertures through which the light appears *. There was a great improvement on this mode of fencing invented by the late John Macadam, Esq. of Craigengillan, by putting on the top of the dike, as close as they can be laid together, stones placed edgewise; and when a considerable extent has been thus laid, thin stones are driven in, like wedges, at small intervals, which bind the whole so firmly together, that, when well built, a stone can hardly be taken out of the top without an iron-crow †.

3. The white thorn is considered to be preferable to every other plant for a fence, being, when placed in a proper soil, a quick grower, becoming strong by age and attention, not running at the root as the black thorn does, and having prickles for its defence ‡. It certainly requires continued care for a number of years, in order to be rendered a good and permanent fence; but when properly trained, and occasionally cut over, or dressed in the wedge-shape, it will last for ages §. If suffered to grow too tall, it always makes a bad fence, becoming open below, and from its height, the crops around must be injured. When hedges therefore come to a proper height and strength as fences, they ought to be cut into the shape of what is called a *hog-main*, *i. e.* brought to a point along the top, and

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* General View of Agriculture of Galloway by the Reverend Samuel Smith, p. 83.

† Ditto, p. 87.

‡ See Kames' Gentleman Farmer, p. 272.

§ See Kerr's Berwickshire, p. 186. There is some reason to hope, that the Cockspur thorn of America, may in some respects be preferable even to the white thorn; and for trying that experiment, considerable quantities of seed have been commissioned from America, by the Board of Agriculture.

preserved in that form by yearly switching *. This can generally be done for a farthing *per* rood of six yards six inches each. This plan ought always to be adopted along the sides of roads, as it keeps them dry, and preserves them from being broken up.

Hedges are often accompanied with hedge-rows, and sometimes by what are called belts of planting.

As to hedge-rows, Mr Wight of Ormiston very justly observes, that he considers them destructive to the fences themselves, as thorns never thrive near the tree-roots, nor under the drop of the tree. The roots, running into the field in all directions, never fail to break and damage the plough, and to interrupt the operations of the field. The corn growing under the shade and drop of the trees, is almost universally laid down, of course not filled, unequally ripened, and not so soon ready for the stack-yard as the other parts of the field. In late and wet seasons the corn is never harvested in proper condition, and in many instances it is totally lost. The grass under the drop is also of inferior quality, compared to the other parts of the field, and is unwholesome to cattle and horses †.

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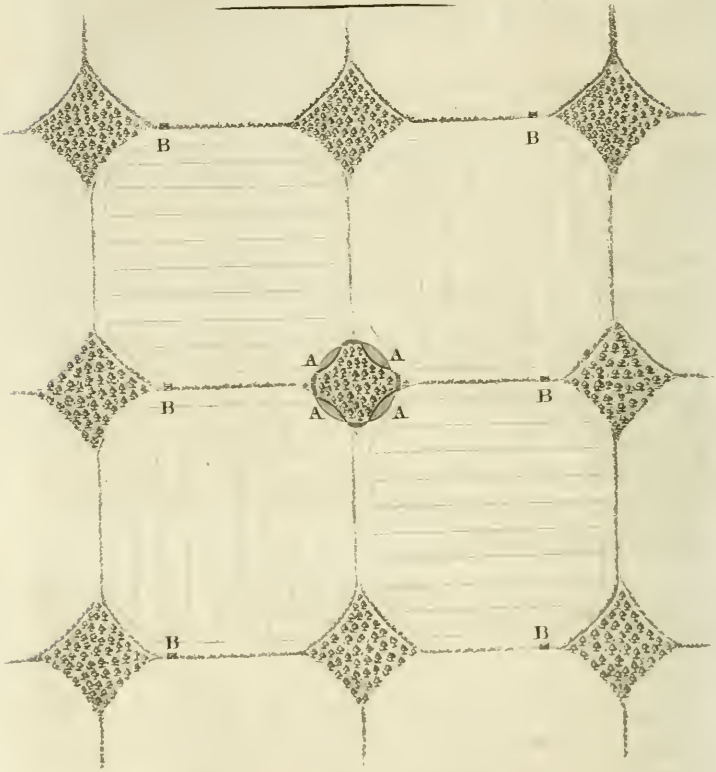
* The only objection to this is, that the farmer has frequent occasion for the cuttings of strong hedges to form temporary fences.

† A respectable correspondent farther remarks, that hedge-row timber, especially ash, is a fatal enemy to corn. The influence of the roots, in attracting moisture and fertility, may be seen in a circular form, on every arable spot in their immediate neighbourhood. They are in fact the landlord's *thieves*, who steal from the tenant's crop every year, ten times the value of their own improvement. The same disadvantage is felt from trees in gardens. When trees also are cut down from hedge-rows, the thorns which grow among their dead roots generally die, especially if the trees cut down are of the fir tribe.

Plan of Enclosures with Clumps of Planting, & Ponds for Cattle.



A A A A Represent the Watering Places for the contiguous Fields supplied from the Ditches.

B B B B The Gates to the Fields.

In regard to belts of planting, they are peculiarly useful in hilly countries, from the warmth and shelter they afford. There is every reason to believe, that in such situations beech is the best hedge, the old leaves remaining till the new ones sprout out, and shelter being thus given to the adjoining fields, even in the midst of winter. They must be strong or woody, however, to turn horses or cattle.

In flat countries, however, it is by far the best system, to plant the corners of fields which are not accessible to the plough, and where a great deal of useful timber may be raised. In the engravings of the plans of farms, that system is explained.

It is well known how expensive it is found in England, to make fences in new inclosures, owing to the price of posts and palings. That difficulty, however, is completely obviated by a plan adopted by William Forbes, Esq. of Callander, in the county of Stirling, of which he gives the following account.

Mr Forbes first causes a ditch to be cast five feet wide, and three feet deep. The mound is between four and five feet broad at the base, and of the same height. In this mound, with a margin of one foot back from the ditch, the hedge is planted. Beyond the mound a second ditch is cut three feet wide and two feet deep, or as deep as the bank can be made to stand. The whole fence, including the two ditches, occupies the space of about fourteen feet. By the time the hedge becomes a fence, the ditches are filled up completely by the earth of the mound, so that no ground is lost.

Mr Forbes also sometimes incloses the face of the mound, in which the hedge is planted, with turf on both sides, the height being four feet and a half, which in the course of a year settles at four feet. This mound is soon covered over with a sward of grass, and at the same time that it is most efficient, it forms the most beautiful fence. The width of this mound at bottom, is five

feet; at top it is from 12 to 14 inches. By the time that the hedge has become a fence, the mound forms an excellent top-dressing, the ditches are filled up, and no more ground is occupied, than that which is taken up by the hedge.

These hedges are planted in single rows at the distance of four inches from each other; and at every three yards' distance, a plant of oak, elm, beech, or other valuable wood is inserted, for a hedge row. The thorns are purchased when seedlings, and trained up in a nursery upon the estate, for two or three years before they are transplanted into the fences. By this process they are naturalized to the soil and the climate *.

By this means the expence of a paling, for defending the hedges, and the vexation of having that paling destroyed or stolen, which must often happen in populous districts, where wood is scarce, are prevented.

These modes of fencing adopted by Mr Forbes, have been carried on, not on a trifling or unimportant, but upon a great scale; for constructing the fences on the Callander estate, no less a number than six millions of thorns have been planted, and the line of these fences measures about four hundred miles in length. The trees of various kinds planted in the hedge-rows, amount to above 200,000.

If a farm is inclosed by thorn-hedges, and under the alternate husbandry of tillage and pasturage, it is an excellent rule, when the fields are broken up, to cut down the hedges, in order to admit the wind. In this case they may be cut down according to circumstances, either to about six inches from the ground, or to between three to four feet, the former if the hedge is thin, the latter if of sufficient thickness. In the former case, all gaps ought to be carefully filled up

* See Dr Graham's most valuable Survey of the County of Stirling, p. 123.

by planting. In the latter case, the breast or face is shorn to the stem. Gaps are best filled up, not by planting, but by laying down branches in the gap, which take root.

It is unnecessary to dwell on the importance of discovering some plant capable of being used as a fence, that would not be materially affected by the sea breeze. It is said that the *Tamarisca Gallica*, of which there is a hardier sort called the *Tamarisca Germanica*, would answer that purpose. It is propagated by cuttings, and takes root without any difficulty. It is of quick growth, and rises rapidly in situations most exposed to the spray of the sea, even at the Lizard Point in Cornwall *.

Sect. V.—*Of Draining.*

There is hardly any point to which an industrious and skilful farmer would be more inclined to direct his attention, when he commences the occupation of a farm, than to the state of its drainage; for on that the success of his future operations must essentially depend. "Lay your "land dry, whatever may be the method pursued, or the

* See Worgan's General View of the Agriculture of Cornwall, p. 49, where the use of this plant for fences is recommended. It is apt to be injured by frost, at least the *Gallica;* but the *Tamarisca Germanica* is not so likely to be affected by it, from the greater severity of the climate to which it has been accustomed. Though rather a feeble plant for a fence, if not affected by frost or the sea-spray, it would be of use from the shelter it afforded. Withering mentions a thorny shrub that grows on the coast of Lincolnshire, which stands the sea-spray.

" expence to be incurred, before you attempt any thing " else," was the maxim of the celebrated Arbuthnott, and is the basis of good husbandry.

Mr Robertson of Ladykirk is of opinion, that with the exception of a few districts of dry loam, the greater part of the counties, both in England *, and Scotland, stand more in need of draining, than of manuring; and that there are very few districts in either kingdom, where a perfect knowledge of this essential source of improvement, is at all general. The difference it would make, were draining in Scotland carried to the extent it might be, is beyond all calculation.

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* In Essex, draining is found to be so essential for land under a regular system of cultivation, or even in pasture, that they will go to the expence of making small ditches over a whole field, filled with small stones, brush-wood, straw, &c. so as to collect the surface-water into what may be called veins or small reservoirs, though it costs from L. 15 to even L. 20 *per* acre; and though the effects will not last above twenty or thirty years. This system, however, is often carried to excess, and the enormous expence attending it may be prevented, by adopting the principles which I believe were originally discovered by the celebrated Elkington. He ascertained, that in fields where the strata are not regular, there are often masses or *pots* of sandy soil, which absorb great quantities of water, and which, when overfull, occasion what are called *land-springs*, which, though only occasional and temporary, yet cause much damage to the fields in which they take place. With uncommon sagacity, Elkington discovered, by the herbage and other outward appearances, where any pots or strata lay; and by making ditches from one to another, so as to connect them together, he drained the field at a trifling expence, as effectually as it was done by the laborious and expensive method adopted in Essex.

In discussing this important subject, it is proposed briefly to touch upon the following points: 1. The nature of the open drains made in Scotland; 2. Of under-drains; 3. Of Elkington's mode of draining, as practised in Scotland; 4. Of ponds made from drains; 5. Of the obstacles to drainage in Scotland; and, 6. Of the advantages which have been derived from it, at least in so far as these particulars have been explained in the course of my recent correspondence.

1. It rarely happens, that any clay district can be cultivated to advantage, without open drains, of various descriptions. In the Carse of Gowrie, the large drains, near the river, are from fifteen to twenty feet deep, and that valuable district has thus been rendered completely dry. In the summer season, it is necessary to clear all these large drains every year, so that the passage of the water may meet with no resistance; for there are miles of drains so connected, that an obstruction of six inches above the level will impede the whole. It is necessary also to employ spademen every day the ploughs are in the field, to clear out the small drains as soon as the ridge is ploughed; for in that flat country, in a ridge of ten or twelve chains in breadth, there are perhaps three or four small drains, which go across the whole field, to carry off the surface-water, and these must be cleared every time the field is ploughed.

On the subject of clay lands, Dr Coventry has well observed, that a complete drainage is absolutely essential, as the first and fundamental step to their improvement. For that purpose, it is necessary to make proper ditches, open drains or water-courses, and to keep them clear. It is evident, that unless the water collected from the different "buts" or "ridges," can easily get away, it will be to no purpose to facilitate its passage from these, or the general surface of the ground, by "water-furrows," or small cuts made by the plough or spade; and the state of the

larger ditches or open drains, with their best direction, is among the first things to be attended to by a cultivator *.

2. On the subject of under-drains, I have received an interesting communication from Mr James Andrew, farmer at Tillylumb near Perth, who has invented a plan which seemed to him a new one, though it will appear, that it afterwards has been tried in foreign countries with success; but that does not lessen the merit of the ingenious cultivator who first attempted it in Scotland.

Mr Andrew states, that the ridges on his farm had formerly been broad, and much raised. His predecessor had levelled them by the plough, and when he entered into the farm, almost all the good earth had been thrown into the old furrows, and completely buried; the crowns of the old ridges were at the same time so much stript of soil, that they were scarcely fit to carry any thing. It was absolutely necessary, however, to do something to bring the ground into a better state. As it lay on a gentle slope,

* An intelligent correspondent informs me, that above twenty years ago, in making drains for carrying off the water from springs in the upper part of a field which appeared to require to be taken in hollow drains, for a great distance, he observed, that the water had a tendency to disappear about the middle of the field. He caused a pit to be dug at that place, six feet deep, and equally wide. Here the water got a vent. He led the hollow drain into it, and filled the pit with field stones, which were covered with twenty inches of earth. The springs or water have never since appeared. He has since done the same in various situations, by carrying a hollow drain, only so far as the water appeared. Sometimes a gravel, and at other times a rocky bottom might be found, at five or six feet deep, which absorbed the water, and rendered farther draining unnecessary.

This is a good plan, where the water does not again burst out, which often happens where the stratum does not end either in the bottom of a river, or in the sea.

cross draining was attempted, but ineffectually. He had then resolved to gather up the ground to the old ridges, by as many ploughings as might be necessary to raise them nearly to their former height, and *to throw a drain into every furrow*, thus designing, by one operation, to dry the ground, to equalize the soil, and to give it a fallow. When these operations were completed, he gathered up a small ridge into the furrows above the drains, to protect them from the surface water. The following sketch will give some idea of the nature of this operation :

Small ridge & drain.	Small ridge & drain.	Small ridge & drain.	Small ridge & drain.

The breadth of the large ridges depends entirely upon the size of the original ridges, which varies considerably. As to the small ridges above the drains, they are about two yards each, and they are fully as productive as the large ones, and rather more so. Thus, it may be said, that not an inch of ground is lost by the drains, and the whole is rendered more fertile and valuable.

The drains are generally about two feet and a half deep *,

* They are cut so deep, as to have what may be called a case in *the till*, or hard clay, for the stones ; and to obtain that advantage, a considerably greater depth was sometimes required. When this could be obtained at two feet and a half, Mr Andrew did not think it necessary to go deeper, as he found that the land was completely drained by such means. Shallowness can only be objected to in regard to durability ; but the duration of drains does not so much depend upon their depth, as that the water in them has a proper run, and that they are protected from too much water from above. The natural slope of Mr Andrew's farm gave a quick run to the water ; and the second object was obtained by

and as narrow in the bottom as an ordinary spade can conveniently work them. He always thought it necessary to go down until a solid tilly bottom was found, in order that the water might always run immediately above the till. The drain was filled to the depth of a foot, or rather more, with small stones, the undermost being always carefully laid in by the hand, and the rest thrown in promiscuously above them. The stones were then covered with a little straw, and earth above all. The expence, on an average, cannot be calculated at less than from L. 8 to L. 10 *per* Scotch acre; but the outlay has been amply repaid, for every object Mr Andrew had in view has been accomplished. In its former state, the ground could only be ploughed at certain times. The farmer was at the mercy of every season, and found none so dry, that in a certain degree he did not suffer some injury; *but now, he can plough almost at any time, the seed can be put in if there is but a single dry day, and in the ordinary course of things, he can always rely upon a crop; the soil also being equalized, the crop is always equal.* Mr Andrew expresses his regret, at seeing the mischief that has been done, almost in every corner of Scotland, by the attempts which have been made to level high ridges by the plough; and I certainly think, that before any proprietor or tenant resolves to carry any plan of that sort into effect, he ought to examine the result of the measures which have been adopted on the farm of Tillylumb *.

It is singular, that this plan, which Mr Andrew thought was a new discovery, should be the common system of Flanders, and should have been introduced into England by John Arbuthnot, Esq. of Mitcham in Surry, who is

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the small ridges, as the water chiefly run in the furrows between the large and small ridges.

* *Straighting the ridges*, however, as will afterwards be explained, Sect. 1, Chap. 2, is a most essential improvement.

considered by Mr Arthur Young as the best cultivator of strong arable land, and, indeed, the best general farmer, that he ever met with, in the course of his long experience. Mr Arbuthnot was convinced of the necessity of complete draining preparatory to every other exertion. After examining the Essex plan of three feet ridges, as a remedy against wetness, which he found well enough adapted to loams through which the water freely percolates, he was convinced that it was not at all adapted for soils so tenacious as to merit the appellation of Clay, and that broad ridges, not exceeding two feet or two feet and a half in height, was the preferable system. The breadth he most approved of, was that of two perches or thirty-three feet; and in each furrow, he dug and filled a well-executed hollow drain, in the manner recommended by Mr Andrew. Under this system, the cleanness and magnitude of his crops formed a spectacle highly satisfactory to those who viewed them. The loss of ground also was trifling compared to the Essex mode, by which, out of three feet six inches, one-seventh part was lost in the furrow *.

There are few objects of greater importance, than to have this system extended over all the tenacious soils in the kingdom.

In regard to light soils, under-draining is a common practice. When artificial grasses are cultivated, it is usual to gather the stones upon the young grass into heaps, immediately after harvest, and to cart them off during the first winter frosts. If there is any appearance of a spout or land-spring in the field, the stones are applied to drain it off: where there is no spout or land-spring, if there is any hollow or flat place through which a cross water-furrow

* See Mr Arthur Young's Letter to the Board of Agriculture, on the husbandry of three celebrated farmers, (Bakewell, Arbuthnot and Ducket), printed *anno* 1811, p. 18.

runs, a drain is made very near, and in the same direction, for it is of the greatest consequence never to allow any water to remain upon the field.

In regard to modes of draining, Mr Pringle of Ballencrief informs me, that in his neighbourhood, common pantiles have lately been used in the making of drains. After they are dug in the ordinary way, a small hollow is made in the middle of the bottom of the drain, taking care to leave a piece of firm ground on either side for the tiles to rest upon. They are laid with their convex side uppermost, and the earth is thrown in. The tiles hitherto used have been those thrown aside, on account of some flaw rendering them unfit to be employed in the roofing of houses, and they are sold at the kiln at 2 s. *per* hundred, instead of 8 s. 4 d., the price of sound ones. A cart carries 400, which cost 8 s., and are sufficient to cover twenty-two roods of eighteen feet and a half each. The tiles are fourteen inches in length, but allowing for breaking and overlaying, the average may be reckoned about twelve inches.

In the few instances which have come under Mr Pringle's observation, the water runs freely; and he has no doubt, that in many places they would be less expensive than stones, but they could not answer where the bottom of the drain is soft and muddy. It is a pity they were not exempted from duty, when employed solely for draining purposes, as some description of bricks are by a recent act of parliament.

3. Mr Newton of Currie-hill, near Edinburgh, informs me, that the soil of one-half of his farm lies on a ridge, sloping both south and north; the subsoil is a strong blue clay in the highest part of the land; but towards the north, the clay is nearer the surface, and of a worse quality, subject to spouts, which have occasioned much expence, and still require draining; but the materials are becoming scarce. The under half of the farm, in regard to

soil, is various: there are some spots of a few acres, of turnip land, upon a gravelly bottom; but the greatest part of the low lands are a heavy soil, upon a clay bottom for two or three feet, and then sand. A great deal of this soil has been redeemed from bogs and pools by draining. Elkington's mode of draining was practised forty years ago by the late Mr Newton, not by boring, but by filtering.

In regard to Elkington's system for draining boggy land, it has answered completely in various parts of Scotland. Mr Wilson, near Cullen, in Banffshire, informs me, that he has had some boggy land drained effectually by means of that process; and Mr Church of Hitchill, in Dumfries-shire, has drained the mossy or springy ground on his farm, according to the Elkington system, with such success, that he has brought it to nearly the same rotation, as the land to which it is contiguous. Thus, by the exertions made by the Board of Agriculture, the principles adopted by Elkington have been successfully carried into effect, in remote parts of the kingdom.

4. Mr Robertson of Ladykirk has adopted an excellent plan in carrying on his draining operations; that of making ponds of pure and excellent water from the conductors in every field, entering and leaving the ponds continually, and very far preferable to any standing pool.

5. Mr Wilson in Simprin, in Berwickshire, strongly inculcates the advantage of draining, and laments that so essential an improvement should still be much wanted in Berwickshire, not from the want of spirit in the farmers, but for two reasons: 1. The want of stones in the low district, as there is not a sufficient quantity even to make the roads, which, in his opinion, is the first of all improvements; 2. The shortness of leases. To remedy the first obstacle, thorns or brushwood should be used; as he has already had such drains running for above nine years. As

to leases, if they are not to be lengthened, the proprietor should cut the drains, and the tenants should fill them up. Freestone may be got at some situations at the expence of quarrying, as has been done in Berwickshire, by that eminent improver and breeder, Mr Robertson of Ladykirk.

6. The advantages of draining are thus explained by Mr Jack of Moncur. His farm principally consists of a fine deep loam soil, of a brown colour. Its subsoil is a mixed clay of different colours, with some strata of very quick sand; and in the sand there were great runs of water, forcing itself up through the soil at all seasons, which very much injured the ground, as it stopped the labour in the early part of the season, encouraged the growth of natural grass, and kept the surface in a sour state, which in time of great drought became very hard and unproductive. But when this kind of soil is properly drained, it soon appears what can be effected by this first and greatest of all improvements: it makes the land so free and tender, that half the labour prepares the ground for the crop; less seed and manure is necessary; and a more abundant crop may be depended upon in all seasons, as neither drought nor damp have any effect upon it.

Mr Allan of Craigcrook, also, considers draining to be the first improvement in agriculture, and that a large proportion of the land in Scotland, is ruined for want of it. He has drained land completely, where it was thought quite impossible, and has improved land, by that operation, that was not valued at 5s. *per* acre, so as to be worth from L. 4 to L. 5. Could money, labour, skill, or industry, be more usefully employed?

Mr Allan farther observes, that many people do not make the drains so deep as they ought to be: where the levels will admit of it, drains ought to be at least four feet

deep, two feet wide at the bottom, and three feet wide at the top, and filled up with three feet of stones. Many, however, would object to such a drain, as too large and expensive. He affirms, that he has derived more benefit from draining a field, than he would have from both dunging and liming it; that is to say, the field carried more grain for two years, by being well drained, than it would have done with both lime and dung, without being drained:— After being drained, half the manure was sufficient.

Mr Andrew of Tillylumb also informs me, that though his draining cost from L. 8 to L. 10 *per* Scotch, or from L. 6, 8 s. to L. 8 *per* English acre; yet the whole expence was in a great measure repaid, in several places, by the benefit derived from the drains, in the course of the last crop alone. The spring and beginning of summer 1811, was a very trying one for land, and more especially for the crop of wheat. For about nine weeks, during the end of April, the whole of May, and the first part of June, there were incessant falls of rain which greatly affected the crop, which in general had contracted a yellowish sickly hue, from which it never recovered; but all this time, such was the effect of draining, that the crop on Tillylumb preserved its verdure, in so much, that several judicious farmers declared, that it was not in the smallest degree affected by all the rain that had fallen.

On the subject of draining, Mr Bruce of Grangemuir observes, that the farmers north of the Tweed labour under great difficulties, in carrying on that essential improvement, for want of a law, obliging neighbouring proprietors to join in an operation of that sort. And it frequently occurs, that the only outlet to extensive swamps, is through the lands of others, who, from various causes, prefer keeping a neighbour under water. A law similar to that regarding fences, might be made, that would be of infinite service. From another respectable quarter, I am also in-

formed, that much land in his neighbourhood remains undrained, owing to the same circumstances *.

Sect. VI.—*Of the Roads on a Farm, and in its Neighbourhood.*

The advantages resulting from good roads need not be dwelt upon, as no country can be improved without these essential aids to cultivation. In various instances, the foundation of the improvement of several districts in Scotland has been justly attributed to them. For instance, in that fertile tract of country, the Carse of Gowrie, prior to the year 1790, there was no road, that could admit of carting through the winter or spring months; every thing was to be carried to market on horseback, and the horses often sunk to their bellies. So great was the slavery of threshing the grain, and carrying it to market along such roads, that many men, possessed of an active spirit, quitted the farming line, or went to places better situated in regard to roads. But now the turnpike-roads in that district are as good as any in the kingdom, and by the judicious application of the statute service money, the greater part of the farmers have been enabled to make good private roads to their own doors, by means of which, 32 cwt. of coal may be carried upon a two-horse cart, from the harbours; and 150 to 200 stone of hay, trone weight, is carried by each two-horse cart, to the towns of Perth and Dundee. By these means, the expence of con-

* See this point more fully explained in Appendix NO. 4. It is to be hoped, that this measure will be taken up by the Highland Society of Scotland.

veyance has been materially diminished, and the rent of land has been prodigiously advanced.

In another district, that of Clackmannanshire, the roads have also been much improved, by which the operations of the farmer have been greatly facilitated; a greater proportion of work is performed at much less expence, the labour of the horses is much easier, a double quantity can be carried to mill and market, a greater quantity of manure conveyed, from the nearest town, or farm-yard, in a shorter period, and wear and tear of every sort greatly reduced. There is indeed no county in Scotland where the landed gentlemen have studied the improvement of their estates in this particular, more than in Clackmannanshire, both as to public and private roads; and, of consequence, there is hardly a district in the kingdom so much improved in so short a period; land which let ten years ago at 50s. will now average L. 5 *per* acre; the farms in general enlarged, much better cultivated, the farmers more comfortable; and it seems to be the greatest pleasure that the proprietors can enjoy, to add to the happiness and comfort of their tenants, *by good roads*, convenient farm-house and offices, good fences, and leases of a proper duration.

It is to be lamented, that in several districts, where the great roads are attended to, the private roads should be neglected. Every farmer, however, ought to lay it down as a rule, completely to repair a certain extent of road each year, say from fifty to five hundred yards, in proportion to the extent of his possession, and a stipulation to that effect might be no improper clause in his lease. The roads on a large farm would thus be almost insensibly gone over, and its value would thus be materially increased.

It is impossible, however, that any improvement can be made on the roads of the kingdom, unless broad wheels are adopted; and it will appear from the following commu-

nications, that they are as well calculated for farming, as for other purposes.

The Honourable Baron Hepburn informs me, that he has tried broad wheels in East-Lothian, and that he has been able to introduce them in that district, though the husbandry servants of East-Lothian are, like their brethren in other counties, attached to ancient habits and usages, and averse to the introduction of new improvements. The Baron had first used them for drawing turnips, and leading off stones from new sown cut grass, but he had lately occasion to send his carts for some flags from the sea-shore, and as these flags were heavy and unwieldy, all his carts, including his broad-wheeled ones, were sent, to give a sufficient power of men to load them; and as the road up the beach was steep, and through a dry and deep sand, it required three horses to bring up each cart to the top of that beach, although two horses brought the loaded cart home from that point. It was soon found, that the broad wheels rolled, and did not sink in the sand, and the loaded carts with broad wheels were brought up with infinitely less fatigue or exertion to the horses. The servants immediately became converts to the utility and advantage of broad wheels, insomuch that those who generally worked these broad-wheeled carts, resisted and reluctantly yielded the use of those carts to their fellow-servants, when ordered to use them in carrying potatoes from the field. The result was, that the Baron has been obliged to purchase a pair of broad wheels for each of his carts.

The Baron adds, he has no doubt that broad wheels will gradually creep into general use among the wealthy husbandmen, but a statutory enactment may be necessary to compel carriers of every description, (a numerous class), to adopt them, as broad wheels, by having more wood and iron, are rather more expensive. Five years, however,

should be allowed to wear out the narrow wheels now in use. The sheriffs of counties should be directed to be particularly attentive in regularly intimating these statutory enactments, the first year, the third and the fifth years, at their several commencements, as the above description of people are generally very illiterate, and, indeed, inattentive to statutory enactments of any kind, as very few ever reach them, or awake their attention.

An intelligent farmer on the borders, Mr Walker of Wooden, is of opinion, that if broad wheels could be brought into general use, it would be attended with a very great saving of expence upon the public roads; at any rate, he is convinced that they are on many occasions of much importance to the farmer. In wet seasons they are peculiarly useful in leading home the crop from wet or soft lands, which have been sown down with grass-seeds; in taking the stones from the same lands in the spring, when they are to be cut for hay; and in leading turnips off wet lands. On such grass lands, while the ordinary wheels sink very deep, and greatly injure the ensuing crop, wheels of only double the ordinary breadth, make almost no impression whatever. He always keeps, therefore, three or four pair of these wheels for the purposes above mentioned. They are made at hardly any additional expence. Each wheel is covered with two old iron rings of the common wheel, after they have become too thin for use upon the road; and as the broad wheels are seldom used but upon soft ground, these old rings last a long time, and they are attended with no trouble or inconvenience, as they are made to fit the axle-tree of the common wheels.

But if it be possible, by any means, to impress the public mind with a deep conviction of the advantage of broad wheels, the following observations, from an intelligent and respectable country gentleman, William Cunningham, Esq. of Lainshaw, will probably have that effect. He states his

full conviction, that no person whose mind is open to conviction, can make a trial of these wheels, *for farming purposes*, without at once perceiving their very great superiority over the old wheels. He is satisfied, that his farm roads will, in time coming, be maintained at one-fourth of the expence hitherto incurred for that purpose; and, as he is draining his own farm to an extent not yet practised in this part of the kingdom, which necessarily requires a proportionate carriage of materials, he expects very soon to be repaid the cost of his new wheels.

He informs me, that he got one pair of broad wheels in the month of May 1811; and that after a very short experience of their effects upon the roads of his farm, he ordered three pair more to complete the regular establishment of his farm, which consists of four single horse-carts. His wheels are five inches broad, and four feet six inches in height. They cost at Morton's manufacture, Leith Walk, near Edinburgh, about L. 11, 18s. cash price. Common wheels of the same height, and about two inches and a half broad, cost, in Ayrshire, about L. 8, 10s. Cylindrical wheels, he affirms, are equally well adapted *to every purpose*, whether of road carriage, or agriculture. In farming operations, their superiority is so great, that he thinks it would be for the interest of every extensive farmer to adopt them immediately, even if he should be obliged to break up, and burn his old narrow wheels. He does not think that they will do where roads have been *deeply* rutted by old narrow wheels, unless great care is taken to avoid the ruts. But he is satisfied that equal weights can be carried with them, and probably greater. They do not shake the horses on rough roads like the wheels with bent axles, and consequently are easier drawn. The weight of the wheels and axle is about 5 cwt. 32 lb. Common wheels, with iron axles, weigh six or seven stones less. The body of the cart weighs 3 cwt. 16 lb. With

these wheels, he carries about fifteen cwt. in single-horse carts, but if the roads were without pulls, a greater weight might be taken. He is determined that all his farm wheels shall be of that description; he considers them to be the greatest improvement in agricultural machinery, since the invention of the threshing-mill; and he conceives that every month's delay, that takes place in the general adoption of them, produces a great national loss.

Mr Morton states, that the broad cylindrical wheel, besides the advantages it possesses upon a good road, or causeway, is also more easily drawn over a new metalled or gravelled road, than the common narrow wheel, in consequence of its having no tendency to remove, or disturb, the materials, having only the effect of levelling those stones which stand highest, and thereby rendering the whole more compact and smooth; whereas, the narrow wheel presses the stones it bears upon, aside, and thereby forms a rut, into which it sinks,—consequently increases the obstacles it has to encounter. He also observes, that a small additional weight to the wheels, (say one-half cwt. *per* pair,) is of much less consequence than the same additional load to the body of the cart *.

Perhaps the most striking fact in favour of the use of broad wheels is this, that the carts of the London and Edinburgh Shipping Company have cylindrical wheels of five inches in breadth, and yet, with a single horse-cart, they frequently draw, (the weight of the cart and the wheels included), no less than forty cwt. or two tons, though

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* It is proper likewise to remark, that a cart with broad wheels goes more solid and regular, and with less agitation than with narrow wheels, and consequently the machine, as well as the horses and the roads, would last much longer, by which the expence of the additional original cost would be amply repaid.

there is a considerable ascent from Leith to Edinburgh, and the road in some places is not in the best state of repair. The Edinburgh and Leith Shipping Company use the same sort of wheels with equal success.

In regard to the encouragement that ought to be given to broad cylindrical wheels; Mr Cunningham is of opinion, that if cylindrical wheels were to come into general use, and were the toll rates much lessened in their favour, great inconveniences might result from the diminution of the revenues of the tolls, which are in many cases mortgaged in security for sums advanced to make and repair the roads, and in other cases there are contracts in existence for maintaining the roads for a term of years.—It is obvious, that till the existing debts are paid, and the current contracts have expired, no general diminution of toll-rates can take place; but were these objects once attained, he thinks, that the roads might be kept up, by levying one-half, or one-third, of the tolls now exacted.

The advantages which the nation would derive by a due attention to the important objects of roads and carriages, are not easily calculated.

Before the subject of roads is dismissed, it is necessary to observe, that in many districts, some plan should be adopted, for enforcing a more impartial distribution of the road funds *; and that, when new turnpike roads are formed, more care should be taken in the expenditure of the money laid out. No sum should be expended, nor any debt incurred, without accurately examining the ultimate

* The jobs in the management of turnpike trusts ought to be regulated by a general law. To carry a particular object, meetings are sometimes held in one district, while they ought to have been held in the other, and other manœuvres of a similar nature are perpetually going forward. Is it then to be wondered at, that our roads should get into disrepair?

expence, otherwise the whole funds will soon be exhausted, and the produce of the tolls will not clear the interest due by the trust. The business then becomes more and more troublesome to attend to, and the road is neglected.

It may be proper also to add, the substance of Mr Loudon M'Adam's directions for repairing roads, extracted from a valuable communication, which I had the pleasure of receiving from him, regarding that interesting particular.

He is of opinion, that where there is a quantity of clear stone, equal to a foot thick, there is no occasion for any additional materials when a road is to be repaired. The stones, to the depth of a foot, should be taken up, (one half of the road at a time to prevent the communication from being interrupted), and then broken, so as to pass through a screen or harp, through which no stone, above an inch in any of its dimensions, can be admitted *. The road should be laid as flat as possible; the less it is rounded the better, provided it is not hollow in the middle. The broken stone should be laid evenly on the road, a coat of six inches at a time, that the materials may be consolidated. Any ruts, that may at first be formed, should be immediately filled up. Every road should be made of broken stone, without any mixture of earth, or any other matter; no large stones to be employed, on

* In regard to breaking stones, Mr M'Adam is of opinion, that the best mode, both for effect and economy, is, by persons *sitting*. The stones are to be gathered in small heaps when picked up, and men or women past hard labour must sit down, upon straw mats, and break them so small as to pass through a screen or harp of an inch in the opening. This method of breaking stones by persons *sitting*, is practised in Westmoreland and in Somersetshire, near Bridgewater; and in these two neighbourhoods they have the best roads, and at the smallest expence.

pretence of *bottoming*, nor sand, earth, or other matter, on pretence of *blinding*. A road made of stone effectually broken, will be a smooth, hard, even surface, which cannot be much affected by the weather, and will be nearly equally good at all seasons of the year.

Sect. VII.—*Instruments of Husbandry.*

It is of peculiar importance, to adopt the best and most economical implements of husbandry, and in general not to incur an unnecessary expence in purchasing them, nor to have more than are truly requisite. In these respects the Scotch Farmers furnish an example which ought to be more generally followed than is commonly the case; for the number of the implements they use, are not only few, but they are distinguished by the simplicity of their construction, their efficiency, and their cheapness. A farmer is thus enabled to do the same work, at less expence, and he can afford to pay more rent, without even raising more produce.

In treating of this subject, we shall consider the nature and construction of the following instruments; 1. Ploughs; 2. Harrows; 3. Carts; 4. Fanners; 5. The Threshing-Mill; and 6. Miscellaneous Articles.

1. Ploughs.—Ploughs with wheels are in general too complicated, and their weight so great, as to require an additional horse, or pair of oxen, to pull them along. In Scotland, the swing plough is almost universally adopted, and rarely more than two horses are now made use of. The horses also are yoked a-breast, by which the advan-

tage of their full strength can best be obtained, animal power being most advantageously exerted, when employed separately, and close to the work. Indeed, when horses are yoked one before the other, or harnessed at length, it is hardly possible that they can pull equally. The power of the fore horses must be exerted, to reduce the traces to a straight line, which cannot be done without pressing on the back of the hindmost horse, where the angle is formed, and consequently greatly distressing him : hence the superiority of ploughs drawn by two horses a-breast, and of single-horse carts. In regard to the operation of ploughing, also, it is to be observed, that less time is lost in turning, more especially in small fields, insomuch that with equal ease, two horses a-breast will do at least one-tenth more work, than the same horses will perform when placed in a line.

The plough generally used in Scotland, is known under the name of Small's plough. But in some of the western counties, as in Ayrshire, Renfrewshire, and Clydesdale, a plough made by Mr Wilkie of Uddington is very common, and much approved of *. The same artist has lately introduced an iron plough †. In the neighbourhood of Jedburgh, Veitch's construction is justly celebrated, though the sources whence its merits are derived are disputed. But as James Small is the artist to whom hitherto Scotland has been most indebted, I propose, in the Appendix ‡, to explain the origin, nature and advantages of his improvements.

The ploughs in Scotland are now almost universally worked by horses; but some intelligent farmers on the borders, think it of advantage to have some ploughs worked by oxen also, as they are not so high priced, and more cheap-

* See Aiton's Report of Ayrshire, p. 214.

† Ditto, Addenda, p. 723.

‡ See an account of James Small, Appendix, NO. VI.

ly maintained; they are of opinion, therefore, that any extraordinary stock, not constantly required, should be of that description.

For cleaning green crops, a double plough, which takes a furrow from each side of the row, is reckoned to be a great improvement, and if properly used, renders the mould as fine as that of a garden.

In general, the horses are yoked a-breast, and never in a line, excepting to take up the last furrow in a wet wheat seed-time, to prevent poaching *.

In some parts of Scotland, it is necessary to have strong ploughs, calculated for breaking up marshy ground, or old ley, where furze perhaps may abound, and, in such cases, four horses are necessary; and farmers make it a rule to have a spare plough or two, so that the horses may not be kept idle, in case one of the ploughs should accidentally break.

2. Harrows.—The harrows used in Scotland are made partly of wood, and partly of iron; but of late, harrows have been made entirely of iron, which are reckoned far superior to the common sort, particularly when harrowing deep lands, as from the narrowness of the bulls or bars, the earth does not clog them †. The construction of harrows must depend on the nature of the soil. Those which are best calculated for strong clay, cannot be suited to light sands and loams.

3. Carts.—It is a general rule with Scotch farmers, that every man-servant shall have a cart, a plough, and a set of harrows, for each pair of horses, so that whether the wea-

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* Communication from Mr Gray of Gorgiemoor.

† Communication from Mr Robert Hope of Fenton.

ther answers for carting, ploughing, or harrowing, the whole horses and servants are always employed.

Single-horse carts are commonly preferred; but when the land is deep, the roads bad, the ascent great, or the load heavy, two horses are generally made use of *. A most intelligent farmer on the borders observes, that when two horses are yoked one after the other, unless the driver is very attentive, they seldom draw together, sometimes one drawing the whole, and sometimes the other. He has only used single carts for twelve or fourteen months; but from the trial he has made, he is convinced that two horses in single carts, will, with equal ease to themselves, draw at least one-fourth more than in a double cart when yoked one after the other. Another great ad-

* Some farmers think, that where six ploughs are kept, there ought to be twelve carts; though by having a cart for each horse, the expence of that article is increased, yet the waste of a cart that carries a ton, is greatly more than where only half that weight is carried. Two horses, however, must be occasionally used. The steady horse, in that case, should be put in the trams, and the spirited horse as leader, as he is apt to do more work than he should. Others are of opinion, that two carts for each pair of horses are an unnecessary expence upon an extensive scale of farming; and, in particular, that at a distance from large towns, twelve carts are quite sufficient for twenty horses, in all the operations of the farm. In winter, horses can be changed forenoon and afternoon, by being wrought in single carts, and the horses are the better occasionally of easy work. But it is proper that each horse should have a cart saddle to fit his back, and that each man take care of his own harness. It is much the more correct plan, upon a great concern, that four or six men be intrusted with the delivery of all the grain. It is needless, therefore, to give each man the charge of two carts; for though no requisite outlay on a farm ought to be withheld, yet no requisite expence ought to be avoided.

vantage attends single carts; the carters cannot run races when going for lime and coals, by which the horses are often rendered lame, and sometimes destroyed outright. This is a practice that too much prevails, notwithstanding the frequent punishments inflicted, and examples made, for that offence.

In summer, more especially, single-horse carts are preferred by intelligent farmers, as the roads are then good, and the horses will bring home more lime to the farm, or carry more produce to market, in two carts than one. By dividing the load also, both carts and harness will last much longer. What weighs much with many sensible men is, their observing, that the people who drive their own horses, always yoke them in single carts. Others contend, that though persons driving their own horses, with great care, may adopt such a plan, that is no reason why the same system should be adopted by the farmer, who must trust his horses to the discretion of every common servant. They admit, that coal and lime, and grain to the market, may be advantageously driven, on good and level roads, by single-horse carts; but they affirm, that they cannot be depended on for leading home the crop, nor for carrying out the dung, as the wheels will sink in pulverised fallows, or turnip land, even if dry, and still more so after rain.

If, however, two horses are to be used, (though after a full trial there is every reason to believe that single-horse carts would be found more effective, and less injurious to the horses), curricle carts, or yoking horses a-breast might be tried, more especially where the roads are broad, so as to quarter with ease: In that way both horses can employ their whole strength, and it is a likely mode of making a powerful and effective draught *.

* Mr Wilson of Sumprin states, that horses going a-breast were tried in his neighbourhood twenty years ago, and did not answer;

In time of harvest, the common box or cart is removed from the axle and wheels, and large frames are put thereon, for the purpose of bringing home the crops of hay or corn from the fields, or for carrying hay or straw to market. Indeed, where the carriage of hay or straw is to a distance, two long carts are sometimes kept, made uncommonly strong, and stayed with iron bars.

In regard to waggons, there are not above six in the whole kingdom of Scotland. In the words of an intelligent farmer, this cumbrous and expensive machine is but little esteemed, and hardly any where to be met with. Every farmer is now thoroughly convinced, that the cart in common use answers every agricultural purpose infinitely better.

4. Fanners.—This excellent instrument is more generally to be found in Scotland than even the threshing-mill. By using it, with the aid of riddles in some part of the operation, all dust, chaff, and other refuse are blown away, and the grain separated into divisions according to its quality, by which it is rendered intrinsically more valuable, than if the good and the bad were mixed together; in the same manner as a fleece of wool is more valuable, when broken or sorted by the wool-stapler *. The threshing-

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the horses fought, or jammed upon one another. He also tried them in a roller, and it had the same effect. But this might have been owing to mismanagement. The cart ought to have only a pole, as in a coach or curricle, which would obviate the difficulty.

* There is an excellent account of the fanning process in Kerr's Berwickshire. It is said that the machine was invented by Dr Papin, was introduced by the Dutch into the barn, and brought to Scotland by Meikle, the father of the inventor of the threshing machine. Others contend, that the idea originated in China, though it has been greatly improved since its introduction into this country.

mill has generally one set of fanners attached to it, driven by a belt from the end of the axle of the threshing drum; but where the machine is driven by horses, the working of a second pair, for cleaning the grain completely, is rather found to be severe upon them: the second pair of fanners is therefore generally driven by hand. Some recommend a small water-wheel, totally unconnected with the threshing machinery, for driving the second fanner, which, by affording a steady equable motion, would separate completely the light grain from the heavy *. By some improvements in the late erected machinery, it is said, that hand fanners are rendered unnecessary, and that the cleaning of the grain is completed, at the same time that it is threshed, so that the grain may be measured into the sacks. This would indeed be an essential improvement. At the same time, owing to the inequality of motion necessarily attendant on the operation of threshing, the second fanner, for separating the light grain from the good, will not accomplish the purpose intended, in a perfect manner, if it goes at the same time with the mill. Perhaps it would be expedient, that the threshing and fanning processes should go at different times, when horses are employed, at least in threshing of wheat.

5. The Threshing-mill.—But the great glory of the Scotch instruments of husbandry is "the threshing-mill," by means of which, these important operations, the separation of the grain from the straw, and in some measure the cleaning of it afterwards, have been carried to a degree of perfection and extent in Scotland, altogether un-

* Mr Cuthbertson finds, that the two pair of fanners attached to his water threshing-mill, perform their work so well, that oats or beans are completely finished for market; wheat and barley, however, require an additional dressing by the hand-fanners.

rivalled in any other country *. There is no doubt, that many attempts had been made, at various times, for constructing machines competent to the task of threshing; but I am fully convinced, that had it not been for the superior ingenuity of Andrew Meikle, no threshing-mill would have been brought to any high degree of perfection in our time. To him may be justly attributed the merit of the feeding-rollers, and the drum; the plan of the flax-mill having been adopted in other cases. Every friend to merit, must rejoice to hear, that the inventor of so important a machine, was rendered comfortable in his old age, and enabled to provide for his family after his death, by the voluntary donations of his grateful countrymen †.

It is not intended, in this place, to give any description of the nature of the machinery; but it may be proper shortly to lay before the reader, 1. An account of the different powers used in driving the machine; 2. A short view of the advantages resulting from the invention; and, 3. Some hints regarding the improvements of which it is susceptible.

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* As a proof of the great number of threshing-mills and fanners erected in Scotland, I am informed that in the Carse of Gowrie district alone, which is a tract of about fourteen miles long and four miles broad, there are no less than 120 threshing-mills driven by horses, and ten by water. In other parts of Scotland, threshing-mills are so general, that it is very difficult to find a man who will thresh with the flail. A mill-wright also has now become a separate trade or occupation from other branches of mechanism, in places where that was not formerly the case.

† The history of the origin of the threshing-mill is very ably explained in the Farmer's Magazine, and in Brown's Treatise on Rural Affairs. It is certain that skutch mills had been previously invented, and mills of that description are capable of threshing oats. That, however, does not detract from the merits of Mr Meikle, whose mills are capable of threshing all sorts of grain equally well.

Threshing-mills are driven, 1. By horses; 2. By oxen; 3. By wind; 4. By wind or horses; 5. By water; 6. By water or horses; or, 7. By steam. Some small machines of this sort are driven by manual labour, but they do not merit any particular notice, and in general it is observed, that unless machines are of a strong and powerful construction, they are constantly going wrong, and require perpetual reparation *.

1. Where a command of water cannot be obtained, which is certainly the least expensive power that can be employed, *horses* are commonly made use of; and when the farms are rather of a moderate size, and where the horses are rarely employed in that labour, some farmers are of opinion, that the exercise they receive is not prejudicial to their health. Indeed, as they are principally worked in bad weather, when other business out of doors could not be attempted, they consider the threshing by horses as attended with little or no expence; but where the crop is large, and in particular where a considerable proportion of it consists of wheat, and where the machine is heavy, the labour must be severe. This additional labour, however, where no other power can be applied, farmers consider to be indispensable.

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* Mr Neil Ballingal states, that the advantage of a mill, strong and well constructed, well managed, and with fanners, is of the greatest importance. But a slight mill, constantly breaking, and with no fanners, no farmer would accept as a present. At the same time, it is remarked by Mr Stewart of Hillside, that in moderate-sized farms in his neighbourhood, where the principal crop is oats, a smaller kind of threshing-mill, without fanners, will suffice, as the farmers find time in the evenings of winter and spring to dress the corn by hand-fanners.

An intelligent farmer, Mr Blackie of Holydown, gives the following calculation of the number of horses required for the different crops. A four-horse mill he thinks is quite sufficient for oats or barley; but where there is much wheat, a six-horse power is required. A three-horse power does very well for potatoe-oats, when the corn is fed in by a careful hand; the mill then threshes much cleaner than a flail: But when the corn is put in faster than the mill is ready for it, the horses are oppressed, and the work not well done.

2. It is said that working threshing-mills by horses, is a power so unsteady, and attended with so much destruction to them, and hence so expensive, that some farmers still prefer the flail, to the erection and keeping up of the machinery and horses. Though such an idea is far from being general, yet it certainly would be desirable, to exempt the horses, regularly working on the farm, from so laborious a task, and oxen have been recommended for that purpose.

A gentleman on the borders, who rents about L. 4000 *per annum*, informs me, that before he had collected water sufficient to thresh his crop, (which may be done much oftener than people are commonly aware of), he was accustomed, for many years, to thresh his crop by oxen; and he adds, that wherever there is a necessity for using animal power, he would recommend oxen, as they are more steady in the machine than horses. His oxen, when employed in the threshing-mill, were fed in the usual way; only from being so near the shed, or court, they were unyoked in the middle of the day in winter, and got a few turnips, in lieu of the hay they were accustomed to get at mid-day, when employed in the field. A piece of wood was fixed to the beam, or what is commonly called the start of the mill, and the oxen were yoked to it by chains, in the same way as in the plough. For six or se-

ven years, he never had a horse in the mill, and each ox was employed nearly three years, one out of three being annually selected for feeding, and a young one trained in its place. When not employed in the threshing-mill, the oxen ploughed or harrowed as usual, and sometimes were employed in carting dung, turnips, &c.

The advantages of using oxen in threshing-mills, are represented in the strongest point of view by Mr Wood of Mill-Rig in Linlithgowshire.

In a communication to a useful institution, the Salton Agricultural Society, he observes, that threshing-machines are so much connected with the farming business, that it cannot be carried on without them. They are in general drawn by horses, and are found to be very injurious to that valuable animal; for which reason, he advertised some time ago, to have one made, to be driven by oxen, so as to suit their natural step. This he happily effected. For two seasons he threshed with oxen, and found, upon trial, both the mill and oxen to answer particularly well. It was thus in his power to have his threshing carried on, without interrupting any work wherein his horses are engaged, besides exempting them from the severe labour of threshing about 100 acres of wheat annually, which proved destructive to his horses, though they were very high fed *. The use of oxen, therefore, in this operation, may certainly be looked upon, in some degree, as an improvement in agriculture. It is but fair to add, that for the first four or five times, the oxen are very awkward in the mill, and great

* It is said, that on the greatest part of farms, hands for threshing cannot be got, independent of the ploughmen; the exemption of horses, therefore, is an object of less consequence. Labourers, however, may be hired, and in bad weather the horses will be refreshed by rest. Besides, the threshing may go on during part of the day only.

care is then necessary to teach them; but after that, they go more steadily than horses. When once a mill also is constructed for the slow motion of oxen, which must go with more velocity on account of the slower pace of the ox than of the horse, it is necessary to employ oxen constantly for the sake of the machinery.

Mr Andrew Gray makes the following observations on this interesting subject. Some persons are of opinion, that as oxen in general move very slow, hence much time and labour would be lost in working them. That, however, can be obviated, by altering the velocity of the machine. It is also doubted whether oxen are as well adapted as horses for walking in a circle. A farmer in the county of Moray, however, informs me, that he has used four oxen in a threshing-mill, at one of his farms, and that he found they did equally well as horses; by which his plough-horses were relieved, and the oxen he worked were kept in good condition, by turnips and straw: and as it has been found from long experience, that oxen, if properly trained, will work equally fair and pleasant with horses, either in the plough, the wain, or any other machine in which they move straight forwards *, it may therefore be presumed, that if taught, they will work equally fair when walking in the same circle, and though oxen in general move slower than horses, the threshing machine can easily be so calculated, as to answer with their slower pace. It

* Horses will carry as well as draw; hence some of the load may be put on their back, and the horse is the better for it, more especially going up hill. Oxen, on the other hand, will draw, but cannot carry; tumbril carts, therefore, having three wheels, are the best for them. If oxen are apt to be giddy in a threshing machine, they should be blindfolded, as horses sometimes are. Giddiness may be occasioned by the smallness of the diameter of the course.

would therefore seem, that oxen are at least equal, if not superior to horses, for working threshing-machines.

These are considerations which merit well the attention of every farmer in the kingdom, more especially as the price of horses is constantly increasing, and as it can hardly now be doubted, that for working in the threshing-mills, and other extra labour, a few oxen on a farm might be attended with infinite advantage.

3. The next power is *wind;* and if water cannot be got, it is contended, that a wind-mill is greatly superior to one wrought by horses. Wind-mills are now so nicely constructed, that the sails contract and dilate, according as the wind increases or decreases; so that now the motion is much more uniform than that of a horse-mill driven by the most careful driver. The next great advantage of the wind-mill is its great power, which permits more work to be done in the same time, and at less expence; as the ordinary servants on the farm, if the wind is favourable, may thresh a sufficient quantity, after having finished their daily labour at either cart or plough; besides, the expence of tear and wear of horses employed at the threshing-mill is very great, as no work upon the farm is half so expensive *. Mr Rennie of Oxwell Mains considers, that a wind threshing-mill, equal to the power of eight horses, will annually save, when compared to horses, besides the saving that would be made by the horses, £. 40 *per annum*, deducting the sinking of £. 200 additional expence, in the erection of the machine; and Mr Wilson of Simprin in Berwickshire is of opinion, that wherever a great quantity of wheat is grown, the resistance is so great, and to overcome it is so destructive to horses, that a threshing-mill ought to be driven either by wind or water.

* Communication from Mr Rennie of Kinblethmont.

Others object to wind machines, on account of the expence of the construction, the certainty of their not going in calm weather, and the danger attending them when the wind blows hard. Mr Brodie of Garwald, in particular, observes, that in hilly situations, the wind is apt to rise in such sudden squalls, as frequently to make that power inconvenient, and not unaccompanied by danger.

Mr Neil of Kelso informs me, that the expence of a good wind threshing-mill will be about L. 550, and that when a horse power is annexed to it, the additional expence, according to the present price of timber, will be about L. 120 more, or L. 670 in all.

4. Aware of these objections to the power of wind alone, Mr Rennie of Phantassie, Mr Brown of Markle, and other respectable farmers, have erected threshing-machines, so constructed, as to be worked either *by wind or by horses*, as may be found necessary. They consider the power of wind to be so uncertain, that without the addition of horses, a great inconvenience would often be sustained. Mr Hume of East Barns has a machine of the same description, but owing to the vicinity of the sea, he has hardly ever had occasion for the horse power. He considers threshing-machines of great advantage, even with horses; but when wind or water can be obtained, it is worth, he states, on a farm of about 250 Scotch, or 316 English acres of arable land, from L. 100 to L. 200 *per annum*.

5. *Water* is by far the cheapest and the best power to be applied to threshing-mills. From the equality and the gentleness of the motion, the machine will last twice as long as one drawn by horses; and as water-mills generally do much more work when in motion, they do not require to be so frequently used. It is calculated, that in threshing a crop of any extent, a pair of horses may be

saved upon the farm, by the use of a water-mill, which cannot be calculated at less than L. 100 *per annum*.

Mr Stewart of Hillside has a threshing-mill driven by water collected from the springs in the upper part of his farm, and gathered in a dam. It has seldom been stopt for want of water, and then only in extreme frosts, when the ploughmen thresh, having little other work to do. Mr Stewart adds, that the barley is cleared of *awns*, by putting it through the mill with a grater upon it, which is done at the rate of three bushels in the minute. This seems to be a useful appendage to the threshing-mill.

6. Mr Hunter of Tynefield, and many other farmers in the improved districts of Scotland, have threshing-mills wrought *by water, or by horses*, when the water is scarce. About half Mr Hunter's crop is threshed by the water, which saves about 10 *per cent.* on the expence, whereas, by the labour of horses only, about 5 *per cent.* is gained. I consider this to be a very useful suggestion. There are many situations, where, by collecting springs, and forming dams, half the labour of threshing might be done by water, without much additional expence of machinery.

7. The last power that has been lately applied for the purpose of impelling threshing-machines is *steam*, and there is one of these machines in East Lothian. It is said, that on some new plan, steam-engines have been invented at Hull, which would cost about L. 200, which would furnish power sufficient to drive a threshing-machine *. But there has not hitherto been sufficient experience to determine the comparative advantages and disadvantages of the plan. It is said that 12 cwt. of coals are required to thresh 50 Berwickshire bolls, or 300 bushels of wheat. It is probable, however, that the alternation of heating and cooling the steam apparatus, may oc-

* Communication from Mr Brown of Cononsyth.

casion much loss and expence in repairing the furnace and boiler; and there is little chance, in districts merely rural, of being readily able to procure work-people who are sufficiently conversant in steam-engines, for keeping the valves, leathers, and other parts of such nice machinery in order. Where coal can be had at a moderate expence, some would reckon steam superior even to water; but as fire is always a dangerous enemy to straw, and farm-servants often careless, it may be sometimes attended with risk.

On the whole, the remarks made by Mr Kerr, on these various powers, seem to be just. The greatest objection to horse-machines, he observes, is the severity of labour which they require, besides often necessarily occupying the time of the farm-horses when much wanted for other purposes. The capital defect of the threshing-mills which are driven by wind, is the extreme uncertainty of that power. During the long continued frosts of winter, when there is hardly any wind, they are often altogether useless for weeks, when straw for litter and fodder cannot be dispensed with; and the same thing sometimes happens during harvest, when straw is much wanted for thatch *. Water-mills, where that power can be had, are

* Wind-mills also are extremely apt to have their arms broken by high winds, more especially under the management of farm-servants, who can never be supposed intimately conversant with their nature, and the mode of working them. This has given rise to so much trouble, disappointment, and expence, that some farmers in Berwickshire are tired of their wind-mills, and propose returning to horse-wheels in their stead. As wind-mills are so common both in England and Holland, this must be owing to some defect in the construction, to mismanagement, or to higher winds being more prevalent in Scotland than in those countries.

certainly the best in every respect; being more economical and steadier in their operation, than when driven either by horses or wind. But water is very apt to fail in autumn, and during long frosts. On these accounts, both wind and water machines, except when the latter have an ample and regular supply of the moving power, ought to be provided with horse-wheels.

Advantages of threshing-mills.—It is impossible to form an adequate idea of the advantages which have been derived from this important invention, without considering the manner in which threshing had been previously performed. There were two methods adopted for that purpose. The first was by a person who contracted to thresh the grain, giving twenty-four parts to the farmer, and reserving one twenty-fifth part to himself: the second method was, to hire a man to thresh the grain, at 1 s. 3 d. *per* boll. Both these modes evidently furnished an inducement to thresh the grain in a slovenly, rather than in a perfect manner; for the more labour that was bestowed on the threshing, the less was the profit derived from it. The mischief was, that by these methods, every part of the business was a distinct process. In the first place, as many hands were collected to bring in the stack, and to build it into one end of the barn, as would, with the advantage of a mill, bring in, thresh, and clean the one half of it, in the same time; next, the tasker, (or thresher who worked by tasked work), had to take it from the heap, (as it is called), to lay it on the floor, to shake it well, and then to thresh it; and when each floor is threshed, he must put the straw out of his way; twice every day at least, he had to gather what corn he had threshed from every corner of the barn, and to separate it distinctly from the straw; women had to attend twice a-day to shake the straw, and men to carry it away; and, last of

all, hands were collected to clean and prepare it for market, after lying perhaps fourteen days on a cold clay floor. Instead of all this, with the mill, and at most nine hands, often with only six or seven, and from four to six horses, the farmer can bring in, thresh, and partly clean, on an average, twenty-four bolls in four hours, at the same time, shaking and disposing of the straw; and in the course of a few hours, the grain may be ready for the market, the door locked, and the key in his possession. What a difference, instead of being a sort of slave to taskers, for at least nine months in the year! A baker also, will, in some particular cases, give 2 s. *per* boll more for wheat threshed by a mill, than by the flail *.

The specific advantages resulting from this invention may be thus stated: 1. The threshing and shaking are so much better performed than they were by the flail, and by the hand, as to justify the opinion that there is an advantage derived, equal to one boll in twenty, over the old-fashioned methods †. The quantity of grain left in the straw by the flail, was formerly so great, that a respectable farmer in the Carse of Gowrie calculates, that, to his certain knowledge, it was equal to the expence of keeping all the work-horses on his farm ‡, and

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* Communication from Mr Richard Somner of Gilchriston.

† Communication from Mr George Farme, Braidwood, near Dalkeith, and Mr Brown of Cononsyth.

‡ There is now no risk from foul threshing, as every farmer can distinguish, in a few minutes, whether the work is properly done or not; but by the flail, he was almost always at the mercy of the thresher, who grew so weary of so tedious an employment, that it is not to be wondered at he should execute it in a slovenly manner. Besides, the labour was an unwholesome employment, from the dust it was apt to raise, and those who worked at it seldom lived long.

the loss was so insufferable, that the farmer was afraid to go from home, for the eight months in the year during which the threshing lasted *. It is not only of importance, its being done in a much more perfect manner, but also, that it can be executed much more expeditiously †, in so much, that advantage may be taken of any sudden demand; a scarce market may be supplied; a stack of from 30 to 40 bolls may with ease be threshed in a day, and sent to market, or to the miller; and all this may be done during weather when the other farming operations must be at a stand. 3. It has been well observed by Mr Brown of Markle, that if in the large farms of this country, hand labour were to be used for separating corn from the straw, a farmer's whole attention would be taken up by barn-work, otherwise the work would be imperfectly executed; whilst much pilfering would go on, unless he was constantly on the watch ‡. At a threshing-machine, any thing of that kind can rarely happen, so many people being employed together when the machine is at work, constantly under the eye of the master, or of some confidential servant; and when the work is finished, every door is instantly locked. 4. One important advantage attending the threshing-machine, worked by any power, is the superior value of the grain; as the speedy way in

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* A tasker (thresher) being once severely threatened for *foul threshing*, very calmly answered, "I'm sure ye'l nae find hail sheaves among the strae,"—a poor consolation to the unfortunate farmer, whose interests were thus so deeply affected.

† Once putting it through the hand-fanners, completes it either for the mill, or the merchant, and a stack can be threshed out, cleaned, sacked, delivered, and might almost be ground, and baked into bread, in one and the same day.

‡ The doors of the barns formerly were almost constantly open.

which the work is executed, prevents that waste and damp, which was produced from the long continuance of the corn among the chaff, thereby rendering it not so fit for meeting the market, and of inferior quality to the consumer *. Hence, as Mr John Shirreff well observes, the corn, instead of lying during one, two, or even three weeks, amidst the chaff and other rubbish, in the corner of a barn, till it becomes quite raw to the touch, and musty to the smell, or, if the floor is damp, sometimes in part springs, grain when threshed by the machine is instantaneously separated from both straw and chaff, as well as every other extraneous substance, and can be immediately measured up into bags, to be disposed of as may best suit the owner's interest. So great is the difference between grain threshed by the flail and the machine, that any person acquainted with the article, may go through a corn-market, blindfolded, and note every bag. This I am assured by several intelligent farmers cannot be questioned. 5. Another great advantage is, that the farmer can thresh his seed-wheat when in a soft state, recently cut, and taken off the field, and without any injury whatever †, which, be-

* Communication by Mr James Cuthbertson. Mr Peter Jack of Moncur observes, that when grain was threshed by the flail, it lay for ten or twelve days on the floor. The first part of the grain lying on the floor so long, became damp and swelled, that though put to a proper granary, yet it soon became musty, from the damp that it carried from the cold floor, and on that account never had the fine flavour in flour, that meal of all kinds now has, never being suffered to lie on the barn floor. North country oats and meal often lose a market in the south, on account of the musty taste it is so apt to imbibe from damp floors.

† On the same system corn might be threshed in hazardous seasons, as soon as reaped, and either immediately kiln-dried or frequently dressed by fanners, attached to a threshing-mill.

fore the invention of mills, it was hardly possible to get executed, in the harvest time, without the greatest difficulty, and at a heavy loss. He is thus also enabled to provide seed-corn in the spring, which formerly was not always an easy operation. When threshing for seed was done in a hurry, it may easily be supposed in how slovenly a manner the operation would be performed. In the busiest time of harvest also, straw can be got for covering stacks, which formerly could hardly be obtained. 6. It is found that strong wheat-straw is more useful for cattle when threshed in a mill, it is so much more softened than by the flail *. 7. If a stack of corn is brought from the field into the yard too soon, and is heated, it is threshed in one day, goes to the kiln and suffers no loss; but before the invention of mills, when threshed by the flail, it was so soured that it was almost unsaleable, and a loss of perhaps 20 *per cent.* was thereby sustained. 8. It is observed by Mr Kerr, that smut balls are not so apt to be crushed by the threshing-mill as by the flail, and that the grain is consequently less apt to be blackened †. 9. Mr John Shirreff remarks, that by the threshing-mill, the separation of the grain from the straw is not only more complete, than by any other known means, but the separation of the straw from the grain and the chaff, by the rake, and of the chaff and small seeds from the grain by the fanners and skreens, all driven by the same machinery, are advantages not inferior, perhaps, to the separation of the grain from the straw in the first instance.—Taking all these circumstances into consideration, and that prior to the invention of threshing-mills, drudgery, it may be said,

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* Communication from Mr Peter Jack of Moncur.

† Berwickshire Report, p. 231.

stared the farmer in the face; and that besides heavy losses, it was the source of endless trouble and vexation to every occupier of land, it is not to be wondered at, that the threshing-mill should be considered the most useful and profitable instrument belonging to a farm, *and that its advantages should be accounted* INCALCULABLE.

Some estimates, however, have been made of the specific advantages to be derived from this invention, which one farmer calculates at the rate of 5 s. *per* acre * on lands under crops of grain, whilst others state it 5 s. *per* acre with horse mills, but at full 10 s. *per* acre upon the whole lands under crop, when the machine is driven by water, by wind, or by oxen †. Mr Dudgeon, Primrose Hill, from general observation, without entering into minute calculations, is of opinion, that the aggregate advantage derived from a well-constructed threshing-mill, wrought by water, and under proper management, (when compared with the old mode of threshing), will be about 8 *per cent.* upon the corn threshed, including labour alone, but without making any allowance for money sunk in erecting the mill, or repairing the machinery. It is calculated by an intelligent farmer, that a threshing-mill saves, on an average, the expence of three men for nine months, which, on a farm producing 1000 bolls, is equal to about L.70, or 1 s. 3 d. *per* boll. Mr Dudgeon, Prora, has made a comparative estimate of the expence of threshing wheat by the mill and the flail; from which it appears, that the saving of charges in threshing alone, independent of other advantages, though the work be performed by horses, and not by any

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* Communication from Mr Charles Alexander of Easter Haprew.

† Communication from Mr Wood of Milrig.

cheaper power, is equal to 47 s. *per* 50 bolls, or 11 d. *per* boll, increasing with the prices of grain. Mr Robert Kerr gives the following estimate of the expence of threshing and dressing 50 bolls of wheat:

Three pair of horses at 6 s. *per* pair, -	L. 0	18	0
Four men at 2 s. 6 d. each, - -	0	10	0
Four women at 1 s. each, - -	0	4	0
	L. 1	12	0
Incidents, as oil, &c. - - -	0	0	3½
	L. 1	12	3½

which is at the rate of 7¼ d. *per* boll.

In the wind or water machine, the expence of the horses is saved, by which the cost *per* boll is reduced to less than 3½ d. By means of the steam power, the cost is restored to nearly the same with horses.

As to threshing by the flail, it was so irksome a task, that as labourers became scarce, the expence would have so much increased, as greatly to have diminished the profit of the farmer, and consequently the value of land *.

Mr Brown, Markle, in his valuable treatise on rural affairs, has drawn up the following estimate of the profit that might be derived by the public, from the universal adoption of threshing-mills. He calculates,

1. The number of acres producing grain in Great Britain, at - - -	8 millions.
2. The average produce in quarters at 3 quarters *per* acre at - - -	24 millions.

* Brown's Treatise on Rural Affairs, vol. i, p. 315.

3. The increased quantity of grain produced by threshing, instead of using the flail, at one-twentieth part of the produce, or in quarters at - - -	1,200,000
4. The value of that increased quantity at 40 s. *per* quarter, - - -	L. 2,400,000
5. The saving in the expence of labour at 1 s. *per* quarter, - - -	L. 1,200,000
6. The total possible profit *per annum* to be obtained, at - - -	L. 3,600,000
7. The actual profit, on the supposition that only one-half of the grain produced, were threshed *per annum* at - - -	L. 1,800,000

Is it then to be wondered at, that he should pronounce the threshing-mill to be the most valuable implement in the farmer's possession; contending, that it adds more to the produce of the country than any invention hitherto devised; and that it ought to be accounted the greatest improvement that has been introduced into Great Britain, during the present age?

It is much to be lamented, however, that the process of threshing by the mill cannot be carried on to the same advantage, unless where the ears are regularly exposed to the stroke of the beaters; reaping by the sickle, therefore, is much to be preferred; at the same time, if the grain is passed twice through the mill, it will be threshed effectually, in whatever mode it may be reaped.

Improvements in the threshing-mill.—It is probable that several improvements will still be made on this machine *.

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* Mr Robert Kerr states, that Mr Dun, a very ingenious millwright at Coldstream in Berwickshire, has made many useful im-

Amongst these, diminishing the size of the drum is certainly amongst the most important. The drum should not exceed from two feet eight inches to three feet, or three feet and a quarter. Mr Sked, mill-wright at Dunbar, has made a machine of six-horse power, with a drum of only three feet and a-half long, and three feet and a quarter diameter. This machine, which has a large outer wheel, threshes with uncommon ease, and very clean, and with so small a drum it can thresh from 10 to 12 bolls of wheat in an hour, whilst the horses are so cool, that they can be watered with safety after working five hours. That able mechanic, Mr Andrew Gray, is decidedly of opinion, that a small drum, with few beaters, is preferable to the larger one with a great number, the small drum making better work, not being so severe on the cattle, and less straining to the machinery. Although it is obvious that a drum, three feet diameter, having four beaters, must take two revolutions, for one of the drum six feet diameter, with eight beaters, it is evident, that the circumference of the one will move

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provements on threshing-mills, in particular on those which go by wind; more especially by causing the machinery to regulate the sails in proportion to the wind and work, in a most effective manner, with no trouble whatever to the people who feed the mill. He has likewise adapted a series of buckets, resembling the chain-pump, which continually return all ill-threshed grain, particularly ill-dressed barley, to the threshing stage; and has, besides, added an ingeniously-devised shaker, beyond the rake, for clearing all the loose grain from among the straw. On the whole, the machines erected by Mr Dun have been carried to very great perfection; always supposing, however, that they possess sufficient moving power of water or wind; for they are rather too much loaded to be driven with any tolerable ease by horses.

nearly at the same rate as the other, because one turn of the large drum, is equal to two turns of the small one, they will give therefore an equal number of strokes in the same time; but it is found by experience, that the small drum threshes much cleaner, or makes better work, than the larger one. The small drum is therefore to be preferred; being easier driven, it must be less severe on the cattle, and by its striking the corn at a more acute angle, of course strips off the grain much cleaner from the straw *.

Another improvement is, instead of two fluted rollers, to have one of them plain, but chipt cross-wise, about half an inch deep in various places. This prevents the straw from rolling around the fluted roller; in which case the straw must be immediately cut, otherwise much mischief may be done. This is supposed to be a Scotch invention, for it was only introduced into Northumberland in the year 1807. When chipped, the straw adheres to the roller, without rolling or lapping round it, which it is apt to do, when the roller is fluted, if the straw is damp. On this subject, however, there is a great diversity of opinion. One respectable correspondent affirms, that a plain roller, instead of being an improvement, is, on the contrary, detrimental to the

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* Mr Wood of Milrig remarks, that he has always found the moderate-sized threshing-mill by far the most useful, and less destructive to the animals which drive it, and sufficiently expeditious for the purpose of any farm; and by employing a certain number of day-labourers, which a farm of proper size has always at command, and by employing the ox for threshing, the horses, and the men who work them, are never taken from other agricultural purposes, very necessary perhaps to be carrying on at the same time.

work; fluted rollers being, in his opinion, necessary to retain the corn for a length of time sufficient to thresh it. Another intelligent farmer, on the other hand, considers the plain roller, chipt cross-wise, a great improvement. He adds, that damp straw is threshed with much inconvenience by fluted rollers. They are not only troublesome, but dangerous. Indeed he had a man who lost his life by being entangled in the rollers, whilst attempting to cut the rolled or *lapped* straw from the roller. A chipped roller also, is well calculated, not only for threshing oats in a damp day, or the wet bottom of a stack, but also for threshing rank pease, a point of considerable importance. Mr Dudgeon, Prora, informs me, that many farmers were so much convinced of the waste of the straw of pulse crops of all sorts, that they continued the use of the flail, when the fodder of pease, &c. was required. Indeed the mill broke off the chaff so much as to render the straw much less nutritive; this the flail corrected by preserving it more entire, and of course making it to last longer. This object may be obtained now by means of the plain and chipped roller. Mr Dudgeon uses three hands to feed the machine, if the pease or beans pass through to any degree of thickness between the rollers, and they receive only that degree of threshing which is necessary for separating the corn from the straw.

It is well known, that accidents have often happened from the difficulty of informing the driver of the horses, that the machine should be stopt. Mr Erskine of Marr has obviated every difficulty of that sort, by hanging a bell, the string of which is within the reach of the feeder of the mill, and by teaching the horses to stop immediately when the bell rings. The horses are also taught to proceed again, when the bell rings a second time.

When horses are yoked in threshing-mills, they ought either to have goggles, or to be blinded, as they are so apt to look back. All horses should have breechings to enable them to stop the machine, and many have been killed, and much mischief done, owing to the want of so essential an article. The lever, by which the mill is wrought, ought always to be placed above the horse's back.

It would be a most essential improvement to make the horses work equally. To obtain that object, a plan has lately been invented by Mr Walter Samuel, a smith near Edinburgh, the apparatus of which is simple and cheap, not exceeding 20 s. *per* horse, by means of which, it is contended, that not only the horses are comparatively greatly eased in the most severe labour in which these useful animals are employed, but that a great saving results in the wear and tear of the machine, from the regularity and uniformity of the movements.

Mr Scott at Ormiston has constructed an improvement, by which that resistance which is so great and oppressive to the horses, when wheat, or corn of strong growth is threshed, can be easily removed or lessened by the foot of the person who feeds the machine, pressing upon a bar or treddle, which has the instant effect of raising the upper roller in such a degree, as to allow the bottom of the sheaf to escape with more ease, and thereby lessening the draught of the horses. This plan has been put in practice by Mr Park of Windymains, and may answer, when the person who feeds the machine is careful and attentive. The expence is only about fifteen shillings *.

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* For a plate and description of this improvement, see The Farmer's Magazine, NO. XLVII.

Mr George Mitchell, at Bishop Mill, near Elgin, in Moray, has discovered a mode for dressing barley in a superior manner, by means of cheap machinery annexed to the threshing-mill, an account of which will be given in the appendix.

Some farmers think it an improvement to yoke their horses in pairs, in the same manner as they do the plough; but this is attended with a loss of the power applied, the one horse being compelled to travel over more ground than the other.

Great diversity of opinion is entertained regarding the kind of threshing-mill that is easiest wrought, some contending for two movements, some for three, and others for four. Mr Rennie of Phantassie recommends a mode of trial, which he thinks would set that matter to rest, that of having three or four models of different movements, but of equal power, to be constructed by an able mechanic, and these to be wrought by means of weights, which he thinks would at once ascertain which of them had the easiest draught; at the same time, it would be difficult to say, with any degree of correctness, which ought to be preferred. If, instead of models, real machines were to be made use of, it would be necessary, in order to make the comparison complete, that the machine should be all new, and that the same horses, the same sort of grain, if possible from the same field, and the same driver and feeder, should be employed to the machines driven by the different movements. The great object, however, is, *clean threshing*, without which facility in movement is no advantage.

As to the cost of erecting a house, the expence, on an average, may be calculated at L. 200 for each machine, including the horse-shed, the fanners, and the loft connected with the framing of the machinery, but exclu-

sive of the barn, the barn lofting, &c. This expence, owing to the higher price of wood, is not likely to be diminished. Mr John Shirreff at the same time remarks, that that must in some degree be counterbalanced, by the present more general introduction and employment of cast-metal segments and pinions, in the construction of which much labour is saved, and consequently wages to the operative mill-wright.

Upon the whole, after the experienced advantage of powerful threshing-mills on large farms, they have now become not only most useful, but almost indispensably necessary; and farmers who have been accustomed to the dispatch, security, and economy, which they contribute to the management of extensive concerns, would find themselves reduced to most unpleasant inconvenience, should any circumstances oblige them to have again recourse to the flail.

6. Miscellaneous Articles.—The other implements used in Scotland are not numerous, consisting principally of bean and turnip drills, (drill-machines for corn are not frequent), stone, wood, or cast-metal rollers *, and scrapers,

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* One of my correspondents has tried a roller made of Aberdeenshire granite, with which he is much pleased. Every person, he observes, knows how imperfectly the large wooden roller acts in the pulverising process, and in many districts it has generally given place to the smaller metal roller. But the granite roller is greatly superior; it is cheaper; it will last for years; and is so weighty, that it may be made of as small a diameter as is necessary. It is said by those who have tried rollers, that they should not be less than twelve inches in diameter, nor more than thirty, because, if too small, they are apt to push the hard clods before

or shovel-ploughs, none of which are either expensive or complicated. A horse-rake for gathering corn stubbles after the scythe, has lately been introduced into some parts of Scotland, and has given satisfaction.

On the whole, it may be safely asserted, that there is no country in Europe, where farming is at all understood, where the implements of husbandry are so few, so simple, so cheap *, or so effective as those in Scotland—a circumstance of infinite moment to the industrious husbandman.

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them, and if too large, to force the clods into the soil, or to rest upon them instead of breaking them. Some recommend hollow cast-iron rollers; but in that case, it would be advisable to have a machine for conveying them from one field to another, to prevent their breaking. It might be set on low wheels, and an inclined plane of stout plank used for drawing it by a horse, or two if necessary.

* The threshing-mill, though it costs a considerable sum, yet is the cheapest of any, considering the work it performs.

Sect. VIII.—*Of Live Stock.*

It is a common remark, that the farmers of Scotland, in general, seldom think of bringing their sheep, their cattle, or their hogs, to that extraordinary degree of fatness, which is the pride of the English breeders and graziers; for which, indeed, the former have no inducement, except when they are within reach of the Morpeth market, as they would find but few purchasers in their own country. Without discussing the propriety of fattening animals to such a pitch, or the refinements of modern breeding, it may be sufficient to observe, that the breeds of live stock in Scotland are, on the whole, well calculated for the soil and climate of that country; and that many of them are distinguished by most valuable properties, which are not to be surpassed, and indeed are rarely equalled, by those of any other country.

Our observations on this subject shall be confined to the four principal sorts of live stock; 1. Cattle; 2. Sheep; 3. Horses; and 4. Hogs.

1. Cattle.—In the General Report of Scotland, a particular account will be given of the various breeds of cattle in that part of the kingdom. It may be observed in general, on the authority of a most respectable correspondent, (Mr Trevelyan of Netherwitton, near Morpeth), that the farmers of Scotland are too apt to overlook and undervalue their own breeds of cattle. In regard both to beauty of form, and quickness of feeding, they are equal to any, and they would improve still more, were the same care

taken of the calves as in the southern districts. Even as matters are now conducted, for delicacy of eating, and excellence of form, nothing can surpass the small breeds in the northern parts of the island, the Kyloes, or the cattle of the Isle of Sky, and other islands in the Hebrides, and the west country Highlanders, or cattle of Argyll. It is supposed, indeed, that the best of the short-horned breed, or Collins's celebrated stock, has a mixture of Kyloe blood in it; and I am informed by a gentleman, eminent for his skill in breeding, that a mixture of the Kyloe blood, in a small proportion, and done with judgment, in a proper manner, and at a proper time, would do good. He adds, that there is not any other breed but the Kyloe, that would admit even of a small mixture with the short-horned.

Of a larger description than the Kyloe, and from their form admirably calculated for fattening, are the breeds of Galloway, Fife, Angus, and Buchan.

In regard to the dairy, the cows bred in several districts of Ayrshire, Cunningham in particular, which have since spread into the counties of Renfrew and Lanark, and other places, are justly celebrated.

In discussing the subject of cattle, it is proposed to make some observations, 1. On the feeding of cattle, and the profit attending that practice, more especially when compared with sheep; 2. On dairy cows, and their management; and 3. On the working of oxen; concluding with some additional particulars, which it is necessary to explain in regard to this branch of the inquiry.

Feeding cattle.—As the farmers in the more improved districts of Scotland, are not partial to old turf, and rarely have any extent, either of permanent pasture or of meadow land, it is usual for them, instead of breeding stock, to

purchase cattle or sheep from the breeding districts, and to fatten them for the market.

This is certainly an advantageous plan for them to follow. The expence, and the risk of breeding great numbers of animals, are thus avoided. The attention of the farmer is not distracted by a diversity of objects. He can alter his system, from cattle to sheep, or from sheep to cattle, as is likely to be the most profitable; and the capital he lays out, is speedily returned. The division of professions between breeding and feeding, though they may be united in peculiar favourable circumstances, yet, on the whole, is a most important link in the progress of agricultural improvement.

Cattle may be fed, in pastures, in fold yards, in open sheds or hammels, or in stalls. These points have been already discussed, (See Sect II.); but some observations still remain to be made on stall-feeding.

By some, feeding cattle in stalls is objected to, as rendering the animals unhealthy. An experienced farmer, however, affirms, that in the space of twenty years, during which he fattened several hundred head of cattle, he never knew one unhealthy animal feed to perfection. He has tried feeding cattle of the same sort, some loose in a warm shade, some in the open court yards, and some in a stall. The last, by his experience, was the preferable system. It is proper to observe, that those fed in the stalls were well curried, kept very clean, to which, probably, this farmer's success in stall-feeding was owing. And here it may not be improper to observe, that though the general principles and practices of husbandry are already sufficiently understood, yet that much information is still wanting regarding the minutiæ of the art of agriculture, on a due attention to which the success of the farmer must necessarily depend.

As an additional proof of the justness of that remark, I am led to state the particulars of an experiment made by a respectable farmer in East Lothian, (Mr Dudgeon of Prora), which proves how much depends upon supplying cattle, fed in winter, on dry food, with a sufficient quantity of water, and the necessity of sparing no expence in furnishing them with that essential article in abundance.

Mr Dudgeon having a number of Highland cattle consuming straw and chaff on a farm unfit for turnips, an old man was appointed to discover, how often they went to a watering trough, within the close, in a short cold winter day. That he might not be confused in the execution of his orders, one particular bullock was pointed out, on which he was to make his report. According to that report, which there is every reason to believe may be relied on, he drank *eight times* in the course of the day, and the man was convinced, that all the rest of the cattle drank as often as the one fixed on. How then is it possible that they can be properly supplied when they are sent out to drink? Twice a-day is as often as cattle are driven out to water, and some of them do not get one drink. The strongest or most forward, first supply themselves, always abuse the water, and, (especially in a pond), render it unfit for the rest, and even for themselves during the rest of the day. Their shivering attendant, glad to get them done with their drinking, hurries them back to the close. Indeed cattle are not able, at one or two opportunities, to drink a sufficient quantity of water, in cold weather, to moisten and digest coarse food. Mr Dudgeon, aware of this circumstance, brought in water by a lead pipe to a cistern, about seventy yards distant from a dam head. The cistern consists of common rough building. A stone or trough is placed within the farm-yard, communicating with the cistern by a pipe of two inch bore, and the trough, being upon a level with the cistern, it

stands always full, being regularly supplied as it is made use of. This is a most valuable acquisition. Mr Dudgeon is convinced, that a moderate-sized ox will, by an abundant supply of water, improve much more rapidly during the course of a winter, if he is supplied with water when he requires it, than when he is only occasionally driven to it.

The profit to be derived from feeding cattle, compared to sheep, has been a subject of dispute. Mr Kerr calculates, that an acre of good feeding land in Berwickshire will support a sizeable ox, or five full sized Leicester sheep*. The ox, he states, will increase in the course of the season to the amount of 16 stone, 14 lb. to the stone, or 224 lb. in all, and the five Leicester sheep will produce, besides the wool, on an average about 12½ stone of mutton, or 168 lbs. In the county of Durham, however, Mr Bailey of Chillingham estimates, that an acre of such land as will feed an ox of 60 or 70 stone, will feed from seven to eight sheep *per* acre. Such an ox, feeding on turnips, will consume from 20 to 22 stone *per* day. By experiments recorded in the Northumberland Report, tups of 12¾ live weight, eat 2¼ stones of turnips *per* day, which is at the rate of eight to one, comparing cattle to sheep. Hence, if they eat grass in the same proportion, and if, as is the case in the Morpeth market, when beef sells at 8 s. *per* stone, sinking the offal, mutton fetches 9 s. the calculation of comparative profit from these data will be as follows :

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* See Kerr's Report of Berwickshire, p. 320. Mr Kerr makes the winter proportion on turnips, ten sheep to one moderate sized fattening ox, with the addition of straw. Ditto, p. 279.

1. Eight sheep, gaining 2¼ stones each, or 20 stone in all, at 9 s. *per* stone, or L. 1 : 2 : 6 *per* sheep, - - -	L. 9	0	0
2. An ox gaining 16 stone at 8 s. *per* stone,	6	8	0
Difference in favour of the sheep,	L. 2	12	0

If seven sheep are taken, the balance would be L. 1 : 9 : 6. If six sheep, the difference is 7 s. in their favour; but at five sheep, the balance is 15 s. 6 d. in favour of the ox.

It is necessary, however, to take into consideration the hide, on the one hand, and the skins and fleeces on the other; also the value of the manure they respectively produce. The latter is evidently in favour of the sheep; for it can hardly be doubted, that two years' pasturage with sheep, will improve land as much as three with cattle.

This, however, is not the only point of view in which this subject is to be considered. A Berwickshire farmer informs me, that he usually purchases in October, at the Falkirk tryst or market, about eighty Highland bullocks; he winters them on straw and meadow hay, and feeds them off for the butcher the following season, in grass inclosures taken for that purpose. They are bought, on an average, at about L. 9 *per* head, and will fetch, when fattened, from L. 14 to L. 15 each. Is any plan more likely to be profitable, more especially if the grass fields are not taken too high? Any other sort of breeding or feeding can hardly stand a comparison with such a system, when the lean stock are purchased at a reasonable price, and the fat find a ready market.

The most intelligent graziers are of opinion, that a mixed stock of cattle and sheep always pay better, than when they are pastured separately. They improve the ground

more, and are fattened with more economy*. Mr George Culley states that to be the result of his experience as a grazier, for no less a period than sixty years. Mr Robertson of Ladykirk, who concurs in the same opinion, calculates, that an acre of ordinary grazing land in Berwickshire will feed well three shearling Leicester sheep, and that an acre and a half of such land will feed a bullock of 60 stone weight. Two acres and a half, therefore, will, (when the stock is mixed, which it ought to be), produce the following sums:

3 sheep at 15 s. each, - -	L. 2	5	0
1 bullock of 60 stone, - -	3	10	0
	L. 5	15	0

Consequently the produce of two and a half acres of English measure, of middling pasture, is only at the rate of L. 2, 6 s. *per* English acre. In rich land the profit must be still greater.

It has been justly observed, that there is not much stock that will pay the expence of grazing from the acquired weight solely. The profit of the grazier must arise, from the improvement of the whole carcase, in consequence of which, the value of the lean is increased, from perhaps 4 d. to 6 d. *per* lb., or in that proportion, whilst the acquired weight sells at the higher rate. This is a point which should always be attended to in the sale, or the purchase of lean stock.

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* It is objected to mixed pasturage, that cattle require a full bite, and sheep a close one.

Dairy Cows.—There is nothing of peculiar importance in the dairy management of Scotland, except in Ayrshire, and in the neighbourhood of Glasgow and Edinburgh. Though much attention has been paid to the breeding of cattle for the shambles, yet, in many parts of Scotland, the quantity of milk produced by the cows, (with the exceptions above mentioned), is very inconsiderable. Indeed, nothing else could be expected, from the miserable manner in which the cows were formerly maintained, more especially in the winter season, when they had nothing but straw to live on. This is the more to be regretted, because the dairy is perhaps the most pleasing of all the departments of husbandry, and as there is reason to believe, that converting herbage into milk, by means of a dairy stock, is the most profitable mode of employing it, and the most productive of human food. The herbage is immediately converted into milk, which is drained off without loss, and as soon as it is prepared; whereas, when herbage is converted into flesh, a part of it is constantly wasted, which must be constantly supplied. It is supposed, that the same quantity of herbage, that would add, as above calculated, 16 stone or 224 lb. to the weight of an ox, would produce 1800 Scotch pints, or 900 English gallons of milk, which, even converted into cheese, (not the most advantageous mode of consuming milk), would produce 36 Ayrshire stones, at 24 lb. *per* stone, or 860 lb. of cheese, besides the flesh that might be obtained by feeding pigs with the whey. In point of profit also, there is no comparison, as the beef is only worth 8s. *per* stone, of 14 lb. each, whereas the cheese sells for 12 s. and sometimes as high as 14s. or 15s. *per* stone of 24 lb. each. More valuable produce, however, is necessary, as the dairy system is attended with more expence.

The profits of the dairy must necessarily be extremely various, according to the quality of the pasture, the age and size of the cows, the mode of feeding, &c.; yet, under proper management, they are very considerable. An eminent dairy farmer, Mr James Ralston in Galloway, states, that every cow on his farm, about two years ago, yielded annually her own weight in Dunlop cheese, then sold at 14s. or 15s. *per* stone, county weight; and that he would not keep a milch cow, that did not yield cheese, in the course of the year, equal to her weight, and which would sell at the price of the cow. Under less careful treatment, an inferior return may be expected. When cows are furnished, and the food provided by one man, and when they are taken care of, and their produce sold by another, from L. 12 to L. 15 is paid for each cow *per annum*.

A farmer in the western parts of Scotland informs me, that he keeps some cows of the Ayrshire breed, and that they will yield, on an average, when the milk can be sold sweet, as taken from the cow, from L. 18 to L. 20 *per annum* each cow; when the milk is churned, and sold in Glasgow, from L. 15 to L. 17; and when made into cheese, from L. 12 to L. 14, according to the quality of the cow, her condition, the manner in which she is fed, and her produce is managed.

The Ayrshire cows, though generally of a moderate size, (from 30 to 50 stone live weight), yield a considerable quantity of milk. Some have produced from 18 to 20 Scotch pints, or from 9 to 10 English gallons *per* day, for two or three months after calving; these instances, however, are by no means common, and the milk of such cows generally contains more serum, than those who give a less quantity.

The following estimate of the produce of Ayrshire cows, at an average, is by no means overrated:

	Scotch Pints.	English Gallons.
1. Produce for 90 days after calving, at 10 Scotch pints, or 5 English gallons *per* day, - - - -	900	450
2. Produce for 90 days after, at 6 Scotch pints, or 3 English gallons, -	540	270
3. Produce for 120 days, at 3 Scotch pints, or 1½ English gallons, -	360	180
Total,	1800	900

Mr Ralston's dairy farms in Galloway are certainly the largest concern of the sort in Scotland. He kept, some time ago, about 120 milch cows, and he is making arrangements for adding about 100 more to the number. The mode he pursues of feeding his dairy stock, is as follows:

They are never fed out of doors until the grass has risen to afford them a full bite: when the weather is dry and hot, they are housed, and fed on cut grass, from six in the morning till six at night, when they are turned out to pasture for the other twelve hours. During bad weather, they are housed both night and day, and fed plentifully with turnips, potatoes, &c. Chaff, oats, and potatoes are boiled for the cows after calving, and they are generally fed on rye-grass hay, during the latter part of the spring.

It is much to be regretted, that in many parts of Scotland, the farmers are not sufficiently attentive to the profits of the dairy. The late Mr Scott of Craiglockhart lamented that his dairy, owing to peculiar circumstances, was much circumscribed, being convinced, from experience and observation, that if properly attended to, it is

the most profitable branch of agriculture. The drudgery is certainly great, and it is only a particular class that will give the attention necessary to ensure profit. Milking thoroughly, and feeding regularly, are first-rate objects. Green crops are now to be had in abundance at all seasons of the year; and cattle thrive as well in a stall or fold-yard, as when roaming in the fields. As a proof of the advantage of the dairy to an industrious farmer, I am informed, on the most respectable authority, that a farmer in the Carse of Gowrie, who occupies 200 Scotch acres of rich land, keeps six cows to furnish milk for his family and servants, and for breeding young stock. They are kept upon a small patch of pasture in good weather, but their principal feeding is cut grass in summer; straw, chaff, turnips, potatoes, and sometimes a little hay, in winter. The sale of the produce of these cows, in cheese and butter, besides serving the family in milk, goes a considerable way in maintaining the farmer's family, or defraying his household expences, all the year round.

In the neighbourhood of Glasgow and Paisley, the farmers are particularly attentive to the profits of the dairy. The Ayrshire cows generally prevail, and they have in their possession some of the most perfect of that excellent breed. Such farmers as live within two miles of Glasgow or Paisley, sell their milk in these towns, when newly taken from the cow. Those who are from two, and thence even to ten miles distance from town, generally churn their whole milk, and sell it, and the butter, in Glasgow or Paisley; and all who live at still greater distance, make the milk into cheese. The produce of these different modes will be in the proportions of 3 d. *per* Scotch pint when made into cheese; 4 d. when churned and sold in butter and butter-milk; and 6 d. when sold as newly taken from the cow.

A very spirited attempt in the dairy line, has been lately undertaken by Mr Harley of Glasgow, who, after having visited all the principal dairies in the north of England, those of Mr Curwen, at Workington, in particular, resolved to establish a plan for supplying, on a great scale, the inhabitants of Glasgow with milk of a quality they might rely on. He has erected houses, on a most ingenious construction, for feeding his cows; and the measures he has adopted, for keeping his dairy implements in good order, for conveying the milk to different parts of the city, and for preserving it from adulteration, will render his undertaking, not only highly useful to the city of Glasgow, but will furnish a model that ought to be followed in other places; as, by such means, large towns may be supplied with an article so essential for the health and comfort of the inhabitants, in its greatest purity.

The following is the substance of the information I have received, regarding the expence of maintaining milch cows in the neighbourhood of Edinburgh, and the profit attending it.

The cows were for some time grazed in the Marquis of Abercorn's park at Duddingston; they were afterwards pastured, and occasionally soiled, at Fillyside near Edinburgh. The expence of keeping them in summer and autumn, was at the rate of 1s. 3d. *per* day, or 8s. 9d. *per* week; but in winter and spring, was necessarily higher. The milk was sold to retailers, and the net profit was L. 23 *per annum*.

The most important improvement that has recently taken place in regard to the management of the dairy, is the invention of cast-iron milk dishes, by Mr Baird of the Shotts Ironworks, near Whitburn in West-Lothian. These dishes are made of cast-iron, softened by annealing in charcoal, turned smooth inside, then laid over with a

coat of tin, to prevent the iron coming in contact with the milk, the rust from which might injure it. The outside of the dish is painted over, to prevent rust also. The advantages they possess over wooden milk dishes, are, 1. That they preserve that proper degree of coolness necessary to cause the milk throw up the cream, in which respect they are so preferable to wooden dishes, that the farmers' wives who have given them a fair trial, affirm, that they throw up one-third more cream, from an equal quantity of milk; and, 2. They are very easily kept clean, by washing them, and giving the inside a rub with beat chalk, on a little flax, or a piece of woollen cloth. It is well known the great labour that wooden dishes require to keep them clean; and should the dairy-maid allow milk to sour in them, it requires much time, and severe scrubbing, to make them sweet and fit for use again: but should milk be allowed to sour in the iron dishes, if they are washed clean, and rubbed all over with chalk, they become as fit for holding milk as ever. These milk dishes are softened by the annealing to such a degree, that although they should fall on a stone, they will not break, unless let fall from a great height. They will retain their coat of tin for many years; and should the tin wear off, from much usage, they can easily be retinned at small expence. They were invented by Mr Baird, and first made at the Shotts Ironworks, about the beginning of the year 1806. Several farmers in that neighbourhood soon tried them; and the demand for them is now so great, that the company can with difficulty make a sufficient quantity to supply the sales during the season.

Table of Milk Dishes, as made at the Shotts Ironworks, near Whitburn, West Lothian.

Numbers.	00	0	1	2	3	4	5	6	7	8	9	10	11
Contents in Scotch pints,	¼	½	1	1¼	2	2½	3½	5	6	7	8½	10½	12
Contents in English Quarts,	½	1	2	2½	4	5	7	10	12	14	17	21	24
Price of each,	1s.	1s. 2d	1s. 9d	2s. 6d.	3s. 3d.	4s	5s	5s. 6d.	6s.	7 s	7s. 6d.	8s. 6d.	9s. 6d.

Mr Baird has also made a cheese shape, measuring 17½ inches diameter in the inside; the price nine shillings. The same article, (cast-iron), will probably be also extended to churns.

On working oxen.—The propriety of working oxen has long been a subject of dispute. There can hardly be a doubt of the advantage of employing them in threshing-mills, a point which has been already sufficiently explained, (See Sect. 7.); but how far they are calculated for ploughs, and still more for carts, has not yet been decisively ascertained. The observations which have been transmitted to me by two most respectable practical farmers in Roxburghshire, (Mr Walker of Wooden, and Mr Walker of Mellendean), are so strongly in favour of the partial use of oxen, that I cannot but submit them to the reader, as justly entitled to peculiar attention.

On the farms occupied by these gentlemen, there are kept fifty working-horses*, and twenty-eight working oxen.

* The horses are kept for road work, and distant carriages.

The oxen are broke in when three years and an half old. Two are used in a plough or cart, in leather collars and harness, in every respect the same as horses. They are laid off to be fed for the butcher, when six years and an half old, and consequently are only worked three years. During the summer months they are fed on grass; but from the end of harvest to the end of May, if the Swedish turnips hold out so long, their constant food is turnips and straw. They never taste any other food, except a small quantity of hay in the field while the ploughman eats his dinner. Upon this food, they keep in excellent condition, and are capable of doing a great deal of work; and when along with the horse-ploughs, they never lose a turn. In the winter months, when the days are short, their whole work is taken at once; in spring, they come home in the middle of the day, and get as many turnips as they can eat. They are peculiarly calculated for breaking up coarse ground.

Mr Walker of Mellendean has three oxen to every plough, and by working only two at a time, and constantly changing them, every ox works only four days in the week. The saving, even on that system, is considerable. Each horse he calculates costs L. 32 : 7 : 6, consequently a pair L. 64, 15s.; each ox L. 14; three oxen, therefore, cost L. 42. There is thus a saving of L. 22, 15s. *per* plough. Where the expence of keeping horses is higher, the profit by the use of oxen is proportionably more. Besides, while the horse (as Mr Walker of Wooden well observes), is yearly diminishing in value, the ox improves till he is six or seven years old, and is then easily fed, and brought to market at a greatly increased weight and value; and in case of death by accident or disease, to which, however, he is far less liable than the horse, even then the loss upon the ox is for the most part trifling; while, in the

same circumstances, the loss upon the horse amounts to his whole value.

After the experience of upwards of twenty years, these gentlemen are of opinion, that oxen are fit for every agricultural purpose, travelling upon hard turnpike-roads excepted; that when employed in the plough, or indeed in almost any of the home labours of the farm, they perform nearly the same quantity of work as horses; and that where any extra stock is necessary for emergencies when a great pressure of work may be required, oxen ought to be preferred; that they are peculiarly calculated for any farm where turnips are cultivated, and where there is no way of disposing of that crop, but by consuming it upon the farm itself. Where turnips cannot be raised, it is more doubtful whether they can be used with equal advantage; but the fact is ascertained, that one ox, fed with turnips and straw, will do more work, than two oxen fed with the best hay; and that with turnips, particularly the Swedes, there is no occasion to give any corn to oxen.

Several other intelligent correspondents concur in recommending the partial use of oxen.

Mr Dudgeon, Prora, had a pair of oxen which worked the plough, without a driver, and never lost one step when compared to a pair of horses. It was owing to the difficulty of getting others as well broke, and of procuring hands to work them, that they were given up.

Mr Wilson of Simprin, in Berwickshire, approves much of some oxen ploughs being kept on large farms; as the oxen must improve greatly, when the weather is unfavourable for ploughing. On turnip farms they may be put to grass for fattening, as soon as the important season of turnips is over.

Mr Stewart of Hillside is of opinion, that bullocks will not only answer well for working a threshing-mill, but

that they may be used to advantage in other work about a farm, provided that two or more pair of horses are kept for performing distant carriages. He breaks his bullocks at two years old, giving them only light work, and so moderately, as not to prevent their growth. It is easier at that early age to correct their faults, and to get the better of any bad habits into which some of them are apt to fall, than afterwards. At three year old, they will draw half a ton of potatoes, for two or three miles; at four years old, Mr Stewart has tried a pair of them, in competition with twenty horse ploughs, greatly to the credit of the oxen. They are in all respects yoked and driven as horses, both in ploughs and carts.

Mr John Shirreff states, that in several parts of Aberdeenshire, he saw oxen ploughs do as much work as horse ones, a pair in each; and he is convinced, that they will be found equal to horses in the plough, provided they be allowed a sufficient space of time, between their yokings or journeys, when they are worked twice a-day, to ruminate. This might easily be obtained, by going out very early in the morning, which would admit of a considerable interval between the yokings. If the same work could be done by oxen as by horses, why should not the same food be allowed them, if it is found really necessary *?

Another intelligent correspondent expresses his conviction, that where twenty horses are required, it would be preferable to have sixteen horses and eight oxen. He always works his oxen with their collars reversed, that is, the broadest part upwards. In ploughing and rolling they are very useful. Horses are better in harrows, from

* It is recommended by an intelligent correspondent, to give working oxen in mid-day some oat or barley meal. The ox would probably go to rest as soon as he had eat it.

their quick step, by which the pulverization of the soil is accelerated. In harvest likewise, when expedition is necessary, horses are to be preferred. In breaking up old turf land, however, oxen are better in the plough, their motion being more steady than that of horses; the flag is less broken in turning over, which is a great advantage, more especially where the drill system is practised. For short carriages, as in carting dung, turnips, &c. the advantage of using oxen must be very great; and they may occasionally be used in the plough, when the carts are sent for lime, or to the market with grain *.

It is contended, that where oxen from 70 to 80 stone weight, (as is the case on the Borders), can be sold completely fat at three years old, that the farmer will find it more profitable to feed his oxen, than to work them; but were that even the case, it is evident, that if the price of horses, and the expence of maintaining them, should increase, the partial use of oxen may become necessary, and from the facts above detailed, is at present, to a certain degree, advantageous. Besides, as the oxen grew older, their weight would increase, and the quality of the beef would improve.

2. Sheep.—There are some of the finer breeds of sheep, as the Leicester, the South Down, and even the Merino, to be met with in Scotland; but, in general, the sheep in that part of the kingdom are more distinguished for hardiness, than for fineness of fleece, or early maturity. They are improving, however, in both these respects, and the Cheviot breed in particular has nearly become, both for form and fleece, a perfect stock for a mountainous district.

* The principal objection to the use of oxen, is the difficulty of shoeing them. Any improvement in the art of shoeing oxen, would be well entitled to a premium. Perhaps the shoes should go over, as well as under the hoof.

Where the flocks are numerous (from 5000 to 10,000 often belonging to one farmer), it is impossible to pay such minute attention to such multitudes, that they can possibly unite all the properties necessary for a perfect stock, namely, 1. Form; 2. Fleece; 3. Flesh; 4. Fat, and 5. Flavour: but I am persuaded that the Cheviot breed will soon possess the most essential of these important requisites.

Mr Robertson of Ladykirk states it as his opinion, that at a distance from manure, in a tolerable climate, and with sound land, nothing will pay the farmer better, than plenty of good grass, occupied *by good Leicester sheep*, and by good West Highland cattle, or by well-bred short-horned oxen and heifers.

It is recommended as a useful plan, instead of permitting sheep to range over an extensive pasture, or even a large inclosure, to confine them to a seven days' shift. This limited range of exercise, it is said, fits them sooner for the butcher; and when the sheep are at all of a wild or active disposition, it is calculated that one-third more stock may be kept by this expedient.

Mr Church of Hitchill keeps a breeding stock of Leicester sheep, which he seems to manage with great judgment, following the example of the great English breeders in that line, which being well known, it is unnecessary to detail in this place. Mr Church considers the Leicester breed to be the best adapted of any, for inclosed arable farms, or for those in low situations indifferently inclosed, as they are easily confined. He conceives it more advantageous to stock his farm with sheep than cattle, as they are perhaps more profitable in themselves, and certainly conduce more to the enriching of the ground by their manure, in particular from their resorting to the high grounds of any farm, which are commonly the thinnest and poorest soil. In a dry season also, upon even a

bare pasture, they will thrive where black cattle would starve. An annual stock of sheep may often be considered preferable to a breeding one, in low warm situations, by rearing lambs for the butcher, and feeding their dams afterwards. But in any part of the country, remote from any good market for fat lamb, or for buying in a proper ewe stock for that purpose, the breeding plan, he observes, is the most convenient.

Having already given to the public my sentiments on the subject of the breeding and management of sheep *, it is unnecessary to resume that subject in this work. It is only necessary therefore to add, that where the carcase is the object, every prudent farmer will breed his sheep, free from that *extra* refinement, which tends to diminish the natural size of the animal, prevents them from feeding to the greatest perfection, renders their constitution too tender, and in some measure destroys their fecundity.

3. Horses.—A gentleman who is carrying on agricultural improvements with great spirit, in the neighbourhood of Penrith, is of opinion, that the breed of horses in Scotland, is infinitely preferable, for the labours of husbandry, to any he has ever seen in England; combining action and strength in a greater degree than any of the English breeds; and he is convinced, that, on an average, they may be kept at much less expence. They certainly possess greater physical weight than blood horses, or those crossed by them, and consequently are fitter for drawing. Their make is strong, and as they go through their work steadily, they are less likely to waste their strength than others are apt to do.

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* See address to the Society for the improvement of British Wool, inserted in a volume of Miscellaneous Essays, printed in 1 vol. 8vo. anno 1802.

In considering this important branch of the inquiry, it may be proper to explain the following particulars, viz. 1. The food given to farm-horses in Scotland; 2. The total expence *per* pair; 3. The advantages of working them abreast instead of lengthwise; 4. The quantity of work they are fit to execute; 5. The manner in which farmers in Scotland supply themselves with horses; and 6. Any articles of a miscellaneous nature.

1. *Food.*—With a view of diminishing the expence of feeding horses, besides oats, hay and straw, made use of so universally in other countries, the Scotch farmers have tried a variety of other productions, as 1. Potatoes; 2. Yams; 3. Carrots; 4. Yellow turnips; 5, Swedes; 6. Boiled barley; and 7. Whins; and not without success. They may at least be considered as useful, by diminishing the consumption of dearer articles.

Potatoes were tried for horses by Mr John Mackenzie of Glasgow, above forty years ago, sometimes raw, and sometimes boiled. The practice of steaming was not known in those days *. Mr Stewart of Hillside, in Dumfrieshire, has given potatoes to his horses for above thirty years. The quantity he gave was about 12 lb. at night, raw and washed clean, having given them a feed of corn in the morning. He thinks it a great improvement to have them prepared by steam; and he is convinced, that

* It is supposed to have been first introduced into Lancashire, by Mr Wakefield, and Mr Eccleston of Scarsbrick-hall. In the first volume of the Communications to the Board of Agriculture, printed *anno* 1797, there is an excellent account of their steam boilers, with a very accurate engraving of them, by Robert Beatson, Esq. They have since been brought to very great perfection, and carried on to a very great extent, by Mr Curwen of Workington-hall, in Cumberland.

when so given, the horses will do full work without corn, and will consume half less hay. His experience of this being recent, it is chiefly on the practice of one, whose account may be depended on, that he states it. The quantity of potatoes which serves a horse for twenty-four hours is 42 lb. About the 10th of June, the horses are begun to be fed on cut clover, and continue to be so till Michaelmas: they get no corn during that time, unless a feed when sent for lime, coals, &c.

Mr Robertson of Almon, with a peck of potatoes, prepared by steam, mixes chaff; and Mr Cuthbertson, a most intelligent farmer in East Lothian, observes, that if a feed of potatoes is given once a-day to work-horses, instead of one of the feeds of corn *, which must otherwise be given them in the months of March, April and May, it not only diminishes the expence of their maintenance, but is also extremely conducive to their health.

If potatoes at all answer the purpose, it is evident that *yams*, being much more productive, must be a still more profitable article to cultivate. It is well observed by a farmer, who did credit to his profession, (Mr Thomas Scott of Craiglockhart), that of late years yams have been by many substituted for the evening feed. He adds, that if work-horses can be subsisted with equal advantage on yams and Swedish turnips, what a promising prospect for increasing the growth of wheat, and bringing fields to a high state of cultivation, without losing a crop! One acre of yams or Swedish turnips will afford more subsistence to cattle, and be maintained, to horses also, than two of oats, or any other grain. By some, potatoes are preferred to the Swedes, being of a more laxative nature, and con-

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* Much depends upon the quality of the oats. Two feeds of oats of good quality is equal to three of light corn.

sequently better for horses when they are chiefly fed on dry meat.

Mr Gray of Gorgiemoor, on such soils as have too great a proportion of clay for growing potatoes to advantage, plants yams for his horses, and always keeps the land in open drills, from the time they are planted, till the crop is taken up, that is to say, without harrowing them down, as is done with the other drills; and, if it is not a very wet season, he has from thirty to forty bolls *per* acre.

In regard to the objection, that raw potatoes or yams, are narcotic and deleterious, and give the gripes to horses, that is easily prevented, by giving them when the horses are cool, and at first in small quantities, increasing them gradually for some days. They will then do no harm. If horses get, at the beginning, a full feed of them, more especially if they have not before been accustomed to potatoes, they are very apt to be griped, and sometimes fatally.

Mr Paterson of Castle-Huntly states, that he is preparing to steam yams and potatoes, which is coming much into practice in the Carse of Gowrie. He has no doubt that it will be a great saving in feeding beasts of every description, and, when deprived of their pernicious juices, abundantly wholesome. If given raw, to horses especially, they are one great cause of the tinge or gripes, which often proves very fatal, if not early attended to; bleeding, emptying the bowels, and laudanum, as far as half an ounce, however, never fails to cure that complaint.

Mr Alexander Maclaurin of Edinburgh strongly recommends steamed potatoes as food for horses, but the price has of late years been commonly too high. Mr Maclaurin received a letter in June 1795, stating, that steamed potatoes, mixed with chopped straw, were then the constant food for horses at Liverpool, and answered well.

Carrots are not much cultivated in Scotland; but it is admitted, that they are an excellent food for horses. Mr Alexander Guthrie, who cultivates them near Edinburgh, states, that for working horses, he knows no food equal to the carrot, and of this he has had complete experience. Were the growth of carrots general over the country, and used as food for working horses, he is of opinion, that two-thirds of the oats consumed for that purpose might be saved. In years of scarcity, this would be of great advantage to the nation, and a blessing to the poor.

The *yellow turnip* has long been cultivated in the northern parts of Scotland, particularly in Aberdeenshire and the neighbouring districts, where it is boiled with chaff, and inferior barley, and is given to horses at night.

It is well known that the *Swedish turnip* is a hearty food for horses, either given raw, or boiled, or steamed; and that horses are peculiarly fond of them. The following particulars, transmitted to me by Mr Hope of Fenton, in East Lothian, are not only decidedly in their favour, but worthy of particular notice.

For the three last years, Mr Hope has been in the practice of feeding his horses with Swedish turnips. In the spring months, when the horses begin to go two yokings a-day, he allows to each pair about one hundred weight, or seven stones. He has found, from actual weighing, that his average crops are about 25 tons *per* Scotch acre; thus, one acre, at the above rate of feeding, serves five pair of horses fifty days. When his horses receive Swedish turnip in that proportion, they always get a feed of corn less *per* day, which, at 6 d. *per* feed, or 1 s. *per* pair of horses a-day, gives L. 12, 10 s. *per* acre, for the value of the Swedes, at the same time fully one-third less of hay is sufficient. This saving, in the first instance, is not the only advantage; for he has uniformly found these valuable roots, are nearly equal to the finest grass in the month of June,

for putting horses into the highest condition for performing the severe labour common during the spring. Indeed, by substituting the Swedes for a feed of oats, his horses have been, for the last two years, in a better condition than he could ever make them before, although they had corn and hay in any quantity they chose to eat.

Some farmers also give to their horses *boiled barley*. This practice is very strongly recommended by Mr Rennie of Kinblethmont, near Arbroath, who gives his horses one feed or lippie * of oats, and *one lippie of boiled barley per* day. He was for a long time prevented from doing it, having formed an idea, that the high price of fuel would counterbalance any advantage attending the plan; but by using a considerable quantity of the refuse of great coal, which burns perfectly well in a well-constructed furnace, he can safely assert, that the expence of coals, for boiling one feed of barley *per* day, for eight months, will not exceed 5 s. for each horse; a sum never to be taken into consideration, compared to the difference in point of condition in which he has always found his horses under that system, compared to that of former seasons, when they had a feed of oats in lieu of the feed of boiled barley. Although he is clearly of opinion, that one lippie of boiled barley *per* day, is of great use to cart or plough horses, still he would not recommend more, it being well known that barley is very apt to scour horses too much; but the feed of oats completely corrects too great a tendency that way. The barley that is used for boiling, is all the inferior sort produced on the farm †. Mr Wilson of Simprin, who has had con-

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* A lippie is the fourth part of a Scotch peck, and weighs from 3 lb. 7 oz. to 4 lb. according to the quality of the oats.

† Mr Maclaurin has also used many bolls of barley for horses, never altogether by itself, for hard-wrought horses, but mixed with

siderable experience in the feeding of horses, has always found oats, beans, and hay, with *a mash of boiled barley in the evening*, the best feeding, when he wanted work done. Swedish turnips, or steamed potatoes, he found not only a cheap food, but sufficiently nutritive for young horses, and full grown horses, when doing little work.

The use of furz or whins has also been tried, and found to answer. Mr Allan of Craigcrook gives his horses, instead of hay, two stones of bruised whins, with three feeds of oats *per* day; and he affirms; that horses will be in better condition with that feeding, than any other that can be given them.

The soiling of horses, however, or giving them cut green food, (the nature and expence of which will be afterwards more fully detailed), has been found the greatest improvement hitherto tried in the feeding of horses; and, indeed, it is justly accounted one of the most important discoveries that has been made in agriculture.

2. *Expence of keeping.*—This varies according to the size and value of the horse, and the work required of him. In Caithness, the average expence is computed at L. 20 *per annum;* in the Mearns at L. 24; a respectable farmer, near Arbroath, makes the expence L. 27. Mr Blair

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oats and beans, when it answered well. He has very frequently also boiled it with beans, as mash for hard-wrought horses, mixed with bran, which is exceedingly salutary for them. He observes, that there is great nourishment contained in barley; it is very weighty, but it is thought too laxative for horses at quick hard work, to be used entirely by itself. A judicious mixture of it, however, among their oats, would improve that food exceedingly, and no doubt that horses would be able to stand their work better. But the price of barley, for these some years past, has precluded the general use of that grain in that way.

of Montague, near Perth, keeps his horses on cut grass, from 4th June until about the middle of October; an occasional feed ofoats is given when driving lime: for other two months hay and a feed of potatoes are given. During the short days in winter, good oat straw is substituted for hay; and as the days begin to lengthen in spring, hay is again allowed. Potatoes are then given, and one feed of oats; and when oat seed and two yokings are begun, two feeds of oats are given with potatoes, as before. The above feeding he estimates at 11s. *per* week, or L. 28, 12s. *per annum.* In the county of Wigton, the expence of keeping horses has been estimated so low as L. 15; but it is admitted, that a good farm-horse, properly kept, and fully wrought, will cost about L. 25 yearly. Mr Stewart of Hillside, in Dumfries-shire, calculates the expence at L. 17 : 15 : 2 *per* horse *.

Mr Newton of Currie-hill, near Edinburgh, states the expence as follows:

Half an acre cut grass, first and second crop,	L. 6	0	0
Thirteen bolls and a half oats, at 22 s.,	14	17	0
120 stones of hay in the spring months, at 15 d.	7	10	0
	L. 28	7	0

* It would require too much room, to enter into the details of all these estimates; at the same time, as Mr Shirreff well observes, it is not the price or total amount which deserves attention, but the quantities of grain, herbage and roots, which labouring animals actually consume, and which, if given to other animals in the same proportion, and of the same weights and powers, would probably preserve them in fair and working condition.

He puts no value on the straw the horse consumes during the winter months, as he conceives the dung to be an equivalent.

Mr Cuthbertson, who gives a very particular detail of the expence of maintaining a horse, estimates it at L. 39 : 0 : 7¼.

1. Soiling from the end of May to the 1st of November, - - - -	L. 12	0	0
2. Hay 1¼ stone *per* day, 30 days, 37¼ stones, at 1 s., - - - -	1	17	6
3. Corn, a peck *per* day for 30 days, 1 boll, 3 firlots, 2 pecks, at 30 s., - -	2	16	3
4. Corn for December, January, and February, half a peck *per* day, 2 bolls, 3 firlots, 1 peck, - - - -	4	4	4½
5. Straw for ditto, at 10 d. *per* day, -	3	15	0
6. Corn for March, April, and May, 1 peck *per* day, 5 bolls, 3 firlots, - -	8	12	6
7. Hay for that period, 115 stone, at 1 s. *per* stone, - - - -	5	15	0
	L. 39	0	7½

The corn usually given, and upon which this calculation is made, consists of oats and beans; when broken barley and beans are substituted, a trifling abatement may be made in the expence of feeding.

Mr Brown of Markle keeps twenty work-horses on his farm, besides two supernumeraries, in case of accidents. He has transmitted to me the following important calculation of the expence of a plough and pair of horses.

1. Expence of each horse when regularly fed, and constantly worked, at the prices afterwards stated:

	L. 35	0	10
2. Interest of money, and wear and tear of each, - - -	7	10	0
For one horse, - -	L. 42	10	10
Ditto, - -	42	10	10
Consequently for a pair of horses,	L. 85	1	8
3. Horse tax, smith's account, and expence of keeping up the harness and implements which belong to a pair of horses, -	12	0	0
4. The ploughman, including all emoluments,	38	0	0
Total expence of a plough,	L. 135	1	8

The following are the particulars of the above expence of maintaining each horse:

17½ bolls of oats *per* horse at 25 s., -	L. 21	17	6
100 stone of hay *per* ditto at 10 d., -	4	3	4
Pease and bean straw, - -	3	0	0
¾ acre of clover and tares, - -	6	0	0
	L. 35	0	10

The annual expence of a horse depends much upon the circumstance, whether corn is given him through the summer months. In Mr Brown's case, each of his horses consumes about 4 bolls of oats, between the end of May and the commencement of harvest. The prices are stated at the rates of the year 1810.

In Roxburghshire, Mr Walker of Wooden, and his brother Mr Walker of Mellendean, who keep in all no less a number than fifty working-horses, calculate the annual expence of maintaining a horse, at L. 34 : 11 : 10½, according to the following estimate :

	L.	s.	d.
Three feeds of oats *per* day, for 34 weeks; and two feeds *per* day for 18 weeks, is 16 bolls 2 pecks Teviotdale measure, or 21 bolls 6 firlots of Linlithgow measure, (6 Winchester bushels each),—at 20 s. *per* Linlithgow boll,	21	1	10½
Three-fourths of an acre of clover and tares, at L. 5 *per* statute acre,	3	15	0
One-fourth of an acre of Swedish turnips or potatoes, at L. 6 *per* acre,	1	10	0
Hay at mid-day, in spring,	1	10	0
Straw,	1	10	0
Shoeing,	1	0	0
Interest on price at L. 40, and casualties,	4	5	0
	L. 34	11	10½

This is independent of the expence of the implements in the working of which the animal is employed.

In explanation of the above statement, it is proper to observe, that these charges proceed upon the average prices of the different articles *in an inland part of the country*, where the value of many of them must be very considerably lower than in the neighbourhood of any large town, or seaport. Straw, for instance, is charged only at 30 s., which must appear extremely low, when compared with the cost of that article near Edinburgh, and yet it could not be fairly stated at more, 30 s. being as much as can be got for wintering a three year old ox in Roxburghshire. A great difference will also be found on comparing the charges for cut clover, tares, turnips and potatoes, with the prices of

the same articles elsewhere; but the prices above stated, are a fair average value of these articles in the neighbourhood of Kelso, excepting perhaps in regard to a few fields, immediately adjoining to that town. Even oats are worth at least 2 s. *per* boll less there than at a sea-port, or near a great market. These circumstances will sufficiently account for a very material difference in this statement, from those received from other quarters, which must always depend upon situation and a variety of other circumstances.

Such estimates throw much light on a most important subject; for, it is evident, that the rent of land, and the value of its produce, must in a great measure depend on the expence at which that produce can be raised. The calculations, however, must necessarily vary, according to the different values at which their food is estimated, and whether the price is charged at the rate of home consumption, or at the price which the articles would fetch at any adjoining market.

3. *Working lengthwise.*—Horses when working a plough in Scotland, are almost uniformly yoked a-breast. It is well known that animal power is more advantageously exerted, when employed separately, and near to the work; and that it is hardly possible, when horses are yoked one before the other, or harnessed at length, that they will pull equally. The line of draught of the fore-horses, indeed, being horizontal, and not at right angles to their shoulders, their full strength cannot be exerted, and a considerable portion of the power employed tends to act against, and to distress the horse next the plough or carriage; or, as Dr Coventry observes, a part of the power of the first horse is exerted, to press down the back of the one behind him, and a part of the strength of the latter to resist that pressure. More time also is lost, particularly in turning; in

short, it may be reckoned, that with equal ease, the two horses abreast, will do at least one-tenth more work, than the same horses will go through when placed in a line.

4. *Quantity of work done.*—This varies in different places, according to the soil and the nature of the work to be executed. In the Carse of Gowrie, it is calculated by Mr Peter Jack of Moncur, that ten horses are absolutely necessary for 161 acres of that strong land, which is only at the rate of 32 Scotch, or about 40 English acres *per* plough; but these horses, as is usual indeed in other cases, have various sorts of work to perform, as threshing, driving lime, &c. The land in fallow must be ploughed in general six times for wheat; for pease and beans twice; for oats after pease two or three times, and for barley three or four times; and they have to harrow about the same extent of land they plough. In wet weather none can be ploughed; otherwise, instead of cleaning or preparing the ground, it would increase its strength and toughness.

Mr Brown of Markle informs me, that in East Lothian the quantity of land usually ploughed by a pair of horses is, upon clay soils, about 40 acres Scotch measure, say eight acres summer-fallowed, eight acres under wheat, (succeeded by grass), eight acres oats, eight acres beans, and eight acres of wheat after the beans. This is a fair average, though, in particular cases, more acres have been cultivated by a plough than the number mentioned; yet, in many more cases, less is done: Hence 40 Scotch, or 50 English acres, is supposed a fair medium. On light land more may be done, though it is believed seldom more is executed, on account of the extra labour necessary at turnip seed-time. A farm with a variety of soils, partly clay, and partly light, has this advantage, that it may be possible to cultivate the latter, when the former could not be attempted.

Mr Dudgeon, Primrose-hill, in Berwickshire, states, that on an average, for six years past, the proportion of tillage, (that is, of land under corn and fallow), to each plough, on his farm, is at the rate of 52 English acres *per annum*, and that he expects to increase that proportion, when his inclosures and other improvements are completed. Mr Walker of Wooden calculates, that one pair of horses will work 50 English acres, besides their proportion of the other necessary business of the farm. Mr Nisbett of Mersington, on his farm at Stodridge, near Kelso, which is a light turnip soil, with six horses, or three ploughs, keeps in tillage 180 English acres, or 60 acres *per* plough.

The following is an abstract of the manner in which Mr Nisbett's farm of Stodridge is cultivated:

Rotation.

	Acres.
Turnips or fallow, - - -	60
Barley or spring sown wheat, -	60
Hay and cut grass, - -	60
Pasture, - - - -	60
Oats, - - - - -	60
Total, - -	300

This rotation of Mr Nisbett's is perhaps the best that can be followed. It divides the labour throughout the year, in a regular manner, which is partly the cause of his being enabled to do so much work with his horses beyond what is generally done. When lime for the land is to be led from ten to fifteen miles, the produce carried as far to market, and firing brought from a distance for a farmer's family and servants; such a proportion of land in tillage, however, could not be cultivated with that stock.

In order to ascertain the nature, and the quantity of work capable of being done by a pair of horses, Mr Hope

of Fenton, in East Lothian, drew up two diaries, one for a clay, the other for a light soil. The clay soil was supposed to contain 250 Scotch, or 318 English acres; the rotation as follows: 1. Fallow; 2. Wheat or barley; 3. Grass; 4. Oats; 5. Beans; and 6. Wheat; and, in that rotation, he calculated that it would be possible for one pair of horses to keep in cultivation 42 Scotch, or 53 English acres. The following gives a general view of the nature of the labour they might perform.

	Days.
1. Ploughing, harrowing, and rolling, -	165
2. Threshing, - - - -	47
3. Various works, as driving dung and fuel, marketing grain, corn and hay harvest, road works &c.	90
4. Sundays, - - - - -	52
	354
Days without work, owing to bad weather, holidays, &c. - - - - -	11
Total, - - - -	365

In regard to the light soil, it would appear from Mr Hope's diary, that a pair of horses, on such a soil, may keep in cultivation about 50 Scotch, or 62 English acres *per* plough. Much, at the same time, must depend, on the nature of the soil; for a dry sandy loam requires more attention to keep it clean of root-weeds, than a dry gravelly soil.

In many parts of the country, however, the number of idle days, as stated by Mr Hope, are considered to be too few; and it is stated by a farmer who has long paid attention to these matters, that instead of eleven days in a year, one day *per* week, besides Sundays, on the average of seasons, would be nearer the mark; as there are many days and half days, equal on the whole to one in the week, du-

ring which the farmer derives but little benefit from his servants and horses. There must also be a difference of several days in the year, between the eastern and the western coast of the kingdom, owing to the greater humidity of the climate of the latter, and some acres less work will be performed by a pair of horses *.

5. *Mode of Supply.*—From the high price of horses, a number of farmers in Scotland endeavour to rear, on their own farms, a considerable proportion of the stock they require, though in many districts they depend on the western counties of Scotland, and the northern counties of England, for a supply. In the Carse of Gowrie, it is usual to keep a spare horse on every farm, in case any accident should happen to the other horses, and to assist a mare or mares with foal, one or two of which are kept on each farm; by whose produce, the stock of horses is for the most part kept up. The farmer, therefore, has seldom any occasion to go to market for any other supply, excepting when he loses horses by accident, which often happens. In other parts of Scotland, farmers keep breeding mares with the same view; and when attentive to their business, they find an advantage in it. This plan, however, requires more attention than every farmer can pay to it; and, above all, it is necessary, that both the mare and the stallion should be of the best cart-horse breeds, crossing with half-bred stallions producing a very inferior stock.

Some farmers object to the plan of breeding, because they lose the work of the mare wholly for five or six weeks, but this is fully made up by the work of the young horses when two or three years old; and in this way they not only supply themselves, but they are also enabled to sell

* Mr Curwen thinks, that thirty English acres are sufficient, on strong clay, for a pair of horses, on the coast of Cumberland.

their work horses, when at a high value, and sometimes an extra young one, which thus becomes a regular part of the return of a farmer.

Aware of this objection, Mr Allan of Craigcrook has begun to try young horses with cows' milk, which he thinks a great advantage, indeed he has thus reared the best foal he ever had *. It is a great saving, as the mare can be worked a few days after she foals. One cow is sufficient for a foal. The foal and cow should go together; for the first fortnight, the foal should be fed four or five times a-day, afterwards three times a-day is sufficient; the milk to be given warm from the cow. If this system be carried on attentively for four or five months, there is no doubt but the foal will be fully stronger than by suckling the mother. A great risk is also avoided, namely, that of purchasing a bad substitute for the mare. It might likewise be a good plan, on a farm where two brood mares are kept, to let one of them alternately suckle the foal herself, while the other was brought up by a cow. By that means the mares would get a rest every two years by suckling the foal themselves, and the work of one of them would always be saved.

Some farmers in Wigtonshire, accustomed to import horses from Ireland, are in the habit of frequently changing, (at least a part of them), by which means they in some degree exempt themselves from the article of wear and tear, by a judicious mode of buying and selling. Where mares are chiefly purchased, and occasionally bred from, this may be done with some profit. The best farmers, however, avoid this practice, as incompatible with regular farming; for though breeding of horses to supply the farm is in many

* This practice is, I understand, known in Yorkshire. In many cases, however, the cow's milk must be as valuable as the mare's labour.

cases a proper plan to adopt, since the prices of horses have become so high, yet frequent change of horses, or, in other words, *horse-dealing*, is not to be recommended.

6. *Miscellaneous Articles.*—An intelligent farmer in the Mearns has adopted a mode, by which he is of opinion that a considerable deal of labour may be saved. He keeps five horses; and by them nearly as much labour is done, as by six, according to the usual mode of employing them. One horse is employed in carting turnips during winter, or in other necessary farm-work at other seasons, without the necessity of reducing the number of ploughs. In carting dung from the straw-yard, three carts are used, one always filling in the yard, to meet the return of another empty; when the leading horse of the empty cart is unyoked, and put to the full one, by which means five horses may be said to do the work of six. In the same manner, while one pair of horses is drilling for turnips, the other three are employed in putting the dung upon the land, either with two or three carts, as the situation of the ground shall require *. By extending the same management to other farm operations, he conjectures that a considerable saving of labour might be effected.

The grinding of corn or beans for horses, more especially when they get aged, and begin to lose their teeth, deserves to be recommended as a most excellent practice. The horses thus receive the whole nourishment; whereas, when given whole, many devour their corn entire, and it is seen to pass through them as they swallow it. Cutting straw into chaff may also be adopted with advantage.

It is more the practice in Scotland than in England, for the farmers to give straw to their horses, though it is said

* It is necessary that the drills should be formed up immediately after the dung is spread, that the sap may be retained.

that wheat straw is better fodder in England than in Scotland; the English cutting it knee high, and only giving the slender succulent part of the stalk to the cattle *. A large proportion of the farm-horses in East-Lothian, and other districts, are maintained on pease and bean straw, during the winter months; but as that species of food loses its juices in the spring, hay must then be introduced. In regard to straw, the following observations have been transmitted to me by an intelligent correspondent who resides near Edinburgh. He makes it a rule to sell all his straw, excepting what is ate by his own horses, and to buy dung. He gets for oat straw from 10s. to 15s. a kemple, and for wheat from 8s. to 10s. *per* kemple, or from 5d. to 6d. *per* stone. A kemple weighs about 18 or 19 stone, although the regulations in Edinburgh market require that it should be only 16 stone. He never sells any barley straw, as he thinks it a better food for horses and cows than oat straw, although it does not bring so high a price by 3s. or 4s. a kemple: indeed, from experience he finds, that when he runs short of barley or wheat straw, his horses do not eat the oat straw for a night or two; and he is convinced, that the preference given to oat straw, is not from its intrinsic value, but from the practice of our forefathers in doing so, and very properly at that time, as the oat crop was always the worst cleaned land, and full of couch and other natural grasses, which made the fodder better.

On the whole, the best and most economical mode of maintaining and of working horses, and the utility of employing oxen *partially* in the cultivation of land, are points of infinite consequence to the farmer and to the public. It

* It is also said, that the farmers in England cut their wheat somewhat greener than those in Scotland, which preserves more of the natural juices, and of course makes the fodder better.

cannot be questioned, that the more cheaply produce can be raised, at a lower price it can be furnished to the public, without injuring the interests of those by whose exertions it is raised. At present, we are under the necessity, for want of attention to the cultivation of our wastes, to import great quantities of oats from foreign countries, which has contributed to render the rate of exchange unfavourable; but such an importation would be rendered perfectly unnecessary, if, either by an universal employment of two-horse ploughs, or single-horse carts, every third horse might be saved; or if horses could have one feed *per* day of potatoes, yams, carrots, &c. instead of oats; or if the partial use of oxen were adopted.

4. Hogs.—The breeding of hogs was formerly but little attended to in Scotland. In the counties bordering with England, however, and in all the more improved districts in Scotland, the prejudices which were formerly entertained against this species of stock have in a great measure died away. One farmer in Roxburghshire informs me, that he keeps six or seven breeding swine; and in Dumfriesshire, and the western counties, a considerable number of hogs is kept, by which the quantity of Westmoreland hams, so celebrated in the London market, is said to be considerably augmented. On the whole, it may be accounted one of the defects in Scottish agriculture, that so profitable an animal as the hog, which thrives upon refuse which no other animal would consume, and the value of which is in a manner all clear gain, should not be more attended to.

An intelligent farmer informs me, that he keeps from five to seven breeding swine, and disposes of most of their produce, when from six weeks to three months old; considering this system fully as profitable as fattening them for sale. He generally has a good demand for them at

these ages, as many people, such as tradesmen, villagers, &c. wish to fatten a pig or pigs, that could not conveniently keep a breeding sow. Having this advantage, there is scarcely a cottager or weaver's family in the neighbourhood, who have not their fat pig killed, after being fed on the refuse of their potatoes, and the offals of their kitchen, to the weight of from eight to twelve stone.

Another correspondent states, that on a small farm, of twenty-two Scotch acres, he has often fed from six to ten hogs, besides rearing a number of pigs, which he annually disposes of. In addition to the profit thence to be derived, the quantity of excellent manure he raises, is the wonder of all the neighbourhood.

There is reason to believe, that the scarcity of pigs in Scotland, is partly owing to the want of information upon the subject. That obstacle, however, is now removed, a very valuable treatise on the breeding and management of swine, having lately issued from the Scotch press *.

Sect. IX.—*On the Soil, the Climate, the Elevation and Exposure, and the Situation of a Farm in regard to Markets.*

Besides all the particulars above enumerated, there are several objects of a miscellaneous nature, which will require the attention of the farmer, before he commences his arable operations, on any particular farm. These are,

* See Treatise on the *Breeding of Swine* and Curing of Bacon, with Hints on Agricultural Subjects. By Robert Henderson, Farmer, Broomhill, near Annan. Printed an. 1811.

the soil of the farm, its elevation and exposure, its climate, and its situation in regard to markets. It is evident that there must be such a diversity regarding these points, that it is hardly possible to lay down any general rules that can be applied to all cases; and yet the system to be adopted by the farmer must, in a great measure, depend on a due consideration of these circumstances combined. In point of fact, it is by his attention to these circumstances, that the good farmer is distinguished from the bad one.

Soils may be considered under the two great divisions of strong and light lands, though there are many intermediate shades between them. The crops to be cultivated in each, as well as the mode of management, must differ materially; for instance, it is a general rule, that wheat ought to be the basis of profitable husbandry in strong, and barley in light lands. In the latter species of soil, there is no difficulty in keeping the land free from weeds, by means of fallow crops; in the former, a summer fallow, once every six years, is considered by all the most intelligent farmers in Scotland, as essentially necessary to keep the land clean.

The importance of climate to a farmer need not be dwelt upon. In many parts of Scotland, wheat cannot be raised to advantage, and in some cultivated districts it has never been attempted. In some districts it is also necessary to sow, instead of the two-rowed barley, the inferior sort called bear or big; and oats, from the hardy quality of that grain, is found to be the most profitable article. In others, pease or beans cannot be cultivated, from the periodical wetness of the autumn. In short, without great attention to the nature of the climate, no profitable system can be laid down by any occupier of land *.

* On this subject Mr Stewart of Hillside observes, that we ought to do more justice to the industry of our forefathers, who

The farmer must also suit his system to the elevation, and even the exposure of his farm. The same plan will not answer at forty and at four hundred feet above the level of the sea; nay, much may even depend on the exposure of a farm, when situated in a hilly district. Where the soil, the climate, and the elevation is similar, the same crops cannot be cultivated with equal advantage on the northern, as on the southern side of the same hill.

The farmer must also take into his consideration, the articles most likely to suit the markets in his neighbourhood, or any others to which the produce of his farm can be sent; for instance, if there is no demand for fat cattle in the vicinity, he must employ his turnips in feeding young cattle, to be sent to other districts where they can be prepared for the butcher. On farms in the interior of Scotland, where wheat is not much in demand for bread, and where markets for that article are not accessible, either by good roads or water carriage, the culture of wheat is not to be recommended, and oats will be found, not only less exhausting to the land, but also more profitable.

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grew corn in such situations, and high climates, as we see were cultivated by them. Our modern farmers would think it labour lost to attempt ploughing, where we see there were ridges and furrows some centuries ago, and crops raised, without the aid of lime, which would now be considered impracticable. To account for this, and for the necessity of ascending so high with cultivation, is not easy. The lower grounds may have been too much wooded, which might occasion mildews, and these woods approaching the high grounds, would moderate the climate there. Certain it is, that for the two or three last years, the crops raised on the highest grounds of Dumfriesshire, have been more productive than on the holms of the dales.

CONCLUSION OF THIS CHAPTER.

What a field of reflection presents itself, on considering the various topics discussed in the preceding Sections; and what advantages would redound to the public, from their being properly attended to, in every part of the united kingdom? The judicious position of the houses and offices of a farm,—their construction,—the proper arrangement of fields,—and inclosures judiciously planned, as appears from the preceding observations, add much more to the value of a farm, than on a transient view of the subject could be imagined. By a judicious system of draining; by good roads; by well-constructed instruments of husbandry; by the choice of proper live stock, and a due attention to their maintenance, the profit of the farmer must also be considerably augmented: and by combining, with a proper attention to all these particulars, a due regard to the soil, the climate, the elevation and exposure, and the situation of a farm in respect of markets, the farmer is enabled, to lay the foundation of a system, which will prove the source of his future prosperity.

Farmers have been too often ridiculed as a stupid and ignorant race; whilst, on the contrary, they are, in the more improved districts of Scotland at least, so well versed in the details of their profession, that there is scarcely a class in the community distinguished by a greater variety of knowledge. Instead of considering a *real farmer*, indeed, as an ignorant clown, he ought to be accounted, not only the most valuable, but also one of the best-informed individuals, regarding all those *useful arts*, on which must depend the prosperity and happiness of a great country.

It is now proper to explain the means, by which the knowledge a farmer may acquire, can be made use of to the best advantage, in the cultivation of arable land.

CHAPTER II.

OF THE PARTICULARS CONNECTED WITH THE ACTUAL CULTIVATION OF AN ARABLE FARM, AND THE MOST ADVANTAGEOUS MEANS OF MAINTAINING ITS STOCK.

AFTER an attentive and intelligent farmer has arranged the system he is to adopt, regarding the various particulars discussed in the preceding Chapter, he will next have to consider, the plan he ought to pursue, regarding the actual cultivation of his farm, and the most advantageous means of maintaining his stock. The following are the points which require his attention.—1. Ridging his fields; 2. Manuring; 3. Ploughing; 4. Fallowing; 5. The Crops to be cultivated; 6. The Rotations to be adopted; 7. Sowing and covering the seed; 8. Weeding; 9. The harvesting of the grain; 10. The preparing it for market; 11. Soiling or feeding his stock with cut green food; 12. Whether it is proper to have any part of his farm in permanent pasture; and 13. The best mode of making hay.

In discussing these particulars, the most important points, connected with the Scotch System of Husbandry, will be explained.

Sect. I.—*Of Ridging.*

The general advantages to be derived from ridges, have been very ably stated by Lord Kames, in his Gentleman Farmer, (Chap. IV. Sect. 3.) It is only necessary, therefore, in this place, to explain those more minute particulars, which have not hitherto been so much dwelt on, and which, without the assistance of a number of practical farmers, it would not have been in my power sufficiently to have elucidated.

On dry soils, ridges are of use merely as lines for marking out the operations of the plough, and the sowing and reaping; the nature of the soil, which is apt to suffer by want of moisture, rendering any sort of draining, which the furrows might afford, prejudicial rather than advantageous. Indeed, where grain is sown by drill-machines, ridges are not required for sowing the grain, as the drill itself, or a marker attached to it, regulates the operation: lines, however, may be of use in sowing the grass-seeds afterwards. But ridges are essential in wet soils, operating as open drains, without the assistance of which, the crops would rarely be productive in rainy seasons. It is of infinite importance, therefore, to the farmer, to be fully master of the rules by which ridges can be formed to the best advantage. This subject may be considered under the following heads: 1. The proper length of ridges; 2. Their breadth; 3. Their straightness, and the best mode of altering the shape of crooked ridges; 4. Their height; and 5. The advantage of ridging diagonally where the ground is steep.

1. *The proper length of ridges.*—The length of a ridge must vary, according to the size of the inclosures, the acclivity of the ground, and the nature of the soil, whether wet or dry.

On fields which have much acclivity, a long ridge is hurtful, not only as tending to fatigue the horses, and to overstrain them in their wind, but also because, after the ground is ploughed in winter, if much rain or snow falls, the surface of the ridge will be injured, more especially in the furrows, by the long-run, and large collection of water, by means of which the finer particles of the soil are washed away, and either carried off the field, or lodged on the head-land at the bottom. In such situations, ridges of about 150 yards are found to be most convenient *.

In regard to wet soils, where the ground is flat, from 240 to 300 yards is considered to be the proper length: If it should exceed 300 yards, the water might not easily get away; and if the field is longer, it is necessary, either to make a head-ridge across the hollow of the field, so as to form a level for carrying off the extra moisture, or, what is still better, without a head-ridge, to have transverse gripes or small open cuts, to conduct the accumulated water to the ditch, on one side or other of the field.

In dry soils, and where the land is level, the ridge may be still longer, and indeed some recommend from 700 to 800 yards; but, on the whole, from 350 to 400 yards seems to be preferable: When it much exceeds the latter size, the horses are apt to be fatigued, and with such a length, as little time is lost in ploughing and turning as could well be desired. Besides, when the ridge is very long, it becomes more difficult to sow, and it has a tendency to discourage the reapers.

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* Remarks by Mr Stewart of Hillside, and Mr Charles Alexander of Easterhaprew.

2. *The breadth of ridges.*—This is a subject on which there is a great diversity of opinion, in some cases only four, in others thirty feet and upwards, being recommended. As the question is of great importance, it may not be improper to state the reasons urged in favour of the different sizes, leaving the reader to judge, from the statements laid before him, which ought to be preferred.

It is maintained by one intelligent correspondent, that when land cannot be drilled or sown before the 20th of October, it is better to plough in the wheat on four feet ridges. On wet soils, this is advisable, because small ridges keep the seed dry * ; and in thin soils, because it increases the staple; for by this system, the soil of five feet is put on four ; and from many years' experience, it is contended, that the produce is as great, as if the whole land had been under crop.

Others contend, that in the case of poor clayey wet soils, the ridges should be made six, or at the most seven feet broad. It leaves the soil equally distributed, and the grain is equally healthful, from the furrow to the middle of the ridge ; nor does it matter what is the direction of the declivity, for the grain, having all the benefit which the sun can give, will ripen equally, which is not the case in high gathered ridges, lying from east to west. Indeed plants are invariably more healthful upon narrow, than broad ridges ; and whoever will be at the trouble to examine a field of corn much lodged, will always find the most standing corn next to the open furrows, and the most laid or lodged towards the middle of the ridge. This plan is affirmed to be the best in every respect, except for sowing broad-cast, which, however, can be done very well by a careful and experienced seedsman. In drilling, a machine can be made of the required breadth. In reap-

* The idea of ploughing wheat in, or under, upon wet soils, is strongly objected to, as the land must be greatly poached by the operation of ploughing, more especially where the ridges are small.

ing, it has a great advantage, that each reaper may have a separate ridge.

On wet land, a correspondent recommends ridges 8 feet broad, to be ploughed crown and furrow. It is not necessary, he contends, in that breadth, to clean out the furrow; for there may be left, without any loss, a narrow slice, which would require another bout of the plough to finish. This is easily torn asunder by the harrow. There is a certain loss in cleaning out every furrow in the finishing ridges, on wet land, unless one horse is yoked before the other, as the horses must unavoidably trample the land on each side the furrow, and water lodges in their footsteps. No loss has ever been sustained by leaving that slice, as has been fully exemplified, by the practice of some eminent agriculturists in East Lothian *.

Others maintain the superiority of 12 feet ridges, even in dry soils, whilst under tillage, for on them an able seedsman can always command the seed, even in a strong wind: such a size also, is well calculated for the drill system of husbandry.

In some parts of Roxburghshire, 14 feet ridges are preferred, both for expedition in reaping, and regularity of sowing; and a most respectable farmer in that country states, that when a young man, he was accustomed, for many years, to sow a great part of his own farm, and if there happened to be any wind, (particularly a check-wind), neither he, nor any one employed with him, could ever sow a ridge of 18 feet, going once about, so as to give satisfaction; hence he was induced to adopt ridges of

* I am informed, however, that it is not uncommon to take up the last furrow with one horse. The utility of clearing out the furrows, on wet soils, is self-evident. Indeed, what is the use of a furrow between ridges in *wet* soil, if it be not cleaned out, to allow the water to escape?

14 feet, to prevent the seed from being unequally laid down. In Roxburghshire, however, they are more apt to be troubled by wind, than in the flat districts on the sea-coast.

Mr Wight of Ormiston, on wet soils, particularly thin wet clays, upon a retentive subsoil, has always found a ridge of 15 feet preferable to all other breadths. He is of opinion, that it is as easy to keep it dry as one of 10 feet, and easier than one of 18; that the furrows are not more bared than the 10 feet, and not so much as those of an 18 feet ridge. The 15 feet can be sown at all times with once going about, even when there happens to be a check-wind, which is not the case with an 18 feet ridge. The narrower one of 10 feet, will also require once going about, or up and down, which is a considerable loss of time; as the seedsman will sow equally well, in two-thirds of the time, a space of 30 feet, contained in two 15 feet ridges, than is necessary for sowing the same breadth contained in three 10 feet ridges. An 18 feet ridge sometimes requires three casts, which the 15 feet one never does. Two harrows completely cover the 15 feet ridge, once about. If a field of 40 ridges, 15 feet broad each, require ten hours to sow and harrow it, the same field, of 60 ridges, at 10 feet broad, will require fifteen hours for the same operations. The 40 ridges will require 79 turnings of the sower and harrows, and 41 turnings of the water-fur plough. The 60 ridges will require 119 turnings of the sower and harrows, and 60 turnings of the water-fur plough. Besides, in all the other operations of the plough, one-third fewer *feerings* * are required for the one than the other. Three

* *Feering* is a provincial term, meaning that part of ploughing given in forming the ridges; in short, the first *two bouts* of the plough, whether the work is given along or across the field. The ploughmen are much valued, who are the best at this operation.

reapers are sufficient for the 15 feet ridge, the proportion of breadth not being wider than these can easily take. The 18 feet ridge is always oppressive to three reapers, and three reapers, on a 15 feet ridge, will seldom be behind four reapers on an 18 feet ridge, from each reaper in the latter case being obliged to stretch over 6, in place of 5 feet, to accomplish the proportion. On these grounds, Mr Wight is of opinion, that in wet soils and climates, the 15 feet ridges are preferable to all others.

Where land is of a loamy quality, but not wet, Mr Rennie of Oxwell Mains also prefers ridges 15 feet broad, as three reapers can easily work them, and they can be ploughed as described in the plan of 8 feet ridges. On land that is ploughed crown and furrow, the grain is equally good on every part of the ridge; but when rounded, and gathered up from the furrow, the grain is not only of inferior quality, not getting the sun equally, but owing to the thinness of the crop, is with difficulty taken up.

Another intelligent farmer, gives the preference to 16 feet ridges, which, he contends, can be more correctly sown with two casts than the 18; besides, two gatherings from the level, lays them in a safe dry position; whereas, with 18 feet ridges, on flat strong clays, in a moist climate, two gatherings and a half are absolutely necessary.

Others prefer a ridge of 17 feet in breadth, as the best size for any soil. They urge, that in narrow ridges, upon wet land, much damage is done, when taking up the furrows, by the horse travelling so much upon the ploughed land, as they are compelled to do, when the ridges are made 10, 12, or even 14 feet broad, and much time is lost in so many turnings and finishings: That if the land is wet, and requires to be laid dry in winter, two gatherings, if judiciously ploughed, will lay the ridge high enough for throwing off the water: That when sown, it can be accurately done with two casts, even in windy weather, and that three

reapers, one man, and two women, can work on it without interruption : Indeed, where only two men are employed by the piece, they universally agree in this particular, that they work with more freedom, and can perform, they affirm, more work, than if three men were upon a ridge, as each man cuts the precise half of it. In short, whether upon a wet or a dry soil, it is maintained, that a 17 feet ridge, is by far the best for ploughing, harrowing, sowing and reaping.

Farmers, however, in general, on soils of a strong or clayey nature, prefer ridges of 18 feet. This breadth they consider to be the most advantageous for preventing wet, and for dunging, sowing, harrowing and reaping. In regard to wet, there is a sufficient width to admit of a gentle slope on each side, effected by twice gathering the soil when ploughed, by means of which the surface water soon gets down into the furrow. The dung also can be easily spread over the surface of such a ridge. As to sowing, it may be done by two casts of the seedsman, unless in high winds. A pair of well-made harrows cover the ridge at a bout *, or once up and down the ridge, and three reapers are found a sufficient number to cut the grain, the centre one making ropes or bands for all the three, and none of them having far to go to lay in the corn they cut down : at the same time, where the crop is abundant, it is the most approved custom in East Lothian, to put four reapers upon such a ridge, and to cause two of

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* A farmer in Roxburghshire states, that his harrows will not completely cover more than 12, or at the utmost 14 feet, at once about; and that when he harrows ridges of 14 feet, he is under the necessity of putting on five harrows, otherwise the work would not be done to his mind. The size of the harrows, at the same time, might certainly be enlarged.

them to lay the corn into one band, or, in other words, to have two rows of bands upon one ridge. In no other way will sheaves be made of a small size, and small sheaves are an important matter, especially in a wet harvest. It is a circumstance strongly in favour of an 18 feet ridge, that a farmer, near Dalkeith, who had been induced to try, on two different fields of 12 acres each, ridges of 10, and even of 15 feet, was convinced, he said, *by dear-bought experience of his error*, and had them all made up again into 18 feet ridges, twice gathered, and with his former good success. A neighbour of his, after several years' trial, was obliged to adopt the same practice.

But, though Mr Brown of Markle concurs with other eminent agriculturists, in preferring 18 feet ridges in wet or clayey soils, yet where the soil is deep enough to bear three gatherings from the flat, without sustaining injury, he is of opinion that a breadth of 24 feet may be adopted with advantage. Indeed, a great many of the ridges straighted by Mr Brown, are of that size.

On very dry porous turnip soils, it is of little importance, as has been already observed, whether ridges are formed at all, unless to regulate the sowing and cutting down in harvest *. An intelligent farmer in Dumfries-shire, (Mr Church of Hitchill), when the soil is dry, has his ridges in general 30 feet wide; and Mr Rennie of Oxwell Mains considers 30 feet to be the proper width in such soils, as it saves time in ploughing, having fewer furrows to clean out in the finishing the ridge; it also saves time in the forming the ridges, when the land has been cross-ploughed; and it keeps more moisture in the land than ridges of a less width.

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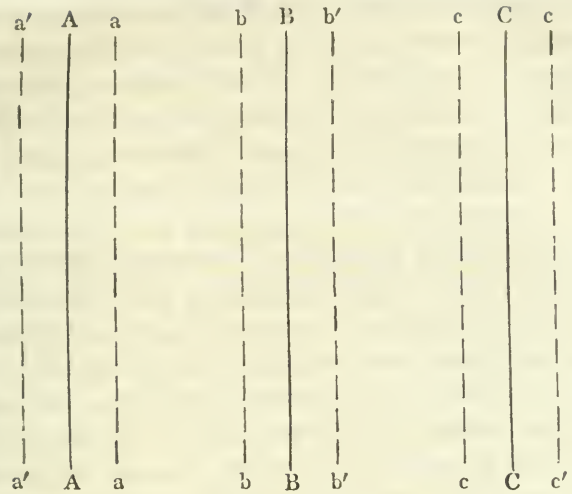
* Remark by Mr Hunter of Tynefield.

In regard to ridges of still wider dimensions, namely, from 30 to 33 feet, as recommended by the celebrated Arbuthnot, that subject, in so far as regards strong lands, has been already discussed in a former part of this work, (See Chap. I. Sect. V. p. 52, 53), to which the reader is referred.

It is objected to broad ridges, that a ridge twenty-four paces wide cannot be ploughed so soon by an hour as two ridges twelve paces wide, because much loss of time is experienced, at each end of the field, from the plough having to move so many yards out of its work, before it arrives at its proper situation for re-entering again the land, whilst little or no loss of time is experienced, in the plough and horses swinging about to enter their work again, in a ridge twelve paces wide. But Mr Kerr obviates this objection by the following simple expedient: Supposing two broad lands, say of 60 feet, marked out by the furrows ABC. One ploughman begins along A, and ploughs the land, always turning round the points AA, keeping his right hand constantly to AA till he has ploughed 15 feet on each side of the furrow to aaaa. The second ploughman has been doing the same round BB, and the third round CC. All now change their stations. The first takes the space between aa and bb, keeping his right hand alternately to BB and to AA. The second does the same between b′b′ and cc in the same way; and so of the rest. In this manner, there is no more travel in a 60 feet ridge than in one of smaller dimensions.



It is evident, in addition to every other consideration, that the breadth of ridges must also depend upon the mode of culture. Where the broad-cast system is followed, the size must be calculated for enabling the sower to scatter the seed, in the manner the most likely to yield a productive crop *. Whereas, when the drill system is adopted, the breadth must be adjusted to the size of the machine. In wet or tenacious soils, it is an excellent plan, to have the horses walking in the furrows of a ridge, and drilling the whole at once.

The only other point that remains to be mentioned is, the method of ploughing wet land, where the ridges have been gathered high for the preceding crop. Some cross the ridges, and open the old furrows afterwards, but that is not so good a plan as cleaving the ridges, and opening the old furrows, after going a round or two, which leaves the old ridges divided in the middle. This method keeps the

* It is said, that a good sower will scatter the seed sufficiently correct in ridges of any breadth; but they are not always to be met with.

field equally dry, levels the land better, and gives an opportunity for crossing in the spring if necessary. But if the land is wet, it would not be advisable to risk cross ploughing, unless when the land is summer fallowed. I am informed, however, that few good farmers ever hazard the clearing of clay soil, except in the summer months.

3. *Straightness of ridge.*—It is extremely material to have the ridge as straight as possible. Mr Curwen justly remarks, that it is the very essence of good ploughing to hold the plough even, which it never can be, if it has to work in a curve. It is calculated that ridges, when much crooked, measure one-fifth more in the serpentine direction, than when taken in a straight line, and consequently they must take one-fifth more labour in ploughing, harrowing, &c. than if they had been perfectly straight. That does not imply that there is more land in the field. No form of ridges can alter the quantity within the same boundary; but their form tends to impede the operations of the plough as much as that addition to the land. In ploughing such ridges, every farmer who has had a plough in his hand, knows how awkwardly the plough moves in them. In the convex side it constantly inclines to take too narrow a furrow, and in the concave side the reverse, owing to the direction of the draft being different from the direction of these sides.

In regard to crooked ridges, many ridges, in the best cultivated parts of Scotland, were formerly very broad, much raised, and greatly curved. Levelling such ridges, in very stiff wet clays, was a very difficult operation, and unless executed with considerable skill and judgment, productive of loss. It should never be attempted but in a year of fallow, and the straightened land should get a full dose of calcareous manure, and much cross ploughing, to mix the old and new staple, and to rouze the fertility of the new soil.

4. *Height.*—It is highly necessary that ridges, on wet land, should be well rounded, so as to form the segment of a circle. This is effected by gathering the soil once or twice, according to its dryness or wetness, in the course of ploughing the ridge. Indeed, Mr Rennie of Phantassie has often gathered the soil thrice, with much success, especially for a spring crop, as it not only lays the land dry through the winter, but enables the farmer to get sooner at it in the spring. The height, however, should not be too great, only sufficient to furnish a declivity to let off the water; for when the crown is raised too high, one half of the ridge is always covered from the sun, (a disadvantage which is far from being slight in a cold climate), and the crop, which is always best on the crown, is more easily shaken by the wind, than where the whole crop is of an equal height *. In arable culture, the more the equality of the soil, (which cannot happen where the ridges are high raised), the more equal will be the crop, and the more abundant will be the produce †.

5. *Line of direction.*—The last point regarding ridges, which it is necessary to consider, is, the line of direction, more especially in steep grounds. In such situations, it has been found a great advantage, both for the facility of ploughing and for draining, to plough diagonally from left to right: the furrow going up the hill, falls off from the plough, the horse has better footing, and less pull, and the furrow catches the running springs ‡. This is particularly to be attended to in the case of drilled turnips; for

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* Gentleman Farmer, p. 74.

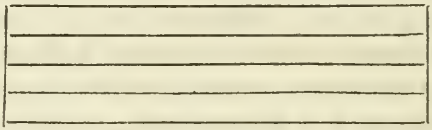
† Remark by Mr Charles Alexander, Easterhaprew. It is a great disadvantage, when ridges are too much rounded, that the sun cannot act equally upon the crop.

‡ Remarks by Mr Stewart of Hillside.

owing to the many furrows between the drills, when the turnips are eaten off by sheep, not only the soil, but their dung and urine, are carried off, which greatly augments the evil. Besides, where the field is steep, the dung for the turnips can be much easier carted on diagonal ridges *.

In regard to steep banks or declivities, there are four modes in which the ridges may be laid out.

1. *When they are planned on the same line or level, thus :*



This is done partly with a view of preventing the soil and manure from being washed down, and partly from the idea, that it is easier for the cattle to work it. But it keeps up the water in the furrows, and is an awkward mode of ploughing. Sometimes this sort of ridge is carried all round a small hill in a spiral form, beginning at the bottom.

2. *When the ridges are straight up and down.*

This is a very improper mode. The soil and manure are both apt to be washed down, and when the plough is going up, the earth makes such a resistance, that it is extremely difficult for the cattle to cleave the ground without the utmost exertions.

3. *From the top of the bank sloping to the left.*

* Remark by Mr Charles Alexander.

This mode also does not answer, for when the plough is going up, the ploughman is obliged to force the earth against the bank, which makes but very indifferent work; and it cannot be done without injury to the cattle.

4. *From the top of the bank sloping to the right.*

This is the proper plan to be adopted, for when the ridges are laid in this manner, the ground always falls from the plough, as it goes upwards, without any great exertions on the part either of the ploughman or cattle. The ground is not forced against the bank, until the plough is coming down, and then it is done with so much more ease, that one-third less strength of cattle will plough an equal quantity of land.

Some farmers, however, when a field is very steep, plough only down hill, the plough being drawn up hill empty. By this method the horses travel up hill in less than half the time they could go with a furrow, and by being quite fresh at the top, they come down with spirit; and by giving the direction a little to the left in going down, the furrow falls away from the plough freely, every inch of the soil is perfectly raised, and lies so close together, that lying in that state for one year in some soils, and in others for two years, the sod rots, and being all laid one way, cuts easily by the plough; whereas, when attempting to plough against hill, the ploughing is not half done, grows up in grass, and, when cross ploughed, makes a bad appearance. The fighting against the hill also, hurts a horse, in one day, more than three days' ploughing in the way pointed out. Only one-fourth of the time is lost, but that is doubly repaid, by getting the work properly done, and the advantage in the after ploughing. Mr

Blackie of Holydean in Roxburghshire, who makes this remark, states, that he has cultivated a great deal of ground on this principle, and that he is never afraid of any land, however steep, if there is soil enough; *and that by this mode land may be ploughed, which would otherwise be impracticable.* In similar situations other judicious husbandmen prefer ploughing in diagonal ridges, so constructed as to admit of ploughing up hill without material injury to the horses; and in this way the furrows are much less apt to be run away or sanded by heavy rains. Where the land is excessively steep, it is often necessary to plough directly across, throwing the plits or furrow slices all down hill; and, with the ordinary plough, going back empty. But where there is much land of this excessive steepness to cultivate, a plough with a shifting mould-board, usually called a *turn-wrest* plough, admits of ploughing both backwards and forwards, shifting the mould-board in such a manner as always to throw the furrow-slice down hill. These two last methods have been suggested by Mr Kerr of Ayton, in his Berwickshire Report, who has seen both practised, and executed the latter himself *.

Another rule regarding this point is, to direct the ridges north and south, if the ground will permit. In this direction, the east and west sides of a ridge divide the sun equally between them, and will ripen at the same time †. In clay soils, however, ridges must be regulated by the run of the water, so that no rule can be applicable to that particular case.

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* The Turn-wrest Plough, with a shifting mould-board, is certainly adapted to ploughing across the slope of hills, as it enables the farmer to turn the furrow always downwards. It is, however, attended with this disadvantage, that it brings, lower and lower, the staple of the soil.

† Gentleman Farmer, p. 79.

Sect. II.—*On Manures.*

It is impossible, in a work of this nature, to enter much at length into the great subject of manures, on which so many volumes have been written. It may be sufficient for our present purpose, to point out the sorts of manure generally used in Scotland, and the mode of applying them generally recommended; together with any useful practices or improvements in the management of manure, peculiar to that part of the kingdom.

The manures principally made use of are, 1. Dung; 2. Urine; 3. Lime; 4. Marle; 5. Sea-ware; and 6. Composts.

1. *Dung.*—This great source of fertility is hardly any where so much attended to as it ought to be, though of late years, more care has been paid in Scotland, both to increase the quantity, and to employ it to more advantage.

In considering this important branch of the subject, it is proposed to explain the following particulars: 1. The quantity raised from the different crops usually cultivated in Scotland; 2. The mode of making dunghills; 3. Whether dung should be employed fresh or rotten; 4. The mode and time of application; 5. The depth at which it ought to be put; and 6. Its price in the neighbourhood of the metropolis.

1. Dr Coventry has given the following estimate of the quantity of dung that may be procured from different crops, on land that will produce seven Scotch bolls, or twenty-eight Winchester bushels of wheat, *per* English acre.

	Tons
By turnips, cabbages, and fallow crops when applied to the feeding of cattle, - - -	6
By clover, grass, or herbage, hay, &c. first year,	6
By ditto, if mowed, second do. -	5½
By ditto, if pastured, second and third do.	5
By pulse crops, as beans, &c. part of their seed being used on the possession by live stock, - -	5½
By pulse crops, when the seed is sold, -	5
By white or corn crops, as wheat, barley, &c. on an average of the whole, - - -	4

It is no wonder, therefore, that green crops should be recommended as sources of fertility, producing proportionally much more manure; at the same time, the dung procured from the herbage, pulse and hoed crops, is stated in the above table rather under the mark, and that from the straw of the corn crops fully high, in proportion to the other; the object being, to shew the comparative advantages of the different kinds of crops, in respect of the manure they respectively afford.

2. Mr Rennie of Kinblethmont proposes, that dung, when taken from the dung-court, should be carried to the field intended to be dunged, and then laid into dunghills, in order to promote fermentation; that a person should attend for the purpose of throwing up the dung; and that no cart be suffered to go upon the dunghill. Great care, however, should be taken, when the rank dung is thrown up, that it be sufficiently wet. With a view also of preventing the escape of the volatile alkali, it becomes very necessary, to cover up the dunghill with a light covering of finely-powdered earth, which tends greatly to increase the quantity of those oily and saline substances, which, in fact, constitute the value of every dunghill. If the dung is in-

tended for wheat, he only gives the dunghill one turn; if intended for turnips, two turns are necessary *.

It perhaps may be here proper to mention, of what importance it is, to have the dung spread and ploughed in immediately, so that none of the most valuable parts may be suffered to evaporate; and it is the constant practice, of all the best farmers in Scotland, to dung, spread, and plough in the manure at the same time, so that none of the dung is ever left exposed to the air.

On the subject of dunghills, the following very useful suggestions are transmitted to me by Mr Dudgeon of Primerosehill, in Berwickshire, regarding the means of facilitating the fermentation of dung, when carried out in heaps to the field. The first is, never to allow the carts to drive on to the dunghill or heap when unloading, as the condensation occasioned by the pressure of the carts and horses, tends to retard the fermentation, by excluding the external air. The second is, not to build the dung in leets, or upright sections, one by the side of another, as these never thoroughly coalesce, and allow the rain and moisture to drain off through the intermediate fissures; but in building the dunghill, let the surface built on, be always kept in a sloping direction from the top of the dunghill to the ground, which makes the dung settle into one uniform mass, thereby enabling it to retain the moisture; and for this purpose a slight covering of earth, (peat-earth, where it can be got), along the top, when the dunghill is finished, will greatly contribute: And the third is, if dunghills are formed in the field during winter, it has

* This covering with finely powdered earth, as Mr John Shireff remarks, is highly necessary, for if dung be turned twice after being deposited, and shaken up loosely, it will be of very little value, unless it be instantly covered at every turning. At all events, moving putrescent matter intended for manure, must necessarily be attended with the loss of some of its finer and most valuable parts.

been found a good practice, when opportunity offers, to heap up snow on the top of them; for snow water, being divested of its fixed air in the process of freezing, is thereby rendered a more powerful agent in promoting putrefaction, than either rain or river water, and from the snow melting gradually, the absorption is more complete, than when *water* is artificially applied *.

3. It is not yet decisively ascertained, which is the best mode of using stable dung, whether in a fresh or rotten state. An intelligent farmer near Perth, (Mr Andrew of Tillilumb), states, that he has sometimes seen it used successfully fresh, as, for instance, put on for potatoes, or ploughed down in the end of the year for beans; but he would rather incline to have it a little rotten: care, however, should be taken, that in rotting, it do not heat too much; for if it turns dry and white, it certainly hurts it much. On the other hand, Mr Walker of Mellendean condemns the practice of using fresh dung, in so far as regards at least the turnip crop. For upwards of thirty years, he has found, in every year, that a small quantity of rotten dung is sufficient for that crop, and if the soil and season are suitable, will almost always ensure a good crop of turnips, and the succeeding crops, according to the common rotation. But he never yet could raise a full crop, with long fresh dung, however thick laid on; on this account, he is always at a considerable expence, about the end of April or beginning of May, in leading out, turning, and watering the dunghills, so that the dung may be in a putrid state when laid on the land

* Mr John Shirreff is of opinion, that stable-yard manure, ought never to be stirred, after it is deposited in the dung pit, till finally carted on the field, and deposited in the soil. For every time it is stirred, its finest parts escape into the atmosphere. In the way some people manage dunghills, more than one half of their most valuable parts are lost in steam, when shaken up as a gardener's hotbed.

in June; and after all, he is obliged every year to manure a part of his turnip land with fresh dung, and wherever it is laid on, the crop is invariably very much inferior. It is contended indeed, that until the mass is heated, it cannot properly be called dung, and that though fresh or long dung will go farther, so will straw, but that is no proof of its being more valuable.

Mr Brodie of Garvald, who has had so much experience in raising turnips, is decidedly of opinion, that the dung of cattle and horses should be properly blended, and well digested, before it is applied to turnips; and, indeed, he maintains, that turnips in drills would be better without dung altogether, than to have it applied in a long, half rotten state, as it tends to admit the drought, instead of affording moisture and nourishment to the plants, while they are young and tender. Whereas, if the dung is of a good quality, a very small quantity generally insures a good crop, especially if the grounds have been previously limed, and are otherwise in a good state of preparation.

Mr John Shirreff observes, that the stable-yard dung can be most advantageously applied, when it is in a saponaceous state, heavy, moist, and compact, when it can be cut with a spade, and when it emits a strong steam, and pungent odour. This state is very different from that to which dung is reduced by repeated turnings, which invariably leaves it open, light, and spongy, (much resembling muirish earth, or peaty soil), when its value must be considerably diminished.

The fact seems to be, that rotten dung is preferable, where drilling turnips is practised, and where a small quantity of manure is inserted in the heart of the drill *.

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* This objection to long dung, it is said, may, even in this case, be obviated, by making the hollows deeper.

In regard to broad-cast crops of grain or turnips, however, fresh dung, (or the dung of stables, &c. applied as soon as made), will go, it is contended, over a greater quantity of ground; nothing is lost in the preparation, and it may be sooner applied.

4. In Scotland, dung is principally applied, 1. To green crops, as turnips, potatoes, and beans; and, 2. To fallows.

When applied to turnips, it is put in the heart of the drill, by which not one particle of it is either lost, or seen above ground †. Dung is generally applied to potatoes in the same way; but is sometimes laid on in autumn, and mixed with the soil. When in drills, it is recommended by an intelligent farmer, (Mr Laing of Campend, near Dalkeith), to make the drills across the field, if the ground is so dry as to admit of it, as by ploughing for the succeeding crop, the way the ridges lie across the drills, the dung is mixed with the soil; on the other hand, when the dung is put in drills as the ridges lie, (particularly in poor soils), in ploughing for the next crop, the dung is turned over in a body, and the crop grows very unequal; for where the dung is, it is very strong, and the other part, which is probably two-thirds, is very indifferent. It answers much the same purpose, if the lines are diagonally drawn. Dung, when given to beans, is generally applied upon the stubble of the preceding crop, and sometimes in the

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* In a dry season, some recommend that the dunghill ought to be well saturated with water at the time it is put into the drill, and the earth immediately after turned upon it, in order to secure the turnip crop. Others contend, that dung, if attentively made, will always be moist, and that the process of fermentation and putrefaction will go on. Cold water would check these, and would prove adverse to vegetation, particularly of turnips, which ought to be promoted with all possible rapidity.

spring, immediately before the seed furrow is given them. As to the time of carrying out and laying on dung, it saves expence if it can be carried out after harvest, but is most advantageously applied when the crops are sown. If applied to naked fallows, which is a disputed point, it may be laid on in the month of July, and it should be ploughed in immediately after.

5. On strong soils, dung is generally mixed with the fallow, after frequent ploughings; and it is recommended, that the furrow, after it is laid on, should not exceed six inches in depth. Other farmers, however, contend, that as calcareous matter has a tendency to sink in the ground, and dung to rise to the surface, the former should be kept near the surface, *and the latter well covered in the soil* *. When dung is lodged near the surface, it promotes too rapid a vegetation in the foliage, which rarely fails to diminish the produce of grain; a circumstance that necessarily circumscribes surface-dressing very much. If the ingredient is volatile, great part of it evaporates, and is lost. Top-dressings, therefore, except with composts, or lime alone, and on grass land, is not practised in Scotland, though not unusual in some parts of England, for young wheat, to give a fillip to the plant.

The propriety of employing dung as a top-dressing to meadow land, is much disputed. It is usual in some parts of the kingdom, to lay on from fifteen to twenty double cart loads *per* English acre, every three or four years; taking one crop of hay, and pasturing the land afterwards. The same quantity of manure would suffice for an arable system, on a succession of four crops; namely, 1. Turnips fed with sheep; 2. Spring sown wheat or barley; 3. Clover;

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* Communication from Captain John Henderson of Aimster in Caithness.

and 4. Oats. In favour of the grazing system, it is contended, that old grass lands let for more rent *per* acre, than the adjoining fields under the plough, which is one reason why the proprietors endeavour to keep them in that state: That such lands, if of the best quality, when in hay, will produce from one and a half to two tons *per* acre, and foggage worth 30s. *per* acre more; or, when in pasture, each acre will graze an ox, producing, in the space of twenty weeks, fifteen stone of beef, worth 8s. *per* stone, or L. 6, to which, if the value of the after-eating is added, the whole will not be much less than L. 7, 10s. of produce *per* English acre, from which there are no other expences to be deducted, than rent and taxes, and the interest of the capital invested, nor is there that risk of losses, by wind, mildew, &c. as in arable crops: That farmers who are in possession of those old rich grazing pastures, find it their interest to keep them so, as essential for a breeding and grazing stock: That if all such lands were under a four-course system, in a few years the clover crops would become small and uncertain, and the quantity of live stock would be considerably reduced; and that in many parts of the north of England, these old grass lands continue in verdure throughout the whole season, if the weather is open, and upon them, in a great measure, depends the maintenance of many thousand head of Scotch cattle. On the other hand, it is contended, that if the farmers were not compelled to lay their home-made dung on the old grass lands, which are thereby much enriched, whilst the adjoining arable land is excessively impoverished, and robbed of the dung it has been the means of producing, the latter would afford the highest rent: That if the farmers were not constrained to adhere to the grazing plan, they would soon discover, that it was more for their interest to pursue the arable system: That under the convertible system of husbandry, properly managed, (if necessary, pasturing

the clover the second year), the crops of clover are not small and uncertain; and that the arable system would certainly produce the greatest quantity of human food.

6. The following is the most accurate information that I have been able to procure, regarding the price of dung at Edinburgh.

Nature of the Dung.	Size of the Cart.	Weight of Dung.	Price.
Horse dung.	Single horse cart,	From 14 to 16 cwt	From 3 s. 6d. to 4 s.
Do. do	Double do. do.	From 24 to 25 cwt.	From 6 s. to 7 s.
Cow dung,	Single-horse cart,	From 14 to 16 cwt.	From 3 s 6 d to 4 s.
Do do.	Double do. do.	From 20 to 24 cwt	From 5 s to 6 s 6 d.
Street dung,	Sing e-horse cart,	From 16 to 20 cwt.	2 s. 6 d.
Do. do.	Double do. do.	From 25 to 30 cwt.	From 3 s. 3 d. to 4 s.

There is a good deal of tanners' exhausted bark used by farmers for compound dunghills, the price of which is only 6 d. *per* single-horse cart.

It is to be observed, that no certain data can be formed, as to the exact weight of dung *per* cart, without actual weighing, as the weight depends on many circumstances, such as the state of the dung in regard to putrefaction, its being in a dry state, or more moist, the size of the cart, and the dexterity of the carter in heaping more on, or tramping, or neglecting to do so.

It is usual to mix all the sorts of town dung into one compost, thirty single-cart-loads of which is necessary for a potatoe crop *per* Scotch acre, in consideration of the future crops. The value of each cart-load may be estimated at 4 s., and consequently the expence of manure is, at the rate of L. 6 *per* Scotch, or L. 4, 16 s. *per* English acre, besides the carriage, which in many cases equals the prime-cost.

Even ordinary farm-yard dung, before it is moved from the fold-yard, or the cow-houses and stables, ought to be carefully mixed, otherwise it can never be of equal quality.

Mr John Shirreff is of opinion, that if the dung of cows and horses be spread over each other regularly as dropped, the whole mass will very soon be in a state sufficiently rotten for use. As straw, if rotted without a mixture of the excrement of cattle, makes a very weak manure, it is therefore proper to mix all the superfluous straw, with what comes from the cattle.

It is much disputed, whether it is for the advantage of the farmer to give straw for dung, it being always understood, that the straw should be taken good care of, and not wasted. It is supposed, however, that unless the straw should happen to be very high priced, it is greatly for the farmer's interest to give straw for the dung, except he is under the necessity of carrying it to a great distance, for in this way he gets all the straw back again, made into good dung, with this great addition, that he also gets the dung arising from the hay and corn which the horses have made use of. The generality of farmers, however, afraid of being imposed on, sell their straw, and buy their dung at the market price.

On the whole, dung is the most essential ingredient for promoting fertility. Calcareous and other manures, in particular cases, are necessary, especially for reclaiming land in high situations, or stiff soils; but animal and vegetable substances, when reduced to a putrid state, are peculiarly well calculated for recruiting exhausted land; and, if a sufficient quantity for that purpose could be procured, the arable land in this island, might be made to produce, triple the quantity it now does. How loudly does not this call for attention, not only to promote its increase, but to prevent its abuse, (both of which, in too many instances, are greatly overlooked), and to improve its quality. In some cases too much is applied, to the detriment of the crop, for luxuriance does not always insure a plentiful increase of grain, and much

gain is seldom ultimately obtained by forcing crops *. The loss generally sustained, however, is not from the application of too much, but of too little manure, as farmers are too apt to fritter away a quantity of dung over fourscore acres, without producing any sensible effect, which would have produced a valuable crop if confined to twenty. Improving the quality of manure, is another most material object to be attended to. It is well known, that when cattle are fed and kept in a house, when they receive the same food in quantity and quality, that their dung becomes a more valuable manure, than what is made from cattle kept in a large open court. This arises, no doubt, from the cattle treading so constantly upon the dunghill, which consolidates it to such a degree, as to prevent the proper effects of fermentation. The latter mode, however, from requiring fewer houses, and giving less trouble, is very generally practised, though the dung is inferior in quality.

2. *Urine.*—This important article to the farmer, has only of late received that attention to which it is so justly entitled. It is calculated that the urine of a horse, from its being so much lighter, is more valuable than the dung he produces, more especially if both were to be conveyed to any distance. It is said that the urine of twelve cows is sufficient to top-dress two English acres of meadow: on the supposition, that an acre would require twenty cart-loads of dung at 5s. *per* cart-load, or L. 5 *per* acre, the urine of each cow would thus be worth above 18 s. *per annum.* Urine is advantageously employed, either by

* Baron Hepburn dungs lightly, and repeats it frequently. Virgil said long ago, that a large allowance of dung forced a great growth of straw; but he adds—"*Vanis illusit avistis—Siliquis fallacibus.*"

pumping it over the dunghill, or as a compost with peat, fine earth, or the refuse of the tan-pit. A plan has been adopted by an intelligent farmer, (Mr Charles Alexander near Peebles), for collecting urine, and preparing it for use, which it is proper to describe. He has made a pit, about twelve yards square, and four feet deep, which he fills with fat earth, carted from headlands, or wherever it can be got most conveniently, and levelled on the surface, so that the urine of the cattle he feeds, which is conveyed to the pit by a sewer, may spread equally over it. The edges are raised about six inches high, by a parapet of puddled earth, for preventing the urine from running over. The earth is carted to the compost pit in the summer, immediately after its former contents are applied to the turnips. The drier the earth is, when laid in, the better, as it imbibes more of the urine. After the compost has received the greatest part of the urine, which is about the latter end of April, (as at that time the feeding cattle are sold off), it is carefully turned over, when it shows symptoms of complete saturation. While the urine is applying, and the mass in a drenched state, there is little fermentation; but when turned over and laid dry, the fermentation of the mass is brisk, visible by its heat, and it is completely mellowed for laying on the turnips in June. In this way Mr Alexander raises above 100 square yards of rich manure, and when applied to the ground, finds its effect to be equal, if not superior to his best dung. It is suggested, that covering the pit, so as to exclude the access of rain-water, and to prevent the exhalation by the rays of the sun in hot weather, would be an improvement on this plan *.

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* By some, this carting of the earth into a pit, and then out again, is objected to as likely to be attended with too much ex-

It is said that bones sprinkled with urine are dissolved by the fermentation thereby excited, and if the same plan would answer with sea-shells, it would render that species of manure much more valuable, and more speedily efficacious.

3. *Lime.*—There is perhaps no country in Europe, where calcined lime is used to so great an extent, and in such quantities, as in the more improved, and improving parts of Scotland. This may be partly owing to the total absence of chalk, which abounds in so many parts of England, and which renders calcined lime less necessary there; but it is principally to be attributed, to the great benefit that has been derived from its use. In bringing in new or maiden soils, the use of lime is found to be so essential, that little good could be done without it. Its first application in particular, gives a degree of permanent fertility to the soil, which can be imparted by no other manure. Its effects, indeed, are hardly to be credited, but their correctness cannot be disputed. Maiden soils, in Lammermuir, of a tolerable quality, will, with the force of sheeps' dung, or other animal manures, produce a middling crop of oats; but the richest animal dung does not enable

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pence, and, at any rate, as practicable only to a small extent. It is therefore proposed, after ploughing the headlands, to cart the urine upon them, and then to remove the soil to the field as a top-dressing, or for turnip drills. Mr John Shirreff thinks that it would be a better plan to run the collected urine weekly over the surface of the dung-heap. Nothing tends more to promote the preparation of dung, or to make it richer, than urine. The whole mass might thus be brought, at an early period, into a state completely prepared for use, which cannot be expected so soon, if it ever arrives at such a state, when deprived of so essential an ingredient.

them to bring any other grain to maturity. Pease, barley, or wheat, will set out with every appearance of success, but when the pease are in bloom, and the other grains are putting forth the ear, they proceed no farther, and dwindle away in fruitless abortion *. The same soils, after getting a sufficient quantity of lime, will produce every species of grain, and in good seasons bring them to maturity, in all future times, always supposing the ground to be under proper culture, and the climate adapted to the crop. This fact proves, that oats require less calcareous matter than what is necessary for other grains; that lime acts as an alterative, as well as an active medicine, and that the defects in the constitution of the soil are cured, even after the stimulant and fertilizing effects of the lime have long ceased to operate. Lime is also peculiarly beneficial in improving muirish soils, by making them produce good herbage, where nothing but heath and other unpalatable grasses grew formerly. The expence of this article in Aberdeenshire is stated to be enormous, very little of it being produced in that country; yet lime is there considered to be absolutely necessary, and, indeed, the foundation of all substantial improvements †. It is supposed, however, not to

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* Marle, although containing calcareous matter, is not so effective. It will produce oats, barley, and early pease in abundance, and in some favourable situations will also produce wheat, when the season is favourable, but wheat crops cannot be depended upon from marle alone.

† Communication from Mr Barclay, Mill of Knockleith. It has been observed, that lime has sometimes been withheld both from low lands after fallow, and from hilly lands after turnips; but in all these cases, with an evident loss to the occupant, by a decrease of produce throughout the whole course.

be so useful on the sea-shore, as in the more inland districts, from the soil being perhaps mixed with sea-shells.

The importance of lime as a manure, is strikingly exemplified by the following information from Mr Walker of Mellendean: He entered into the possession of that farm twenty-five years ago, and then gave the whole farm, (with the exception of a few acres of the *richest soil*, in different fields, which had for ages been manured as infield), a good dose of lime. From the newly limed land, his returns were fully equal to his expectations, and greatly superior to those from the richest spots that had received no lime. Being very desirous to ascertain how long the limed land would maintain its superiority, he kept both the limed and unlimed, under the same management in every respect, during his first lease of twenty-one years; and he can affirm, that at the end of that period, his crops upon the limed land were equally good, and as much superior to those of the unlimed land, as they were at the commencement thereof. Having got a new lease of that farm, he proposes laying lime upon every spot of ground that was not limed formerly, being convinced that he has been a considerable loser by his experiment. How long therefore the effects of lime may last, he will not take upon himself to foresee; but he can safely say, that there is land upon his brother's property at Wooden, that was limed by his father upwards of thirty years ago, where the effects of the lime, upon every crop, are still as apparent, as when it was first laid on the land.

It is proposed, in discussing this subject, very shortly to explain the following particulars: 1. The soils to which lime is applicable; 2. The distance from which it has been carried; 3. The quantity used; 4. The best mode of slacking; 5. The common modes of applications; 6. The plan of top-dressing the surface; 7. The price; 8. The

use of pounded limestone; and 9. The causes which may occasion its failure.

1. This manure is certainly well calculated for clay lands. Some recommend laying on a certain quantity of it, to the amount of 20 bolls of shells, or 60 bushels to the Scotch, or 48 to the English acre, and as hot as possible, every time the land is fallowed. This plan, however, is objected to from respectable authority, and it is contended, that so small a quantity of lime shells is quite unfit for stimulating any kind of soil, except where it is of a dry muirish nature, and not formerly limed. To lime land every time it is in fallow seems unnecessary, more especially if a sufficient quantity were applied in the first instance *. From 60 to 70 barley bolls *per* Scotch acre, or from 360 to 465 bushels *per* Scotch, that is, from 288 to 365 bushels *per* English acre, are quantities frequently given in East Lothian. In regard to loams, if they are in good condition, and in good heart, perhaps liming once in the course of two rotations will be sufficient †. It is a rule, however, in regard to the application of lime, and other calcareous manures, that they should only be applied to land in a dry state, and well drained.

2. It is astonishing the distance from which lime is carried in some parts of Scotland. Mr Blackie of Holydean, in Roxburghshire, drives it twenty-two miles, and the carriage, when hired, is 7s. 6d. *per* boll of shells. In all the parish of Moffat, where of late considerable improvements have been carried on, and corn, turnips, and clover, raised

* Mr John Shirreff remarks, that to specify a quantity for all lands is impossible, so much depends upon the depth and quality of the soil; also on the quantity of calcareous matter either previously applied, or originally in the soil.

† Communication from George Paterson, Esq. of Castle-Huntly.

in great perfection, 1000 feet above the level of the sea, the lime is carried from Douglas, at twenty-seven and thirty miles distance. It is sometimes carried on the borders, but in no great quantity, about thirty, or even thirty-two miles *; and in Aberdeenshire, they are said to drive it that distance inland, after being imported from Sunderland.

3. The quantity used varies much. It is evident, that strong deep soils require a greater quantity than those which are light and shallow. Baron Hepburn is of opinion, that it should be applied frequently, and in small quantities at a time, especially on gravelly bottomed loams, which are apt to become too open and pliable by an over dose of lime: by following this practice, he finds his crops wonderfully improved, both in regard to quantity and quality. Mr Robertson of Ladykirk informs me, that he has never seen lime used in too great a quantity, if the land is judiciously cropped; if otherwise, it will ultimately hurt the soil. He has laid on no less a quantity than 100 bolls of shells, 4 Winchester bushels each, *per* English acre, and frequently with much success. On dry land a less quantity will do. Mr Blackie of Holydean considers 16 bolls of shells, on such land, a sufficient dressing. Dr Coventry is of opinion, that in general, about 6 tons of unslacked or newly-burnt lime, of ninety or ninety-five *per cent.* of purity, may be sufficient for the statute acre of land that has never been limed; but if the lime be impure, a greater proportion will be requisite.

The information transmitted to me by Mr Walker of Mellendean upon this subject, is of peculiar importance, as he has limed perhaps more land than any individual in the whole island, and in the course of thirty years has tried various experiments in regard to the quan-

* Communication from Mr Walker of Mellendean.

tity that should be applied *per* acre. On newly broken up land from old turf, he has laid on from 20 and 25 to 40 and 45 bolls of shells, of 4 Winchester bushels each, *per* English acre. On light and thin (outfield) soils, the crop on that part of the field that was limed at the rate of 20 and 25 bolls *per* acre, was as rough, and appeared equally good, with the crop on the land that had received 40 bolls *per* acre; but when it came to be threshed out, the grain was found very inferior in quantity, and still more so in quality. Upon clay soils, the effects of the lime, where a small quantity was laid, were hardly discernible; while that part of the field that received 40 and 45 bolls, produced an abundant crop. Finding the produce of the land that was limed with a small quantity so very inferior, he laid on, (when the land came to be re-fallowed), 20 or 25 bolls more, the effects of which were never perceptible. He is therefore decidedly of opinion, that every kind of soil should have a good dose at once, in which case he considers no repetition to be necessary for a long time after; but if repeated at all, the second liming should be considerably greater than the first, which seems to be the general opinion of the Scotch farmers. As to repeated liming in small quantities, Mr Walker is convinced, that whatever is laid out in that way, after the first dose, is so much money thrown away. He can give no stronger proof of his conviction in that respect, than his practice upon the farm of Rutherford. He entered to that farm in June 1808, and since that time he has gone over about *eight hundred and fifty acres*; and though a great part of it consists of a light dry soil, and the lime has to be carried twenty-four or twenty-five miles, consequently at a great expence, yet on no part of the farm has he laid less than 40 bolls of shells, or 240 Winchester bushels *per* English acre, and on many places fully 50 bolls. Nothing, in his opinion, assimilates the produce of outfield, to that

of infield land so much, as a good dose of lime laid on at once. The consequence of this liming has been, the most productive crops, of every description, to be seen in all that neighbourhood.

Mr Aitchison of Clements Wells also has found that lime answers every purpose he could wish, in promoting the improvement of his estate in Peebles-shire, where the climate is cold and moist. He began to improve that property in 1806, and in October 1811 he had laid on it, 10,386 bolls, or 62,316 Winchester bushels. His ridges are 18 feet broad, and according to the quantity he wishes to put on *per* acre, his overseer has the following table to conduct the operation.

If it is proposed to lay on 25 bolls *per* acre, betwixt each heap, of one firlot each, there ought to be a distance of - - - - 30 feet.

If 30	bolls,	-	-	-	$25\frac{1}{4}$
35	do.	-	-	-	22
40	do.	-	-	-	19
45	do.	-	-	-	17

And in the same proportion as high as 50 bolls. He never puts on less than 25 bolls, or 150 bushels of shells *per* Scotch, (130 bushels *per* English acre), and on heavy land he has gone the length of 70 bolls. The day the lime comes to the field, a man follows the carts, and covers it up immediately with earth, by which generally in a few days it is reduced to powder. When in that state, it is spread on the land. After trying several other methods this was found to be the best. The improvement effected by lime on that property has been very great.

4. The slacking of lime completely is a most important operation. The common mode is, to lay it in heaps from the kiln upon the ground intended to be limed; but this, although the most expeditious, is by no means the most

advantageous method. In the first place, if the lime is not all of the same quality, (which is seldom the case), the best lime commonly dissolves first, and the inferior quality continues unslacked; so that it must either be spread in that state, or the good lime must be allowed to receive too much moisture, or again to re-absorb its fixed air, both of which should be prevented. The best mode of slacking, is to lay down the shells in a heap near to water, and by once turning and watering the whole mass, it is reduced to a complete powder; in which state it should be applied to the soil, and ploughed in immediately with a shallow furrow, when there is no doubt but it will mix more intimately with the soil, than by the former method *.

The necessity of slacking calcined lime, as soon after it is burnt as possible, is obvious. If any sudden rain should fall, it would be converted into mortar; no art can then separate it, and mix it equally with the soil; nor would double the quantity have the same good effect. Even after it has been reduced to powder, if any rain should happen to fall, or if by any means it receive too much moisture, while it lies thin spread on the surface of the field, it will partly be formed into hard insoluble cakes, and may remain in that state for years, without mixing with, or being of the least benefit to the soil. In the course of repeated ploughings, Mr Paterson of Castle-Huntly has observed pieces of hard lime come up, as insoluble, as if they had been pieces of an old building.

Considering these circumstances, I was much pleased to find, that a mode had been discovered by Mr Niel Ballingal in Fife, which obviates these difficulties. His plan is, to lay the calcined lime down on any thick head-ridge

* Communication from Mr Rennie of Kinblethmont.

of good earth, within the field where it is to be applied, and the instant it is so, two men are ready to make up a compost of the lime-shells and earth; three cart-loads of earth to one cart of shells, raised to a ridge long and narrow, five feet high, that rain may not enter it. The moisture in the earth slacks or reduces it to a powder; it swells to a considerable bulk, and then all cracks and openings are closed with a spade, and a little more earth put over the whole. In this way he has had it frequently mixed up for six months, and in one particular instance fifteen months before it was carted away; and yet when carried on to the land and spread, the whole mass put on the appearance of white lime, flying with the wind, as if newly from the kiln. This mode he means always to follow, being certain of its advantage. It can be mixed as intimately with the soil as if new from the kiln, and he has had crops from it in this way, superior to an equal quantity of hot lime *, both tried without dung. The application commonly is to the summer-fallow; but he has also applied it to pasture, quite hot, and in compost as above, and found both answer well; but the time of application was July, and he soon found that it ought to lie at least one year or more before the field was ploughed.

Mr Ballingal having used from 500 to 1000 bolls *per annum*, for several years, his experience may be confidently relied on. He remarks, that lime, if exposed to rain, or even to frost, and slacked like mortar, loses half its effect; no care can then mix it intimately with the soil.

* This is an important fact, it being generally supposed that when inserted in the form of hot lime, in a state of perfect powder, its effects are greater and more immediate than in any other way. By Mr Ballingal's plan the lime can be carried to the field in autumn, or even in winter, which, though an old practice, could not be done with equal safety, as under the proposed system.

His land is wet, and often when the lime is driven, unfit for carting upon the field, nor are the ridges prepared for spreading the lime; without having fallen upon such a plan, therefore, he could never have used lime to equal advantage. He adds, that an intelligent neighbour of his brings his lime from the kiln, lays it in small heaps, about a firlot of shells in each heap, or four heaps *per* boll, on the fallow; covers these instantly with earth, which slacks the lime, and when it is completely so, he spreads it in powder, quite hot, on the fallows, and ploughs it in with a light furrow. This saves labour and expence. He never uses water in slacking lime, and the effects of his practice are very good; the earth, or rather the moisture in it, slacks the lime most completely, and no water is necessary *. This is an excellent practice, and very common in many counties: and many intelligent farmers prefer it to the other plan, which they think would be attended with too much expence to be generally imitated. At the same time, an intimate mixture with the soil is of the utmost importance in the application of lime, any plan that contributes to that object merits attention.

Having often heard farmers complain of the difficulty they experienced, in procuring water, in sufficient quantities, thoroughly to slack their lime, in some districts, and in others, of the loss they sustained in carrying on their lime husbandry, by unexpected rains, I have procured

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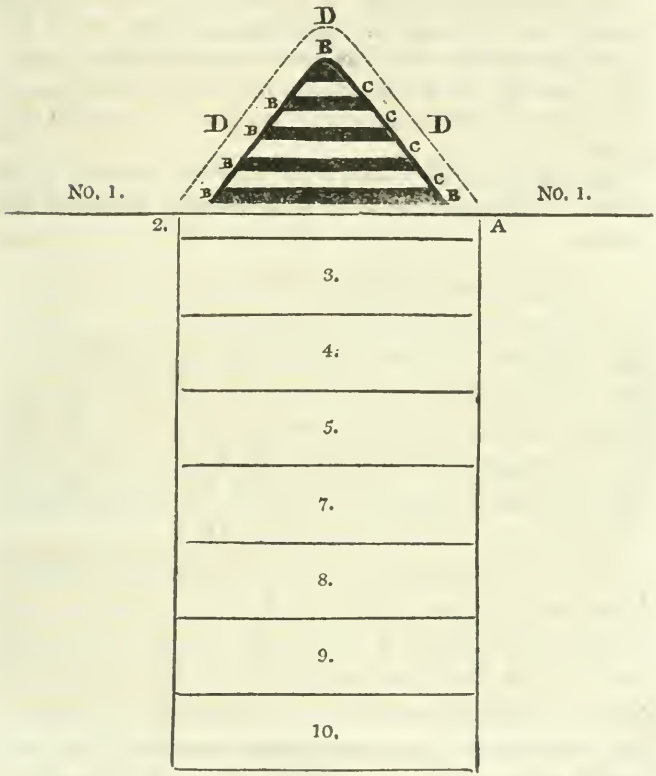
* An intelligent correspondent contends, that lime is best laid on the land in small heaps, and immediately covered with earth, which in a damp or moist season slacks or falls it; but he frequently puts on water from a water-cart, which slacks it directly, and it is immediately spread in that quick state, harrowed, and ploughed in, when it mixes most intimately with the soil. Lime should be in powder, and the land in a powder-like state when it is laid on.

from Mr Ballingal, the following sketch, which, with the references thereto, will fully explain his system.

Plan of a heap of Earth and Lime, in alternate strata, as practised by Mr Niel Ballingal in Fife.



Reference to the Plan and Section of the Compost Midden.

No. 1. 1.—Surface of the ground.

No. 2.—A small trench made under the surface, afterwards filled with lime 4 inches deep.

No. 3.—First space dug out equally deep as No. 2. the earth of which is thrown back, and left to cover up the end of the heap when completed.

No. 4, 5, 6, 7, 8, 9, and 10.—Similar trenches, 8 feet by 3½.

Section.

A — First bed of lime, 4 inches thick.

B B — Earth 6 inches thick alternately with C C lime, until about 5 feet high; but the height depends on the depth of soil where the lime is laid down.

D D D — Expansion of the heap after lying about 48 hours.

When expanded to the utmost, it is smoothed again with a spade, all cracks filled up, and the rain does not penetrate but runs off.

The proportion of earth to lime most advantageous is 3 to 1 of lime-shells. Each cart then carries out when full 1 boll lime. Forty carts of the composition is sufficient for an acre of strong soil; 30 carts if gravelly or sandy.

The compost heap may be of any length; but 150 or 200 bolls is enough for one. If proper earth can be got in different places of a field, it saves carriage.

4. Mr Dudgeon of Primrose-Hill considers it to be the most advantageous mode of applying lime, to lay it on in a powdery state, upon ground when under summer-fallow, before the fallow receives the last furrow, and then to mix it intimately with the soil, by harrowing, before it is ploughed in. In regard to liming fallows, Mr Rennie of Phantassie observes, that it is the most profitable mode of application, if it is laid on at a proper season. He has been in the practice, for these ten years past, of laying lime on his fallows, from the 1st of April to the 1st of October, and always found, that the first laid on produced the best crops, which he ascribes to its being more minutely mixed with the soil by the more numerous ploughings and harrowings, and of course the fermentation more complete, than what is laid on late in the season: June and July, therefore, are to be preferred, so that the lime may be completely mixed with the soil before the crop is sown; and as it is both a valuable and expensive manure, too much attention cannot be given it.

Applying lime to green crops is attended with more difficulty. From observation and practice, Mr Rennie recommends, that, for a crop of turnips, lime should be laid

on so early in the spring as to admit of two, if not three ploughings, and as many harrowings, after it is laid on, so as both to mix it properly with the soil, and also to let it have time to cool in the land, otherwise it will be very apt to cause the loss of the turnip crop.

Mr Park of Windy-Mains is accustomed to lay lime on the land intended for turnips, immediately after harvest, when the land has got the first furrow. He first makes a pair of harrows go backward and forward on each ridge to smooth it, then lays down the shells in huts about 60 or 80 bolls *per* acre Scotch; as soon as it is powdered, he spreads the huts, and harrows the field, and lets it remain till May, when it may be prepared for receiving the dung.

Mr Brodie of Garvald, who has long paid peculiar and successful attention to the management of lime, adopts the following plan in applying lime to his turnip land. After the ground intended for turnips has got a winter and a spring furrow, the lime is laid on, and well harrowed in: it then gets another furrow before making up the drills, and is again well harrowed, for the double purpose of getting the lime intimately mixed with the soil, and taking out any quickens, or other weeds, by which the field is infested. The turnips are sown in drills, both as being better for the turnip crop than when sown broadcast, and the lands are got better cleaned either from annual or perennial weeds. It is reckoned an advantage, to have the lime got forward during the former summer, previous to its being laid on for turnips; for on a turnip farm, there is so much spring labour, that it is hardly possible to drive any considerable quantity of lime, from any distance, at that season of the year. When it is new from the kiln, it is so hot, that it is apt to dry up the moisture necessary for bringing the turnips into leaf; in this case, the lime ought to be laid on a piece of very dry ground, in large heaps, and thrown up to a considerable thickness, which will

make it in a fine state for laying on in the spring, that is, neither in a wet or in a very hot state.

In regard to green crops, Mr Paterson of Castle-Huntly thinks it better to lay on the lime after the green crop, rather than before it, so as it may be well mixed with the soil, before it comes in contact with potatoes or other roots, it being apt to burn and blister their skins, and to spoil their appearance, if it does no more mischief. Some farmers, however, have put lime upon the ground after it is planted with potatoes, and harrowed it in. But this practice cannot be recommended.

The application of lime to grass, particularly on light or dry soils, and where the land has been long pastured, is a most advantageous system. It may be applied after the land has been a summer in pasture, or cut for hay; but the ground should be made as bare as possible, otherwise it will be difficult to spread it equally over the sward or surface. The lime should be laid on in autumn, and the land should remain in grass for another season, till it is absorbed. If intended to be applied to old ley, either lay the lime on one year before cropping, letting it lie upon the surface, or lay it on about Martinmas, and let it lie on the surface till February, then plough it down, and sow the ground when the weather is suitable. Suffering ground to remain for some years in grass, is certainly the best preparation for lime, as it has then fresh mould, and vegetable matter, to act upon.

Mr Cuthbertson recommends, that no lime should be laid on high ridges that are intended to be flattened; the ridge should be brought to the same round in which it is intended to remain, before that operation is accomplished, because, in performing it, there is a great risk of burying the lime. Mr Barclay remarks, that when the application is made, the land should not be too wet; and it

is necessary at all times to have the lime brought to such order, as neither to fly off with the wind, nor go into clods in the spreading.

Mr Brodie of Garvald observes, that some speculative agriculturists recommend liming upon the surface, to extirpate the heath and improve the pasturage, without attempting to bring ground under the plough, as the soil and climate may be unfit for the raising of grain. If the lime is at any considerable distance, there is reason to suspect that this would not turn out a profitable concern. At the distance of eight or ten miles, a good liming would not cost less than L. 10 or L. 12 the Scotch acre. It cannot be expected that this improvement, on such hills as those of Lammermuir, would even pay the interest of the money. Gentlemen proprietors may improve at this rate, but a tenant would be extremely imprudent were he to throw away his capital, without a prospect of being repaid. It is surely better to lime land worth the improving, to bring it under the plough, and then to take a few corn crops to refund the expence. The tenant is thus reimbursed, and has an ameliorated pasture, as the reward of his industry and superior management.

6. Mr Kerr, the intelligent Reporter of the Husbandry of Berwickshire, has transmitted to me the following calculation of the expence of liming. The lime he used was brought by sea to Eyemouth; and the price, besides carriage, amounted to 25 d. *per* boll, in shells, each boll containing 4 Winchester bushels; hence to lime an acre of land with 35 bolls will cost about L. 3, 15 s. besides carriage and spreading, which the distance being short, may amount to 10 s. more, or L. 4, 5 s. *per* acre; and as this operation is usually repeated twice during a lease of nineteen years, liming, in his situation, may be considered as a yearly charge of 10 s. *per* acre.

How astonished would not many farmers be in other countries, when they hear that Scotch farmers subject themselves to an expence of 10s. *per* acre *per annum* for lime alone, a sum not much inferior to the average rent of much land even in some English counties. But the expence is well bestowed, were it only from the benefit thence to be derived in the cultivation of green crops of every description. For though such crops can be raised by large quantities of dung, yet where calcareous substances are applied, as Mr Brodie of Garvald has found by long experience, a less quantity of animal manure will answer the purpose. This is making the farm-yard dung go farther, with more powerful and more permanent effects; and from weightier crops being thus raised, the quantity of manure on a farm will be most materially augmented.

7. That ingenious and intelligent writer, Lord Kames, strongly recommended the use of pounded limestone, where fuel is scarce or dear. He observes, that three pounds of raw lime is, by burning, reduced to two pounds of shell lime, though nothing is expelled by the fire but the air that was in the limestone, the calcareous earth remaining entire. Two pounds of shell lime, therefore, contain as much calcareous earth, as three pounds of raw limestone. Shell lime of the best quality, when slaked with water, will measure out thrice the quantity: but as limestone loses none of its bulk by being burnt into shells, it follows, that three bushels of raw limestone contain as much calcareous earth, as six bushels of powdered lime; and consequently, if powdered lime possess not some virtue above raw limestone, three bushels of the latter, *beat small*, should equal, as a manure, six bushels of the former. These suggestions, however, have not been acted upon, probably owing to the difficulty and expence of beating the limestone sufficiently small. At the same time the

advantage derived from the use of limestone gravel in Ireland, is, however, highly favourable to Lord Kames's doctrine*.

8. It is an ascertained fact, that lime is of no advantage in the neighbourhood of Edinburgh, where the land has been long accustomed to aration and city manure. Mr Allan of Craigrook, near Edinburgh, has given lime the fairest trial, by liming one ridge, the whole field over, at the rate of 60 bolls *per* acre, and leaving the other unlimed, and he has uniformly found, that the liming has had no effect. The reason, probably, is this, that the land having been so often manured with Edinburgh street-dung, which frequently contains a proportion of shells, the use of stone lime is thereby superseded. Indeed, some are of opinion, that the land in the immediate vicinity of Edinburgh had been abundantly limed at some former period, which, in addition to the calcareous matter mixed with the street-dung, renders any additional liming unavailing.

Mr Hume of East Barns finds, that lime does not answer on his farm near Dunbar, which he attributes to the great quantities of sea-ware, mixed with shells, which have been laid on these lands from time immemorial, and their having been formerly under constant crops of corn, and never in grass till lately, and even now only one year at a time. It is well known, he adds, that lime acts best on land that has been much in grass. Any local circumstances of that sort, however, cannot diminish the credit of a manure, of such essential importance to the improvement of the country †.

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* It would be extremely desirable to ascertain, whether limestone gravel might not be found in Scotland; to the discovery of which, I hope the attention of that public-spirited institution, the Highland Society of Scotland, will soon be directed.

† It is an interesting object of inquiry, whether lime is equally efficacious on the sea-shore, as in the inland districts? It is well

4. *Marle.*—In the improved districts of Scotland, lime is much more in use than marle, and hardly any observations have been transmitted to me regarding this branch of the inquiry. One intelligent correspondent, (Captain John Henderson), recommends it as a good mode, to apply it upon the hay-stubble, after the first crop; if the marle is thus used, the land should be pastured the next season, and afterwards ploughed down either for oats, or for wheat, in districts where that grain thrives. At any rate, it should be allowed to *batter* on the surface, previous to its being ploughed down, to prevent its falling down to the bottom of the furrow, as the land falls from the plough. Dr Coventry remarks, that the value of most marles is nearly in proportion to the quantity of lime or calcareous earth in their composition, taken in conjunction with their distributability, or the ease and completeness with which they may be mixed with the soil. Hence it happens, that though nine tons of the carbonate of lime in marle would be much the same with six tons of unmixed lime, yet the impure marle, when fully broken, being more distributable than lime, especially if it be imperfectly slacked or at all clotted, perhaps a quantity of that marle, containing seven tons of the carbonate of lime, may be of equal value as a manure with the other—the six tons of lime. Clay marles, however, are often very weak and impure; hence it often requires sixty, and, in some cases, even eighty tons of marle, to supply seven or eight tons of the carbonate of lime. Where that happens, lime itself is undoubtedly, in many respects, the cheaper and preferable article.

5. *Sea-ware.*—The importance of this manure, when it can be had near at hand, and in considerable quantities,

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known that gypsum is not. Seaware contains kelp, which, from the alkali it possesses, may act as a substitute for lime.

is very great. It is calculated, that land possessing this advantage, is worth more rent to the amount of from 10 s. to even 15 s. *per* acre, for the land that possesses it. Tangle, or drifted sea-ware, has been spread on old grazing pastures, and has had a wonderful effect in increasing the quantity of herbage, and in making the land eat cleaner. It acts as a condiment, for both cattle and sheep not only eat the grass on which it had been spread with avidity, but throve well, and were made sooner fat *. Mr Newton of Cartland-hill, near Inverkeithing, mixes it with long dung, and finds that it makes a most excellent compost. The ware, however, in that part of the frith, is of a weaker sort, and has less saline substances in it. When of a more powerful description, it should never be used as a compost, but laid fresh on the land. If there is no land under the plough ready for it, let it be put on grass lands, but in that case great care should be taken to lay it thin, otherwise it will kill the clover plants.

On some farms near Dunbar, the land is covered with sea-weed every second year, which enables it to go through that severe rotation, 1. Turnips; 2. Spring sown winter wheat; 3. Clover, either cut or made into hay; and, 4. Wheat again. It is only, however, by the farmers having such a command of manure, eating the turnips on the ground, and drilling and hand-hoeing the wheat crops, that such a system could be persevered in. For the second wheat crop it answers extremely well, to apply the sea-weed early in spring, on the grass to be cut, if it is laid on in dry weather. Sea-weed should never be applied on ground for

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* Another of my correspondents states, that he has had sea-ware spread on old pastures; that it produced a great quantity of grass, but the cattle, he observed, were not fond of eating it. Perhaps it had grown too rank before the cattle were put in, and it ought to have been cut for hay.

turnips after March, as it seldom incorporates with the soil in such a way as to insure a good crop, and if the weather is not moist in the summer, it is probably one cause of breeding the fly, so destructive to turnips.

6. *Composts.*—Some farmers condemn the use of composts of earth, with either lime or dung, as too expensive; requiring much time before they can be applied; troublesome to carry and to spread; and where the price of labour is high, not likely to pay. They prefer, therefore, putting on any good earth by itself, that may be found about the farm. Such compounds, however, when properly applied, have their advantages, in particular, when they are laid on, 1. muirish lands, and 2. fallows or grass fields.

1. Mr Hope of Fenton informs me, that he had on his farm fifty-two acres of muir land. His system was, to summer-fallow, to dress it as much as possible with a compound, made with the scourings of ditches, high headridges, and any spare earth he could find on other parts of his farm; by which means he has gone over nearly the whole fifty-two acres twice during the last eight years, at the rate of sixty double cart-loads each time *per* acre; and now, as the nature of the soil is much improved, he finds that farm-yard dung can be applied with far greater advantage, than before the application of the compound dunghills; the soil having become much firmer, therefore stands the summer's drought better, which frequently before burnt up the crops, although well manured. After the summer-fallow, he never sows wheat in winter, as he has repeatedly experienced, that after this muirish kind of soil has been wrought very fine in summer, from its being incumbent upon a bottom so extremely retentive of moisture, a great part of the plants were completely destroyed in the spring; he now, therefore, always sows in the spring, ei-

ther wheat, barley, or oats, as circumstances permit; along with this crop he sows grass seeds; allows the grass to remain one, two, or three years, then oats after the grass, which finishes the rotation.

This is evidently a most material improvement, altogether founded on the use of *compound dung-hills*, by which a soil was in a manner created or manufactured, so as to render it fit, from its texture, *to retain* moisture and manure, two of the principal sources of fertility.

2. Many farmers apply composts to fallows, more especially when the soil consists of thin clay, (in which case the effort it makes is very great), or when the quantity of lime or dung is inconsiderable. The compost should be well mixed and broken, spread on the ploughed surface of the fallow, and ploughed in. The fallow should get two ploughings, besides harrowings, after the compost is laid on, that it may be well mixed with the soil before the crop is sown.

3. Composts are peculiarly calculated for top-dressing grass fields, if to remain in that state for some time, for pure dung is apt to evaporate and to lose all its substance. When composts are put on grass fields, at the rate of about sixty cart-loads *per* acre, about the month of February, their effects are very great.

On the subject of composts, the following additional particulars remain to be explained.

Where no moss or peat earth can be procured, it is an excellent practice, when the head-ridges, (on which the plough turns, and where of course much rich earth must be deposited), get high, to take off about a spade deep, and to lay it up with dung and lime during the winter, to be used in spring as manure for the barley or oats intended to be laid down with grass seeds. Mr Hunter of Tynefield, however, is of opinion, that hand labour, in every case of turning and preparing composts, is too expensive,

and thinks it better, where any depth of soil has accumulated on the head ridges, to turn it with the plough, after harvest, and to mix about sixteen bolls of lime shells, with about 150 yards of earth, which is sufficient to manure an acre.

An intelligent farmer, (Mr Laing of Campend, near Dalkeith), is of opinion, that by making composts judiciously, the fertilizing powers of dung or lime may be increased, in the ratio of one-fourth, or that instead of twenty, by judicious management, twenty-five acres may be manured with the same quantity of dung; for that purpose he proposes to collect cleanings of the road, scourings of the ditches, or accumulated earth on head lands, with as much dung as will raise a fermentation or heat in the dunghill, turning it over for a few weeks before driving, that it may be thoroughly incorporated *.

Mr Dudgeon of Prora observes, that compounds of all kinds are valuable; they so act upon one another in the mass, that the chemical properties of the whole are changed so as to render it efficient as a manure. Earth and lime make a good compost, and when the lime is applied in its ordinary quantity, in addition to the earth, the

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* Mr Laing very strongly recommends, when wheat is sown with one furrow after grass, (which in most soils is a very precarious and uncertain crop), manuring it with dung or lime compost, after being ploughed, as it would derive great benefit from the carting consolidating the soil; for in ley wheat, very often there is a vacancy between the furrows, from which the plants die when they are extending their roots for food, which the carting and treading of the horses would in a great measure prevent. The advantage of treading wheat land has long been known in England, and should be secured, as often as the circumstances of the case, and the pressure of labour, at the busy seasons of the year, will admit of it.

effects are truly astonishing. It even produces good crops, though but the one half lime is applied.

Recent improvements in manures.—Three improvements have recently been discovered in Scotland, in the art of preparing manures, of which it may be proper to give some account in this place; namely, 1. Lord Meadowbank's; 2. Dr Rennie's; and 3. Mr Mitchell's.

1. In various parts of the Highlands and islands of Scotland, it was not unusual to bed the cattle with moss or peat earth, for the purpose of increasing the quantity of manure; but Lord Meadowbank certainly was the first, who investigated that species of manure, on scientific principles, and communicated the result to the public. By his plan, one ton of dung will ferment three tons of moss earth, which is certainly one of the most valuable discoveries that has been made in agriculture, and must, if duly attended to, greatly enrich many hitherto neglected districts *. Mr Thomson of Bewlie, in Roxburghshire, in-

* See Mr Aiton's Treatise on Moss Earth, printed in 1809. The following is the process recommended by Lord Meadowbank:

The moss and dung must be thrown up in alternate strata into a compost midden, about four feet and a half high. Moss may be laid six inches deep, dung ten inches; moss six inches, dung four inches; moss six inches, and then a thin bed of dung; and cover the whole with what remains of the moss. The heap should be put loosely together, and made smooth on the outside.

The compost, after it is made up, gets into a general heat, sooner or later, according to the weather, and the condition of the dung; in summer in ten days or sooner; in winter not perhaps for many weeks, if the cold is severe. It always, however, has been found to come on at last; and in summer it sometimes rises so high as to be mischievous, by consuming the materials (*fire fanging.*) In that season, a stick should be kept in it in

forms me, that he has had the experience of this compost for five years, to a very considerable extent, and has found it to answer. In making compost dunghills, he has, as nearly as possible, followed Lord Meadowbank's directions; but when he has plenty of dung, he puts only two or two and a half cart-loads of moss, instead of three to one cart-load of dung. From this compost, he has raised

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different parts, to pull out and feel now and then; for if it approaches to blood-heat, it should either be watered or turned over; and, on such an occasion, advantage may be taken to mix it with a little fresh moss. The heat subsides after a time, and with great variety, according to the weather, the dung, and the perfection of making up the compost, which then may be allowed to remain untouched, till within three weeks of using, when it should be turned over, upside down, and outside in, and all the lumps broken; then it comes into a second heat, but soon cools, and is taken out for use. In this state, the whole, except bits of old decayed wood, appears a black free mass, and spreads like garden mould. Use it weight for weight like farm-yard dung, and it will be found, in a course of cropping, fully to stand the comparison.

Let it be observed, that the object of making up the compost is to form as large a hot-bed, as the quantity of dung employed admits of, and then to surround it on all sides, so as to have the whole benefit of the heat and effluvia. Peat nearly as dry as garden mould in seed time, may be mixed with the dung, so as to double the volume and more, and nearly triple the weight, and instead of hurting the heat, prolong it. *Prize Essay, by Lord Meadowbank*, pages 149, 150, and 151.—This manure succeeded with Mr Dudgeon, Prora, beyond expectation on fallow for wheat; and with twenty carts *per* acre, in place of twelve of farm-yard dung, has been completely equal to it. But there is reason to believe, that merely for want of attention, and allowing it to be too much heated, the plan has sometimes failed, and in such cases has got a character it did not merit.

as good turnips as from dung alone, and from it has raised as good crops of wheat after fallow, to the extent of forty or fifty acres *per annum*, as from dung. He has on his farms plenty of moss, and when it is within reach of arable land, he can from experience recommend the moss compost as a great acquisition to farmers.

2. Dr Rennie of Kilsyth has paid particular attention to moss earth as a manure, and has discovered a very simple process by which it can be rendered valuable. He proposes, that it shall be laid alongside of a pool formed for receiving the juice of the dunghill. For ten days it ought to be saturated with that liquid, occasionally turning it during the process of watering; it should then be allowed to lie in a thick heap, and to acquire a very gentle, almost an imperceptible degree of fermentation, after which it is fit for application. By the abstraction of its juices, however, it is evident that the dunghill would be greatly deteriorated.

As connected with the subject of peat as a manure, it may be proper to remark, that Mr Church of Hitchill strongly recommends what may be considered as a recent improvement in Scotland, namely, the use of peat ashes as a manure for turnips. They should be burnt in the Berkshire mode, and though the ashes are said to be a manure of only short duration, yet Mr Church has had satisfactory experience of the advantage to be derived from them. If by their means a good crop of turnips can be obtained, and afterwards eaten off by sheep, the land will thus be as much enriched, as if the turnips were grown from farmyard manure. Putting on as many ashes as just to cover the surface, will secure a good crop. When peat is plentiful, this is an object well worth attention.

4. One other improvement in the preparation of manure remains to be described. It is a discovery made by Mr Mitchell, surgeon at Ayr, which both the inventor and others in his neighbourhood have tried with the most be-

neficial effects. The following description of the process is given by Mr Mitchell: "Take thirty-two Winchester bushels of lime, and slack it with sea-water, previously boiled to the saturated state, or to the state of brine, to the consistency of soapers' waste. This quantity is sufficient for an acre of land, and may either be thrown out of the carts, with a shovel, over the land in the above state, or made into compost, with forty carts of moss or earth, in which state it will be found to pay fully for the additional labour, and is sufficient for an acre of fallow ground, though ever so reduced before. Its component parts are muriate and sulphate of lime, mineral alkali in an uncombined state, also muriate and carbonate of soda. All the experiments have done well with it, but especially wheat and beans, and it has not been behind any manure, with which it has been compared. There is one instance, in which it was tried, in comparison with seventy-two cart-loads of soapers' waste and dung, and although this was an extraordinary dressing, nevertheless, that, with the new manure, was fully above the average of the field. The experiments this year are more extensive, and as far as the season has gone, look well, and promise a good crop *." This species of manure, however, could only be prepared near the sea, or in the neighbourhood of the salt springs in Cheshire; but as a sufficient dressing, for an acre, can be transported in four single-horse carts, it may be carried twenty or thirty miles inland to advantage.

Mr Mitchell calculates, that 3000 gallons of sea-water, boiled down to about 600 gallons, will slack 64 bushels of lime-shells, a quantity sufficient for two acres. The expence of carrying the water from the sea, the evaporation and slackening, will cost 20 s.; the 64 bushels of lime-shells cost him 40 s., or L. 3 in all; hence the total price of this manure is only at the rate of 30 s. *per* acre, and the

* Aiton's Ayrshire, p. 385.

expence of carriage must be trifling, owing to the smallness of the bulk. The price, however, must depend upon the strength of the sea-water, the price of the coals and of the lime-shells. In situations where the sea-water is strong, double the quantity of lime, slackened at the sea-side, would answer the purpose equally well, and it is in the power of every one to make it. Indeed brine might be prepared, by making pits in the neighbourhood of the sea, where the soil is retentive, or reservoirs in the rocks, and filling them in the summer months with sea-water, the heat of the sun would soon make the water of the strength required at very little expence. Mr Mitchell has also made some experiments with urine and lime, which he has found a good manure. He gets the urine at the Barracks at Ayr in considerable quantities. He has likewise used as much lime as dried up the whole night soil, in cleaning the privies at the barracks, and found it not only useful as a manure, but that it prevented a nuisance which formerly used to annoy much both the town of Ayr and the garrison. The lime made the contents of the privy so easy to work, that the price of the night soil and ashes, which formerly used to sell for L. 6, now fetches L. 40. The persons who have the sale of barrack dung, ought to be compelled to mix the night soil with lime, all over the kingdom.

Sect. III.—*Of Ploughing, and the most Advantageous Modes of conducting that operation.*

The swing plough now commonly used in Scotland, as improved by James Small, from the simplicity and the excellence of its construction, is perhaps the most useful instrument ever invented. It is cheap, is applicable to all soils

and situations, can be worked by two horses or two oxen without a driver, and is calculated either for deep or shallow ploughing, as the case may demand. It requires more skill in the management than wheeled ploughs, which the farmer may set to any particular depth, and which the ploughman cannot vary from at pleasure; but the dexterity which the Scotch ploughmen attain by practice, cannot be surpassed, and such a check is therefore unnecessary. Bad ploughmen, at the same time, may certainly be met with in Scotland, as well as in other countries, but not so frequently. To this perfection, the premiums given to the best ploughmen, at annual competitions in various districts of the country, have greatly contributed *.

* It is perhaps but a just tribute to the first promoters of this scheme of ploughing matches, to make mention of them in this work. There may have previously been incidental meetings of this sort, but they seem to have been first established, under a proper system, in the county of Clackmannan, when Mr Reoch, from Long-Niddry in East-Lothian, became occupier of the farm of Hilton, about the year 1780. Mr James Stein, distiller at Kilbagie, who farmed extensively in the same county, (and who employed the late George Miekle to erect the first threshing-machine in Scotland, on an improved system), together with Mr Reoch, were accidentally led to appoint a competition of ploughs upon a certain field, where judges, after a strict examination of the work, awarded small marks of distinction to the victors. Other similar meetings succeeded, and honorary medals to the best ploughman, and small pecuniary rewards for the exertions of those who were unsuccessful competitors, were distributed. In short, the example had a wonderful effect, and since, under the patronage of the Highland Society of Scotland, the same plan has been introduced into almost every county in that part of the united kingdom. The original ploughing matches were warmly patronized by Mr Erskine of Mar, who has uniformly displayed an ardent zeal for promoting agricultural improvement of every description, much to the credit of his own character, and the benefit of the public.

The importance of good ploughing is such, that an intelligent farmer remarks, he has often observed a difference in the crop of some ridges where he has had a bad ploughman, when compared to the rest of the field, where the operation had been judiciously performed. Indeed, if one field is ploughed only four and a half inches deep, and another nine inches, the latter becomes capable of giving room and nourishment to twice the length of roots the former can maintain, consequently becomes more productive, and can afford a higher rent. Besides, the horses of a good ploughman suffer less from the work, than those intrusted to an awkward, and unskilful hand.

The great difficulty in ploughing is, to determine the width and depth of the furrow slice, which must vary according to the object the farmer has in view, and the nature of the preceding and succeeding crop, &c. The following table will give some idea of what is considered to be a proper size, in different circumstances, though it must be regulated, in almost every case, according to the nature of the soil that is to be worked.

TABLE OF PLOUGHING.

Nature of the Ploughing.	Width. Inches.	Depth. Inches.
First fallow furrow,	10	6-8-10
Second furrow ditto,	9	6-7
Third furrow,	8	5½
Fourth furrow,	7	5
Seed furrow,	7	4
Oat crop from turnips,	9	6-7
Oat crop from clover ley,	9	5-6
Beans, when on one furrow,	9	6-7
Beans, if with a second furrow,	9	5
Barley, first furrow,	9	6
Barley, second furrow,	8	5

Barley, last furrow,	-	8	4
Potatoes, first furrow,	-	9	4-6
Potatoes, second furrow,	-	8	5

The depth of ploughing, as already observed, must, in a great measure, be regulated by the soil there is to work upon. On thin soils, more especially on a rocky substratum, the ploughing must necessarily be shallow; but where the soil is of a depth sufficient, it is material to plough deep at the commencement of a rotation, and afterwards to vary the depth, according to the different crops intended to be raised. If summer fallows are not ploughed deep enough, when they receive the first furrow, it is impracticable, in a dry season, to go to a sufficient depth afterwards, though it is desirable not to go deeper, than it is practicable to clear the soil turned up, of every description of root weeds.

It is said, that when the soil is incumbent on sand, coarse clay (till) or gravel, it is much better to rest contented with the depth of soil you already have, than attempt to increase it, at the hazard of bringing up such unproductive substances. But such an idea is condemned by many intelligent practical farmers. It is observed by them, that though deep ploughing without manure, or frequent exposure after it is brought up, may be unprofitable, (as the subsoil is less productive than the surface in its natural state), yet where these are properly applied, the soil, its thickness being increased, becomes more impervious to wet, and less so to drought, and of course more fertile; nor where the land is shallow, is the turning up of a little *till* or coarse clay to be apprehended, if the *till* is not of a poisonous quality; as by that means you deepen the soil, which, when the new earth is mixed with lime and dung, will be found a great improvement *. Where sea-

* Baron Hepburn says, that though deep ploughing shall bring to the surface a sour-looking, obdurate, pale yellow coloured *ti*

sand, abounding with shells, can be had in considerable quantities, that will be a sufficient corrector.

The following general rules regarding the depth of ploughing, have been recommended from various respectable quarters, and as the subject is of infinite importance, it cannot well be too much inculcated, nor represented in too many points of view.

Maxims as to deep Ploughing.

1. The depth which land ought to be ploughed, must be regulated, 1, by the depth of soil, and 2, by the means of improving it; when the soil is deep, whether light or clay, it ought to be ploughed as deep as a pair of horses can go, and at some seasons, perhaps, it might be advantageous to plough it with four horses; but where the land is thin and poor, and the means of enriching it scanty, the depth of ploughing ought to be in proportion to the quantity of manure.—2. Deep ploughing is highly advantageous upon every soil, and for all crops, except on those soils where the substratum is of an ochry sand, which soils, in fact, are scarce worthy of being cultivated, unless in situations, where much alluvial compost, or short town manure, can be procured.—3. It is a general rule, never to plough so deep as to go through the soil that was formerly manured and cultivated, excepting upon fallow, and then only when you have plenty of lime or dung to add to the new soil.—4. Deep ploughing is liable to this objection, that it requires more manure to enrich a great body of cultivated soil, than it would do to enrich a smaller quantity. It is, however, to be remarked, that whilst lime sinks in the ground, putrescent manures ascend. In

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or coarse clay, I care not, *experto crede*, the manure given to the fallow mellows it sufficiently.

a burying ground, the soil is never meliorated below the grave, whilst it is enriched to the very surface. There is no great danger therefore in putting dung deep. If laid on shallow, it is not only dried up, but actually volatilizes and is lost.—5. Farmers who follow the practice of deep ploughing, find a great advantage from it, both in dry and in wet seasons. The extreme of either is not so prejudicial as if the crop had been ploughed with a shallow furrow.—6. Many farmers recommend, when fallowing land, to go as deep as possible the first furrow, by which the subsequent furrows will be more easily done, and to expose the soil to the winter's frost and to the summer's heat; but when land is ploughed in spring for beans or oats, a strong soil cannot be ploughed with safety, above five or six inches, and when lime or dung has been mixed with the soil, a shallow furrow, not exceeding four or five inches in depth is advisable *.

Deep ploughing is not to be recommended: 1. According to some, when rich old leys are broken up for cropping, though many respectable farmers are decidedly of opinion, that old grass land should be ploughed with a strong furrow at first, so as the harrowing process, upon which the crop materially depends, may be sufficiently executed. 2. When grass only two or three years old

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* When Mr Wood commenced his operations on the Great Tew estate in Oxfordshire, he began with a deep ploughing, though the farmers in the neighbourhood assured him, that it would spoil the staple of the lands; but when they saw 54 Winchester bushels of oats, and other crops in proportion *per* acre, their ideas were soon altered, and the valuator of the crops said, "That they must now all try to spoil the staple of the land to get good crops." Their ploughing had formerly been so shallow that it hardly covered the dung, which they considered an advantage.

is broken up, more especially where it has been pastured with sheep; a system to be particularly attended to in ploughing land that is much infested with annual weeds, as, from the extreme condensation of the soil by the trampling of the sheep, a furrow, even of a moderate depth *to appearance*, will make the plough penetrate below the staple that had been cleared by the culture given during the previous fallow; from which circumstance, myriads of the seeds of annuals are raised to the surface, where they vegetate, and materially injure the crop cultivated, besides replenishing the soil with a fresh supply of their own seeds. 3. When lime has been recently applied, as it has such a tendency to sink from its own weight, and the moisture which it imbibes. 4. Where turnips have been eaten off by sheep on the land where they grew. In all these cases, from four to five inches deep will be found sufficient. And, 5. If land is infested with grass, which generally runs much on the surface, the first ploughing should not be deep.

In the following cases, deep ploughing is advisable. 1. Where the first furrow is given to land intended to be fallowed in the end of autumn or beginning of winter, and where grass or root-weeds do not abound, the soil is thus pulverized and sweetened by the frost; and, 2. In muirish or cold soils, as it affords a greater scope for the roots of plants to procure nourishment, admits the superabundant moisture to subside from their roots, and prevents the summer drought from making an injurious impression on the growing crops: for it may be remarked, that on such land, shallow ploughing exposes vegetation to be starved or drowned in wet weather, and to be scorched or withered in dry.

We shall now proceed to give a general view of the advantages of deep ploughing, a practice which cannot be too frequently recommended. Some of my correspon-

dents complain, that it is likely to get into disuse with slovenly farmers, and to be too much neglected by many who merit a different character. To prevent the introduction of so injurious a system as shallow ploughing, it would be advisable, in some cases, to have one or two strong ploughs, calculated even for four horses, by which the strongest and stiffest land may be cultivated to the proper depth, whenever it was necessary.

Advantages of deep Ploughing.

1. Bringing up of new mould is peculiarly favourable to clover, turnips, beans, and potatoes; and indeed, without that advantage, these crops must diminish in quantity, quality, and value. 2. Deep ploughing is of infinite consequence, not only by furnishing more pasture to the roots of the plants, but, above all, by preventing the injurious consequences of either too wet or too dry a season. This is a most important consideration, as, if the season is wet, there is a greater depth of soil for absorbing the moisture, so that the plants are not likely to have their roots immersed in water; and in a dry season, it is still more useful, for in the lower part of the cultivated soil, there is a reservoir of moisture, which is brought up to the roots of the plants by the evaporation which the heat of the sun occasions. 3. By deep ploughing, also, the ground may be more effectually cleared of roots and weeds of every description: at the same time, where they abound, it is a good rule, not to bury them by the first ploughing, otherwise it becomes difficult afterwards to clean the land: But after the land is cleaned by hand picking, and by the instruments employed for that purpose, it is then proper to raise fresh mould, to incorporate with the manure to be afterwards applied. 4. By deep ploughing, animal and vegetable manures may be

covered, which is not the case with shallow ploughing, in consequence of which, much of the value of such manures is lost *. 5. An intelligent farmer, after pointing out that deep ploughing increases the staple of the soil, keeps the roots of the corn from being injured by wetness, and also enables the crop longer to resist drought, adds: "*I however found deep ploughing attended with good crops, when ridges, shallow ploughed, in the same field, were but indifferent.* A decisive proof in favour of deep ploughing †."

* It is hardly possible to bury animal manures, every atom of it rises to the surface; but fossil manures have a tendency to sink.

† The Norfolk farmers, generally possessing a thin light soil, with a poor and barren subsoil, prefer shallow ploughing at all times, and argue that it is easier to keep a small quantity of soil in good heart, than a greater quantity, which would be formed by deep ploughing, and also that it is easier to keep it clean of root-weeds; nay some imagine that the *pan*, as it is called, retains moisture, though it is evident that a thin soil must soon have all the moisture in it much more speedily evaporated than a deep one. Mr Church has heard the farmers in that county say, that the land was always injured when the *pan*, or top of the subsoil, was broken by deep ploughing, which was never done but by a careless or bad ploughman. There may be some ground for their partiality in favour of their mode of ploughing thin and light soils; and it would not be advisable for them to alter their system, unless they fallowed their lands, gradually deepened them, and limed and dunged the new soil. But if on these principles they were to increase the depth and quantity of the surface soil, their crops would be more certain and abundant, more especially in dry seasons. The following valuable hints on this subject, are drawn up by one of the most intelligent farmers in Scotland, whose name, if he had permitted me to use it, would have done credit to any publication.

"After shallow ploughing, the crop, in heavy rains, is very apt to be socked about the roots, in consequence of which the

It is another important advantage resulting from deep ploughing, that it has a material effect in improving the climate of any district, where too much moisture may abound, which would be retained by the imperviousness of

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straw is whitened prematurely, and the grain does not come to perfection; hence the necessity, when the surface is thin, of thickening it by deep ploughing. I have seen deep ploughing this kind of land, for the first, and even the second year, after ploughing up the under-soil, produce a teazing crop of thistles, which was hurtful to the corn crop; but after the cold soil is well mixed with the old surface-soil, and after the lime and dung applied to it, *when summer-fallowed*, has begun to operate on the new soil, I have found great benefit from this operation; but it is the winter furrow before the summer fallow that should be ploughed deep; the lime and dung applied to the fallow, as I have already mentioned, operate strongly on the fresh soil. I would recommend ploughing even light lands, although thin, to a proper depth, though gravel or stones may be turned up and mixed with the surface-soil. I have found no inconveniency by it. Both turnips and corn crops, as well as pasture grass, stand out better, both in wet and dry seasons, when a shallow surface-soil is deepened, even by an under stratum that may appear very worthless. As proof of the utility of deepening surface-soils, both wet and dry bottoms, look at the patches of gardens that have received deep digging or shallow trenching, belonging to the cottages placed on the skirts of the muirs all over Scotland, and you will observe the additional verdure and luxuriance of crop upon these patches, more than upon the lands adjoining, the surface of which is often very little more than scratched by the plough, and the dung and other manure applied to it has not deepness of soil to operate upon, so as to produce a good crop."—It is to be observed, however, that the quantity of dung usually applied to patches of garden ground, so far exceeds what any farmer can afford to give his corn fields, particularly in a muirland district, that the comparison here adduced, cannot, in that respect, be relied on.

the soil. Of this fact there is most satisfactory evidence. Dr Moir of Leckie, in Stirlingshire, had an estate of about 1000 Scotch acres, in the Carses, or lower parts of that county, which had been ploughed to the depth of only two inches or two and a half. That small portion of the soil had, accordingly, by continued cultivation, become much pulverized; whilst the subjacent stratum had, on the other hand, become hardened and compacted by the same process, so as to become totally impervious to water. The water consequently stagnated between the soil that was held in cultivation, and that which lay immediately beneath it, as if the latter had been clay or rock. He was accidentally led to try the effect of a double depth, and drains were at the same time constructed, to carry off the superfluous moisture. By these means, the ground has been rendered dry and fertile. The water, which was formerly lodged two and a half inches below the surface, now finds room to diffuse itself, and any superfluous quantity is carried off by proper drains. The result also has been, that since this improved mode of cultivation has been introduced, intermittent fevers, which were formerly epidemic in these Carses, are now altogether unknown in that neighbourhood *.

But although deep ploughing, to a certain extent, is advisable, yet there is a medium in this as well as in other things. Mr Hope of Fenton, an intelligent farmer in East Lothian, states, that he has tried the experiment of ploughing very deep with four horses, the result of which was far from encouraging a continuance of the practice. In one case, where he ploughed part of a fallow field

* See Dr Graham's valuable Report of Stirlingshire, p. 246 and 247. More cleanliness, and better living among the lower orders, have also contributed to the great diminution which has taken place in fevers of an intermittent sort.

with four horses, at fourteen inches deep, the crop of wheat was evidently worse than upon the rest of the field, that was ploughed in the usual manner; the land at the same time was of good quality, sufficient to have admitted a furrow much deeper than what was given. The reason of the inferiority of the crop upon the deep ploughed part, appeared to be, in consequence of that part of the soil, which had for ages been regularly manured, being turned down below the reach of the roots of the plants, and soil of a poorer quality brought up in its place. He is therefore inclined to think, that it is unnecessary to plough deeper, than where there is a fair probability of the different kinds of plants sending their roots; and as beans, clover, and turnips, the only tap rooted kinds usually cultivated in this country, seldom send their shoots above seven or eight inches down into the soil, and the culmiferous species not so far, it is probable, from these circumstances, that from seven to nine inches may be deep enough for all the purposes of ordinary culture. Occasionally, however, ploughing even a little deeper, in the course of a rotation, for the reasons formerly assigned, is advisable.

The following points remain to be touched upon, regarding ploughing. 1. The angle at which the furrow slice should be laid in particular cases; 2. The proper time for ploughing wet and dry soils; 3. The advantages of water-furrowing; and, 4. The rate of ploughing with a pair of horses.

1. As one principal object in ploughing is, to lay the land so that the harrows may, in the most effectual manner, raise mould to cover the seed, this object is most effectually accomplished by ploughing land of every description, with a furrow-slice about seven inches deep, and which, if about ten inches and a half broad, raises the furrow-slice with a proper shoulder; thus endeavouring to form, by the shoulder of each furrow, the angle 45, the

point which ought to be referred to, when determining between the merits of different specimens of ploughing. That is best obtained, by allowing the plough to incline a little upon the left side, and making the breadth of the furrow always bear a due proportion to its depth, which is about two-thirds, or as six deep and nine broad *.

2. In regard to the proper time for ploughing either light or clay soils, it is a proper maxim, that light land should be ploughed when it is in a moist state, but clays in a medium state neither wet nor dry. When perfectly dry, they will not plough at all, being so hard and tenacious, and they ought not to be ploughed when wet, as the land would be ruined by poaching. This circumstance renders the cultivation of clayey soils so extremely difficult.

3. In preparing land for a crop, water-furrowing is a very important operation, more especially in wet soils and climates; indeed not only are these water-furrows, or surface-drains made and dressed by the plough, but a *spade-man* is also employed, in all the well-cultivated districts of Scotland, to clear them out, as soon as the ridge is ploughed: the land is thus never injured by surface-water †.

4. An intelligent farmer, (Mr Blackie of Holydean), has sent me the following statement of the number of miles

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* Remarks by Mr Hope of Fenton. This is the general, if not the universal opinion of the Scotch farmers. In Norfolk they think that the soil should be completely reversed, without a shoulder, and perfectly flat. The angle 45 is strongly recommended in Bailey's Essay on the Construction of the Plough, and in his Durham Report; and in Brown of Markle's Treatise on Rural Affairs.

† Hints from Mr Peter Jack of Moncur. It is very strongly inculcated, and minutely described, in the Berwickshire report.

his ploughs travel in a day. An English acre of land, he observes, is ten chains long, and one broad; one chain is 66 feet: divide that into 80 furrows, which is as narrow as any body ploughs,—the whole furrows in one acre measure no more than ten miles*. An acre in one day is very good work for two horses, yet is a very slow pace when divided into eight hours' work. Turning at the ends of the land takes up one-tenth of the time. In a dry fine soil, and on level ground, a pair of good horses will plough twelve chains; on wet heavy land, nine, sometimes not more than eight chains; in crossing or stirring turnip land in summer or spring they will do sixteen chains, and in some very fine free land two acres. It must be remarked, however, that these things must greatly depend on the nature of the soil cultivated, and the season of the year in which the work is performed.

Mr Erskine of Mar, who has paid much successful attention to many branches of husbandry, calculates, that the number of yards travelled in ploughing an acre and a half with a sixteen inch furrow-slice, is - 16,320 yds.
And with a furrow-slice of 18 inches, - 14,400
The furrow-slice of 8 inches, - - 32,640
—— —— —— 9 —— - - . 29,040

* Mr John Shirreff remarks, that the distance travelled by the horses ploughing an English statute acre, with 80 furrow slices to the chain of 66 feet, is certainly ten miles, exclusive of turnings. But there are 88 furrow slices, nine inches wide each, in 66 feet, so that the horses ploughing a furrow slice of that width, travel eleven miles in ploughing a statute acre, exclusive of turnings. And, admitting the turnings to be one-tenth, the horses actually travel twelve miles and 176 yards, in ploughing a statute English acre.

To the same intelligent correspondent, I am also indebted for the following tables:

Tables, showing the Quantity of Ground ploughed, according to the different breadths of the Furrow-slices, and the rates of the Horses walking.

Breadth of the Furrow-slice.	Rate per Hour.		Length of Way travelled in ploughing	Quantity of Ground ploughed.		Breadth of the Furrow-slice.	Rate per Hour.		Length of Way travelled in ploughing.	Quantity of Ground ploughed.	
Inches.	Miles.	Furlongs.	Yards.	Roods.	Poles.	Inches.	Miles.	Furlongs	Yards.	Roods.	Poles.
8	1	—	14,144	2	24	8	2	—	28,168	5	7
9	—	—	14,157	2	37	9	—	—	28,193	5	33
10	—	—	14,148	3	11	10	—	—	28,188	6	21
11	—	—	14,157	3	22	11	—	—	28,215	7	5
The Rate of walking, being one Mile and half a Furlong.						The rate of walking, being three Miles.					
8	1	½	14,960	2	30	8	3	—	42,296	7	31
9	—	—	15,004	3	4	9	—	—	42,350	1	30
10	—	—	15,012	3	19	10	—	—	42,336	9	32
11	—	—	15,048	3	32	11	—	—	42,273	10	27
The rate of walking, being one Mile four Furlongs.						The Rate of walking, being four Miles.					
8	1	4	21,216	3	36	8	4	—	56,336	10	14
9	—	—	21,120	4	14	9	—	—	56,386	11	26
10	—	—	21,163	4	35	10	—	—	56,376	13	2
11	—	—	21,186	5	14	11	—	—	56,430	14	10 *

* It is supposed that in England in general, the common breadth of the furrow-slice is about nine inches; but the generality of the farmers in Norfolk, for various reasons, prefer having their furrow-slices full eleven inches broad; so that the quan-

The effect of short ridges, and consequently of frequent turnings, is most strikingly exemplified in the following table, drawn up by Mr Erskine of Mar, from actual experiment.

Names of Fields.	Length of Ridges.	Breadth to give an acre.	Breadth of the Furrow-slice.	Number of Furrows in the acre.	Time it takes in turning	Time taken up in stirring the soil.	Number of Hours in the day's work.
	Yards.	Feet.	Inches.		H. M.	H. M.	H. M.
7. South Gubber,	78	186	8	279	4 39	3 21	8
3. East Loch,	149	98		147	2 27	5 33	8
11. Harperhill,	200	73		109	1 49	6 11	8
2. South Muir,	212	69		103	1 43	6 17	8
17. Long Bog Croft,	274	53		79	1 19	6 41	8

Thus it appears, when ridges are 78 yards in length, that no less a space of time than four hours and thirty-nine minutes is spent in turnings, in a journey of eight hours; whereas, when ridges are 274 yards long, one hour nineteen minutes is sufficient, in the same length of time. What then must not the waste of time be in small paddocks, and when four or perhaps five horses are yoked one after the other?

It may be proper also to observe, that some farmers, convinced of the advantages of frequent ploughing, keep an extra stock for that purpose. Mr Andrew of Tillilumb states, that he constantly keeps four pair of work-horses,

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tity of the ground stirred in the same number of hours worked by them, must be considerably more than farmers in other districts can do, where the nature of the soil requires to have the furrow-slice of a narrower breadth. I understand that it is the practice in Norfolk to allow four horses for each plough, two for a journey of five hours in the forenoon, and the others for five hours in the afternoon. This must greatly increase the expence of cultivation.

and generally in spring and autumn has been in the custom of making up a fifth pair for harrowing, by yoking a saddle-horse and young colt. This is rather more than is usually kept on farms of such an extent, (112 Scotch or 142 English acres), but he has an advantage by it, being thus enabled to dress his land more completely; and the frequent ploughings, he finds, effectually prevent the depredations of the slug-snail.

Here it may not be improper to take notice of a system, which was practised in East Lothian forty years ago, that of spring sowing, without spring ploughing, and which is still occasionally adopted. Lord Kames, in his Gentleman Farmer, first printed *anno* 1776, has strongly recommended it, even though the scarificator or scuffler was then unknown *. Mr Wight of Ormiston, for twenty-five years past, has been in the practice of sowing barley and oats upon the winter furrow, and with much advantage, the crops being always more certain and more abundant. Independent of the increase of spring labour, by ploughing lands sufficiently clean and prepared before the winter, it is a dangerous and precarious operation turning up clay soils in the spring, more especially for barley, besides bury-

* "The preferable method for sowing oats, and especially in a clay soil, is to turn the field over after harvest, and to lay it open to the influences of frost and air, which lessens the tenacity of clay, and reduces it to a fine mould. The surface-soil by this means is finely mellowed for the reception of the seed; *which it would be a pity to bury by a second ploughing before sowing.* We are taught by experience, that this soil ploughed before winter, is sooner dry than when the ploughing is delayed till spring; and as early sowing is a great advantage, any objection on account of the superficial crusting is easily removed by a strong harrow, which would produce abundance of mould for covering the seed." Kames's Gentleman Farmer, p. 95 and 96.

ing and losing the advantage of a fine mellow surface, which cannot be regained after a spring ploughing. There is also the risk of rain during the operation, which in many instances sours the land so completely, as to render the chance of a crop very precarious. Mr Fletcher of Balinshaw, in Forfarshire, was accustomed to sow barley on a winter furrow, above twenty years ago. A respectable farmer in the Mearns observes, that if too great an accumulation of work was likely to be apprehended in the early summer months, an additional ploughing might be saved, by sowing oats on the winter furrow; and another intelligent farmer near Dalkeith, (Mr Mylne of Smeaton), remarks, *that ploughing for barley in spring is unnecessary* *, *unless in a very bad season, when the land could not be wrought, as it should have been, before winter.* Mr Yeaman of Murie, near Dundee, also tried barley on a winter furrow; and it was observed, on the crowns of the ridges, and as low down as the middle, between that and the furrows on each side, the barley was more luxuriant, and appeared richer than that sown in the common way; but towards the furrows, probably owing to the ridges being too much gathered, it was thinner and shorter, so that on the whole the difference of produce would not be material. A ploughing, however, was saved. Mr Stewart of Hillside states, that in his neighbourhood a second furrow is not given for oats, however early in the winter the land has been ploughed; nor is there any difficulty observed on that account: and Mr Thomson of Bewlie, in Roxburghshire observes, that it is a common practice in that part of the country, to sow oats after both the winter and spring furrows. From his own experience, he certainly prefers the winter furrow for oats, particularly when a dry spring

* It is said, that without ploughing in the spring, the weeds would soon be master; but that is prevented by the use of the scuffler.

and summer takes place. Old ploughed land keeps in the sap, and brings forward the young plants equally; whereas the corn sown in the spring furrow, in a dry season, does not come half away at first, and is full of aftershots, hence does not produce nearly so good a crop as the winter ploughed lands. It must be remarked, however, that a great part of the ground which carried turnips, must in every year be ploughed in the spring months; also, that in all backward seasons, much of the grass land intended for oats cannot be got ploughed sooner than February or March.

On a point not yet finally settled, it is proper to state the arguments on both sides, leaving the question to be ultimately decided by future experiments. The farmers in the Carse of Gowrie do not think it would answer their strong soil. When they have spare time in the beginning of winter, to plough part of their clover leys before Christmas, (which is sometimes the case), they think the mould or soil is too close, and on that account the oats are a more stinted crop, than when the ley is ploughed in January or February; and Mr Dudgeon, Prora, maintains, that clover ley ploughed soon in February, upon soft land, and upon all deep light loam for oats, will generally produce from one to two bolls *per* acre more, than if it had been ploughed about Christmas or early in January. The early ploughed land is also more apt to carry couch grass among the oats *. Mr Paterson of Castle-Huntly is decidedly of the same opinion. He admits, that barley might be sown on the winter furrow, where the soil is loamy, with a better chance of success, for that particular crop; but he

* Remarks by Mr Jack of Moncur. This is a great argument against too early ploughing for oats, as it sets the couch-grass roots in motion, and greatly increases their quantity in the soil; thereby both injuring the immediate crop, and adding greatly to the trouble and expence of the subsequent fallow.

contends, that repeated ploughings, both in clay and loam, during the driest season of the year, before the barley seed-time, is so necessary for perfectly cleaning the land *, that no saving of labour could compensate the want of them, which saving of labour *is supposed to be the best, if not the only reason, that can be given for sowing barley on a winter furrow.* As to the absurdity of burying that part of the surface after being prepared and meliorated by the influence of a winter atmosphere, and bringing up a soil less prepared, he asks, may not this be rather more speculative than solid † ? He is much inclined to think, that it would be much better to give the land another ploughing, as it would mix and soften the soils, render them more capable of receiving and covering the seeds, and enable them to spread their roots to greater advantage, by which a more certain crop would be insured. Upon the whole, he is clearly of opinion, that it would be impossible to keep the

* On this subject, Mr John Shirreff remarks, that the ground on which barley is to be sown, is always supposed cleaned *previously* by summer fallow, by turnips, potatoes, or some other cleaning crop, and never to depend on cleaning to be administered that very spring on which the barley or other grain crop is to be sown. So far from destroying, annual weeds at least, spring ploughing promotes their vegetation and increase.

† Mr Wight of Ormiston cannot concur with Mr Paterson in the idea, that burying the surface, prepared and meliorated by the influence of a winter atmosphere, and bringing up a soil less prepared, is more speculative than solid. The soils can never be more softened, or rendered more capable of receiving the seeds, than after a winter's frost; and he has always observed, that the seeds were abundantly covered, and enabled to spread their roots to sufficient advantage, so much so, that the barleys are in general rather too luxuriant than otherwise. He agrees, however, with Mr Paterson, that it is too early to plough clover leys before Christmas, and that ploughing them in January or February will insure a better crop, and a cleaner one.

ground clean, and in such good order for a succession of crops, without sowing barley, or something of the same kind, after having gone through all these operations.

On the other hand, it is contended by a number of intelligent English farmers, that spring crops may be successfully sown without spring ploughing: That the land can be effectually cleaned from root weeds by a couch-rake, and may be sufficiently stirred and pulverized by the cultivator or scuffler: That it is of infinite consequence to expose strong clay soils to the winter frosts, (which can only be done by early ploughing), but that the benefit of that practice is lost, if that part of the soil is ploughed down, that has been meliorated by the frost and the atmosphere. Can any thing, it is said, be more absurd, than to bury that dry friable porous surface, which the frosts have left in so favourable a state, and upon which, if rain falls, no plastering ensues, as it dries speedily, and remains in a porous state; whereas, if ploughed in spring, any rain that falls, so impregnates the soil with moisture, that if worked, it plasters, and the north-east winds harden it like stone.

As the practice above alluded to is of such peculiar moment, I thought it necessary to insert these observations, though not peculiarly connected with the husbandry of Scotland.

Sect. IV.—*On Fallowing.*

Summer fallowing of land, or the practice of working it during the summer months, has undoubtedly been the chief source of improvement in the clay soils of Scotland;

for the ground in cultivation, having been kept in constant tillage for ages, was infested with weeds of various descriptions, which by no other means could have been kept down or eradicated. In dry soils, since the introduction of the turnip husbandry, fallowing has no longer become necessary* ; but in strong lands, it is still accounted the foundation of their fertility, by the most intelligent practical farmers that Scotland boasts of. Indeed, the peculiar correctness and attention with which the fallowing process in strong soils is executed in Scotland, is considered to be one of the most important and distinguishing features of the Scotch system. It is not repeated so frequently as it is in many districts in England, occurring in general but once in the course of six years; the soil of the field subjected to this operation, however, by frequent ploughings, though consisting of the strongest and most stubborn clay, is thus completely pulverised, weeds are extirpated, insects are destroyed, and fertility insured during the whole course. It is evident, at the same time, that a large proportion of the richest land in the country is annually subjected to this process. Could the practice be dispensed with, therefore, and the same weight of crops raised both as to quantity

* A respectable farmer in Angus, (Mr Brown of Cononsyth), recommends fallows even in dry soils. He states, in a communication to the author, that one-seventh of the dry land of his farm is in fallow or turnips, but in general he only sows about ten acres of it turnips, as he finds that he has much better grass, when sown among wheat after fallow, than with oats after turnips; and when broke up from ley, the difference of the oat crop, in favour of bare fallow, is also discernible. A crop of wheat is obtained at less expence than turnips and oats, and on an average of years, is as valuable ; the manure produced by wheat straw may not be so rich as when many turnips are raised, but a greater quantity is procured, and if driven out into a large dunghill in the winter months, will answer perfectly well for fallows.

and quality, as when fallowing was practised, there cannot be a doubt but a saving of a prodigious magnitude would arise to the public.

In considering this subject, it is proposed to give, 1. An account of the manner in which the fallowing process is performed; 2. The expences attending it; 3. A statement of the advantages derived from the practice, as transmitted to me by a number of the most intelligent practical farmers in Scotland; 4. An account of some cases where fallowing strong lands is not adopted in Scotland; and 5. Some miscellaneous particulars connected with this branch of the inquiry.

1. *Of the manner in which fallowing is performed.*—As the most intelligent farmers in Scotland are convinced, that their after-crops are good, in proportion to the correctness with which the summer fallowing process is executed, they bestow the greatest possible attention on that operation. They commence the ploughing, if the season will admit of it, as soon as the sowing of the winter wheat is finished. Mr Brown of Markle recommends, that this should be done by gathering up the ridge, which both lays the ground dry, and rips up the furrows. The second ploughing should be given as early as possible after seed-time, and the ridge should be cloven down, by a strong furrow, preparatory to cross ploughing, which is a most essential part of the process, and one that ought to be carefully executed. Against the end of June the land should be so completely reduced by harrowing and rolling, as may permit couch-grass and other root weeds to be completely gathered by the hand. It should then be ridged up, when, if sufficiently cleaned, dung may be applied; but if not in that state, another ploughing must be given, previous to the application of manure, after which it ought to be seed furrowed, by the end of August, and of course be ready for sowing

any time after the middle of September. It has been found, that by allowing land to lie for several weeks between seed-furrowing and sowing, it gets consolidated before the roots of the plant strike in the ground, in which way the plants are not so apt to be thrown out of the soil by the spring frosts *.

The process of fallowing, therefore, according to the Scotch system, is both laborious and expensive, but it is the pivot on which depends the proper cultivation of clay lands in Scotland. The number of ploughings, (including one or more cross-ploughings), where the soil is stubborn, must be as many as from six to seven. Rolling is also necessary to break the clods, in order that access may be had to the root-weeds mixed with the soil, and the land must be harrowed for the purpose of bringing those weeds to the surface. There is reason however to believe, after every solid clod has been crushed and reduced by the roller, that this object may be attained by the scuffler, when the irons are bent. After harrowing, it is a most essential part of the process to collect the weeds by hand-picking, the expence attending which is well bestowed. Mr Brown justly observes, that more root weeds are taken off by one gathering, than can be destroyed by a couple of ploughings, allowing the season to be ever so favourable; and if hand gathering will save one single ploughing, (which cannot be stated at less than 12 s.), the expence is amply repaid. Some burn the roots that are gathered upon the field, and spread the ashes, whilst others accumulate them into a heap, frequently turning it over, till the weeds rot, and by mixing the whole with lime, a most excellent compost is made, by means of which an enemy is converted into a friend †.

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* Communication from Mr Hope of Fenton.

† See Brown's Treatise on Rural Affairs, vol. i, p. 202.

2. *Of the expence attending the process.*—Nothing but the deepest conviction of the advantages to be derived from that operation, could induce such multitudes of skilful and intelligent farmers, to incur the numerous and heavy charges attendant upon the summer fallowing process. It is evident, however, that the expence must depend upon the amount of the rent, the number of ploughings, &c. and the value of manure applied. Indeed, the crop of wheat succeeding the fallow, must pay the rent and expences of two years; of the amount of which, the following calculation will give some idea.

	Per Scotch acre.	Per English acre.
1. Six ploughings, harrowings, &c. - - -	L. 4 0 0	L. 3 3 0
2. For the rent of two years at L. 3 *per annum per* Scotch, or L. 2 : 7 : 3 *per* English acre, - -	6 0 0	4 14 6
Total,	L. 10 0 0	L. 7 17 6

Mr Somner of Gilchriston, however, estimates, that *including lime* as well as rent and labour, the expence cannot be less than L. 15 *per* Scotch, or L. 11, 16s. *per* English acre. Nay, L. 20 and upwards have in many cases been so expended; but the whole of that sum cannot be charged against the fallow crop, as the lime remains productive for many years afterwards.

3. *Advantages of fallowing clay soils.*—Nothing could justify such an expence but advantages of a superior description; and the returns which I have received in favour of the fallowing system, are so extremely important and satisfactory, that though it may appear tiresome to some readers, I think it incumbent upon me to give extracts

from a number of most interesting communications which I have received, explaining the advantages of the system.

1. These benefits are very ably stated by one of the first farmers in East-Lothian, (Mr Hunter of Tynefield). That gentleman observes, that he has always experienced, a naked fallow necessary, once during a rotation of six, (1. Fallow; 2. Wheat; 3. Clover; 4. Oats; 5. Beans; 6. Wheat); and he is persuaded, that it will be found the case, in every soil not of the turnip sort. Clay soils become hard when constantly cropped, by being always ploughed in winter, or early in spring, and as in so moist a climate as that of Scotland, they must be often wet during the operation of ploughing and harrowing, they lose their fertility, becoming as it were impervious to the sun and air, as well as to the root of plants, &c. Summer ploughing is necessary to rectify this; besides giving opportunity to take out all sorts of root weeds, to put in lime, &c. &c. Other drilled crops, as beans, pease, or tares, must be sown early in spring. Potatoes also must be planted in April to have a full crop, and cannot be substituted for a fallow to any tolerable extent; even the ruta baga seems to Mr Hunter unfit for the purpose in our northern situations, as it is long of coming to its growth, and ought to be sown early in May, otherwise it will seldom be a full crop. The grand object with the skilful agriculturist will be, to keep his land clear of weeds of all sorts, and summer fallow has ever been found the only sure method of doing so. Hitherto no plant has been found so well fitted to permit that as the field turnip, which may be drilled, with the best prospect of success, from the first week of June, to the second week of July inclusive, giving full time to clean and prepare the land properly, which, together with the ploughings in the rows among the turnips, completes the fallow in the most perfect manner. This, however, is only applicable to soils of a light description.

In the Carse of Gowrie also, fallowing is considered to be indispensable. That operation, it is said, is necessary to meliorate the ground, to make it of a kindly texture, to clean it of weeds, &c. It likewise gives an opportunity to repair all the small drains in the field; enables the manure to be applied at a proper time, and the land to be sown at a favourable season; by which means the successive crops are greatly encouraged, (the ground being in complete order to yield its produce), and less dung answers the same purpose for a succession of crops *. A most respectable correspondent assures me, that one-fourth less dung may be used to a fallow field, than to one in a constant course of cropping, and that the effects will be more discernible in the first than in the latter case.

Mr George Robertson remarks, that in other countries, fallows often take place once every three or four years, and the land is so imperfectly worked, that it has an equal tendency to promote the growth of weeds, as to destroy them. The Scotch husbandman, on the other hand, is more energetic, for he cultivates his fallows thoroughly, with five or six or seven ploughings, and thus converts the soil of a field into the soil of a garden. This insures fertility throughout a whole rotation of six years, with a certainty not otherwise attainable.

Another correspondent maintains, that naked fallows upon a strong clay, incumbent upon a retentive bottom, can alone enable the farmer to pay a high rent. And he contends, that upon strong stubborn clays, *newly brought into culture*, it is for the interest of the farmer to fallow every *fourth year*, instead of every sixth. Deep ploughing, naked fallow, lime and every other species of manure that can be procured, are indeed the groundwork of that system, which enables our farmers to pay such high rents,

* Communication from Mr Drummond of Westbank.

with an inferior soil and a precarious climate. As a proof of the advantages of fallows *on clay soils*, he refers to the inferior produce of land in the Carses of Gowrie and Falkirk, before the introduction of summer fallow; and to the present state of clay land in the neighbourhood of Edinburgh, where the great command of manure induces the farmers to follow the system of constant cropping, though on farms but a few miles distant from their own, better crops are raised, upon the same description of soil, without the aid *of the dung of Edinburgh*, but with a fallow.

Mr Rennie of Kinblethmont is decidedly of opinion, that fallow upon wet-bottomed land is quite indispensable every sixth year, and that any attempt to get quit of that useful and necessary operation, upon strong clay soils, must always be attended with ruinous consequences. The only effectual substitute for fallow is turnips, but that crop cannot be introduced upon soils such as above described, and wherever turnips cannot be grown to advantage, fallows are absolutely necessary.

Mr Brown of Cononsyth states, that considering the short period of dry weather which is to be found in spring, even on the eastern parts of Scotland, the foulness contracted by many fields, in spite of the exertions of the most active farmer, and the difficulty of rendering them clean, even by a whole summer's work, any expectations of success, in clearing the land during the spring alone, and thereby abolishing summer fallows, cannot be well founded; and, although summer fallow may possibly be removed to a greater distance, yet he is convinced that the process is of such importance to agriculture, that it must be continued.

Mr Spears of Dysart is also decidedly of opinion, that on strong soils, no management will turn out so advantageous, as having always about one-sixth of the farm under summer-fallow. A heavy strong soil, he is convinced, cannot be

kept clean and in good order, without this system, and to this he has paid particular attention, both in his own practice, and in that of others. A farmer cannot depend on getting his strong soil sufficiently cleaned throughout the summer, under green crops, so as to insure a full crop of wheat; whereas, under a properly managed summer-fallow, it hardly ever fails of producing a large crop, of the best quality, and, on an average, at least 13 bushels *per* Scotch, or about 10 bushels *per* English acre more, than when after any crop, with this great additional advantage also, that of requiring little more than one-half the manure that must have been used in raising wheat on any other system, and also having a greater bulk of straw for being again converted into manure. Besides, the land is left in infinitely superior condition, and which will show itself for several successive crops; the beans also, or other green crop after the fallow wheat, will be easily cleaned, and if the soil be good, the beans or green crop may be followed with another crop of wheat, at least in part. On a dry loamy soil, a great deal no doubt may be done without summer-fallow, by preparing for the wheat crop with beans, potatoes, turnips, &c.; because on this soil, you can, in general, depend on having these crops sufficiently cleaned, and taken from the ground in a proper time for sowing wheat, though in such cases, much must depend upon the season. Mr Spears long ago endeavoured to do away the necessity of fallow, by sowing the whole of his wheat after beans and other green crops; but as his farm consisted of a heavy loam mixed with clay, and upon a retentive bottom, he could neither depend on getting his wheat sown in proper time, nor the land kept in good order. In fact, had he persevered in that system, notwithstanding a great command of manure from his distilleries, he should have failed in raising the quantity of wheat for which his farm was adopted, whilst the soil would have got quite foul, in spite

of every exertion to prevent it, which is uniformly said to be the case, in every instance, where the process of summer fallowing, on clay soils, has been neglected.

Mr Rennie of Oxwell Mains observes, that it is next to impossible to clean land so well with green crops, but that there may remain a great many root-weeds, so very prejudicial to the soil. The proper time for doing this effectually, is in July or August, and it must be accompanied with deep ploughing, which can never be performed if the land is under a crop.

Another intelligent correspondent remarks, that wheat sown after fallow, stands a better chance of escaping the effects of the mildew, in consequence of the crop being brought earlier in the season, to that state of maturity, which renders it unassailable by that destructive disease. This will be more especially the case, if the crop is laid down without dung, as rich manuring is very apt to occasion that disease. Upon the best soils, however, many agriculturists refrain from dunging their fallows, reserving the manure to the year when the land is either under clover or beans, though at that time it cannot be so frugally applied.

As fallows are the surest foundation for growing wheat, and as bread corn is the only article of which this country is in danger of being in want, it is an additional reason why the fallowing system should be continued upon clay and heavy soils, especially as these soils can, by no management, be fit for sowing wheat on them in the spring; and it is uniformly observed, that the grain of wheat crops sown upon regular fallows in September or early in October, is of the best quality, owing probably to their reaching maturity earlier, and receiving the greatest heat of the sun.

Mr Cuthbertson of Seton Mains informs me, that on consulting with several very intelligent farmers, it was their universal opinion, that there could be no mode of management introduced upon a strong clay soil, so proper or so

profitable as fallow. Where land is improper for the growth of turnip, how is the soil to be kept clear of all the noxious substances which infest such soils, but by fallow? It is certainly true, that beans are a crop well calculated for strong soils, after they are put in good order, and an excellent preparation for wheat; but at the time when beans are required to be sown upon strong soils, no opportunity whatever is afforded the farmer, of effectually cleaning the land of couch grass, and other weeds, which will always be propagated in abundance, where summer-fallow forms no part of the system. Were pease or beans to be sown even so late as the end of May or the beginning of June, still it would be impossible, in the short space of dry weather which may usually be calculated on, previous to that period of the year, to clean the land in such a way as to supersede the necessity of a summer-fallow *.

To cultivate beans for winter fodder, would be procuring that article at a great expence indeed. They could never, to whatever purpose they might be applied, indemnify the farmer for the expence of working the land, and sowing a crop, which requires to be seeded at the rate of six firlots *per* acre when sown in drills. No abatement in that quantity of seed could be made, for if the crop is to be cut early for fodder, thick sowing would become the more necessary to hurry it on, so as to enable the farmer to cut it down, before the period of the regular corn harvest takes place. The best rotation for a clay soil, Mr Cuthbertson considers to be, 1. Fallow; 2. Wheat; 3. Clover and rye grass for hay; 4. Oats; 5. Beans, or yams with dung; 6. Wheat, and then to return to fallow: a full crop of rye

* Mr Kerr remarks, that it is possible to sow beans as late, but they will never ripen, unless sown at least as early as March. The partridge pea may be sown in May, but no other field variety.

grass and broad clover, either for soiling or hay, would go much farther in feeding horses or cattle, than any of the green crops that can be raised on a clay soil: Clover and rye grass is always a sure crop upon such a soil, when the land has been previously prepared by a well-managed summer-fallow, and the sowing and labour are not nearly so expensive.

Mr Shirreff states, that a greater quantity of straw, and consequently of putrescent manure, will be obtained in six years, with a fallow year, than in seven with no fallow, owing to the superior state of fertility in which the land is put, by the operations of the fallow year.

Mr Somner of Gilchriston maintains, that fallowing clay land, places it, not in an unproductive state, but quite the reverse. When land of that description is properly fallowed, it will produce, under a rotation of six crops, one-fourth more of corn, straw, or grass, with the same quantity of manure, than the same land would have done if no fallow had taken place. Mr Somner farther thinks, that when the land is in grass, stock is so much fonder of it, that in the same field, the land that has been fallowed will be eat bare, when the other is neglected; an opinion which I understand is a very general one with Scotch farmers. The land also is much easier kept clean, and easier ploughed and harrowed during the rest of the rotation. Clay soils in general are wet: ploughing such lands therefore, a second furrow in spring, (which must be the case occasionally where fallowing is neglected), is often attended with very injurious consequences; whereas, after a proper fallow, one furrow, judiciously given, is much safer, and in most cases will be sufficient for each crop in the rotation. Fallowing seems to have the property of making clay land tender and mellow, and of improving rather than exhausting it. On such soils, a well-prepared fallow may be justly called "*the groundwork of good husbandry.*"

On the subject of fallows, the late Mr Scott of Craiglockhart, one of the most intelligent and experienced farmers in Scotland, was decidedly of opinion, that naked fallows, in many cases, were indispensably necessary. He asserted, that stiff stubborn tilly land, intended for a wheat crop, never could be sufficiently pulverized, without undergoing that process, and that the manure applied could not operate with the same effect, when under a drilled crop, as when under a fallow. The consequences frequently were, that the crop of wheat, after the fallow, more than equalled, both the drilled crop, and the one that succeeded it; and what is of great importance, the land which had been summer-fallowed, was in better order, and in a higher state of productiveness, than the land which had carried a drilled crop. He contended, therefore, that moist or stiff soils, overrun with weeds, which propagate from the roots, could be effectually cleared of them, solely by a naked fallow. Indeed, I have seldom seen a Scotch farmer who entertained a different opinion.

Mr Kerr considers the grand objection to all substitutions for a naked fallow on clay soil, to be, the impossibility of eating the crop on the land, or carting it off during winter, without totally subverting the whole benefit of the fallow work, which had been given to that substituted fallow crop.

Another intelligent correspondent, (Mr Wood of Millrig), states in the most decided terms, that naked fallow has paid him much better than drilled crops, the bean in particular, the roots of which take away the nourishment of the earth where the clover-root is fed. The bean is also a great encourager of the white snail, a determined enemy to red clover *.

* Mr Wood, in another communication, contradicts the doctrine, that clovers will not continue to thrive well in rotations of

Mr Wight of Ormiston is likewise of opinion, that a naked fallow pays better than a drilled crop. He has had frequent occasion, in the course of fallowing, to plant some potatoes upon some part of the fallow field more adapted for drill crops than the rest. The ground thus planted, was always dunged with stronger, and a greater allowance of manure, than the naked fallows. The wheat crop after the naked fallow was much heavier, and more luxuriant, than that after the potatoe, although the wheat after the potatoe was superior in quality. The after crops of the rotation upon the naked fallow, were throughout superior in every respect to those after the potatoe, and the land much cleaner in the end.

Nor is it the least important advantage of a fallow, that less dung is necessary, to produce the same effect, whilst lime may be applied, and with a greater probability of success, than in any other stage of the rotation. If dung is laid on a fallow, and well mixed with the soil, its operation

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four or five crops. He declares, from many years' experience, that there is little or no danger of clover succeeding every fourth or fifth year, provided a complete summer-fallow intervenes betwixt the clovers; but if green crops are to serve as a substitute for a fallow, he has found, in that case, in the same field, the clovers give way, when they succeeded on the fallow part of the ground, the green crop roots taking away that nourishment which is necessary for the support of the clover plant, and perhaps, being of the same nature, that may have some effect. He could clearly see it is the farmer's interest to make almost any sacrifice to insure red clover, as it can easily be reduced into calculation, that it is the best crop, when pastured judiciously, for nourishing the earth, the roots being upon an acre more weighty than the weight of beef or mutton fed from it, consequently it is great gain, when the roots make up for what is taken from the surface. It is probably the new earth turned up in the operation of fallowing, which renders the clover plant so successful.

is instantaneous, as the whole pores of the soil are then open to receive the nourishment that is administered. I must, at the same time, remark, that in those districts of England, where fallowing is practised, the application of dung to the crop of beans is becoming a favourite system. That experienced and respectable border farmer, Mr George Culley, is of opinion, that dunging naked fallow is totally unnecessary, (except on very lean hungry clays), and most commonly injures the succeeding crop of wheat by making it too luxuriant. On the dunged land, there may be more stooks in the field, but there will be fewer bushels in the barn, than if the land had been limed and no dung given. This is also the opinion of some Scotch farmers. Mr Andrew of Tillilumb near Perth, when he fallows, *gives no manure*, as he finds that fallow wheat with manure is apt to be too luxuriant. Mr Allan of Craigrook, near Edinburgh, also prefers fallow without dung. Where land is of a good quality, Mr Wight of Ormiston has frequently experienced, that a well-prepared fallow will produce a superior crop of barley, without dung, to that produced with it, both upon naked fallow and after potatoe. Mr Dudgeon of Prora likewise contends, that if the land is of very good quality, a well-prepared fallow will often produce better wheat, without dung, than with it. It is proper however, to add, that in general this can rarely happen, unless an over-doze of manure is bestowed ;— a practice which every good farmer studiously avoids.

Besides these advantages, fallowing is supposed to contribute materially to the destruction of snails and other vermin in the ground, not only by destroying them and their eggs in the course of the operation, but also by exposing them to the attacks of rooks and other birds.

In addition to all these authorities, it may be proper to add that of Mr Brown of Markle, to whom I am particularly indebted for many useful observations on the several

sections of this work, and on the subject of fallows in particular. In his valuable Treatise on Rural Affairs, he declares it as his opinion, that without summer-fallow, conducted in the manner already described, perfect husbandry is unattainable on all heavy or cold soils, and upon every variety incumbent on a close or retentive bottom *; and Dr Coventry, after considering the objections which have been urged against summer-fallowing, the abuses to which it is liable, and the advantages attending it, very justly observes, that the discordance of practice and opinion respecting it, is principally owing to circumstances not having been correctly discriminated, or to differences in respect of soils, seasons, climates, &c. He adds, "*that there are certain situations, in which it cannot be advantageously relinquished for any other process of tillage whatever* †."

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* See Brown's Treatise on Rural Affairs, vol. i, p. 191.

† Introductory Discourses, p. 70. Dr Coventry has more fully explained his sentiments on this important subject in the following words:—"A summer-fallow," he observes, "may, in most instances, be employed in the commencement of a course of good culture, and in several cases, it may even be occasionally introduced during its continuance. In the former, it may be found requisite for the following purposes; to have a better opportunity than otherwise, of removing all wetness, stones, or other obstructions to perfect tillage; to render the land to a due degree clean of weeds, and of a proper texture; and to get the surface so adjusted, as to have no injurious inequalities, or any thing that can prevent the ready discharge of water from it, and the employment of the best mode of raising and collecting the crops from it. In the latter, it may be had recourse to where fallow crops could not, in comparison with it, be advantageously retained, from whatever cause. The circumstances that chiefly render it necessary or proper to retain summer-fallowing in the course of management, are those which arise from the character of the

It may be proper also to add, that Mr Curwen, who, at one time, was strongly prejudiced against naked fallows,

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climate, and the nature of the *soil*, jointly. Wherever it is a dry, free soil, on a sound under-ground or bottom, as a loam well replenished with mould, or a sandy loam, or a gravel or sandy soil, or any other of a description suited to bear turnips or potatoes, then, after having been once made clean, it may, by fallow crops, seasonably employed and well conducted, be afterwards preserved in good condition, and fallows become unnecessary. But, on the other hand, wherever it is a loamy or clayey soil, or a retentive subsoil, or one apt to be wet, some difficulty occurs as to its application and management. There are two things which especially merit attention in such kind of land. These are, the *climate*, and the *degree of fertility* in the soil itself. If the situation be high-lying and cold, then the only species beans, and perhaps cabbages too, might be found unfit for cultivation. The unfavourableness of the climate might not permit beans to ripen or become of much value as a crop; and cabbages, in a late, cold situation, whatever may be the degree of fertility in the soil, may not be eligible for culture; inasmuch as they may not continue through winter in good condition, and at any rate might then be with difficulty removed from the ground; and, if they were at all of any material benefit, they would require to be made use of in the beginning of winter, a period so limited, as greatly to diminish their value to the cultivator. Probably, therefore, in most clayey lands, situated 400 feet or upwards above the level of the sea, where the climate is cold, and the harvest late, fallow crops will be found unsuitable. In lower lying grounds, again, it will be found that the soil must possess a certain degree of *fertility*, before fallow crops of beans, or any other species adapted for a clayey soil, will so far answer as to admit of being raised on a large scale, and to become preferable to a summer-fallow, with the total loss of a crop for the year. Where the land is poor, or the means of rendering it duly productive, manure namely, is not at hand, the bean or cabbage crop, or any other such, might prove

when he saw the crops which resulted from that process, and heard the arguments in its favour, from individuals, second to none for intelligence, and skill in their profession,

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comparatively of no great value; and on such land, the seed of the wheat crop that succeeds them would require to be earlier sown, to insure success from it as a crop. A fallow well conducted, will be more favourable for the timely sowing of the wheat-seed, than tillage with and after beans, poor crops of which might not compensate for the injury that might be produced by the delay in the wheat sowing,—a consideration which will be admitted by those who understand the advantage derived from a summer-fallow, in giving a superior tilth to the land above what can be done with a fallow crop. Most probably, wherever a clayey or loamy soil is so poor as not to yield five Lothian bolls of beans (20 Winchester bushels) *per* English or statute acre, it had much better be cultivated by a summer-fallow than by any such fallow crop. If it possess such a degree of productiveness as to yield seven bolls, or 28 bushels, of beans *per* acre, then that fallow crop may take the place of a summer-fallow, either occasionally or more constantly; and it might do so almost constantly, on land that has been once rendered to a full degree clean, if the fallow crop be employed at proper intervals, not at too distant periods, and if its culture be properly managed. Again, should the fertility of the land be above the degree mentioned, so as to bear nine or more bolls, or about 36 bushels of beans, or a produce of cabbages corresponding to that amount of beans, then such fallow crops, correctly managed, and not otherwise, may with advantage totally supersede the employment of any summer-fallow. Many husbandmen have relinquished, with great benefit, on clay soils, naked fallows for fallow crops, namely such as are raised in rows and capable of being properly cleaned by horse-hoeing; and others have done so without any gain, and some with direct loss; and both the errors in practice, and the discordance in opinion on this matter, must be referred to a want of due discrimination in th difference of cases."

could not but question his own judgment, and to doubt it rather than theirs. He confesses himself therefore much shaken in his opinions. His practice has been to make the intervals of his green crop so wide, as to admit of a great deal of cleaning; but yet he candidly acknowledges that he cannot shew his land, in equal order, with what he observed in East-Lothian and Berwickshire. Fallows, he observes, are generally done in so slovenly a manner as not to deserve the name. Before deciding on their utility, Mr Curwen with great propriety urges their being attended to with the same care and attention that is practised in East-Lothian. Indeed, in a district where such rents are paid, (the greatest in the united kingdom), whilst summer-fallow is steadily maintained and judiciously executed, the boldest theorist should pause, before he pronounces decidedly against a practice, the beneficial consequences of which are thus strikingly demonstrated *.

4. *Cases where fallowing strong lands is not practised in Scotland.*—Near towns, where manure abounds, and rents are high, the fallowing process is avoided as much as possible. In the neighbourhood of Glasgow, where rents are from L.6 to L. 7 *per* Scotch acre, (from L. 4, 15s. to L. 5, 10s. *per* English acre), several thousand acres of land, even of a clayey quality, are cultivated under the following rotation, namely, 1. Potatoes; 2. Wheat; 3. Clover; and 4. Oats. The potatoes get from thirty to forty tons of dung *per* acre; but the wheat gets only a moderate dressing of hot lime. Under this, and other rotations of a similar nature, it is admitted that the land is apt to get foul, and to require a naked fallow, but

* See Report of the Workington Society, for the year 1810, p. 88, &c.

the farmers have an aversion to that mode of improvement, substituting in its stead, what they call a *bastard fallow*, that is, three furrows after the clover has been harvested; the land is then sown with wheat, after getting a small quantity of dung.

An intelligent farmer near Edinburgh, (Mr Gray of Gorgiemuir), adopts the following rotation on his strong lands: 1. Potatoes, after being well cleaned by repeated ploughings, &c. and manured with from forty to fifty cart-loads of Edinburgh street dung, thoroughly mixed with his farm-yard dung; the produce from forty to sixty bolls of potatoes * *per* acre, (from 860 to 540 Winchester bushels *per* Scotch, or 288 to 432 *per* English acre). Where there is too great a proportion of clay in the soil, to grow potatoes with advantage, then *yams* for horses are planted, and the land is always kept in open drills, from the planting to their being taken up; that is to say, without harrowing them down, as the others are done; if it is not a very wet season, the produce is from thirty to forty bolls *per* acre, equal to from 270 to 360 Winchester bushels *per* Scotch, or from 176 to 288 *per* English acre. This he considers to be preferable to the crops of beans he used to have on the same land: 2. After potatoes or yams, then wheat, (drilled, where the soil is light, by Cook's machine), and sown with grass seeds in the end of March, or beginning of April: 3. Clover, twice cut; and 4. Oats †.

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* The Edinburgh potatoe boll is 400 cwt.; consequently five bolls make a ton.

† This idea of cultivating yams instead of beans, on very strong lands, merits particular attention in this part of the kingdom, as a bean crop fails so often. Regarding the culture of yams, the late Mr Scott of Craiglockhart observed, that of late years *yams* have been by many substituted for the evening feed of

5. *Miscellaneous particulars.*—The crops which may be cultivated on strong lands, instead of a naked fallow, are, 1. Beans; 2. Pease; 3. Tares; 4. Potatoes or yams; 5. Swedish turnips; 6. Cabbages; and 7. Rape or Cole seed. The question is, whether any of these crops will be more profitable to a farmer, than three bolls of wheat, or twelve Winchester bushels of additional produce *per* Scotch acre, (about nine and a half bushels *per* English acre), together with those other advantages attending fallow, in the course of five successive crops, which have been already pointed out?

1. Beans are certainly calculated for strong soils, being an excellent preparation for wheat, and when drilled, they also enable the farmer to keep his lands clean; but the crop is seldom sufficiently early in Scotland, to be safely harvested in wet seasons. Mr Robertson of Ladykirk justly observes, that our southern neighbours have much the advantage of us in the bean husbandry. The great source of distress attending bean crops with us, *is their lateness*. In passing through the country near Aylesbury, he saw their beans *covering* the ground, and all in bloom on the 14th of June. Our wet weather generally commences about the 20th of October. Before that period, the winter wheat in Scotland should all be sown, but the beans are often in the fields. There can be no doubt, that fallows might be reduced in number, were drilled beans more carefully cultivated;

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horses. If work-horses can subsist to equal advantage, partly on yams and Swedish turnips, what a promising prospect for increasing the growth of wheat, and bringing fields to a high state of cultivation without losing a crop? One acre of yams or Swedish turnips will afford more subsistence for either horses or cattle, than two of oats or any other grain. On the other hand, it is said, that, generally speaking, one-fourth more wheat will be grown on strong land, after fallow, than after Swedish turnip.

but the climate of Scotland will not admit of it, at least to any great extent. It is contended, however, that the straw of an English acre of beans, if cut down merely as fodder, would be worth L. 5, and that if used as litter merely, it would produce at least 120 stone, which, converted into dung, would manure half an English acre. It is questionable, however, whether it would be advisable, to run the risk of losing the benefit of a well-prepared fallow for such advantages.

2. Pease might be cultivated on strong land, either for the seed, for fodder, or for litter; but if the crop should not answer, (which often happens), there would not only be no profit, but the ground would be instantly filled with all kinds of weeds.

3. Tares are liable to the same objection, and, unfortunately, the winter tares are not calculated for the climate of Scotland, otherwise they might be cut so early for soiling, as to furnish an opportunity, in the end of summer, or beginning of autumn, to clean the land *.

4. Potatoes or yams might be raised on strong land, but not to any great extent. They require to be sown so early, that not one year in ten will the season admit of root weeds being completely eradicated; and in wet autumns, how are they to be taken up? It is the opinion also of the most intelligent farmers, that it is impossible to make foul ground clean, with a crop of potatoes or yams, though if once thoroughly cleaned, it may be preserved in that state, by crops of potatoes and yams for many years.

5. Ruta baga or Swedish turnips may be raised to

* Mr John Shirreff states, that he has raised winter tares with success. The crop ought to be sown as early in the month of September as possible. Farther experiments on this plan of early sowing are well worth trying.

advantage on strong soils. They may be sown in the end of May, and taken off the field in September. They are also easily preserved till wanted; but if taken off early in the season, the crop will not be abundant, and there is great risk when the crop of wheat is afterwards laid down, that the land will be in bad order. If barley, however, were to follow Swedish turnip, that objection would be removed, as the land might, in that case, have both winter and spring ploughing. The following rotation might in that case be tried: 1. Ruta baga; 2. Barley; 3. Beans; 4. Wheat; 5. Clover; and 6. Oats. It is objected, however, to this rotation, that ruta baga increases considerably in size, till checked by the strong frosts in December; consequently that if it were taken up in September, it would occasion a great loss of weight and value in the crop; and that the wheat crop would probably exceed in value, both the ruta baga and the barley: a loss rather than a benefit would therefore arise from omitting summer-fallow.

6. Cabbages, properly cultivated, yield a great quantity of food for cattle; but they are not calculated for an extensive scale of farming. With cabbages, a certain proportion of ground might be appropriated to the cultivation of green kale; the one for food in autumn, and the other in March and April, which are the most hazardous months of the year to the farmer, and the most difficult to provide for. Some maintain, that cabbages do not exhaust the soil, if drawn before the white fibres shoot out from the roots in spring, that is so long as they can be pulled up with ease; but by others they are regarded as the most scourging green crop that can be cultivated.

7. A most intelligent correspondent on the borders, informs me, that the best way he ever knew of treating clay soils is, instead of a naked fallow, to sow rape or cole (as it is called in the southern counties of England) in drills, with a

little dung in the drills. The crop may be eat off in August, or the beginning of September, and then wheat may be sown. This is the method he generally prefers with clays, instead of a naked fallow, and he never saw more beneficial crops of red wheat, than he has thus obtained upon poor clays. The rape was fed where it grew, and after making *cast* or *culled ewes* as fat as bacon, (indeed nothing of the vegetable tribe will feed sheep so quick as rape in autumn), he immediately ploughed it, and sowed invariably *red wheat*, as being the hardiest sort for poor clays, and he never missed a fair crop, and much safer and better than he got on naked fallows; namely, from 23 to near 32 Winchester bushels *per* English acre. He well remembers a crop of red wheat upon one of these poor clay fields, got in the year 1795, after rape fed on, which crop was fully worth the value of the land it grew upon, wheat indeed being very dear that year. The circumstances of this statement, coming from such respectable authority, cannot be questioned; at the same time it is hardly possible, that the ground could be placed in that husbandman-like condition, by the culture given to the rape crop, as by a naked fallow. To decide the question, it would be necessary to fallow a part of the same field, and to compare the future produce of the part that grew rape, with that which was fallowed.

These hints are submitted to the consideration of intelligent farmers, who may be of opinion, that notwithstanding the great improvements that have been made in agriculture, it is still capable of amendment, and that it cannot be brought to the perfection of which it is capable, without ample discussion, and repeated experiments. It must be admitted, that though fallows are now in a manner exploded by many of the ablest farmers in England, more especially in the counties of Norfolk and Suffolk, yet the greater moisture of the Scotch climate, seems to

render them so necessary in our wet and tenacious clays, that Mr Rennie of Phantassie emphatically calls them "the main spring of the husbandry of Scotland." But though fallows seem to be necessary in this country, yet, in process of time, their frequency may be diminished. The climate may improve as cultivation is extended: By perpetual accessions of lime and dung, the texture of our strong soils must be altered, and will become more of a loamy nature: By repeated cleanings, the quantity of weeds of all descriptions must be greatly lessened: Instruments also may be invented, which may prove more effectual for cleaning and pulverizing the soil, than those at present in use: New plants may likewise be discovered, or a more advantageous mode of cultivating old ones: Nor is it possible to foresee, what improvements may be effected in draining, in consequence of which, the cultivation of wet soils may be facilitated, and either stock may be fed upon the ground, or its produce may be removed without injury.]

Sect. V.—*Of the Crops usually cultivated in Scotland.*

The crops principally cultivated in Scotland, are, 1. Wheat; 2. Barley, including bear or big; 3. Oats; 4. Pease; 5. Beans; 6. Tares; 7. Turnips; 8. Potatoes; and 9. A mixture of Clover and Rye grass. Some carrots, and in particular instances, cabbages, kale, rye and flax are also occasionally cultivated; but none of these articles find a place in the general husbandry of Scotland. As this work is not intended to be a treatise regarding every point connected with agriculture, but, in a great measure, a condensed statement of the information transmitted to me by

the farmers in the more improved districts of Scotland, regarding the system of husbandry pursued by them, it is proposed, in general, to take notice only of such particulars, communicated to me in the course of my inquiries, as seem to be entitled to attention, unless where it may be necessary to add some remarks regarding the practices of England, by way of illustration.

1. *Wheat.*—The growth of wheat has greatly increased in Scotland. It is not only more frequently introduced into rotations, but is also cultivated in many districts where it was formerly unknown; and in situations, where, from their elevation, it was formerly thought impossible to raise it. In the parish of Temple in Mid-Lothian, for instance, it has already been grown, from 500 to 600 feet above the level of the sea, and some are trying it, and it is said with success, even in higher situations *.

There is nothing that seems more likely to promote the successful culture of wheat in Scotland, in districts where the soil is cold, or the climate unfavourable, than to sow it early in autumn. In a farm, which a tenant had declared, would not carry wheat, that he had tried it often, without success, a new possessor resolved to sow it on the 12th of August, and he had the satisfaction of cutting down his crop on the 10th of August in the following year, and it would have been cut earlier, had the weather permitted. As it was, there was no farmer in Scotland, and few farmers in the northern counties of England, who had such a quantity, as 300 bolls of wheat, cut down so early. It proved of uncommon good quality, and sold at a high price, for seed†.

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* Communication from Mr George Farme of Braidwood, near Dalkeith.

† Communication from Mr Allan regarding his farm of Oldliston.

In regard to the more fertile districts of Scotland, the general opinion of Scotch farmers is against sowing wheat so early as the month of August. By one of them who has sown wheat to a great extent for thirty years, I am informed, that he has tried every period of the year from the middle of August, to the middle of March; and the result is, that he is firmly convinced, that the latter end of September is the most appropriate time for sowing wheat on clay soils, if the weather will admit of it. But good crops may be got sown long after that time, if the weather is favourable.

An intelligent farmer strongly recommends kiln-drying seed-wheat, as a better means of preserving the crop from smut, than the usual practice of pickling or steeping. From eight or nine years' experience, he states, that it has been found at least an equal preventive against the loss produced by that disease; and allowing it had no superiority over the method more generally in use, in respect to that property, still it would be entitled to a preference, because it can be kept without injury, should the weather turn out unfavourable for sowing at the time intended, which is not the case with wheat prepared in the other way; for unless it be sown almost immediately after pickling, it becomes unfit for seed *, and can scarcely be applied to any other purpose. Wheat, to be prepared for seed by kiln-drying, ought to be completely dried, but not subjected to a heat which might in any degree scorch it †. This information is strongly corroborated by the evidence of Mr Fowler of Prestonpans, who has in one year prepared 40 bolls of wheat in this way for seed, and who has no doubt of its

* This point will afterwards be more fully discussed.

† Communication from Mr James Cuthbertson of Seton-Mains. This plan is mentioned in the original report sent to the Board of Agriculture, regarding the county of Clackmannan.

answering effectually. The process, however, requires so much attention and skill, that it is not likely to become general, and the usual plan, when properly executed, is found to be effectual.

An important particular connected with the culture of wheat in Scotland, is the practice of sowing winter wheat in the spring months. The late Mr Shirreff sowed winter wheat in spring, with success, about the year 1773. Mr Brown of Markle states, that he commenced this practice as far back as the year 1779 *, as did his neighbour Mr Rennie of Phantassie, about the same period. Above thirty years ago, Mr Wight of Ormiston successfully tried the practice upon clay soils. The same plan had been adopted by several people before, but not to any considerable extent, and only in seasons when, owing to the wetness of October, it could not be sown at the customary time. It is of great importance to be able to sow wheat after turnips, for the month of March is not found too late when the season is favourable. Mr Rennie of Oxwell Mains, in East Lothian, who possesses a farm of an excellent soil, and in a favourable climate, informs me, that his March sown winter wheat, *anno* 1809, was as good, both in respect to quality and produce, as what was sown in November and December. He adds, that wheat sown

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* Mr Brown farther informs me, that in 1800 he had above 140 English acres of land sown with wheat in the months of February and March, all of which yielded grain of the finest quality. This was completely ascertained, in consequence of his having been a candidate for a premium offered that year, by the Society of Arts, to the cultivators of spring wheat, which premium was adjudged to him. He adds, that the summer of 1800 was particularly dry and warm, and that to these circumstances must in a great measure be attributed the goodness of the crop.

in autumn very frequently lodges in moist seasons *, and on that account is deficient both in quantity and quality. This, however, only happens on rich soils. On wet soils, the farmer often sows early in autumn, not from choice, but lest he should lose an opportunity of doing it. In regard to the difference of produce between autumn wheat, and the same kind sown in spring, Mr Rennie thinks, that in ordinary seasons, the spring sown is equal in quantity on light dry land, but is not to be depended on where the soil is wet, or the climate unfavourable, nor is it so early ripe as that raised from seed sown in autumn †.

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* The lodging of the autumn sown wheat may be owing to the crop being too thick. Three bushels *per* Scotch acre, sown in October, is equal to four bushels sown in March, on account of the latter not stocking, and the straw, from the thickness of the crop, proving weak.

† Though not strictly connected with the subject of Scotch husbandry, I cannot deny myself the pleasure of inserting the following note, containing some particulars transmitted to me by that celebrated farmer, George Culley, regarding the spring culture of winter wheat.

" Respecting the sowing of winter wheat in the spring, after turnips, I can speak in a very full manner, as I am persuaded very few farmers in this island have had more experience of that practice. I believe that spring sown winter wheat had not been much tried in this county before my late brother and I settled in Northumberland in the year 1767. We had made some small trials of it in the county of Durham before coming north; immediately on our taking Fenton farm, however, we tried it upon a pretty large scale, namely, from 100 to 200 acres in the year. But for many years after, having extended our farming concerns, we seldom grew fewer than 500 acres and upwards annually, and with never-failing success, one year excepted, when a partial mildew took place, and until those last three fatal years, when most of the wheat in these northern parts of the island have been more or less affected with

The real spring or summer wheat, has been of late introduced in various districts in Scotland. It possesses

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that dreadful malady! Not that spring sown wheat was more hurt than the winter sown, but perhaps less injured upon the whole. Nevertheless, I do not know whether I ought to recommend it to be much sown in the southern counties or not, because, in the trials we made in the county of Durham, we had nothing like such plentiful crops as we produce here.

" Besides, in the county of Durham, and all the way from thence to the southward, they can grow more barley in quantity, and better in quality, than we can by much, and it is also always much higher sold; consequently the growing of spring sown winter wheat after turnips, becomes not so much a matter of consequence to them. Allow me to remark one thing, which I cannot account for; we can perhaps produce the best oats of any in Great Britain, and yet we grow very indifferent barley. Perhaps, not only the friable fertility of our turnip soils in Glendale Ward, but the vicinity of the mountains, may be favourable to the production of spring sown wheat. Perhaps a more rapid vegetation takes place in the vales adjoining mountainous districts, than at a distance from them. It is very proper in you to say, ' winter wheat sown in spring,' because a discrimination is highly necessary between winter wheat sown in the spring, and the Siberian, or real spring wheat. We tried the real spring wheat several years; but in both quantity and quality, it was invariably much inferior to the winter wheat sown in spring.

" Prior to our coming into this district, no wheat was grown in Glendale, except in the haughs by the river sides, or some particular pieces of strong land, unfit for turnips. But now, and for many years, thousands of acres of spring sown wheat have been grown with the greatest success, which had never produced any wheat before; and until these last unfortunate years, we seldom produced less than from three to four quarters *per* acre after turnips, and frequently more. Upon the weaker turnip soils, we *ourselves* sow a red wheat, the seed of which we got several

some advantages, being for a much shorter period in the ground; and though sown in the end of April, or the beginning of May, will ripen as early as winter sown wheat. It is certainly, however, not so productive as wheat sown in winter, or even winter wheat sown in spring; and the ear being shorter, the crop cannot be equally productive. It will probably, however, be a great acquisition in districts, where sowing winter wheat does not answer, and more especially where the vegetation is rapid.

It is of great importance to try new varieties of wheat, at first on a small scale, but to be extended afterwards if found to answer. Mr Wight of Ormiston informs me, that he had lately occasion to see a very fine close luxuriant crop of wheat growing in a field of high exposure, and thin land. He was informed that this wheat was early, could be cultivated on fallow without dung, and that it possessed a quality which no other wheats had, that of not being liable to be thrown out of the ground during the winter by frost. Hence it had acquired the name of "the creeping wheat." It will produce at the rate of 8 Linlithgow bolls *per* Scotch, or 26 Winchester bushels *per* English acre. Such a sort of wheat may be of infinite consequence in our more northern districts. In the southern counties, it would be well worth while to try the best sorts of the celebrated Dantzick wheat, which sells at so high a

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years since from a village called Burwell, in Cambridgeshire, an excellent and productive kind."

Mr Culley adds, that he has known winter wheat do pretty well when sown even in the beginning of April, but he does not approve of it. There is no fear of a plentiful crop, but it is so late in ripening, that six times in seven it suffers from the equinoxial gales; and he is decidedly of opinion, from long experience, that the best time, or season for sowing autumnal wheat in the spring, is February, and the first ten days in March.

price, and which is probably hardy enough to be cultivated in favourable situations. It may be difficult, however, to procure it, in a state capable of vegetation, as it is generally old wheat that comes to our market; it is sometimes kiln-dried, and at other times, previous to its being shipped on board the craft in the Vistula, spread out on sails, and dried hard in the sun. The excellence of Dantzick is probably owing to the heat of the climate, but still a change of seed, from a better climate, may prove highly useful.

In regard to the culture of wheat in general, many intelligent agriculturists begin to be apprehensive, that from the high price of that article, farmers have been tempted to sow it too often, and that it comes round too frequently in the rotation, which may contribute to those diseases which have of late affected that species of crop, to an extent never formerly known in Scotland. It is remarked at the same time by Mr Pringle of Ballencrieff, that in East Lothian he does not observe the crops of that grain falling off, though they are more frequently introduced than formerly; in many instances, once in three years. The failure for four years past was entirely owing to the coldness and wetness of the weather.

2. *Barley.*—This species of grain was formerly the great favourite of the Scotch farmers, but is not so much run upon as formerly, since crops of wheat, by the introduction of fallows, have become more certain and productive. By some barley is condemned, as the least profitable of any of the white crops, as not being so prolific as oats, nor so profitable as wheat. It is remarked, that all crops exhaust the soil, in proportion as they are heavy in grain upon the acre, and produce the least weight of straw, to be converted into manure. Hence barley ought, in general, to be accounted a more severe crop than either wheat or oats, because the straw gives neither equal food to the

animal, nor dung to the earth, and of course is not so profitable to the farmer, unless upon particular soils. It is also contended, that land is not more exhausted by wheat than by barley, if these crops are raised either after fallow or turnips. On the other hand, it is maintained, that though on very strong or very rich land, a greater quantity of oats than of barley may be grown, yet upon good dry land, and after turnips, as much, and in many seasons more barley will be grown than oats; and on such soils, that barley is found to be more profitable than even wheat, producing from 40 to 50, and in some cases even 60 bushels *per* English acre. It is also to be observed, that as great quantities of turnips are left growing in the field, both for cattle and sheep, in the spring, no other grain but barley can with propriety be sown at that advanced period of the season *. In late harvests also, which so often happen in Scotland, barley will ripen sooner than any other grain. The principal objection, therefore, to the growth of barley, is the uncertainty of the demand, arising from the unfortunate circumstance of its distillation being so frequently prohibited.

In many parts of Scotland, more especially in the northern districts, the culture of that species, called *bear* or big, is recommended instead of the two rowed barley. An intelligent farmer in the Mearns assigns the following reasons for preferring bear: The crop of grass, he observes, is almost constantly good or bad, in proportion as the ground is more or less pulverised; and as bear may be sown three, or perhaps four weeks later than barley, it may be done, even in a northern climate, at a season when

* The real spring wheat is certainly an exception, as it should be sown in the end of April or beginning of May. It is a singular circumstance, that in many parts of Scotland, barley was the latest ready of all the crops of grain last season, (*anno* 1811).

the land can be brought to a finer tilth. If the grain crop should happen to lodge, as bear will be sooner ripe than barley, and consequently earlier taken off the ground, the danger of rotting the young grass is less. In northern districts, the earliest grains ought to be cultivated; and barley is not only later than bear, but it requires to stand longer in the stook before it be fit for stacking. No doubt barley is the more valuable grain of the two; but that cannot be put in competition with the risk of a late and precarious harvest, and perhaps the loss, or at least the deterioration, of the two following crops of grass, by which, not only the food for cattle is lessened, but the land becomes fouler; since weeds will vegetate, if the land be not better occupied. The produce also from bear, will be found to be greater than from barley, though this circumstance is probably overlooked by the farmer, as he generally sows the latter on his best land. On tolerable farms, the inferior land will yield nearly as much bear, as the best will barley; and had bear been substituted on the latter, the produce would have been much greater. But on ordinary land, yielding a tolerable crop of bear, there will be a considerable deficiency of barley *. How unfortunate it is, that

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* Mr Grierson, late corn-merchant in Leith, who had much experience and knowledge in the corn-trade, transmitted to me some observations on the subject of feeding of horses with bear. He was of opinion, that bear was better for feeding horses than barley, and better than oats for horses, not much wrought, in dry countries, but not so good as oats in wet countries, or in wet roads, where horses require more heating food *. Horses, however, are fed to most advantage with beans and oats, ground

* According to this remark, big would be the best food for horses in England and Scotland, during the summer season, which would be a great point to establish.

the culture of so useful a crop should be checked by improvident enactments, imposing a higher duty on bear, in proportion to its value, than on barley.

When barley was sown under the old system of management, without fallow, it was found necessary to sow it late in the season, for destroying a greater quantity of weeds; but now when the land is cleaned so much both of seed and root weeds, barley can seldom be sown too early in dry lands. Sowing it in the beginning of March is the best means of securing an abundant crop, and of superior quality. Mr Wight of Ormiston has often seen barley sown in the winter furrow, early in March, and it never failed to produce an abundant crop, particularly upon clays. It is remarked, however, that with early sowing there is less straw. Some farmers contend, that clover succeeds better after wheat than after barley, owing to the straw

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as small as malt. It is hardly to be conceived, the difference of the ease to a hard-wrought horse who has ground meal to eat, and one that has his oats to eat whole, as he has not half the time to rest as the one that has ground corn, and cannot perform the same labour, or last so long. This is a most important consideration where so many horses are necessary for agriculture; and a very trifling expence would add a grinding machine to the threshing-mills, for all the corn necessary for feeding the horses and pigs on a farm. That bear is not more cultivated and in higher request, he was convinced was owing more to prejudice than any thing else; for it is well-known, that it produces more seeds than barley, and is less injurious to the ground; and may be sown for twenty years on the same ground in succession, without either lessening the produce, or impairing the quality, provided the land is fallowed before winter, and twice ploughed before sowing, with a sprinkling of dung or sea-ware. It is very seldom more than ten weeks on the ground in favourable situations, and barley never less than fourteen.

being stronger; but that opinion is contradicted by the experience of many respectable practitioners, who state, that in a dry spring it is almost impossible to make grass seeds vegetate among winter sown wheat. Clover always succeeds best with spring ploughing, and hardly ever fails after barley.

3. *Oats.*—There is no species of grain that succeeds better in Scotland than the oat, and it is the crop for which by far the greatest part of that country is the best calculated; indeed, taking the after crops into consideration, it will, on the whole, be found the most profitable. Convinced of the superior advantages of this crop, some farmers have given up sowing barley, as from two to three bolls more of oats may be expected *per* acre *, as the straw of it is much inferior, either for feeding live stock, or for producing manure, and as the sale of it is uncertain. Oats are also preferred, in some cases even to wheat, as it has been found that sowing oats after grass is more advantageous than sowing wheat, however profitable that article may be †. Oats also are a better crop after pease, than even after grass ‡.

It is well-known that various sorts of oats are cultivated in Scotland. Mr Thomson of Bewlie greatly prefers the potatoe oat. Either after turnips, or after clover ley in good condition, there is almost a certainty of having a

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* Dr Young, near Stonehaven, informs me, that he has had 15 bolls of oats *per* Scotch acre, or 72 bushels *per* English acre, on a field of seventeen acres, though two of these acres had never before been under crop.

† Remarks by Mr Trotter of Newton in Linlithgowshire.

‡ Remark by Mr Charles Alexander, Easterhaprew, near Peebles. It is proper to observe, that when a field is fallowed, any mossy part of it should be sown with oats instead of wheat.

good crop of that sort; they ripen and fill very well even when lodged, being strong in the straw, and they sell at 3 s. *per* boll (Teviotdale measure), higher than other oats. They will grow very well even in high inland situations and cold climates, and if cut down in time, there is little risk of their shaking. In exposed and elevated situations, however, Mr Brodie of Garvald greatly prefers the red oat. They unite the advantages of earliness, good grain, and a power of resisting the wind, superior to any other; and by growing them, farmers are enabled to cultivate higher grounds, than otherwise they could venture to do, with every prospect of reaping the fruits of their labour. Church's oats are recommended for ripening early, ten days or a fortnight sooner then the potatoe oats. They are sown at the rate of about 6 Winchester bushels *per* acre, have yielded from 60 to 80 Winchester bushels *per* English acre, and in some instances even more. It would be very important to raise a species of oats without a bosom pickle, as the grain would then be more equal in point of size and quality, and less liable to shake; and it is said, that a large plump oat of that sort is to be found in Lincolnshire *.

4. *Pease.*—For some years past pease have been a precarious crop in Scotland, principally owing to the continual rains in the month of August, which kept the pease constantly in a growing state, in consequence of which the pods did not fill till the frost came on. Had there been dry weather in the months of July and August, the crops would probably have been abundant †. It is contended,

* Mr John Shirreff informs me, that the potatoe-oat, when first introduced, was of that description, and might have been preserved so, by accurate selection, and separate culture. By the same means it might be restored to that state.

† Observations by Mr Neil Ballingal in Fife.

however, that even in drier climates, a crop of pease will not succeed, if sown on the same land, above once in ten years.

Some farmers who find that clean pease will not answer, sow pease and beans mixed, with a hand drill, the rows at twenty-seven inches distance, so as to admit the horse and the hand hoe at discretion. Mr Hope of Fenton finds, that this plan answers better than sowing these crops separately. Mr Kerr is of opinion, that mixing the two sorts gives very material aid in harvest, as the pease serve to bind the beans. Besides, it considerably improves the quantity and quality of the fodder, which is a circumstance of great importance.

It is surprising that the farmers near Edinburgh have not attempted to raise early pease, an article which sells at so high a price, in the Edinburgh market, during the month of July, though considerable quantities are supplied by the numerous gardeners in the vicinity. About twelve years ago, a gentleman sowed two acres with white pease, and sold the whole, by the middle of July, at L. 35 *per* acre. Immediately afterwards, he prepared the ground for turnips, which were sown by the end of that month, but unluckily the seed was bad, and the turnip crop almost totally failed. He had no doubt of his making from L. 40 to L. 50 *per* acre of the two crops, had the turnip-seed been sound; and he would have persevered in that plan, had he not unfortunately died. To take a crop of turnips, after early potatoes, is a common practice in the neighbourhood of Aberdeen.

5. *Beans.*—It would be a great advantage to husbandry, were an early bean discovered, which would bear to the common bean, the same qualities that the hot seed does to the cold seed pea, as this would remove the principal obstacle to the bean husbandry in Scotland, the

lateness of the crop. It is certainly lamentable, to see the bean crop out in the fields, while, with a better climate, the land ought to have been sown with wheat. Some improvements might be made in the harvesting of beans, which would lessen that obstacle to their culture. Mr Mitchell of Balquharn has, for that purpose, successfully adopted the following plan. When the beans are ready for binding and stooking, he carts them off to an adjacent stubble field, if nearer to the stack-yard so much the better. The beans are kept there till they are ready to be stacked, and the farmer's anxiety in regard to his wheat seed, can be no excuse for harvesting his beans too early. It may be objected to this plan, that it is a great additional labour, and that there must be a certain loss in loading and unloading. To the first of these, the answer is, that ten hands, with four horses, if the fields are at a moderate distance, will shift ten acres in a day; no great sacrifice, considering the motive; and, with regard to the second objection, beans recently cut are not very apt to husk out, and, with ordinary attention, the damage is inconsiderable *. This plan is strongly recommended by the experience of Mr Brown of Markle, who informs me, that in the bad harvest of 1799, he had 75 Scotch acres of beans and pease in drills, few of which were harvested till the middle of December. He removed a considerable part to an open stubble field, and by employing a servant to keep the sheaves on their feet, the whole were safely

* That excellent plan of drilling beans was, it is said, begun at North Berwick about the year 1770, in the neighbourhood of which place weighty crops of this article are still cultivated. Some farmers, however, still prefer the broad-cast system, upon very strong stubborn clays, but erroneously. It is remarked, that beans cannot be planted too near the surface; if merely covered it is sufficient.

stacked a few days before Christmas, in excellent condition.

Mr Blane of Blanefield, in Ayrshire, tried a most successful experiment with the culture of beans in 1810. He was prevailed upon by a new ploughman, who had lived in a district where beans were much cultivated, to try two acres and seven falls Scotch measure, with that crop. The seed was sown in drills, distant from each other from twenty-eight to thirty inches, on the 11th, 12th and 13th of April. The quantity sown was twelve Winchester bushels, and both horse-hoeing and hand-hoeing were duly attended to. The months of May and June were dry, but the rain fortunately came on about the end of July, the blossoming became universal, exhibiting a uniform surface of stalks; in general upwards of six feet in height, many nine, and some even ten feet high. Many of the stalks had from 40 to 55 pods. The whole exhibited a sight, equally beautiful to the eye, and agreeable to the smell. Many fields in different parts of the county, (the season in general proving unfavourable to the bean crop), had been mown down for green food to horses, where there was not the smallest indication of beans. This crop, however, turned out very different, a rich and luxuriant crop having been cut down on the 4th of October, and safely secured in the stack-yard upon the 2d of November. The produce from the two acres and seven falls of clean marketable beans, was rather above 25½ bolls or 102½ Winchester bushels; he had paid for the seed 9s. *per* bushel; and if he had sold the produce at the same price, instead of using the greater part of them in the stable, his crop would have yielded L. 46, 16 s., besides the benefit of the straw, which could not be calculated at less than L 10 more. The crop was raised without the aid of dung, and after two crops of oats.

6. *Tares.*—This article is not much cultivated in Scotland, a few acres only on every farm being raised for soiling horses, between the cuttings of clover; but Mr Allan of Craigrook has carried it to a still greater extent, as he considers tares one of the most valuable and profitable crops he can cultivate. The proper time for sowing tares *for seed* is about the second week of March *, in drills about thirty inches wide; and three firlots of tares is, in that case, a sufficient quantity of seed, but it is thought better to sow rows of beans and tares alternately, as the beans keep up the tares; in that case, half a boll of tares, and the same quantity of beans, is sufficient for seed. On this subject, Mr Dudgeon of Prora remarks, that as tares are much earlier than beans, they should be sown on the surface, when the beans are harrowed; this should not be done till the drilled crop is

* Mr Kerr observes, that the time mentioned is very proper for a crop of tares *intended for seed.* But what are wanted for cutting or soiling, ought to be sown at two or three times, to give a succession. The first as early in February as the season will allow, to come in immediately after the first cutting of clover. A second crop in the beginning or middle of March, to stand for seed. And a third sowing in the end of March or beginning of April, to cut green for the horses during harvest. Beans answer excellently, to stake the tares intended for seed; but those which are meant to be cut green, ought to have a small admixture of oats; which both serves to hold them up, admits the air, aids the scythe, and increases the food.

It is a pity our Scotch climate does not answer for winter tares. Mr Kerr tried them twice ineffectually; but was told they sometimes come forward to cut before clover, but very rarely. The earliest sown tares in spring, should, however, be of the winter sort, being the hardiest. Winter tares, it appears would answer if sown in September. That plan, however, can rarely be adopted, as it is seldom possible to get the land cleared from the former crop, and ploughed for the tares, so early in the season.

near breaking the surface *. Without this precaution, he has witnessed a great loss of tares in reaping. If they could be kept late enough for the bean, no method can be devised, by which a greater crop could be procured.

7. *Turnips.*—Drilled turnips is one of the great boasts of Scottish agriculture, and though the idea of drilling them was originally taken from the celebrated Tull, yet the precise mode of conducting this operation, now universal in this country, certainly originated in North Britain. Other attempts of a similar nature may have been previously made, both in England and Scotland, but Mr Dawson of Frogden is the individual, who first brought that practice to its present state of excellence.

In discussing this subject, it is proposed briefly to consider the following particulars: 1. The process of drilling; 2. The different sorts of turnips cultivated in Scotland; 3. The produce of each sort; 4. The manner of consuming them; 5. The mode of preserving them; and lastly, Any miscellaneous particulars which may be entitled to notice.

1. The process of drilling turnips, is very ably described in the Berwickshire Report, and in other publications †, and the annexed plan, taken from that report, will give a general idea of the system.

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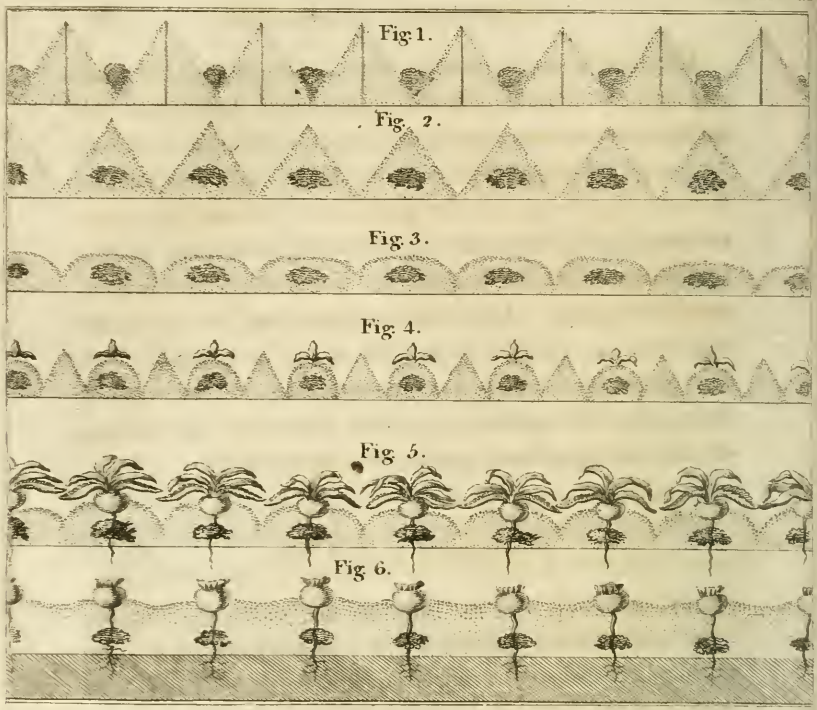
* Mr John Shirreff is of opinion, that beans should *not* be harrowed till they have broke the surface, and got several green leaves, when they become pliant, and bend to the harrow; whereas, if you harrow them when about to burst forth, you break them over, for the embryo plant is very brittle.

† In the year 1797, Mr Alexander Low of Woodend, in particular, drew up, with great clearness and ability, for the late Duke of Bedford, a short account of the Berwickshire mode of turnip culture, as then practised.

TABLE EXPLANATORY of the SCOTCH MODE of CULTIVATING TURNIPS in DRILL.

To be Placed Opposite Chapter 2.d page



Scale of the Upper Figures 0 1 2 3 4 5 6 *Feet*

Fig. 7. *The Scale one Quarter of the Upper Figures*

It is not proposed, in this work, to enter into all the *minutiæ* of the culture of drilled turnips, which it would be difficult to imitate from description merely. It would be advisable indeed, for those who wish to try the plan, to procure a person, experienced in the process, to conduct it; it may otherwise fail, owing to want of attention to some minute particular, which may be of more importance than is commonly imagined. The annexed plate, and the subjoined explanation, will give a general idea of a system, which cannot be too strongly recommended to the attention of those, who may wish to introduce the culture of turnips, on the most improved system, in other districts.

Explanation of the Plate.

Fig. 1. is a section of the drills, as first formed, and having the muck or dung spread out in the hollow drills, with a line pointing out where the ridglets are afterwards split.

Fig. 2. represents these drills, as split open, to cover the muck; what was formerly the hollow drills is converted by this operation into the ridglets, and *vice versa*.

Fig. 3. gives an idea of the figure of the drills or ridglets, after having been rolled by the drill machine at the time of sowing the seed. The seed cannot be sown too soon after the land is thus prepared for its reception.

Fig. 4. is a representation of the appearance of the field, after the earth has been gathered into the intervals between the turnip drills, as formerly practised, but which has now given way to the use of the horse-hoe.

Fig. 5. shews the situation of the drills, on finishing off the field, in the older method, by splitting open the gathered ridglets in Fig. 4, but which practice is not now generally followed.

FIG. 6. gives an idea of the situation of a field of drilled turnips, as now generally finished off; the furrows or hollow drills not being opened out, the shaws or tops of the plants being removed for the use of the young stock, previously to the feeding flock being laid on.

FIG. 7. gives a plan upon a smaller scale than the preceding sections, of a turnip field in regular drills, in which the drills are laid off obliquely to the usual direction of the ridges, to facilitate the more equal distribution of the muck, which had been covered up in the drills, when afterwards ploughed for a grain crop.

2. The sorts commonly cultivated in Scotland, are known under the name of the common Globe Turnip, the Yellow Turnip, and the Swedes; the Tankard and White Norfolk have also been successfully raised for early consumption by sheep. The Globes, and the Swedes, however, are the most prevailing varieties.

Some experiments have been tried by Mr Blaikie, a native of Roxburghshire, who is now bailiff to the Earl of Chesterfield, with the three first sorts. The globe turnip produced the largest crop, but was the most tender; the yellow proved a fine crop, was more nutritious than the globe, and stood the winter better; the Swedish turnips maintained their superiority for hardiness; and the yellow Scotch was next in regard to that very essential quality.

The yellow Scotch field turnip, to a certain extent, may be considered as a valuable acquisition, for the following reasons:—1. It is more hardy than the globe, tankard, red top, green top, or any variety of the Norfolk turnip.—2. It does not draw more nourishment from the ground than any of those varieties, consequently does not require that any extra preparation should be made for it.—3. It is not so hardy as the Swedish, but has the advantage, in not requiring so much manure;

does not exhaust the ground so much, nor does it require to be sown so early by a month; this gives time for cleaning and preparing the fallows, which are too often but imperfectly cleaned when the Swedish are sown.—4. The yellow Scotch is also a good table vegetable, being palatable, more nutritious, and not so watery as the Norfolk varieties.

When Swedish, yellow Scotch, and Norfolk turnips were strewed indiscriminately over a field, and cattle and sheep turned to them, it was observed that the stock selected the yellow Scotch, after being used to them. This, however, depends much upon the particular period of the season when the trial is made.

It is also maintained, though not ascertained by decisive experiments, that the yellow is by far the best turnips for milch cows, and that they thrive much better than the Swedes in light soils.

Mr Walker of Mellendean finds that the Scotch yellow turnip stands the frost as well as the Swedish, and he thinks that horses prefer them to any other. If they are found to stand the variations of the weather in spring equally with the Swedish, they appear to him to deserve the preference in other respects.

Mr Culley finds, that neither the yellow, nor any other turnip, the Swedish excepted, will retain its juices in the spring, and he considers the Swedish, on that account, as entitled to a decided preference. Mr Rennie of Phantassie also considers them, as without exception, the most useful plant of the whole species, and without them, there is no safety or security, either for feeding or breeding stock. He recommends, therefore, that one-third of this species, in so far as turnips are cultivated, should be sown on every farm. The only objections to them are, their being of so hard a nature, as to be very pernicious to the teeth of stock, particularly the very young when shedding

their teeth, or the very old; and that they require rich land, or a great deal of manure. They may be transplanted, but in that case do not come to the same size as those which grow upon the spot where they were originally raised.

Mr Gray of Gorgiemuir, near Edinburgh, finds Swedish turnips more profitable on his clayey soils, than beans or yams, and he gets them off without poaching the land, though of a wet description, by the following method. When he can spare hands, and the weather will permit, the turnips are pulled, the roots cleaned, and laid in heaps with the tops on, all lying one way. When frost comes that will bear the carts, he sends the turnips, in this state, to the cowfeeders in Edinburgh, and sells them readily at a shilling *per* cwt. when common turnips will only fetch ninepence *per* cwt. The portion proposed to be kept for the horses till spring, are brought home and stored up in any spare corner, after the tops are cut off, which are given to the cows. Mr John Shirreff recommends it as a more advantageous plan, to draw and store the whole, when they could be disposed of at convenience.

Mr Aitchison of Clement's Wells commonly sows about 30 acres of turnips yearly, of which, from 15 to 20 acres consist of the Swedish sort. These serve his cattle and sheep till the grass gives a good bite. If his sheep are young, he cuts the turnips for them with a machine. He adds, that in his opinion, a greater quantity of good food for stock, is got from the two sorts of turnips, and at less expence, than what is procured from any other article he has ever tried. Mr Kerr observes, that the Swedish turnip is perhaps the best winter vegetable we have except the potatoe. Five pounds weight of beef or mutton will make richer Scotch broth, along with Swedish turnips, than seven pounds along with an equal quantity of any other

turnips. It is fully equal to a mixture of carrots and turnips in that respect, and much sweeter.

A new plant of the turnip sort has been lately introduced into Scotland, called noll-kholl. It rises like a cabbage plant till it is about three inches high, then forms like a Swedish turnip, and appears to be much of the nature with that useful plant. They were first raised in East Lothian by Mr Alexander Johnston, surgeon in Dunbar, who some years ago received a few seeds from General Sir David Baird, on his return from the Cape of Good Hope. I have seen them in great perfection at Lord Lauderdale's, near Dunbar. A correspondent informs me, that they are cultivated in Strathearn, and that the sheep preferred them much to turnips.

3. The produce of the turnip crop necessarily varies. Mr Paterson of Castle-Huntly found that his globe or common turnip weighed fifty tons *per* Scotch, or forty *per* English acre, when entire, but only forty-six tons when the tops and tails were cut off. Mr Allan of Craigrook states, that on his farm at Oldliston, the common white turnip weighed from forty to fifty tons *per* Scotch acre. The Swede turnips also, when properly cultivated, produce a heavy crop. I am informed from undoubted authority, that a Scotch acre of that sort, in East-Lothian, weighed no less than forty-four tons, which is at the rate of about thirty-seven tons *per* English acre. The crop appeared so great, that several respectable farmers in the neighbourhood attended to see it weighed.

In regard to the weight of turnips on the different soils, Mr Rennie of Phantassie states, that in the best land, worth L. 5 *per* Scotch acre, the produce may be forty tons, which is at the rate of about thirty-two tons *per* English acre. Where the land is of inferior quality, the produce must necessarily be less. The profit to be derived from such a crop, must depend upon various circum-

stances; the value is generally calculated at 5s. *per* ton to the grower, when sold on the ground, but the person who buys them ought to have a profit of from 1s. to 2s. *per* ton, to indemnify him for his outlay on the stock fed, and his risk, labour, &c. In regard to the question, whether it is most profitable to feed sheep or cattle with them, that must depend upon soil, situation, markets, &c. Sheep are generally preferred on dry soils, and in good situations, but cattle in the colder and higher climates *.

4. The mode of consuming turnips, by feeding cattle and sheep, is well known; but there is one mode of giving them to sheep, adopted by Mr Hunter of Tynefield in East-Lothian, which seems to merit particular attention.

He states, that he has been in use, for several years past, to convert part of his straw into manure in winter, by folding sheep, and giving them turnip on the top of the straw. In 1808, he had 300 sheep, mostly black-faced wedders, three years old, from the Highlands, at L.20 *per* score, fed on turnip in the following manner. A fold, containing an English acre, was made in the corner of a field on a southern exposure, sheltered from the north and west by a strong thorn-hedge: the whole fold was then covered with straw a foot thick. The sheep were turned in, and turnips carted and laid on half of the fold upon the straw, and a daily supply was continued on the same half till the straw under them was a little wet: the turnip was then laid on the other half, covering that part where

* Mr Curwen states, that an acre of turnips will feed sixteen sheep for six months or a hundred and eighty days, allowing 28 lb. to each sheep *per* day, and 4 lb. for waste of tops, &c. This gives some little more than 41 tons *per* acre. Mr Logan lets his turnips at 6d. *per* week, and made L.9 of them *per* acre. This gives 38 tons.

the turnip had been first laid, with fresh straw, and he continued to change, from side to side, once in two or three days, always giving fresh straw the whole season. The sheep lay very dry, the straw serving as a drain to receive moisture. As the *palm* or chaff upon the straw was eaten by the sheep, they fatted apace, and were sold in March at L. 42 *per* score. The quantity of manure produced was very great, (no doubt partly depending on the quantity of straw used), in one year not less than 800 tons of the best manure he ever saw on his farm. The particulars of this important experiment, and other interesting particulars therewith connected, will be given in the Addenda.

Another intelligent correspondent informs me, that for some years, he has adopted a similar practice of feeding sheep, by keeping them confined in a standing fold during the winter months, and giving them turnips thrice a-day upon the straw. It requires, however, a considerable quantity of straw, as they must always get some every second or third day, and in wet weather every day: but it is certainly an excellent method of making manure where there is plenty of straw.

Several intelligent farmers have of late years grown *ruta baga* or Swedish turnips, for the use of the horses and other stock, during that critical period when the common turnips fail, and grass has not yet become abundant, and for these purposes this esculent is invaluable. But Mr Church of Hitchill observes, that where the soil is thin and dry, it is impossible to raise a good crop of Swedes under any management. He therefore begins to entertain an idea of substituting potatoes in their room *.

* Mr Kerr observes, that potatoes, he understands, are now very extensively applied to the use of cattle and horses in Lanarkshire. If this is ultimately found to answer, and the practice become universal, it will secure the country against the possibility

5. Mr Blair of Montague, near Perth, on the first appearance of severe frost, has been accustomed, for thirty years past, to store up turnips, cutting off their tops and tails, and thus preserving them sound and good for three months, much to the advantage of his farm: and the cow-feeders near Edinburgh have long followed the same practice. Mr John Shirreff received thirty guineas from the Society of Arts, for communicating to that public-spirited institution, a simple mode of drawing and stacking, either the whole, or the greatest part of his turnip crop for several years in autumn, intended to be consumed during the following winter and spring, a practice which he found attended with much convenience, economy and emolument*.

6. The celebrated George Culley has communicated to me a fact, which, though perhaps known to many intelligent farmers, may not be so universally propagated as it deserves to be. It is this, That all *crude soils*, or even such soils as have been cultivated, but which have had little or no calcareous matter mixed with them, will produce better turnips, with a plentiful application of lime or shell marle only, without any dung whatever, than with dung without any lime or other calcareous substance. This he finds from long and repeated experience.

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of famine in the very worst of years. It will become a source of tangible human food, usually applied to animals, who may be supplied from other sources calculated for their subsistence. In a year of dearth, the high price of potatoes will naturally induce the farmers to stint their cattle, for the supply of the people, and to replenish their own pockets.

* This useful communication is printed in the 22d vol. of the Transactions of the Society of Arts, p. 118. This experiment took place *anno* 1803.

It is said that the turnips in Berwickshire are seldom injured by the fly. This may perhaps be attributed to the superior culture for which that district is so much distinguished, by means of which the young plants are enabled to push away at the beginning with more vigour than when the management is less perfect; for it is a general observation, that the more rapid the vegetation of the plant, the better is it able to withstand the effect of the insects' depredations. The Berwickshire and Roxburghshire farmers, have a great advantage in the culture of their turnips, from the freshness in which their lands are preserved, by the system of two years' pasture in their rotation.

It has been remarked in Banffshire, that mixing earth or moss with the offals of fish, makes an excellent compost, particularly for turnips, and that the best turnips are always after fish dung. This should be attended to on the sea-coast, where such quantities of fish, and of fish offal, may be had.

The late Mr Barclay of Ury, whose authority as an agriculturist ranks so high, always dunged for *turnips in the preceding year*; that is, the turnip was the second crop after the dung, the muck in this case being completely incorporated with the soil, before the seed is sown. This practice has been followed by some farmers in the Mearns, and it is said with success. Mr Kerr, however, on this head remarks, that this plan, though frequently tried, has never answered in Berwickshire, where *recent dunging* is found, by experience, quite necessary to insure a good crop of turnips. He knew a farmer who lost his turnip crop; in a great measure by dunging before winter, to save spring labour.

Though the process of drilling turnips in Scotland is well known, it would be a great object gained to the farmer, if some means could be devised, for making them vegetate equally in a dry season. The seed is sometimes

steeped, to make it spring readily, and even the drills watered after the seed is deposited; all these are known and occasionally practised in Scotland. But by the following accident last summer, Mr Church of Hitchill has been led to conclude, that sowing the seed on the moist dung, as spread in the drills, would secure a certain and regular vegetation, and afterwards ploughing down the dung in the usual manner, but perhaps not covering it quite so deep, would be a practice well worth adopting in a dry season. Mr Church having prepared his ground for sowing Swedish turnips, some seeds of the globe turnip were deposited by accident on the dung spread for the Swedish before it was ploughed in, which was sown in the usual manner. On the same day, about an acre of the globe turnip was sown on land of the same quality, and dunged in the same way. From the dryness of the season, neither the Swedish nor the globe turnips vegetated till a month after sowing, and these crops turned out moderate. But the seed which had accidentally fallen on the dung as above stated, vegetated rapidly, and the turnips attained a great size, indeed they could not get larger for want of room in the drills; many of them weighed from 15 to 28 lbs. with tops and tails. This practice may prove highly useful in dry seasons, and indeed should always be tried, as the expence of the seed is but trifling. The great difficulty will be, to lay the soil sufficiently thin and regular over the small seeds.

On the whole, there is certainly no branch of husbandry more desirable to bring to perfection, than the culture of turnips. The common sorts can be sown with advantage from the tenth to the end of June, giving the farmer ample time to clean his ground. It is, besides, a fact well known, that the close deep shade of the turnip leaves has a tendency to rot all below them. There is perhaps no article that produces, at so cheap a rate, such a quantity of

food for stock, or that is the means of raising so much valuable manure. Experiments, however, are still wanting, regarding the culture of this root, before it can be brought to perfection; in particular, it would be necessary to ascertain, the specific weights of each sort *per* acre; the quantities of beef and mutton produced by equal weights of each sort of root; the quantities of manure required for each sort; and the effects of each on the following crops in the rotation.

8. *Potatoes.*—The culture of potatoes has greatly increased in Scotland, owing to the following circumstances: 1. The excellent mode in which they are raised; 2. The demand for them at market; 3. Their proving so valuable a preparation for crops of wheat; and, 4. The custom adopted by farmers, of giving portions of land for raising potatoes, both to their own servants, and to the inhabitants of any neighbouring town or village.

1. Nothing can be superior to the mode of raising potatoes by the plough, and in drills. The following account of that process, though peculiarly applicable to the neighbourhood of Glasgow, does not vary materially from the practice usually adopted in other parts of the kingdom.

The ground is prepared for a potatoe crop by ploughing in winter, or rather in autumn; and to keep it dry, during winter, the ridges are gathered, and the furrows kept clear. It is sometimes ploughed once, and sometimes twice, and well harrowed during the spring, and the drills being formed, the dung and cuttings are put in and covered with the plough. In sandy ground the cuttings are put below, and in heavy soil above the dung. The potatoes are dressed in summer in the ordinary way, the drills being pared or sliced, horse-hoed, hand-hoed, weeded, &c. as in other parts of the country.

In regard to the produce and value, that must vary according to the condition of the ground, the time and man-

ner of culture and cropping, the season, and other relative circumstances. A potatoe crop will average from 40 to 50 bolls *per* acre. They will sometimes fall short of 40, but many have reaped more than 60 bolls from one acre. General Spence sold last year a potatoe crop, for part of which he was paid L. 29 *per* acre, and potatoes were raised from part of the field, at the rate of 80 bolls *per* acre. Andrew Moodie, Esq. reaped, for a first crop, upon deep moss, near Paisley, from 17½ acres, near one acre of which was occupied with roads, ditches, &c. 774 bolls of potatoes, which he sold at L. 418 : 6 : 2. Robert Cameron, in East Walkingshaw, near Paisley, raised 60 bolls *per* acre, from moss-ground. Potatoes are usually sold at from L. 18 to L. 28 *per* Scotch, or L. 24 : 7 : 8 *per* English acre, the purchaser digging up and removing the crop. In a field, near Elderslee-house, potatoes, planted without dung, after a crop of oats, from old pasture, to which no manure had been given, sold at L. 27 *per* Scotch acre.

Mr Andrew of Tillilumb, near Perth, adopts the following plan in the cultivation of potatoes: 1. He cross-ploughs; 2. Puts in the dung; 3. Ploughs a second time; and, 4. The ground is either drilled for potatoes, or another ploughing given, and the potatoes planted after the plough in every third furrow. He usually follows the last mode, as he thinks it best calculated to do justice to the ground, and generally brings a good crop. Repeated ploughings after the manure is applied, cannot however be recommended. The expences, besides rent and dung, may be stated as follows:

Seed *per* acre, 2½ bolls, (32 stone Amsterdam, 17½ lbs.) at 12 s. *per* boll,	L. 1	10	0
Cutting the seed,	0	2	6
Planting,	0	4	0
Cleaning, after being horse-hoed,	0	12	0
	L. 2	8	6

Potatoes at Perth sold this year at about L. 15 or 15 guineas *per* Scotch acre; and if L. 5 is supposed for rent, and L. 5 for dung, it will appear that there is not too much profit for so much labour, and that the chief profit lies in the state of preparation the ground is brought into for the succeeding crop. In a wet season, potatoes do not answer upon heavy land *.

The average produce of potatoes near Edinburgh, is from 40 to 60 bolls *per* Scotch acre, and the value from L. 20 to L. 30, average L. 25.

2. The consumption of potatoes is annually increasing in Scotland, every prejudice against the wholesomeness of that root having been long ago exploded. The simple modes in which they can be prepared for the table, is of the utmost advantage to the poor; and by the addition of salted herring, both the taste, and the nourishment afforded by that useful article, may be improved. It is difficult to conceive how the people of this country could have subsisted, had it not been for the fortunate introduction, and

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* The following is the expence of cultivating one acre of potatoes near Dalkeith.

Dung, 40 single-horse carts, at 5s. - -	L. 10	0	0
Three ploughings and harrowings, - -	2	0	0
Seed, cleaning with horse and hand-hoe, -	3	10	0
Taking up and housing, - - -	2	10	0
Rent, - - - - -	5	5	0
	L. 23	5	0

Hence at the average value of the produce near Edinburgh, (L. 25,) the profit is trifling, and there must sometimes be a loss. But Mr John Shirreff remarks, that they save the expence of preparing the *three* following crops in the rotation, and thence their profit arises.

extensive culture of this most valuable plant. Indeed, the same numbers could not have been maintained.

3. Potatoes are found an excellent preparation for crops of wheat. The frequent ploughings necessary for raising that article; the quantity of dung allotted for it; the frequent hoeings, the stirring which the ground receives when they are gathered, (sometimes perhaps more than is necessary), and the favourable period of the year when they are taken up, are excellent preparations for the culture of that important grain. Wheat after potatoes, therefore, is almost universal, wherever both are cultivated. But this plan can only be followed near great towns, where alone potatoes can be used in great quantities, and sufficient muck purchased to raise them.

4. The culture of potatoes is very much increased by two practices: 1. That of farmers giving a certain portion of land for raising potatoes to their servants; and, 2. By a practice of farmers in the neighbourhood of towns and villages letting land to the inhabitants for the same purpose, they furnishing both dung and labour, at least in so far as regards the cleaning processes. Near Cullen, in Banffshire, they get a fall of ground for a load of dung, which the farmer puts on his turnip field, as the people consider the potatoes of a better quality when raised without dung. Mr Stewart of Hillside, by letting an acre for potatoes, gets the labour of 120 reapers *. They give

* An acre of potatoes gives 120 days reaping, *(shearing,)* at 55 yards for each day, the drill being 34 inches wide. The acre thus pays L. 9, the reaper furnishing seed; the wages, reckoned at 1 s. 6 d. besides victuals, which together make 2 s. 2 d. *per* day. The reaper *(shearer)* has his potatoes at nearly 20 s. *per* ton, often much less: the advantage of the farmer is, having these reapers at his call, and only on the days when required.

the seed only, and take up the crop. The land is let to labourers and tradesmen in a neighbouring village. The value of the potatoes is above the ordinary wages, and the reapers besides receive maintenance when they are employed; but it is a great advantage to have a number of labourers at command, more especially during a critical harvest.

The culture of potatoes is likely to be materially increased by the following circumstance. Mr Spears of Dysart informs me, that within these three or four years past, the farmers occupying a dry loamy soil, in place of raising only turnips for feeding, now raise nearly half potatoes *, and half turnips. In this way they find, that by giving their cattle as many potatoes as they can eat, the one half of the day, and turnips the other half, they become fat in little more than half the time requisite to feed them with turnips alone. They likewise find, that an acre of potatoes, will go farther in feeding, than an acre of turnips, with this great additional advantage, that no weather can affect the feeding of the cattle, when they have potatoes always at command †; whereas formerly, during severe storms, the turnips were often so much hurt by the frost, as to do the cattle no good, while it continued. They are also thus enabled to keep them on much longer in the spring, as potatoes may be used two months after common turnips are quite useless, though this argument does not apply to the Swedes. This plan seems to be gaining ground, and is likely to answer in the western districts, where they prefer the culture of potatoes to that of turnips. By turnips an ox may be fattened in five months. By this new mode of feeding alternately with turnips and potatoes, three months, or even

* It is a pity, that these farmers do not get the Patagonian, or bullock potatoe, from Mr Church of Hitchill, in Dumfries-shire.

† It is said that by storing turnips, the same object may be attained.

less may be sufficient, the cattle being probably tempted to eat more from a change of food. It is not likely, however, that an acre of potatoes will go farther than an acre of even common turnips. The same land that will produce 12 or 13 tons of potatoes *, would yield 40 tons of turnips. It is probable the latter would go farther in point of fattening, and at any rate would produce the most manure. It is a most important circumstance, at the same time, in favour of potatoes, that when they are produced, they can easily be converted, if necessary, from the food of stock, to that of man, and consequently, in times of scarcity, would prove an invaluable resource. They do not require also such strong land as the Swedes.

9. *Clover and Rye-grass.*—Red clover, with a mixture of rye-grass, and sometimes with some white and yellow clover, and perhaps rib-grass, are the grasses almost universally sown in Scotland. Some experiments have been tried with lucern †, sainfoin, chicory, &c. but not to an extent entitled to any particular notice.

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* Mr John Shirreff is convinced, that from the first of October, till Christmas, raw turnips will feed faster than raw potatoes.

† Two experiments have been reported to me of the culture of lucern in Scotland, one by a proprietor near Edinburgh, who has about three acres of this plant, with which he maintains ten or twelve horses during the summer season. The other is by Mr Duffin, vinegar merchant at the Abbey. He has had it for several years growing in a plot of his garden; the plot is not near a rood, and it maintains one horse to him during the summer months: he has three luxuriant cuttings, and an after-cutting in the end of autumn. From the first sowing it grows annually; it lasts from ten to fourteen years, yielding good crops, and perhaps may remain in vigour much longer. He has tried transplantation, and

The introduction of red clover was one of the most fortunate circumstances that could have happened to the husbandry of Scotland, more especially since the mode of cutting it green for stock, or soiling, has been adopted; the produce is immense, whilst from the size of its root, which remains in the ground, it does not exhaust, as otherwise would be the case. It is also an excellent preparation for other crops. It is said, that land soon grows tired of clover, but, where that is the case, to any extent, it is to be attributed to the want of deep ploughing, one of the principal advantages attending summer-fallow. Clover delights in new soil, in so much that when it is at first tried, in any ground tolerably fertile, the produce is hardly to be credited.

The propriety of cultivating rye-grass, is an important subject of discussion. It is certain, that many English farmers, who are eminent in their business, abhor rye-grass on strong lands, from a multitude of observations on the wheat which follows it; for the cases are many, in which fields, partly sown with clover alone, and partly with clover and rye-grass, where the superiority of the wheat after the clover alone, induced them to resolve on the omission of rye-grass in future. Mr Rennie of Phantassie concurs in that opinion. He observes, there can be little doubt that rye-grass is very hurtful to wheat, and when wheat is intended, no rye-grass ought to be sown. But wheat after grass, or even after clover alone, being now almost totally given up, oats paying better, the observation

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it answers to his wish, for lucern throws out a number of fresh shoots from its root. It requires to be hoed clean from any other grass or weeds. There cannot be a doubt of its thriving well in Scotland, in rich deep soils, which it requires, as its shoots go far into the ground; hence a tilly or rocky bottom is improper for it.

does not apply to the system of husbandry practised in Scotland.

Some maintain, that cocksfoot answers all the purposes of rye-grass, particularly as a mixture with clover; that it supports more stock, and does not equally exhaust *, but this is a circumstance not yet fully ascertained, and rye-grass, if properly cultivated, is certainly a valuable plant, either sown by itself or mixed with clover. In regard to rye-grass, either cut green, or converted into hay, a person of much experience in the management of horses, (Mr Alexander Maclaurin of Edinburgh), considers rye-grass mixed with clover, as a strong, pleasant and substantial food for horses, even at hard work, and every season he has given it green, even to post-horses, in the stable, and it has answered well. He is also of opinion, that hay made of clover and rye-grass, if cut at a proper season, (before the plants are too ripe), if safely got in, and properly thatched, so as to prevent its being injured by the winter rains, instead of becoming dry and husky, as some people imagine, improves by time, and is much fitter for the use and benefit of horses, than if used some months before, and indeed will retain this perfection all the ensuing summer, autumn, and next winter; on the supposition, always, that it is preserved from rain. Good old hay, for that reason, always gives a higher price than new. In a comparative view of rye-grass mixed with clover, and meadow hay, the former is to be accounted much preferable to the other, on account of its strength and substance, by which horses are enabled the better to stand hard work. The fibres of meadow-hay are soft and small, and according to Mr Maclaurin's opinion, dissolve sooner in a horse's stomach, consequently not so proper for hard working horses as the other. Mr John Shirreff remarks,

* All difference between cocksfoot and rye-grass, must depend on the weight of the crops, and quantity of seed carried by each.

that every cultivated vegetable is more nutritious than a natural and wild one of the same sort. The hay of a natural meadow cannot possibly be obtained in a state equally perfect as that of cultivated herbage, because, being composed of many plants, some of which are faded, some too young, some wiry and run to seed, and some fresh and in flower, they cannot assimilate into a homogeneous fragrant mass, so readily as the other. Clover hay, therefore, always sells higher than natural meadow hay, whether low or upland.

Mr Robertson of Ladykirk states, that from long experience, they find, in Berwickshire, perennial rye-grass to be peculiarly valuable. It is the earliest and latest grass they have, but it should *be fed close*, and not allowed to go to seed, otherwise it will exhaust the land *. Mr Andrew of Tillylumb observes, that he has never found a mixture of rye-grass among clover prejudicial to the ground, provided it was cut in due time, just when the bloom is falling from the rye-grass; but, if allowed to ripen, he believes it may be nearly as exhausting as a crop of grain. In short, clover and rye-grass hay, if cut in due time, is a most nourishing and wholesome food, either for cattle or horses, and will keep good for several years, if properly stacked and thatched.

In regard to the value of clover and rye-grass, even at a distance from large towns, Dr Young, near Stonehaven, informs me, that the common price, when sold in very small villages to cowfeeders, is from L. 10 to L. 12 *per* Scotch acre, when milk is sold at 2½d. *per* Scotch pint.

The cultivation of artificial grasses in Scotland, is already so generally known, and will be so fully detailed, in the General Report now drawing up, of the Husbandry

* Mr John Shirreff is of opinion, that annual rye-grass is more relished by stock, and carries a heavier crop.

of Scotland, that it does not seem necessary to dwell upon it longer in this place. It is only necessary to add a maxim regarding the culture of clover and rye-grass, that ought never to be deviated from, namely, that they should never be sown but when the land is in the very best condition, and, if possible, with the crop immediately after a summer fallow or after turnips.

10. *Miscellaneous articles.*—It is evident, that in various parts of an extensive kingdom, a number of articles must be cultivated, to a small or a moderate extent, which do not form a part of the general husbandry of a country In Scotland, the most important of these are, carrots, cabbages, kale, rye, and flax.

Carrots.—This species of crop is not so much cultivated in Scotland as it ought to be. Its culture seems to be attended with no more difficulty than that of cabbage, potatoes, or turnips, and if properly managed, with little, or perhaps no more expence. An active improver, (Mr Alexander Guthrie), states, that in his attempts to raise the carrot, with hardly any exception, he has succeeded beyond expectation. For working-horses, he knows no food equal to carrot, and of this he has had complete experience. Were the growth of carrots general over the country, and used as food for working-horses, he is of opinion, that two-thirds of the oats consumed for that purpose might be saved. In years of scarcity, this would be of great advantage to the nation, and a blessing to the poor.

Mr Butterworth, who rented some land near Edinburgh, to carry on the cultivation of carrots, informs me, that he tried that root for seven years upon the same ground, without dunging, and with great success, and had one year twenty acres, which he sold at 5 d. *per* stone, and two acres and a half for L. 60 Sterling, without being at the expence of draw-

ing them.—He ploughed the ground in October *, in the common and ordinary way; in March he ploughed it again in the same manner, and harrowed it well, and where it was sheltered, he sowed the seed immediately after the harrowing, that the weeds might not get a start of the seed, which is of great consequence. The drills † were made at one foot asunder. He then rolled the ground with a heavy roller, drawn by two horses; when the rows appeared, he run the Dutch hoe betwixt the rows, and hand-weeded the rows, leaving the plants four inches asunder; in about three weeks after, he weeded a second time, and kept them very clean. In October, he cut off the tops with a scythe, and raised the carrots by ploughing the ground in the ordinary way, as many as were required; but where the ground was dry, he let them remain with their tops on, to guard them from the frost, and raised them as he had occasion: frost destroys them, if left in wet ground, during the winter; but in dry ground they keep best till the spring, when they begin to grow, and should be raised in March. Mr Butterworth sowed about 7 lb. of seed ‡ *per* Scotch acre; they yielded a profit equal to wheat, and improved the soil till he had the best crops of barley and wheat after, that could be imagined; the ground was very indifferent before it was improved by the cultivation of carrots. He sold the spot, which was at Burnhead and Stonehouse, near Liberton, twelve years ago, at more than double the price paid for it, without any improvement, except by cultivating it with carrots. On an average the produce was about 2200

* In other parts of the kingdom, autumnal ploughing is found much to increase weeds, and to add to the expence of hoeing.

† Drilling has been tried in Suffolk, but did not succeed.

‡ Never more than 5 lbs. of seed sown in Suffolk broad cast by the best farmers; the seed being good, that is to say new. This is nearly the same as 7 lbs. *per* Scotch acre.

stones or 13¾ tons *per* Scotch acre. Where the ground was cold, and not sheltered, the ground was not sown til April.

Mr Guthrie states, that in the attempts he made to steep the seed, he partly succeeded, and partly failed, the seed being bad; it was steeped in pure water twenty-four hours *. He has tried to transplant carrots, but did not find it to answer. He does not think it a good plan to cut off the tops, the second growth coming too late to protect the carrots from the frost, as he allowed them to remain in the ground during the winter. He has given them to his horses during the whole of April quite sound and fresh, and they eat the tops as well as the root.

Mr Paterson of Castle-Huntly also cultivates carrots. He cuts the tops as required, and gives them to the cows; the produce of one acre of which, served to support nine milch-cows for a fortnight; after which the carrots were taken up with the plough; the remainder of the tops were cut quite close to the body before housing.

Mr John Shirreff has made an interesting experiment, on a small scale, to ascertain, whether carrots are deteriorated, or otherwise, by cutting off their tops in summer, and converting them into hay.

Weight of the roots of the carrots, grown on a small piece of ground, drawn and weighed on the	lb.	oz.
30th November 1810, - - -	16	4
Ditto of the leaves, - - -	8	0
	24	4
Ditto of the leaves cut on the 7th of August,	7	8
Total,	31	12

* In Suffolk this is reckoned a most important part of the system.

	lb.	oz.
Weight of the roots and leaves of carrots grown on an equal extent of land, and of similar quality, drawn and weighed on the 30th of November 1810, - - - -	46	2
Weight of the leaves alone, - -	13	12
Weight of the roots alone,	32	6

Thus it appears, that the roots alone of the carrots, the leaves of which were not cut till they were drawn in November, amount to a greater weight, than both the leaves and the roots of the carrots that were trimmed over on the 7th August, and that the difference on the whole was nearly 50 *per cent.* on the one produce, and to 30 *per cent.* on the other. This agrees with the idea, that the sap prepared by the leaves, add size to the roots.

It is also proper to observe, that the weight of root, which is the most valuable part of the plant, is nearly double in what was uncut in summer, whereas the extra growth of leaf in consequence of summer-cutting, is only about 12 *per cent.* at the utmost.

In regard to the culture of carrots in Scotland, it has been ascertained, in the most satisfactory manner, that they can be raised on peaty soils with the greatest success *.

* The following account of this important fact I have received from a respectable proprietor in the county of Fife; and though already published, it may not be improper to reprint it in this place.

It is well known, that carrots delight in a soil where they find no difficulty in striking their roots downwards. Deep sandy soils were therefore recommended for that valuable article, but there is reason to believe that peaty soils will be found greatly preferable.

There are difficulties, however, in establishing a more extensive culture of this plant in Scotland, at least in the

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A gentleman in the north of Scotland, being desirous of cultivating that root, and understanding that celery throve well on peat, he resolved to try whether carrots also might not answer; and he pitched on an acre of low meadow-ground for that purpose, which might have been converted into peats for fuel. It was trenched in November 1805, and a crop of oats taken in 1806. After the oats were removed, a moderate quantity of rotten dung, and some lime, were laid on the ground; it was then dug over with the spade, and in spring 1807 sown with carrots in drills.

In the beginning of the year 1808, the ground got a small quantity of dung, and was again dug over with the spade, and sown with carrots. The crop was very abundant, and some of the carrots measured eighteen inches in length, although the ground was only trenched to the depth of a foot.

The quantity *per* acre was from thirteen to fourteen tons, which was sold, when delivered at Leith, for 7s. 6d. *per* cwt. or L. 7, 10s. *per* ton. The produce of an acre, therefore, when the crop answers, is immense, L. 101, 5s. *per* Scotch acre. The value of carrots, as food for cattle, is well known, and it must be of peculiar consequence, therefore, in the Highland districts of the country, to cultivate that root.

From 168 to 200 carrots weighed one cwt., and, when sold in the Edinburgh market, fetched, even the small sized, 1d. each, and the larger sorts 1½d. and even 2d. each.

The principal difficulty is to get good seed. If that can be obtained, no crop will repay so well the expence of cultivation on a peaty soil. Suffolk is the best county for obtaining it.

The quantity of good seed required *per* English acre, is from 5 lbs. to 8 lbs. As farm-servants are not well acquainted with the culture, it is best to sow the larger quantity. The price varies, according to the season, from 1s. 6d. to 2s. *per* lb. The proper season for sowing field carrots, is from the middle to the end of March. They should be sown in drills, but not in raised ridges like turnips, and not rolled. The drills should be eighteen inches

western parts of it. A respectable correspondent remarks, that it requires a very favourable season, dry land, and in full condition, to produce a good crop, and unless it is also very clean from weeds, it requires very minute attention, and too much time, for persons not acquainted with their excellencies, to risk the chance of raising them in such quantities as might prove useful for stock. Parsnips are not only easier raised, but preserved, and have more nourishment in them than any other vegetable, as he has ascertained by feeding with them for many years, and distilling them.

The most satisfactory information which I have received, regarding the culture of carrots in Scotland, was from Mr William Scott, who had been land-steward for many years to Admiral Elliot of Mount Teviot, in Roxburghshire, and to General Robertson of Lawers in Perthshire.

In the course of twenty-seven years' experience in the culture of carrots, he has found all kinds of soil nearly equally good for raising that root, provided it was old well-fertilized land. Such he always chose out of the green crop or fallow plot, and the extent of ground he destined for carrots, was never less than three or four acres, and sometimes more.

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apart, if drilled on level ground; but if done with a plough as turnips, they would require two feet.

To those who have peaty soils already in cultivation †, a trial of so promising an experiment is earnestly recommended, and that they would be pleased to communicate the result to the President of the Board of Agriculture.

† When peaty soils are first cultivated, they ought always to be trenched in the beginning of winter, and exposed to frost. If dug in summer, the heat of the sun hardens them, and converts them into peat for fuel. But old peaty soils may be trenched for carrots in spring. The produce has amounted even to 16 tons *per* Scotch acre.

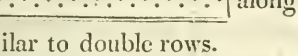
The crop which preceded them was generally oats, for several reasons, 1. The carrots formed a part of the same field with other green crops; and, 2. They were more certain not to be cut down, or injured by the worm, when they were taken after a corn crop, than after the ley or grass one.

The ground was turned by means of a trench ploughing, as soon after harvest as the oats were carried off the field, and lay in that state till the end of February; then it was worked with the plough and harrows to a loose mould, and was afterwards formed into ridges, 30 inches wide, and from 16 to 18 deep. These were formed by going twice round in the same direction somewhat similar to trench ploughing, which raises the top to the above height from the bottom: by this method all the surface mould is accumulated.

The manure Mr Scott used for the first seventeen years, was rotted dung, turned over and prepared for the purpose; but since that period, he has always preferred a well-prepared compost of peat-moss and dung. About ten tons or double cart-loads were given *per* English acre, regularly spread in the bottom of the drills. In doing this, care should be taken, not to break down the ridges; for if this is done, the dung may be left too near the top of the ridges or surface, and the carrots would grow short, and full of fingers or divided roots; whereas, when the dung is laid full 16 or 17 inches deep, not a single fork-rooted carrot will be seen. A singular proof of the advantage of laying dung deep, at least for carrots.

After the dung is spread according to the above-mentioned direction, the drills are split down, and raised up the same way as before, going twice round every ridge, in order that there may be fully 16 inches from the dung all of good mould.

The dung being at the bottom, makes the tap root of the carrot push immediately down, and swell to an enormous size, the roots being often 16 inches in girth, and 18 or 20 inches in length. Mr Scott has frequently had cart-loads of them picked out, and shewn as a curiosity, and not one of them of less dimensions.

Before sowing the seed, a rut is made along the top, about four or five inches wide, and three deep, by means of a hoe, to allow room to the plants to stand in this shape,  along the top of the ridge or drills, similar to double rows.

Many crops of carrots are lost by bad seed. The best and cheapest Mr Scott ever got was from Messrs Dicksons, Shakespear Square, Edinburgh. As the quality of seed varies in different seasons, he always tried it in a hot-bed, or something similar, on purpose to see how it sprung. This trial at once showed, what was the proper quantity to sow. Six, seven, or eight pounds, *per* English acre, sometimes produced a greater number of plants, than sixteen pound at other times, which quantity has been sown, and the plants were far from being too thick *.

Mr Scott has steeped the seed in brewers' draff or refuse, in wet sand, and in a wet bag, which several modes all answered the same purpose. When the seed is too late of being sown, many think steeping necessary; but he does not approve of steeping in *early* sowing, as the sudden transition from a warm, to a cold situation, checks the growth of the young plants. When the season is warm, the seed sown springs of itself, if the soil has moisture in it; if it has not, the seed had much better lie dry, till rain come,

* It is the difficulty of procuring good seed, and the minute attention required in the culture of carrots, that renders them so rare in our fields.

for half-sprung seed, sown in mould, without moisture, will dry up, and never again revive,

After the above-mentioned ruts are made, girls employed in the farm-work, got a proper portion of seed in their aprons, and turning their backs to the wind, they sow it of the proper thickness, walking gently down the furrows a certain number of steps to a handful, and causing their fingers and thumb to move so that the seed might drop equally along in the rut.

This mode of management has answered equally well in Strathearn, as in Roxburghshire. At Lawers, the crop in 1810, was 33 tons and 70 stones Dutch, produced from less than a Scotch acre and a half of ground, of as fine, large, and clean carrots as could be wished for, which were used for horses, milch-cows, young calves, swine, poultry, &c. Several persons near Lawers, tried to raise that root, but did not succeed, owing entirely to improper management, and no fault of either soil or climate.

The tops make excellent green food for cattle, and could be made into hay, if at that time a season could be had to dry them.

Mr Scott has tried the seed which was got the summer following, from those which had been left in the field all winter, and it answered equally well as any other.

The best way to preserve carrots is, to top them close by the head of the root, and lay them gently down in a heap within a house. It must be done gently, for when a person throws them from him at a distance when toping, they are bruised by the fall, and are so damaged, that they soon spoil, in the same way as an apple, when bruised on one side. They should be turned over once a month, picking out the spoiled ones, which attention will make them keep sound till the end of April.

From the end of February to the first of April, carrot-seed may be sown; but early sowing is preferable.

The second thinnings of carrots afford great relief to young pigs, as at that time no potatoes can be had. Upon the whole, no food is so good for young animals of all sorts as carrots.

About nine English pounds will serve for a feed to an ordinary work-horse, a milch cow, or a bullock of from 35 to 40 stones. A barley firlot, which contains four pecks, will weigh from 70 to 72 English pounds.

When the ground is properly cleaned, an English acre of carrots cannot be raised and stored into their winter quarters under L. 5, 5 s.; but the value of the root, when the crop proves a good one, is immense.

Cabbages and Kale.—I am informed, that cabbages, when properly cultivated, yield more food for cattle than any other crop whatever *. Mr Waddel at Dockenyfauld, near Glasgow, raised cabbages on his farm, at the rate of fifty tons *per* acre, and putting them up to the neck in earth, and covering them with straw, he thus preserves them for his cows till the month of February. This plan, however, cannot be adopted on a great scale.

The late Mr Scott of Craiglockhart recommended the cultivation of cabbages, as green food for cattle in autumn, and green kale for the same purpose during the months of March and April, which last is certainly the scarcest period of the year for food to stock, more especially in high situations. The kale, (greens or coleworts), however, are not found to be above two-thirds the value of cabbages, and often not half so valuable; and Mr John Shirreff is of

* It is said, that as the roots of cabbages weigh from one to two pounds each, and are of no use, they must occasion a loss to that extent. On the other hand, it is contended, that the roots both of kale and cabbage are much liked by stock, if sliced down for them.

opinion, that both kale and cabbage are infinitely inferior to turnip. They require much more expensive manipulation, and must be earlier put in, otherwise they do not arrive at any size. Thus, there is not the same opportunity for cleaning and preparing the land for the following crops in the rotation. They are not likely, therefore, to become prominent articles in the husbandry of Scotland.

Rye.—This species of grain is not very extensively cultivated in Scotland, and the winter sort, without which the countries on the coasts of the Baltic could hardly be subsisted, is almost unknown. My principal reason for mentioning it at all is, that in the opinion of a most intelligent practical farmer in Roxburghshire, rye, on muirish grounds, is a more certain crop than oats; a fact little known, but of infinite importance in carrying on the improvement of our barren districts. Mr George Culley remarks, that rye, like oats, will answer on crude soils, without the application of calcareous manures, which renders that crop peculiarly calculated for waste lands, when first brought into cultivation. The principal objection, however, to the culture of rye in Scotland is, that there is little demand for it at home, but it might be exported.

Flax.—This is an article that might be more cultivated in some parts of Scotland than hitherto has been the case, but it is far from being an unimportant one, even in its present state. It is supposed, that there are at least 5000 acres of flax raised in the country, producing above L. 20 *per* acre, and consequently worth at least L. 100,000, besides furnishing the raw material for a most valuable manufacture. The board of Trustees at Edinburgh have printed and circulated very useful directions for the culture and management of flax, with some observations also on the culture of hemp. This last article might be raised, with much

advantage, on peaty soils, in the Hebrides, where there is such a command of sea-ware as manure, and where the people, more especially in the winter season, want employment.

Sect. VI.—*Rotation of Crops.*

Of all the subjects included in the present inquiry, this, perhaps, is the most important, and the most difficult to discuss *. The returns transmitted to me regarding this single point, exceed eighty in number, and would form a moderate volume. It is my duty to endeavour to compress that mass of useful information, within a moderate compass. With that view, I propose briefly to point out the various modes of cropping suggested in the course of the inquiry. It must depend upon the judgment of the farmer, to adopt those which are best suited to the climate where he resides, the nature of the soil he cultivates, the size and situation of his farm, and a variety of other circumstances which will necessarily require his attention, in determining which ought to be preferred.

Every farmer must be aware, in fixing on his rotations, that it is necessary for him to ascertain, not only the various articles for the production of which his farm is calculated, and which are likely to yield him the greatest profit; but also the succession in which these articles ought to be raised, so as not to diminish the fertility of his soil; or, as Lord Kames has well observed, so to intermix his crops,

* Even in gardening a rotation of crops is advisable. See Nicol's Gardener's Kalendar, p. 21.

as to make the greatest possible profit, consistently with keeping his land in order *.

The subject of judicious rotations, has been very ably touched upon in one of the first reports drawn up for the Board of Agriculture, by Mr Maxwell of Fletton. That intelligent farmer justly remarks, that after all the volumes that have been written on farming, a *rational system* is the only true groundwork of general improvement, and that those who carry into execution a profitable system of management, or, in other words, a judicious rotation of crops, bid fair to engage the notice of the neighbourhood, in spite of the impression of those habits which attach to unlettered farmers, and thus may be the source of essential service, both to the cause of agriculture, and to their country.

On this part of the subject it may be sufficient to add, that almost the same crops, which, under one system, would be extremely unprofitable to the farmer, and injurious to his land, under another rotation, with an intervening green crop or fallow, might not only be profitable, but might promote its fertility †.

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* Mr Church of Hitchill remarks, that to adopt a judicious mode of cropping, requires a degree of judgment in the occupier, which can only be obtained by experience and observation. Where the different processes are properly executed, (on which the profit of the farmer must greatly depend), the difference between a good and a bad system, will be found greater, than could have been imagined by those who have attended but little to the subject.

† Compare, for instance, the old course in the Carse of Gowrie, 1. Wheat; 2. Barley; 3. Oats; 4. Pease and beans, when the crops were trifling,—with the new system, 1. Fallow; 2. Wheat; 3. Beans; 4. Barley; 5. Grass; 6. Oats. Under the first course the rent was only from 25 s. to 30 s. *per* Scotch acre. Under the second it has in many cases risen to L. 5 or L. 6 *per* Scotch acre,

In considering this important subject, it is proposed shortly to discuss the following particulars: 1. The principles or maxims on which rotations ought to be arranged: 2. The various sorts of rotations which have been adopted in Scotland, for various periods of two, three, four, five, or for a longer period of years: 3. Of double rotations, where two systems are in a manner blended together, and carried on at the same time: And 4. Any miscellaneous particulars connected with this branch of the inquiry.

1. OF THE PRINCIPLES ON WHICH ROTATIONS OUGHT TO BE ARRANGED.

I have endeavoured, in the preceding section, to point out the various articles which are principally cultivated in Scotland. These articles must be raised, either constantly on the same ground, or one year must be appropriated for the growth of one sort of crop, and the next for the production of another. There are few cases where the same land will constantly yield one and the same plant, or where a repetition of the same crop, or indeed of the same species of grain, without some interval, is not found to be injurious. Hemp is one exception to that general rule; for in Russia, the same ground invariably produces it, without either fallow or any intermixture of crops, but in consequence of great quantities of putrescent manure being annually applied. It appears from Mr Butterworth's experiments already mentioned, that carrots have been successfully cultivated for seven years, on the same ground. In some instances, bear or big has been sown for years on the

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and upwards. The latter rotation, Mr John Shirreff remarks, would be improved, by having the clover after the wheat, instead of the barley.

same ground in succession. But in general, a change, or rotation of crops, has been found not only expedient, but necessary. Indeed every farmer who conducts his operations on rational principles, will be attentive to such a change.

The propriety of adopting any particular rotation must depend on a variety of circumstances, more especially the following: 1. *On the climate*, whether it is wet or dry. Wet climates, for instance, are favourable to the production of oats, dry climates for pease, and for the harvesting of beans *; and the rotations to be adopted in each climate ought to be formed accordingly. 2. *On the soil;* for clay, loam, or sand, have each various crops best calculated for them. 3. A rotation must also depend *upon the situation of a farm*, in regard to the probable sale of its productions: for instance, a large field of potatoes, which might be worth L. 25 *per* acre, near a great town, might not be worth L. 5 in a remote part of the country†. 4. *On the means of improvement by extra manure*, as lime, marle, sea-ware, town dung, &c.—The celebrated Dunbar rotation, of, 1. Turnips; 2. Wheat; 3. Clover; and, 4. Wheat, could not be possibly carried on, without the command of sea-ware, which that neighbourhood possesses: and, 5. The rotation must also depend *on the state or condition of the soil*, whether it be

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* Mr Rennie of Phantassie observes, that beans require moisture, and they never produce a full crop, on dry land, but in a wet season.

† That able reporter, Mr Kerr, in his account of the Berwickshire husbandry, remarks, that unless near large towns, where potatoes are substituted for fallow or turnips, they never constitute a complete part of any rotation, because unsaleable, unless at prices inferior to the expence of their cultivation, and if universal, or even but a little more extended, they would be unsaleable almost at any price. Berwickshire Report, p. 214.

old cultivated land, or a new improvement; whether it be land which has been cropped judiciously, or by exhausting management; whether it is in good heart, or the reverse; whether it is foul or clean.

We shall now proceed to state the maxims, which have been recommended, as the best calculated to lay the foundations of judicious systems of rotation.

1. A farmer must have more than one kind of crop upon his farm; indeed he could not otherwise carry on his business. For instance, had he nothing but wheat, he might not be able to procure hay and oats for his horses, and so on. By having various articles also, he does not run so much risk, either in regard to the season, or to the sale of the produce afterwards. Besides, if a farmer were to cultivate but one crop, he might often be materially injured by one unfavourable season; or if the article which he raised was not saleable, the land had better have remained unploughed.

2. To have the crops so arranged, that the labour of ploughing for each, of sowing, weeding, reaping, &c. shall proceed in a regular succession, and that the labour or business be not too much crowded on the farmer, at any one season of the year, nor any quantity of extra stock rendered necessary; but that the crops produced on the farm, shall be cultivated by the same hands, and with the same cattle. To this general rule, hand-hoers in spring and summer, and reapers in autumn, must form an exception.

3. To avoid forcing crops, or frequent repetitions of the same articles or species*; as a diminution both in quantity

* The celebrated George Culley is of opinion, that the greater distance the repetition of any sort of crop can be kept the better,

and quality, except in very rare instances, never fails to be the consequence. By frequent repetitions of the same crops (as Mr Scott of Craiglockhart remarks), the soil loses stamina, which neither manure nor cultivation can renovate. Great luxuriance in vegetation can be made to take place, without much real productiveness, as we see where grain is sown on the sites of dunghills *.

4. To avoid two white crops in succession, but alternately to have white and green crops. On this head, it is contended, that it is impossible to lay down general rules, without modifying them by such circumstances as are often only to be known by real practitioners: and though the system of alternate green and corn crops, is, beyond question, an excellent one in general, deviations from it may sometimes be admitted; for instance, when old rich leys are broken up, two crops of oats in succession may be permitted. This, however, is objected to by one of the ablest farmers in the kingdom, who maintains, that on dry lands, the second crop should be either turnips or potatoes, as the situation answers, and on clays either beans or fallow, which in general will pay better than a second crop of oats.

5. To avoid crops likely to encourage weeds; and, founded on this principle, Lord Kames objects to the culture of pease, which, if not an extraordinary crop, are apt to foster weeds. If the land has been previously fallowed for wheat, and thus cleared of weeds, pease, after wheat, he

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and that the rule holds good in regard to leguminous, as well as white crops. It would seem, however, from Mr Butterworth's experiments, that carrots are an exception.

* Mr Andrew of Tillilumb, near Perth, finds, that if clover is cultivated only once in eight years, the produce is not only about double, but that the succeeding crop of oats is better by two bolls *per* acre.

thinks, may be hazarded *. This doctrine, however, is in a great measure superseded by modern improvements.

6. To raise those crops the most likely to be productive of manure; hence green crops are to be recommended, and barley is to be avoided, producing, when compared to other crops, the smallest quantity of straw †.

7. To arrange the crops so as to keep the land in good condition, and increasing, rather than diminishing in point of fertility ‡. This is best accomplished by the alternate husbandry, (or white and green crops in succession), and giving every part of a farm the advantage of being occasionally pastured.

8. To commence a lease with a meliorating system, but during the remainder of the term, to crop the land in such a manner, as to reap, *in moderation*, the advantage of the improvement that has been made. In forming a rotation, therefore, those articles should be included, which are the most likely to afford a profitable return to the farmer.

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* Gentleman Farmer, p. 143. Mr Robertson of Ladykirk considers pease to be a good crop previous to a fallow, to bring about land that has been smartly cropped, and lime has a good effect after pease.

† A fair average of straw produced by the different crops, in the way they are generally cut, according to Mr Brown of Markle's calculation, is, Wheat, 180 stones; Beans and pease, 150; Oats, 160; and Barley only 120 *per* Scotch acre, all Scotch weight, containing 22 lbs. avoirdupois, *per* stone.

‡ Mr Andrew of Tillilumb remarks, that it ought to be a leading maxim with all farmers, never to take a crop but when their ground is in good condition. Hence their first care and chief study ought to be, how they may bring their ground into, and keep it in the best order, and not what they can *draw* or *take* for the season. If they are kind and generous, the grateful earth certainly will *give*, under proper management.

Keeping these maxims in view, we shall now proceed to consider, the various rotations which have either been adopted by, or recommended to, the attention of the farmers in Scotland.

2. OF THE VARIOUS SORTS OF ROTATIONS.

It is not unusual, in treating of this part of the subject, to consider rotations as they are applicable to different soils, for instance, clay, loam, &c.; but I think it on the whole more expedient, to discuss the different courses of crops, according to the number of years they respectively require to finish the rotation; some occupying two years, some three, some four, some five, &c. Under each head it will be proper to explain, for what description of soil each rotation is best calculated.

Two years' Rotation.—In particular cases, some farmers have adopted a rotation of two crops. A field belonging to the Honourable George Abercromby, embanked from the Forth, carried, for several years, beans and wheat alternately. Upon his best loams, Mr Brown of Markle also takes wheat and beans alternately, summer-fallowing the ground, when its condition requires that process. Mr Fairie of Farme, near Glasgow, has adopted the same system, giving a moderate dressing of dung every fourth year. Dr Charles Stuart, on his farm near Edinburgh, has tried a similar system on four acres and a half of loam, the rotation being wheat and green crops alternately; but the latter were alternate potatoes and beans, both drilled. In the course of fourteen years, he has had, on this field, four crops of potatoes, three of beans, and seven of wheat. To every green crop, putrescent manure was applied; thirty tons at least to potatoes, and twenty-five to beans. The

potatoe crops were all good: The two first crops of beans were very good: The third, indifferent. The crops of wheat were large, producing from ten to thirteen bolls, Linlithgow measure, *per* Scotch acre, or from 32 to 41 bushels *per* English acre. The only deficiency was in crop 1789, which averaged but nine bolls *per* acre; that might be ascribed, however, to a season peculiarly unfavourable. There is no evidence of diminished fertility in the field, for in August 1810 it was covered with a luxuriant crop of turnips. It was perfectly free from couch-grass, and rooted perennial weeds, which are now in a great measure extirpated by hoeing and weeding, but it is still much infested with annual weeds, particularly the wild mustard and radish, which may be imputed to the neglect of the farmers in the neighbourhood, who rarely drill or hand hoe their crops, and to the use of Edinburgh dung, stored, from that neglect, with the seeds of these, and other injurious plants, which the richness of the soil brings both speedily and universally to vegetate. Dr Stuart adds, that the quantity of produce from the above rotation has not diminished, but that both the wheat and beans have degenerated in quality; and on this account, though the result might not be thought unfavourable by many, he would not adopt it, if he had a larger space of land on his farm calculated for wheat.

It is evident, that it is only in the richest loams, or most fertile soils, or where manure is plentiful, that such a rotation is at all practicable.

Three years' Rotation.—We shall next proceed to consider a rotation of *three crops*, and finding no instance of the sort in Scotland, it may not be improper to give an example practised by a native of Scotland, Mr Arbuthnot, who farmed in Surry. That respectable gentleman, and most intelligent farmer, practised, for nine years, a three

course system, viz. 1. Beans; 2. Wheat; 3. Clover, and when he quitted the farm where that plan was adopted, he was fully persuaded, that he could have continued the same rotation for many years longer. This, however, was effected by means of London dung, which he had at command, and which he gave to the bean crop. He also ploughed nine inches deep, with a swing plough, the construction of which has been justly celebrated.

Other farmers have followed a similar system; for instance, 1. Potatoes, cabbages, or hoed crops, with manure; 2. Wheat; and 3. Clover or grass: Or, 1. Hoed crop, with manure; 2. Half oats, and half barley; 3. Clover or grass.

Dr Coventry has made some observations upon these courses, to which he urges the following objections: 1. That there is rather too large a proportion of fallow or cleansing crop, more than what can be wanted in ordinary situations, to preserve the land free of weeds. 2. By there being but one-third bearing corn, it is less profitable than it might be. 3. There are two species of crops in the first example; which circumstance does not permit the labour to be sufficiently divided and extended over the year, and leaves too much to be risked on the success of a particular crop. 4. The quantity of straw obtained for food or litter, to live stock, must be rather scanty, or in a deficient proportion to what will in general be wanted.

The advantages of such a system, he states, in the following terms: 1. From the great proportion of green crops in this course, much manure will be procured, for all the straw will be converted into dung. 2. This scheme is calculated to render or preserve the land very clean of weeds. It may therefore answer as a beginning course, in situations where the ground is foul, and manure wanted; but it may be relinquished afterwards for a better one. It is not indeed in general use in any district, and has only been fol-

lowed by some individuals, who have found it of benefit in the respects above mentioned.

Four years' Rotation.—Rotations of *four crops*, however, are by far more general, and will require more ample discussion. The first to be pointed out, is the celebrated Norfolk system, namely, 1. Turnips; 2. Barley; 3. Clover; and, 4. Wheat, which has been adopted in several parts of Scotland. Even in Norfolk, however, this course is no longer so generally recommended. It is considered prejudicial to the landlord; and, on a lease of twenty-one years, if constantly persevered in, it would not be found profitable to the tenant. Half the farm has annually a white straw crop, which, from the frequency of the repetition, would not be productive; besides which, the number of sheep and cattle kept under this system is comparatively trifling *. It is also much doubted, whether wheat will prosper so near the barley crop; and it can hardly be questioned, that without a plentiful supply of extra manure, both the turnip and the clover crop will fail, unless the land is refreshed by grass for at least two or three years.

It may be proper to compare this rotation, with others on a similar principle, for dry soils.

In Roxburghshire, Mr Walker of Mellendean's rotation is one-fourth in turnip and drilled beans; one-fourth in wheat and barley after turnips and beans, and sown down with grass-seeds; one-fourth in hay, soiling, and pasture-grass; and one-fourth in wheat or oats, after hay and pas-

* Dr Coventry remarks, on the Norfolk system, that though the land on which this scheme is pursued, seldom, if ever, becomes by it less fertile; yet for poor ground it seems not to be sufficiently meliorating, or fitted soon to raise land to that degree of productiveness in which it is found to be the most valuable to the cultivator.

ture. In the light soils of Norfolk, neither beans or oats are cultivated, and beans are certainly not suitable to very light turnip land.

Mr Rennie of Phantassie, and Mr Brown of Markle, generally adopt, in their turnip soils, the following rotation: 1. Turnips; 2. Winter wheat, sown in spring *, or barley; 3. Clover; and, 4. Oats. This is certainly a productive rotation, and it is strongly in its favour that it is recommended by such eminent farmers, who are justly accounted at the head of their profession.

Mr Hunter of Tynefield's rotation is, 1. Turnips; 2. Wheat; 3. Grass, (mostly sheep fed); 4. Four-fifths winter wheat sown in spring, and one-fifth oats. He adds, that under this rotation, the produce of his farm has been improved, both in quality and in quantity, since its commencement to the present time, *and continues to improve.* The additional quantity is to the amount of no less than $1\frac{1}{4}$ bolls *per* Scotch acre, or 4 bushels *per* English acre.

I have now to state a course of cropping still more severe, which I think may be called *the Dunbar Rotation*, as hitherto it has only prevailed in that neighbourhood.

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* In regard to winter wheat sown in spring, *after turnips*, an experienced farmer, (Mr Dudgeon of Prora), observes, that it may be safely sown as late as the middle of March, and it has succeeded even later, and that on fine land it may be safely taken in preference either to barley or oats, if sheep have eat the turnips upon the ground. This is the most valuable, and the least expensive method of using them. But fine land, by this scheme, would be over-dunged, were it not for the practice adopted of stripping out a part of the turnips, to the amount of one-fourth, one-third, or even one-half, (leaving the alternate rows), and carrying those drawn out to the cattle. When a certain breadth is thus stripped, the sheep-flakes can be set upon the drills which remain, and the stripping be carried on as they need more ground.

The course is, 1. Turnips; 2. Drilled wheat; 3. Clover; 4. Drilled wheat. Being extremely anxious to ascertain, not only the details of this system, but also whether the plan, when persevered in, continued to be productive, I procured the following particulars regarding it, from Mr Hume of East Barns, and Mr Rennie of Oxwell Mains, two respectable farmers, by whom it is adopted. They informed me, that some deviations were occasionally made from the plan, (but not such as to alter the general system), by cultivating, on rich spots, pease, or beans, or potatoes, in lieu of turnips, and by having three green crops in succession, when the soil is much subjected to the growth of annual weeds, or requires to be refreshed. It would appear, however, that without a good climate, such as they enjoy in the lower part of East-Lothian, and great quantities of sea-ware, or other adventitious manure, it would be perfectly impossible to continue such a rotation. The quantity and sorts of dung usually applied, is, to the amount of about thirty double horse cart-loads *per* Scotch acre, to the land intended for turnips, whereas not more than one-half that quantity is given by the majority of farmers, and in many instances not more than twelve such carts. The turnips are always eaten on the ground by sheep, which is, (where the situation will admit of it), by far the best and cheapest method. The same quantity of dung or sea-weed is also applied on the grass land before ploughing. It is found, that applying the sea-weed early in spring, on the clover to be cut, if laid on in dry weather, answers well for the succeeding crop of wheat. Notwithstanding, however, all these advantages, Mr Hume, in a recent communication, informs me, that he is now fully satisfied that wheat will not grow with success, on light lands, every other year, for any length of time. After practising it for fourteen years, though by the force of manure he could grow abundance of straw every other year,

yet the grain at length turned out liker rye than wheat. He proposed, therefore, trying oats, instead of the second crop of wheat.

The soil where this rotation prevails is of a dry quality. If such a rotation were attempted on wet soils, it would be advisable to sow oats after the grass, instead of wheat *,

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* Upon the trial of a small piece of grass, partly wheat, and partly oats, both close together, Mr Dudgeon of Prora actually had thirteen bolls of oats, and only seven of wheat *per* Scotch acre, or 62 bushels of oats, and only 22 of wheat *per* English acre, The wheat and oats were both sown near the middle of February, both equally well harrowed, and covered with the mould; but the former, besides being deficient in quantity, was much inferior to good wheat, while other spring-sown wheat, on such land, but not sown after pasture, was as fine as usual.

I am informed by Mr Brown of Markle, that a great many years ago. he made a trial of wheat and oats after clover, the result of which was clearly in favour of oats. He measured one acre of the clover land, and sowed the remainder of the field with wheat, and in the spring sowed the reserved acre with oats. Each acre of the wheat produced 8 bolls, which he sold at 21s. *per* boll, or L. 8, 8s. *per* acre, whereas the oats yielded 14 bolls of saleable grain, for which he obtained 14s. *per* boll, or L. 9, 16s. Besides, the land which carried oats was in far better condition than the other.

Other intelligent farmers, also, object to wheat after grass. Mr Andrew of Tillilumb, near Perth, states, that if only one ploughing is given to wheat after grass, the slug-snail eats it up. This is also partly the case, though it gets several ploughings, unless they are given very early in the season, as thus he apprehends the ground does not yet get time to rot and pulverize, so as to gather that firmness and closeness which would prevent their lodging therein; and besides, he thinks that there is a *something* about the ground after grass, which is not congenial to wheat:

(and that is in general the preferable system), but in land of a very dry quality, the drought is frequently very prejudicial to the crop of oats, which require moisture, and consequently should be sown early in dry climates.

The principal objection to this system, according to Dr Coventry, is, that too much labour comes to be performed at one period of the year, and that too much is risked, or left dependent on the success of a single species of crop.

One most important observation on this subject has been made by Mr Rennie of Oxwell Mains, namely, that wheat sown after grass, early in autumn, often fails; but if sown in spring, it generally succeeds. It is never at the same

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hence, though the snail may not devour it about this time or in winter, it dies away in the spring, or blights in summer.

Another farmer remarks, that he sometimes sows a few acres of wheat, by preparing it with rag-fallow; that is, by giving the ley two or three furrows, and proper harrowings, to reduce the turf. However, if the loss of winter pasture, extra work beyond what an oat-crop requires, and the foul state the land is commonly left in, by this practice for fallow, is put to the debtor side of the wheat account, perhaps this method of growing wheat does not prove more profitable than an oat crop. He has tried, he adds, wheat after grass, but never found it answer with only one furrow.

Mr Wight of Ormiston is perfectly satisfied, that oats in place of wheat after grass three years old, or upon clover ley, is by far the most sure, profitable, and advantageous crop to the farmer, independent of leaving the land in much cleaner order; and that wheat upon a rag-fallow is a bad system, not equal to oats upon one furrow, and never fails to leave the land very dirty, besides the extra labour required.

In short, almost the whole evidence decidedly proves, that oats after clover is of greater value than a wheat crop, and it is much more consistent with the rules of an improved system of husbandry.

time so good in quality, or so productive in quantity, as wheat after turnips, or even after pease and beans.

Mr Church of Hitchill recommends a plan for cultivating wheat on a clover ley, which has been found to answer, and which seems to merit particular attention. He proposes breaking up the grass in the beginning of July immediately after the crop of hay is taken off, or the land is out of pasture, then sowing it with rape or cole, after one furrow, and eating it down with sheep in September and October. As soon as that is done, the land should receive only one furrow, and should then be sown with wheat. This method reduces the land to a fine state, and at less expence than by a bastard fallow; and though the summer pasture is partly lost, yet the feed in September and October amply compensates for it. The ground is more sensibly enriched than by the summer pasturing, and rendered so fine, that the wheat crop could easily be drilled. By this method the soil is not only put into a rich and mellow state, but that SOMETHING is removed which makes wheat after grass otherwise unsuccessful.

Mr Hume of East Barns observes, that it is more in the rotation, than in the mode of ploughing, that most farmers are deficient. He is convinced from experience, that pease are not calculated for East-Lothian to any extent: if his lands therefore were unfit to carry beans, and were dry enough for turnips, he would consider the four-course shift of 1. Turnips; 2. Oats, Barley, or Wheat; 3. Grass; and 4. Oats, as the best mode; and if the farm were so situated, as not to be able to give a thin dunging every fourth year, in the turnip drills, in that case let the grass remain two, or even three years old, so as to require only a fifth or sixth part annually dunged. If the lands were clay, consequently unfit for turnips, he would take fallow, wheat, grass, and oats; the grass to remain one, two, or three years, as above. The grass, after the first year, would pay little on

clay lands, but when in grass, there is no expence, and all the other crops must be good; but on land that will carry beans, he thinks, a six-course shift the best, which will afterwards be described.

On land calculated for that system, 1. Fallow or fallow crops; 2. Wheat; 3. Clover; and 4. Oats; is peculiarly advantageous; and from the profits resulting from the adoption of that rotation, an active and intelligent farmer, (John Tennant, Esq. of Girvan Mains in Ayrshire), has gradually been enabled to stock three different farms; and beginning with a rent of only L. 50 *per annum*, he now annually pays L. 2700 or *fifty-four times* the sum he originally paid when he commenced his professional business. There can hardly be a stronger argument in favour of that system.

Mr Brodie of Garvald, in an upland farm, where the fixing of a proper rotation is of peculiar importance, adopts the following course: 1. Turnips; 2. Barley; 3. Grass; 4. Oats. He recommends the red oat in particular for such situations, and in the more northern or higher situations and districts, it is probable that bear or big would be better than barley.

The rotation of four crops adopted near Edinburgh, namely, 1. Potatoes; 2. Wheat; 3. Clover; and 4. Oats, is a very productive one, but unfortunately is only calculated for the neighbourhood of great towns, where there is a great command of manure.

There cannot be a better preparation for wheat than potatoes *, nor one more valuable, in respect of produce, but

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* This is certainly consistent with the experience of Scotland, and yet in the neighbouring county of Northumberland, one of its most intelligent farmers, Mr Bailey of Chillingham, informs me, that on the strong lands of that county, clover almost uni-

they require a great quantity of dung, and are not always marketable, their value in the feeding of stock not being yet generally known, nor equal to ruta baga.

We shall now proceed to state rotations of four in clayey soils.

In thin clays, a four course shift is recommended, as, 1. Fallow; 2. Bear, or Barley; 3. Clover; and 4. Oats; because such soils become worse the longer they remain in grass. It is thought, however, by many respectable farmers, that the clover should be pastured, not only for one, but for two years, and that the rotation should be extended to five years.

On the estate of Monorgan, in the Carse of Gowrie, the following rotation was adopted on a fine friable dry clay, and has been for many years followed with much success: 1. Fallow; 2. Wheat; 3. Drilled beans; and 4. Wheat.

A farmer, who has taken about 300 acres in that district, at the rent of about L. 6, 10 s. *per* Scotch acre, proposes to adopt the following course: 1. Beans; 2. Wheat; 3. Clover; 4. Wheat.

This rotation, however, is strongly objected to from a number of respectable quarters. It is said that clover never answers after wheat and beans, and that wheat after clover is very *precarious* on the best of soils, and cannot therefore be depended upon during a long lease, as a source of profit. The crops of beans and clover cannot afford that rent; and no allowance is made for summer fallow, though the practice cannot be dispensed with in the Carse of Gowrie. The idea of having one-fourth of a farm under

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versally fails after wheat and potatoes. Perhaps they do not plough so deep in Northumberland, which is essential for the frequent successful repetition of clover, or the land may be injured when the crop is taken off.

beans, as a preparation for wheat, in so moist and changeable a climate as that of Scotland, would never answer, as it is very difficult, even in favourable seasons, to sow any quantity of wheat after beans. Oats, instead of the second crop of wheat, would be a great improvement on this rotation.

Five years' Rotation.—Rotations *of five crops* have in many cases been recommended both for strong and light lands.

Mr Rennie of Oxwell Mains thinks, that a rotation of five, 1. Turnips or plain fallow; 2. Wheat; 3. Grass; 4. Pease or beans drilled; and 5. Wheat, would, if well executed, answer well on light soils, having a powerful tendency to exterminate weeds. He does not think that there can be any loss in having a plain fallow, even on the driest soils, it being almost next to an impossibility to clean land so well with green crops, but that there will remain a great many root weeds, so very prejudicial to the soil. The proper time for doing this effectually is in July or August, and must be accomplished by deep ploughing, which can never be performed if the land is under a crop. The rotation of five, above detailed, is what he means to adopt, if his land tires of wheat every other year; but while the wheat turns out in the manner it has hitherto done for these some years past, he will certainly continue his present system of 1. Turnips; 2. Drilled wheat; 3. Clover; and 4. Drilled wheat, the most advantageous rotation that can well be adopted.

Above forty-two years ago, John Mackenzie, Esq. of Glasgow, adopted the following system: 1. Potatoes; 2. Wheat; 3. Grass; 4. Pasture; 5. Oats;—a plan which, he maintains, has not yet been improved upon. On the subject of cropping, Mr Mackenzie observes, that whenever the farmer discovers that he can be as well paid by culti-

vating food for the use of cattle, as for man, from the increased quantity of manure procured under that system, Britain will cease to find it necessary to import corn. Grain, he adds, should in general never be sown, but when the ground is laid down to grass, or ploughed from it *.

On light soils, of moderate quality, a five field course is adopted by that intelligent farmer Mr Charles Alexander, viz. 1. Turnips; 2. Grain; 3. Grass; 4. Grass; 5. Grain.

Upon moss or peaty soils, after effectual draining, the following course is recommended: 1. Potatoes or turnips; 2. Barley or bear; 3. Clover; 4. Pasture; and, 5. Potatoe oats, which would prove a most advantageous crop. Peaty soils, however, are apt to get puffy by tillage, and require, in general, more pasture to consolidate them.

Mr Maxwell considers the following course of crops, for five years, as preferable to every other: 1. A cleansing crop of whatever kind is best suited to the soil, as turnips, tares, or cole-seed, to be hoed, but not to stand for seed; 2. A crop of white corn of the kind best suited to the soil, to be laid down with clover; 3. Clover, either grazed or mowed; 4. Beans, where suited to the soil, sheep-fed and hoed, or some such meliorating crop adapted to the soil; 5. White corn suited to the soil †: and he contends, that

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* Mr Curwen concurs in these sentiments. He remarks, in his Report to the Workington Society, *anno* 1810, p. 103, that the first lesson in modern husbandry is, to correct and control too extensive ploughing, which is effectually done by confining the tenant to alternate white and green crops. The proportion of green crops, with few exceptions, is too little, even in the best cultivated farms in this country. When this shall be fully understood, a great and essential point will be gained, and the progress of good husbandry will become very rapid.

† It is remarked, on this system, that some corn-crop, as oats, ought to follow the clover, and not beans.

however various our soils, and however different in their nature, the same order or course of cropping ought to be pursued, (fen lands always excepted), changing only the species of our corn and vegetables, and adapting them to the nature of the soil we have to work upon, and the demand in the market for the articles that are cultivated.

It is certain, that by such state of cropping, a soil of tolerable natural fertility, might not only be supported without foreign aid, but might increase in fertility; but Dr Coventry on this subject has well observed, that when crops, *intended to ripen their seed*, are objects of culture, there is only wanted a degree of vigour and luxuriance in the plants, sufficient for that purpose; and if the fertility of the soil be raised to a higher pitch than is necessary, or consistent with that object, injurious, rather than beneficial effects, may be the consequence. Land may be too rich for corn crops, and it is better to keep it in *a well-balanced condition*, or in a medium state of productiveness, than in too fertile a condition; besides the climate may be unfavourable for pulse crops, in which case a second year of herbage would be preferable to beans or pease *.

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* It may not be improper to state, in a note, the improved systems of cropping in Norfolk, a district from which Scotland has derived so much valuable information. The courses, as recommended by that eminent agriculturist Mr Coke, consist either of five or six crops. The five course is, 1. Wheat; 2. Turnips; 3. Barley; 4. Clover; 5. Grass. The six course is, 1. Pease; 2. Wheat; 3. Turnips; 4. Barley; 5. Clover; 6. Grass. It is now ascertained, that for a district possessing a soil and climate similar to that in the neighbourhood of Holkham, the alternate use of the five and six course system is the best husbandry, because pease will not succeed above once in ten years.

We shall now proceed to consider the rotation of *six crops*, which is deservedly a favourite system in Scotland.

Six years' Rotation.—In a light soil near Alloa, Mr Kerr of Lorne's Hill has adopted the following rotation: 1. One-half potatoes, one-half turnips; 2. One-half wheat after potatoes, one-half oats after turnips; 3. Hay; 4. Pasture; 5. Oats; 6. Barley. Here, however, there are two white crops in succession. Perhaps it would be advisable to convert it into a rotation of five, leaving out the barley or the sixth crop, and putting barley instead of oats after turnips the second year. Nothing can succeed barley with so much advantage, as clover and grass-seeds. Mr Rennie of Phantassie likewise observes, that in good lands, pasture ought never to succeed hay, which ought to be taken as a crop and ploughed after.

Mr Robertson of Ladykirk proposes the following rotations on a good soil, 1. Potatoes or turnips; 2. Barley; 3. Grass; 4. Potatoe oats; 5. Beans; 6. Wheat. On inferior soils, 1. Turnips or fallow; 2. Wheat; 3. Clover; 4. Pasture; 5. Pasture; 6. Angus oats.

On all the strong lands in the Carse of Gowrie, and in other fertile districts in Scotland, the following rotation of six crops, with some variations, is considered as preferable to every other: 1. Fallow; 2. Wheat; 3. Beans; 4. Barley; 5. Grass; 6. Oats; and, as it seems to be admitted, that on strong lands in Scotland, fallow is necessary once in six years, there cannot, on the whole, be a better system for such soils. Where wheat can be taken the fourth year instead of barley, the produce is still more valuable. By some farmers, the course is altered in the following manner: 1. Fallow; 2. Wheat; 3. Clover; 4. Oats; 5. Beans; 6. Wheat. This seems to be on the whole the best system, for the clover will produce a more abundant

crop when it succeeds wheat after fallow, than when it is the second crop after beans; and Mr Rennie of Phantassie observes, that this system will be less expensive in the culture than the preceding one. All these rotations, however varied, are founded on the acknowledged principle, that the alternate husbandry is the most advantageous.

Since the decrease of the value of barley, and the great demand for wheat, they have, in the Carse of Gowrie, in some degree, deviated from the regular system above pointed out, by sowing about one-half of the fourth division with wheat and grass-seeds, to bring the grounds again into a proper rotation, in order that the whole fifth division may be under grass; and still farther to increase the quantity of wheat, a great part of the sixth division is often sown with wheat instead of oats. By thus stealing from the barley and oat divisions, which is done *only in favourable seasons*, there is often one-third part of the farm in wheat, instead of one-sixth part, as the rotation before points out. Such practices, however, cannot be recommended.

On the subject of this rotation, it is only necessary to add, that some intelligent farmers disapprove much of sowing wheat on limed fallows, being so frequently thrown out of the soil, the lime opening the soil, and admitting the frost; the consequence frequently is, little more than half a crop of inferior wheat. Some change, therefore, in the rotation in this respect, or some other mode of application for the time, would be advisable. Mr Dudgeon of Prora very properly suggests, that perhaps barley on the fallow, having been so little sown for many years past, would be extremely productive; and Mr Wight of Ormiston has no hesitation in declaring, that barley, instead of wheat, on limed fallows, without dung, if sown on the winter furrow, would be a very productive, and not a precarious crop. Some-

farmers have, it is said, found by long experience, that barley is a better crop after fallow, than wheat, the great pulverization that the soil receives during the fallow being admirably calculated for that crop. About thirty years ago indeed, barley used to be the first crop after fallow in Scotland. But the price of wheat is so much better, that it is extremely hostile to any change of system.

Seven years' Rotation.—Some farmers have tried a rotation of seven crops. Mr Cunninghame, near Perth, who rents about L. 1200 *per annum*, has adopted the following course: 1. One-seventh potatoe and naked fallow; 2. Wheat; 3. Beans; 4. Wheat, when the season admits; 5. Barley; 6. Clover; 7. Oats, or sometimes a few acres after grass sown with wheat, after three furrows and a little dung. This rotation is highly exceptionable, as barley after wheat cannot possibly be recommended; besides, clover, after two such crops, can never answer in a succession of years.

3. OF DOUBLE ROTATION.

There is a mode of cropping to which I think the name of a *double rotation* may be given. It is where a particular course has been laid down, but where part of the farm is alternately put under different crops, so as to prevent too frequent a repetition of the same sort of grain, on the same spot. Mr Wood of Milrig proposed, on that principle, to cultivate 1000 acres of convertible land, in Oxfordshire, under the following system:

		Acres.	Second Round of Cropping.
1. Summer-fallow, turnips and beans, -	1st division,	200	2d divis.
2. Wheat, -	2d, —	200	3d, —
3. Clover, one year old,	3d, —	200	4th, —
4. Clover, two years old,	4th, —	200	5th, —
5. Wheat and oats,	5th, —	200	1st, —
	Total,	1000	

It is intended to shift the turnip and the bean allotments every time to different ground.

By sowing down with clover the second division annually, and breaking up annually the fourth, it comes into the place of the fifth, which is taken off regularly for summer-fallow after the wheat and oats. It is thus placed into the first division, and of course changes all the divisions round, as often as that mode of agriculture is followed. By this means the farm is always kept under the same crops, only the different divisions are changed alternately. Mr Wood considers this system as peculiarly calculated for farms at a distance from large towns, as all the divisions would be maintained in a high state of cultivation and fertility.

Another sort of double rotation is one which is frequently practised in Berwickshire, where a part of a farm is preserved in grass for three, four or five years, then brought into the regular rotation, and another field taken out of it. An intelligent farmer, Mr Thomson at Bewlie in Roxburghshire, has adopted this plan with much success. His rotation upon the dry soil division of his farm is, 1. Turnips or fallow; 2. Wheat, barley or oats; 3. Clover, partly cut and partly pastured; and, 4. Partly wheat, but principally potatoe oats; but he has a fifth division which

is kept in grass, and which is thrown out of the rotation for three, four or five years, and then brought in again; so that in the course of a twenty-one years' lease, each division, in its turn, remains in grass for that period of time. In lands which are not naturally fertile and productive, this plan must be attended with very advantageous consequences. Every part of a farm thus derives a proportional share of the advantage of being kept in grass, which is infinitely preferable to the plan of preserving one part of a farm constantly in grass, and the remainder under a rotation of crops.

On the whole, however, unless in situations peculiarly favourable, or in the neighbourhood of towns, the six course shift seems to be the preferable system, and I shall briefly lay before the reader the rotations, which, in the opinion of my most intelligent correspondents, seem, generally speaking, to be the best, varying according to the nature of the soil under cultivation.

If, in addition to these systems, one-seventh part of a farm were thrown into grass, for three, four, or five years, in the manner above described, agriculture, on good soils, in so far as regarded the rotation of productive crops, and the preservation of the land in a state of permanent fertility, would be brought to all the perfection of which it was capable.

1. *On clay land.*—1. Fallow; 2. Wheat; 3. Clover; 4. Oats; 5. Drilled beans and pease; 6. Wheat.

Barley is excluded from this rotation, not being very favourable to the growth of wheat, and the latter being so much more valuable. Pease should be mixed with the beans, and sown at the same time, in the proportion of about one-fourth. Five firlots of the two sorts, or twenty pecks *per* Scotch acre.

2. *On Loams.*—1. Turnips or fallow; 2. Wheat and barley; 3. Clover; 4. Oats; 5. Pease or beans; 6. Wheat.

This, on its proper soil, is a most productive rotation; and lands, to which it is adapted, will pay the highest rent. It can hardly, however, be long persevered in, except in very fertile land, assisted by foreign manure. The winter wheat may be sown in spring, after turnips, till the 1st of March, and barley afterwards.

A most intelligent farmer on the borders, recommends the following rotation on such a soil: 1. Turnips; 2. Winter wheat sown in spring till the middle of March, and, after the late eat turnips, barley; 3. Seeds, either clover alone, or clover and rye grass with a little yellow or hop clover amongst it; 4. Oats; 5. Beans; 6. Barley or wheat. As wheat after beans, though bulky, is very apt to be coarse in the grain, he thinks that barley ought to be preferred *, giving the ground two or three furrows, which leaves the land in an excellent state for turnips. He finds, that early oats after clover, is invariably, on all friable soils, the most beneficial crop, producing seldom less than 60 Winchester bushels *per* English acre, and much more profitable than wheat, which is so apt to be mildewed. This course divides the crops in a most advantageous manner; all the most valuable grains are grown without any two in the same course, except a little barley twice, owing to a part being sown after the late eaten turnips. Some people sow oats after turnips; as, in the northern districts, barley is frequently so cheap, and sometimes lower in price than oats. But barley, to a certainty, answers best

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* Others prefer wheat, as the crop is a sure one, if the beans have answered; and it is only on particular soils that the grain is worse.

to sow late after turnips, and oats are found, by long experience, to do worse after turnips than any grain. Besides, clover seldom does well amongst oats, rather better among barley, but invariably the best with spring sown wheat. Amongst barley, if not lodged, they will succeed; but from the rich state the land is in, barley is apt to lodge, which ruins the seeds, except sprat or battle-door barley is sown, which seldom lodges. Grass seeds never fail among spring sown wheat, which is not so apt to lodge as winter and autumnal sown wheat, or perhaps any other grain. Mr John Shirreff also remarks, that as the wheat is sown earlier than the barley or oats, so is the clover, and this early sowing secures moisture, and promotes vegetation.

Many respectable farmers, however, prefer potatoes to turnips, as a preparation for wheat; and Mr Aitchison of Clements Wells informs me, that in 1809 he planted seven acres of potatoes, and seven acres of turnips in the same field, and in a good soil and climate. After the potatoes, he reaped 40 bushels *per* Scotch acre, and after the turnips only 20. The first was sown in November, the last in February. He is positive in regard to the produce, as it was threshed from the field *.

3. *On light soils.*—1. Turnips or potatoes; 2. Oats or barley; 3. Grass; 4. Grass; 5. Grass; 6. Oats. Even

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* On this experiment, it is remarked, that the result of this trial does not prove that potatoes are preferable to turnips as a preparation for wheat; but only that wheat sown in November, is a surer crop than what is sown in February. Had the turnips been removed in November, or at the same time with the potatoes, the experiment would have been decisive.

light soils, under such a rotation, would be productive, and, instead of being exhausted, would improve in fertility. The grass, if it can be avoided, should not be made into hay, unless where sheep have been fed on it, with turnips.

4. *Miscellaneous particulars.*—Some particulars still remain, which it was difficult to comprehend under any of the preceding heads.

1. When any farm or district begins to be improved, it is necessary to commence with what may be called *gentle rotations;* that is to say, with crops not likely to exhaust the soil. When the late Earl of Findlater began his improvements in the county of Banff, every field was kept for four or five years in grass, before any white crops were taken from it. The soil was thus enriched, and is now enabled to undergo more severe cropping. Fairlie's rotation in Ayrshire was of the same description: the land was pastured with dairy stock *for six or nine years;* lime was then applied, and three successive crops of oats were taken; then a crop of hay, and afterwards the land was pastured as formerly. This system, though now justly reprobated, was probably suited to the times when it was established, and laid the foundation of the present fertility of Ayrshire. Mr Church of Hitchill observes, that for moderate soils, having no other manure than what they produce, the rotations must at first be extremely gentle, if ever they are intended to be put in a progressive state of improvement. Mr Park of Windy Mains, near Dalkeith, observes, that he is also under the necessity of adopting a gentle rotation, as his land is of very weak quality, originally all *outfield*, being mostly covered with whins and heath not many years ago.

2. It is remarked, that near towns, where adventitious manure may be obtained at pleasure, any fixed rotation, to be invariably followed, is not so necessary; on the contrary, that farmers, in such situations, ought to charge the particular articles they cultivate, according as a demand is likely to arise for each.

3. Mr Drummond of West Bank, in the Carse of Gowrie, has tried flax on strong lands as a preparation for wheat, but he found that flax is by no means a sure crop in that description of soil, and that the succeeding crops were very deficient, although the ground got more manure. He found, at the same time, that the wheat after flax, was better in quality than after any other crop, but it was deficient in quantity about one-fourth, compared to wheat after fallow, and the after crops were still more so, in proportion.

4. It may be proper to conclude with observing, that in the opinion of a most intelligent agriculturist, (Mr Logan of Fishwick), farmers have been induced, in many parts of Scotland, from the high prices of corn, to plough too much; and there is reason to apprehend, that the great source of manure, namely stock, being neglected, sold off, or almost given up, that the soil will be exhausted by the severity and weight of cropping,—a circumstance which, in the course of a few years, must produce serious mischiefs. Importation being permitted, grain cannot rise in price in proportion to the decrease of the produce on the fields, in consequence of the land not being refreshed, and enriched by grass and stock. The result must be, that the price of stock will rise enormously on account of its scarcity, a circumstance which cannot be remedied under a succession of years: for, first, the lands worn out must be fallowed, and laid down to grass, which would be improper pasture for sheep for a few years; and next, stock must be bred for pasturing the land after it is laid down. The supply

of Highland cattle has been of late rather less than formerly, of course the prices higher, which also will raise the price of other breeds. Another difficulty will also occur; farmers, who had excellent flocks of sheep of the Leicestershire breed, have rashly parted with them, for the purpose of turning their farms into tillage, and cannot get such flocks again, but at great expence, and after a lapse of years.

On the whole, the convertible system of husbandry, where one-half of a farm is in grain, and the other half in grass and green crops, is in general to be recommended. By the grain crops, a sufficient quantity of straw is provided as food for cattle, where that mode of feeding is adopted, or for being converted into dung, in addition to a reasonable profit to be derived from the grain. By the grass and green crops, a number of cattle are well kept both in summer and winter; and when they are well littered as well as fed, a regular and sufficient supply of valuable manure is secured. By this means also, the cattle are so well kept during the winter, that should a late spring ensue, or a scarcity of grass be apprehended, and consequently an overstocking, (an event which cannot be too anxiously guarded against by the farmer), a ready market will be insured for them *.

It is to be hoped, that with the assistance of the facts and observations above detailed, no farmer will find any difficulty in arranging his crops, so as to produce profit to himself, without injuring the fertility of his land, or diminishing that great source of national prosperity and subsistence.

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* Remark by a farmer in the Mearns.

Sect. VII.—*On the Sowing of Seed.*

The points which it is proposed briefly to discuss in this section, are, 1. The important subject of sowing crops drilled or broad-cast; 2. On the advantage of sowing early; 3. On sowing old wheat seed or new; and, 4. On the pickling of wheat seed.

1. It has long been a subject of dispute, whether it is most advisable to sow the different crops usually cultivated on arable land, drilled or broad-cast. Without entering into so wide a controversy, I shall endeavour shortly to state the opinions entertained by the intelligent farmers, with whom I have lately corresponded, on the subject of Scottish Husbandry.

It seems to be universally admitted, that it is the most advantageous system, to drill turnips and potatoes, and that drilling, in regard to these articles, is greatly preferable to the broad-cast mode, for the following reasons: 1. As it carries off the extra moisture in wet soils: 2. As it exposes more surface to atmospheric influence, by which the soil is meliorated; and, 3. As it gives an additional opportunity for the vegetation and the destruction of weeds *.

It would appear likewise, from the experiments of Mr Butterworth and others, that drilling carrots is an advan-

* Remarks by Captain John Henderson of Aimster in Caithness. Some prefer turnips broad-cast, imagining that they are better protected from the frost, by the earth, than when raised in ridges; in which case the earth is apt to fall from them.

taceous system, as the plant can thus be cultivated on soils, where otherwise it would hardly be practicable, the drills furnishing an artificial depth of soil in which they can be raised.

The most intelligent Scotch farmers approve of the system of drilling beans, as the pods of beans are placed on the stem from the root upward, and of course derive essential benefit, when filling, from the admission of air by the open space left between the drills. This is universally admitted on light or loamy lands; but where the soil is of a strong and stubborn nature, the broad-cast system is in a few cases preferred, more especially in the Carse of Gowrie, it being found difficult, it is said, in a rainy season, to perform the necessary drilling operations in clay, which renders the crop uncertain and precarious, and not a cleaning one *. As there is no comparison between the two systems, any doubt on the subject can only arise from differences of climate. Besides, as Mr Robertson of Ladykirk observes, every season is not wet; a smothering crop may always be obtained by drilling, in wet seasons. In a dry one, by that process, the land may be fully cleaned.

Many farmers also drill their pease, more especially in light and pliable lands; but on strong clays, it is maintained that pease sown broad-cast succeed better. Mr Wight of Ormiston observes, that upon clay soils, and more especially in high situations, the broad-cast system can be sooner got at than the drilling one, and in a rainy sea-

* Observations by Mr Peter Jack of Moncur. These reasons, however, are objected to. Mr John Shirreff remarks, that even in the wettest seasons, a certain portion of cleaning can certainly be exhibited by hand-hoeing and hand-weeding, besides the regular admission of air, which is peculiarly wanted in a rainy season.

son or backward spring, the latter operation cannot be easily performed, the crop consequently must be precarious and late. It is remarked by Mr Stuart of Hillside, that pease sown in drills may be calculated for cleaning the land, but not for obtaining a crop; and Mr Charles Alexander observes, that he has several times attempted the drilling of pease, but never with success; the slender nature of that plant not admitting of horse-hoeing, except when young; and as it is not of upright growth, not well even then. As that plant supports itself by the plants taking hold of one another, the interstices prevent the tendrills from getting hold, except in the row, when the wind blowing across the drills lays them over on one side, and retards their podding. This may be the case when crops are drilled at wide intervals, but the rows should not be above from twelve to fifteen or eighteen inches from each other. Pease, when drilled, should always be fully hoed, cleaned and finished, before the 10th of June. It is contended, that they may always be drilled by a proper machine, when the land can be harrowed.

In regard to white crops, some eminent farmers, Mr Brown of Markle in particular, consider the advantages of the drill system to be at best but problematical*. The intelligent farmers, however, in the neighbourhood of Dunbar, whose lands are subject to annual weeds, and who sow a great deal of wheat in spring, have adopted the drilling

* One of my correspondents remarks, that in regard to the drilling of white or culmiferous crops, he has had no experience; but it appears to him that the operation is tedious and minute, without any adequate benefit. The drilling of these can never be meant for cleaning the ground; a very good farmer will have it clean before they are sown in it. It is not so easy, however, to get the better of annual weeds.

system with much success, and consider it essential for the culture of their land.

Some experiments made by Mr Hope of Fenton, East Lothian, are among the most satisfactory and decisive I have met with, on the subject of drilling. From them, he is inclined to draw the following conclusions: 1. That it is of no advantage to drill winter sown wheat, as the crop is rarely injured by annual weeds, and where the soil is infested with root weeds, as the crop, in ordinary cases, will completely meet in the rows, before the root weeds make much appearance, it is impossible, without injuring the crop, to render much benefit to the land with the hoe. 2. On all land, however, where annual weeds are abundant, he considers it of great importance, to use the drill for white crops of every description sown in the spring, it being understood at the time, that plenty of hands can at all times be obtained for using the hoe; for it is better to sow in the common method broad-cast, than to drill without hoeing.

Mr Hope adds, that an experiment was tried in his neighbourhood, which places the advantage of drilling in a very favourable point of view. A field of grass land, of good quality, which, in consequence of imperfect cultivation, was full of annuals, was all drilled, with the exception of six ridges in different parts of the field, which were sown broad-cast, that the difference of produce between the two might be ascertained. The drills were made at a foot distance between the rows, and the drilled part of the field was hand-hoed, during the summer, at the expence of one guinea *per* acre *. The difference of produce was very great, for the

* Mr Scott of Craiglockhart recommended the Dutch hoe as the best, for the operator proceeds backward, leaving the wrought ground and cut weeds untrod; the work is also much lighter, as less force is requisite, and stooping unnecessary.

broad-cast yielded only 9 bolls *per* Scotch acre, whereas not less than 15 bolls was the produce of the other.

Among the advantages of drilling, Mr Hope states, that he has uniformly found the expence of cutting a drilled crop in harvest less than what was sown broad-cast; the difference being in this proportion, that three reapers will do as much work in the former case, as four in the latter.

Mr Church of Hitchill recommends drilling wheat crops, not only for the purpose of having an opportunity to eradicate weeds by hoeing, but to give the grain a good hold of the ground*, which may prevent the frost throwing it so easily out in the spring, and the wind loosening the roots of it so readily when it is in ear and beginning to fill. On light land, he has sometimes observed the grain make no farther progress towards perfection, after a high wind at this period, which he presumes is principally owing to the roots being loosened, the ascension of nutriment to the ear being thereby prevented.

Mr Robertson of Ladykirk is of opinion, that the propriety of drilling beans, turnips, and potatoes, cannot be doubted, and that the more labour and hoeing bestowed on the bean and turnip crops, with judgment, and in dry weather, the better will be the returns. In regard to potatoes, Mr John Shirreff remarks, that, if the soil continues to be stirred, and the fibres which nourish the plants are continually disturbed, the stems will be puny, and the bulbs few and small. Potatoes should not be disturbed after being considerably advanced. Any annuals which

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* It is a great advantage, as Mr John Shirreff remarks, to be able to regulate *this hold* of the ground, and to give all the seed at the same time the same hold. This advantage drilling affords; whereas, in the broad-cast mode, the seed must be deposited at very irregular depths; and as there can only be one *best* depth, all others must be faulty.

may appear, should be drawn by the hand. Mr Robertson observes, that drilled crops of white corns are less apt to be beat down in wet seasons.

It is remarked, from the highest authority in the Carse of Gowrie, that the culture of white corn crops by the drill, might be a beneficial mode of husbandry in that valuable district, as it would be the means of extirpating the growth of annual weeds, which are so destructive to the spring crops in the Carse, particularly the beans, the pease, and the oats sown early upon well frosted land, which are often rendered not half a crop by the growth of wild mustard.

An intelligent farmer near Arbroath, (Mr Rennie of Kinblethmont), states it as his opinion, that the drill system ought to be adopted, wherever turnips, potatoes, beans, or even pease, are sown ; the intervals not less than twenty-seven inches, regularly horse-hoed, and the rows hand-weeded by women; which, if properly executed, leaves the ground in as good order as if it had undergone a naked fallow. None of the above-mentioned crops can be cultivated to advantage broad-cast; for in case of its failure, the ground is sure to be left in a wretched state indeed. In case of the soil being light, and much infested with annual weeds, the drill system may with great propriety be adopted with wheat, barley, and oats ; but in that case the intervals should not exceed from nine to twelve inches, to be either hand-hoed, or done with a machine made for the purpose. The seed to be deposited by a sowing-machine, and the grass-seeds covered in with the last hoeing, which answers perfectly well.

The following, on the whole, seems to be the result that may be drawn from this important discussion.

That turnips and potatoes ought to be drilled in all cases. In regard to turnips, Mr Shirreff remarks, that the greater facility afforded by the drill mode of culture

of simplifying and expediting hand-labour, the more regular and correct adjustment of the number of plants to be left on a given surface; and the more equable admission and circulation of air among the plants in the drilled, than in the broad-cast mode of culture, gives the former a decided preference.

That drilling carrots is advisable, more especially where there is not a great depth of soil.

That beans should be drilled, not only on light and loamy soils, but also on harsh, strong, and stubborn clays, otherwise they would in a manner be excluded from a soil which cannot be profitably cultivated without them.

That pease ought to be drilled in dry soils and climates, where the object is to clean the land; but in clays, if the land is clean, sowing broad-cast, or in narrow drills which prevent the bad effects of wind, suits better the nature of that plant, in a windy climate.

That autumn or winter sown wheat may be cultivated broad-cast, but that spring sown crops, whether wheat, barley or oats, are most likely to be productive upon light soils, where annual weeds abound, when cultivated in drills*.

2. In a precarious climate, it is necessary, not only to cultivate early sorts of grain, but to sow early, in order to secure, if possible, an early harvest. This is particularly the case with oats upon strong and wet soils. They should be sown, therefore, as soon as the season answers, and the land is in good order to receive the seed, at least any time after the first of March. It is of advantage to sow even light soils early, that the crop may get forward, before the drought sets in.

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* It may be proper at the same time to observe, that in several districts in England, particularly in some parts of Norfolk and Suffolk, they carry their ideas in favour of the drilling system, in so far as regards crops of grain, still farther.

3. I am informed by an experienced farmer, that old wheat, *if kept in the stack unthreshed till wanted*, is greatly superior to new seed. The former springs immediately when sown, whereas the latter will not vegetate well till it gets rain, which may not happen for some time, more especially if the wheat is sown early. There is reason also to believe, that old seed wheat is not so liable to the smut, as the new seed, and that it produces straw of a stronger quality, and not so apt to lodge. Many intelligent farmers doubt these advantages, and contend, that keeping old seed in the straw must amount at least to 25 *per cent.* on all the quantities used.

4. The plan of kiln-drying seed wheat has been already alluded to, (see p. 239), and the suggestion of such a system has led to some important observations from Mr Walker of Mellendean. He remarks, that having frequently lost his crop by getting kiln-dryed wheat from the London market, he thinks that such an operation should be adopted with the greatest caution. He is convinced, at the same time, that if care is bestowed on the ordinary way of pickling, there is no surer remedy against smut. For several years, he has always pickled as much as will sow a field, a day or two before he begins to sow, and has often, when bad weather came on, kept it for some time in that state, without its being injured; he is convinced indeed, that unless the wheat has full time to dry, before sowing, the cure is not completed. He has long been in the practice of sowing considerable quantities of wheat, both in autumn and spring, and was led to draw this conclusion, from having often observed in his wheat fields, a few ridges alternately clean and smutted, and he knew of no difference that had taken place in the pickling, on the contrary, he had attended to that operation himself, and sent the wheat to the field in quantities of one, two or three bolls at a time as wanted by the sowers. He could

find no reason for a part of the crop being clean and a part smutted, but that a part of the seed had been used too soon after pickling. This led him to make the experiment of preparing a whole day's sowing a day before it was used; and he can only say, that since he begun that practice, which he has almost invariably followed, he has never been troubled with smut. It is proper to observe, that the wheat must have as much lime put upon it, as soon as it comes out of the pickling tub, as will dry it quickly; for if it is allowed to continue long wet, the germinating power will be altogether destroyed. It is remarked, however, by some farmers of considerable experience, that where urine is used, there is an absolute necessity of using the seed immediately *.

In regard to harrowing the ground, or rolling it, these operations, however important, are so well known, and so similar, according to the Scotch and English systems of husbandry, that it seems unnecessary to dwell upon them in this place.

Sect. VIII.—*Of Weeding.*

It does not seem necessary to dwell at any length on the subject of Weeding, as it is a point which has been so frequently discussed, and respecting which there is nothing peculiar in the Husbandry of Scotland. The fallowing of strong soils is certainly favourable to the extirpation of

* Mr John Shirreff observes, that if wheat has been pickled with *stale* chamber-ley, dried with quicklime, and put close together, to lie for a day, not a grain will vegetate. It ought to be spread abroad, as thin as possible, to dry and get air.

weeds in land of that description. The practice of drilling turnips, potatoes, and beans, materially tends to keep those crops clear of weeds; but until the practice is established, of drilling all crops sown in spring, as wheat, barley, and oats, annual weeds cannot be altogether extirpated; for spring culture is favourable to their growth, more especially when the land is dunged for a crop of grain, or when the preceding crop consists of turnips fed off by sheep, and the ground is afterwards ploughed so deep as to raise the seed of annual weeds that had not been exposed to the turnip culture, and the hoeings which accompany it.

It is almost incredible how long seeds of an oily quality, as those of wild mustard, wild radish, wild marygold, broom, &c. will remain in the ground, and yet when acted upon by moisture, the warmth of the sun, and the force of manure, they will vegetate, and become strong plants. Soil dug from the bottom of deep ditches, will produce these weeds. A most intelligent correspondent informs me, that he has seen ground originally a field of broom, which had been in tillage for thirty years, yet when fallowed, limed and dunged, and sown with wheat, on the wheat being cut, the young broom was found to be thicker on the ground than the wheat stubble. This was probably owing to the fallow, which turned up soil containing these seeds, which till then had been buried below the vegetative influences of the sun and air.

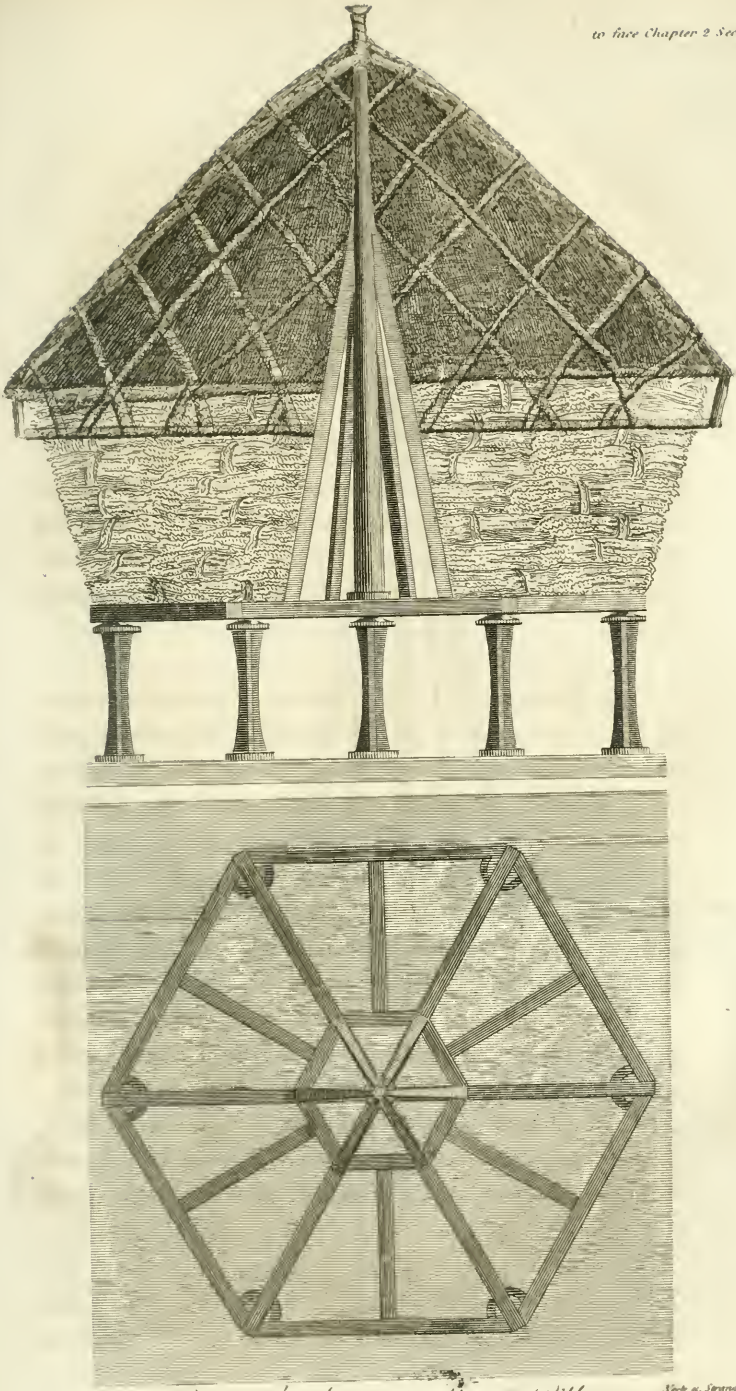
Some conjecture, that the seeds of weeds are often mixed with clover; but I am informed from respectable authority, that such an idea has rarely any foundation, though he has known pernicious seeds of weeds imported amongst the Riga lintseed; also another sort of bad seed, called gripgrass, amongst the English lintseed, but he never saw any amongst the clover seed that ever was in the least troublesome. With rye-grass, however, the seeds of weeds are often imported.

Sect. IX.—*Of harvesting Grain and preparing it for the Miller.*

This is a point on which it is not proposed to insist at any considerable length, but merely to detail any peculiarities in the Husbandry of Scotland, in regard, 1. To cutting down; 2. To carrying in; or, 3. To stacking the crop; and 4. How wheat, injured by a bad harvest, is prepared for use.

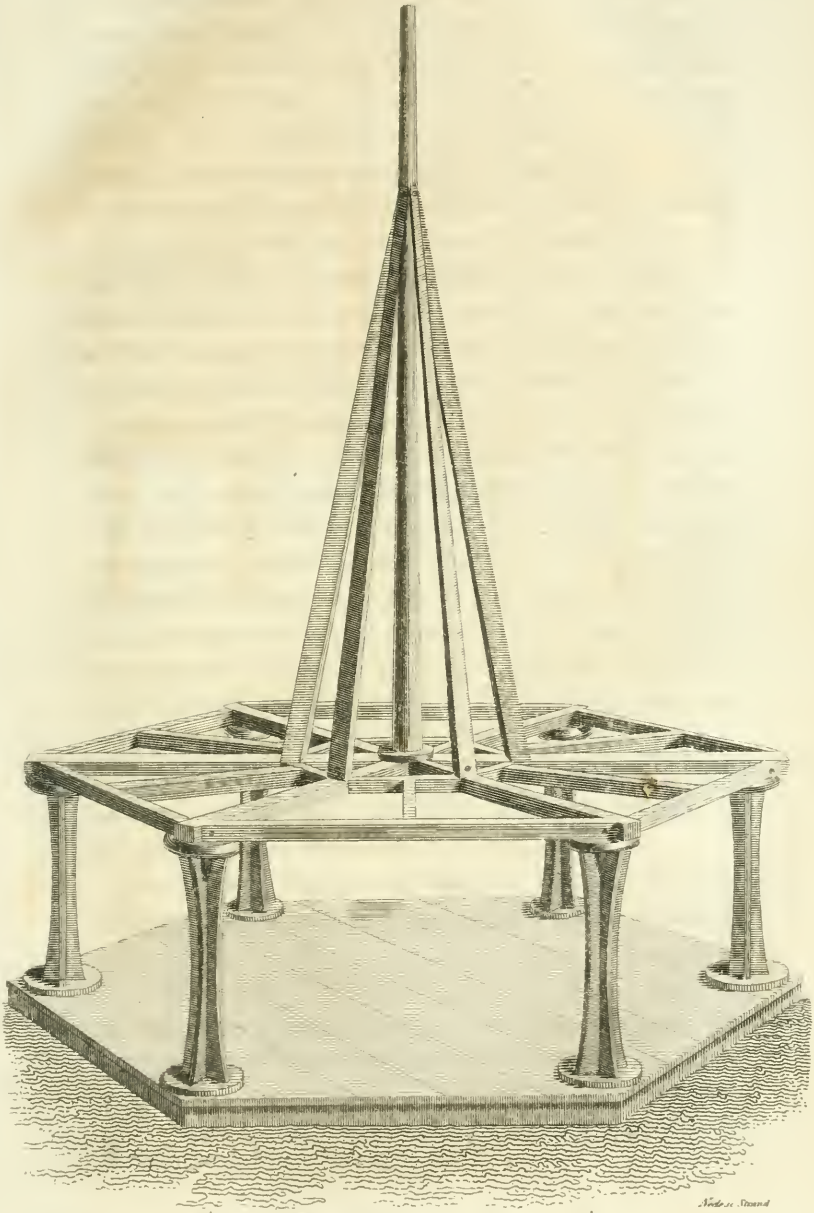
1. In Scotland, the crop is almost universally cut down by the sickle or hook, the scythe being very rarely used; and notwithstanding the liberal premiums offered by a repectable and public-spirited Institution, the Dalkeith Farming Society, no reaping machine has yet been invented, that will answer the object they had in view. Many suppose, that it is almost necessary to cut down corn with the sickle, if threshing-mills are in use; because, where these machines are employed, the grain must either be regularly placed and bound, or it must pass twice through the mill. But that intelligent border farmer (Mr George Culley) informs me, that he mows his barley almost every year, except what is lodged; and that he finds no difficulty in threshing it by the threshing-mill, passing it only once through the machine *. The men mow the corn in the

* On this head, that experienced and intelligent farmer Mr John Shirreff observes, that more ears would probably escape un-



Made at Strand

Corn-Stack with Iron-Pillars, and a-Boss in the Center.



Neele n Strand

Cast-Iron Pillar Corn Stands,
with a Base made of Timber.

same manner as if they were mowing grass for hay; but by using what they call a bow, fixed at the heel of the scythe, they are enabled to lay the barley almost as straight as if cut with the sickle, so as to tie it up into sheaves very neatly. He considers this as the cheapest, and in every respect the completest mode of harvesting barley.

To many of the more fertile districts, great numbers of Highlanders, both male and female, annually resort, to reap the crops, and receive a certain sum *per* day, and their victuals, for the work they perform. In the Carse of Gowrie, the harvest was formerly performed by men and women hired expressly for that purpose; the men at a guinea, and the women at 15 s. for the harvest; during which time they got a breakfast and dinner of bread and beer, and a small quantity of oatmeal for supper. At that time the harvest used to cost about 5 s. *per* acre, including all expences. Some time after that, the harvest wages rose to 30 s. for the men, and 20 s. for the women, varying, as the farmer and they could agree; but the expence altered according to the price of meal, and the length of the harvest, from a favourable season, or the contrary, and it has been as high as 9 s. or 10 s. *per* acre. About fifteen or sixteen years ago, some men came to the Carse as contractors, and agreed to cut down the crops at a certain sum *per* acre, but that plan did not continue long.

About six years ago, another practice took place in that district, which continues to this day. It is called *threaving*,

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threshed, than would pay the difference between cutting by the scythe and the sickle. At the same time, he admits, that a great benefit arises from mowing grain crops, by the additional quantity of straw obtained. That advantage, however, may be got by mowing the stubble.

and now almost universally prevails. By this plan the reapers are paid in money, without victuals, so much for every threave they cut down. For a threave of wheat, consisting of twenty-eight sheaves, each sheaf measuring thirty inches round, they receive 4 d.; and for a threave of barley, oats, or pease, of twenty-four sheaves, each thirty inches round, 3 d. Mr John Shirreff remarks, that this is certainly on the whole the fairest mode of paying reapers, the reward being exactly in the ratio of the work done. It is evident, this can never be the case when a field is cut down either by the day, or the acre.

This mode of harvesting is certainly of very great advantage to the country in general; for thus whole families, men, women, and children, obtain employment; they bring their provisions with them, remain in the field the whole day; the old teach the young to cut down; every one does something; and according to what they perform, they are paid. A hundred, or a hundred and fifty persons, young and old, may frequently be seen in a field at the same time, and besides the advantage of getting such a quantity of ripe corn cut down in a day, perhaps it is an excellent school to fill the whole corn field with good reapers or shearers *.

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* Communication from George Paterson, Esq. of Castle-Huntly. Another respectable correspondent from that district observes, that the growing crops of corn are now cut down by the threave. The wheat-threave consists of twenty-eight sheaves, each sheaf measuring thirty-six inches in girth, at the band; for cutting and binding of which is paid, in his neighbourhood, 6 d. *per* threave. The barley, oats, and pease, or bean threave, consists of twenty-four sheaves, of thirty inches girth, for cutting and binding of which is paid 4 d. each threave. These dimensions of the sheaves

Mr Blaikie has sent me the following detailed account of the mode of harvesting in Roxburghshire, part of Berwick and Selkirk shires. The reapers are mostly bespoke, or hired in the public markets, for that purpose, in the month of August. They are engaged for the harvest, which, at an average, continues about four weeks, but they are still paid for every day according to the above wages. The now common wages are, women, 12 s. 6 d. *per* week, men 15 s., with victuals. Two men and four women, with a bindster, make what is technically called a Band-wind. These, upon a field where the corn is not strong, and lying fair to the sickle, will cut two English acres, and sometimes two Scotch acres *per* day. But where the corn is cross lodged and very strong, they will not do more than one acre and a-half English. Two English acres, however, *per* day, may be an average when the work is properly performed.

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are varied according to the fancy of the farmer, and the price is either more or less according as the size of the sheaf is increased or diminished. Hence what may cost 6 d. and 4 d. in one part of the district, may be charged only 4 d. and 3 d. in another. On this subject Mr John Shirreff remarks, that it is not material to the reaper, unless in regard to the time required for making the bands and the additional sheaves, what the circumference of these sheaves are, provided the same number of sheaves is reckoned to a threave, and *the price paid in the ratio of the squares of their diameters.* As to the sums paid, circles being to each other as the squares of their diameters, if 900, the square of thirty inches costs 4 d.; so 1296, the square of thirty-six, should cost 5.648, &c. &c. Where 6 d. therefore is paid, a threave costs more in proportion than it ought to do.

3 men at 15 s.	L. 2	5	0	L. 4	15 0 *per* week.
4 women at 12 s. 6 d.	2	10	0		

Victuals for seven days *per* week, as they get victuals on Sundays.

Oatmeal pottage and milk for breakfast, at 2 d. each, - -	L. 0	1	2		
To dinner 1 bottle of ale, at 2 d. each, - -	0	1	2		
18 oz. of good wheat bread, at 4 d. each, - -	0	2	4	L. 0	5 10 *per* day.
Supper same as breakfast, at 2 d. each, - -	0	1	2		7
For one week,				L. 2	0 10
					4
Victuals for seven people for four weeks,				L. 8	3 4
Money wages as above, L. 4 15 0 *per* week,			4		
	L. 19	0	0	L. 19	0 0
Meat and wages for seven labourers, for four weeks, - - -				L. 27	3 4

According to the above statement, seven reapers should cut 48 English acres in four weeks, the common duration of harvest, and the expence would be 11 s. 4 d. *per* English acre to a fraction. Some give the reapers more liberty than others; where that is the case, they may cut 50 acres in place of 48, but the loss will be double the expences saved. In wet seasons, where it is necessary to open out corn to dry, &c. the expence *per* acre must be higher.

On the expence of reaping, Mr Brown of Markle observes, that besides the maintenance of reapers in bad weather, (which often amounts to a considerable sum),

there is to be added, the expence of salt for seasoning their pottage, and fuel for cooking it, together with the wages and victuals of the overseer who attends the reapers, all which articles will not a little increase Mr Blaikie's estimate. In short, the reaping process, taking every expence into consideration, cannot be duly and sufficiently executed under fifteen shillings *per* English acre; and when it can be done at that rate, the farmer may be satisfied.

In order to train up reapers or shearers, an intelligent farmer, Mr Mitchell of Balquharn, puts four or five, according to their ability, on a separate ridge, and gives them, as an awkward squad, a sum in proportion to three on a common ridge. At the same time, it is a good rule, in general, to have as few reapers as possible on a ridge when they understand their business, for the more there are the less work will be done. The lazy and idle, as Mr John Shirreff remarks, will take every opportunity of saving themselves, and it will be difficult to ascertain who is to blame.

Attentive farmers take particular care to cut the crop very low; for by high cutting, besides the unavoidable waste, a great deal of manure is lost. By attending to this, and converting the straw into dung at a proper season, a sufficient quantity may be procured, to raise good crops of turnips, the greatest part of which being eat up on the ground by sheep, insures a succession of good crops of grain, until another crop of turnips is taken.

2. Grain is sometimes carried in by single-horse, but generally by two-horse carts, to which frames are fixed, in order that the cart may convey a greater quantity of grain at a time. Carts in this way will easily carry at once from ten to twenty stooks, according to the size of the sheaves. In a note will be found the different modes

of making and fixing these frames *, which are found highly advantageous.

It is certain that carts are more easily managed than waggons; and that by using them, the carrying of corn in harvest goes on with the greatest expedition. The ordinary mode of disloading these carts is for the driver to stand upon the top of his load and fork the sheaves up to the builder, in which way the sheaves are kept more secure and firm than if the whole load was upset, and left to be forked by another person, as recommended by Lord Kames.

3. It is well known, with the exception of the celebrated barns at Inverary, where the Duke of Argyle is obliged, from the unceasing wetness of the climate, not only to preserve, but actually to dry his corn in large

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* There are three different modes of fitting up the carts for harvesting grain or carrying hay. 1. By the first the limbers or shafts are fixed together by cross spars, and the upper framing mortised into the limbers. 2. Another method is to fix the limbers together by cross spars, but the upper framing is fixed together separate from the limbers, and fixed upon them by screws. Both these plans are thought preferable to the first, because the shafts are not so much weakened by so many mortises cut in them, besides the advantage of the upper framing being easily taken off, so that the cart can, at any time, be made use of for carrying wood, large stones, &c. This frame will cost from L. 2 to L. 3, according to the quality of materials, and goodness of the workmanship. 3. A frame, called a hay-top, is occasionally fixed upon the common cart, either with small ropes or iron chains. These frames will cost from 15 s. to L. 1, 10 s. or L. 1, 15 s., according to the materials and quantity of iron-bolts made use of in fixing them together.—Communication from Mr Andrew Gray.

buildings erected for that special purpose, that the corn in Scotland is almost universally kept in stacks.

At Lord Haddington's seat at Tynninghame, the stacks are built on stone pillars, which is found to be a very advantageous system. It takes nine pillars with capes to a stack. The price of these depends very much on the convenience of getting the stones. There they can be quarried, carted home, wrought, and put up, for about 3 s. each. It will require about twenty feet of timber to make the frame that goes on the pillars; the price of which also depends on the situation, and whether it can be got by short carriage. From the present high price of timber even there, including every expence, a complete set of nine pillars, and the timber necessary for a stack, cannot cost less than L. 3. The advantages resulting from this method, when the object is to be kept free from vermin, may be about two bolls in thirty; but in a wet season, such as the last (1809), they are found very useful for drying the corn, when not put into the stack in the best condition, as they allow a free circulation of the air under, and the corn is not injured by imbibing moisture, as it must necessarily do, when set down on the ground in a wet state *.

Near Alloa, they have invented cast-iron pillars for stacks, (an engraving of which is annexed), which seems to be a useful invention where stone cannot be had. These pillars are two and a half feet long, and the round cape or bonnet at the top, as well as the foundation, is one foot in diameter. After levelling the ground intended for the stack, so that all the seven pillars may stand plumb or

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* Communication from Mr David Buist, overseer at Tynninghame.

perpendicular, and level on the top, they are placed on the level surface, and require neither building nor flag. Being placed in this way, they can be removed with very little trouble or expence. Vermin have also no way of getting up cast-iron pillars of the above description; and neither rats nor mice have been found in any stack properly standing upon cast-iron pillars. The price of seven pillars is 50 s. and the frame, which is made of the very coarsest of timber, may be valued, (including workmanship and nails), at 8 s.; so that one stack costs 58 s *.

There is another invention, which I believe is peculiar to Scotland, called *bosses*, the nature of which the annexed engraving will explain. These, with cast-iron pillars, are admirably calculated for harvesting beans in wet seasons. The process is thus described. A triangle is first erected on the middle of the frame, which forms a boss of about three feet wide; railing must be nailed across the boss so close as to preserve the sheaves from falling into it; but when railing is not at hand, a strong straw rope is commonly used in its stead. After the builder has reached the top of the boss, he places therein a sack filled with straw, which, when he builds round, he pulls up until he reaches the top of the stack; so that by the vent left by the sack, the air reaches even to the top of the stack. As to the

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* Communication from Mr John Laing, overseer at Tullibody. Mr George Culley informs me, that on his side of the Tweed they prefer oblong stacks to round ones, because they can add one eke or leet (as they are provincially called) to another, always to be set east to west, for he has seen them blow over when set north to south. He is also of opinion, that oblong frames are simpler made, and cheaper timbered than round ones. But they do not seem to be so well calculated for any exposed situation.

question, how soon beans can be put in, by means of bosses, that depends upon what state the beans were in when cut. It is therefore necessary to mention three different cases in which beans are cut: First, before either leaves or pods have changed their colour; if cut in this green state, they will require a long time, especially in a bad season, even with bosses, and it is hardly practicable to preserve green cut beans, in any season without them. Secondly, when above half of the pods have turned yellow, and part of the leaves have fallen off; when cut in this state, (which is thought much the best), they will require from seven to eight days with bosses, and fourteen without them, if the weather is dry. And, thirdly, when the pods have all turned blackish, and the leaves fallen off, in this state three or four days may do with bosses, and seven or eight without them, provided no rain fall in the interval. On the whole, it may be affirmed, that beans, by this mode, may be harvested in half the usual time, and be preserved in much better condition. It is supposed that the beans grown upon strong clay, or carse land, require longer time to fit them for the stack, than those produced upon dry land *.

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* In a wet season, white grain is often stacked in the manner here recommended for beans, with this addition, (if the state of the grain seem to require it), of having vents left also across the stack in two opposite directions, at different heights. These afford a great additional circulation of air. Some make a vent in the middle of the stack, but very improperly leave no opening at either top or bottom.—Remark by Mr Church of Hitchill. It may be proper to add, that by means of the invention of bosses, one row of sheaves of corn, in very bad harvests, may be put on the stacks *from the sickle*, placing the heads of the sheaves to the centre. This may be of use in uncommon bad harvests, such as in the latter end of the year 1811.

Any thing that would tend so materially to improve our mode of harvesting beans and pease, (for the latter crop might be treated in the same manner), the culture of both of which is so desirable, is of the most essential consequence to Scottish Husbandry.

A very simple but effectual mode of preserving beans in the stack, is to have two or three funnels as long as to reach near its centre, to communicate with a vacuity prepared by drawing up a sheaf of thatch while building. Each funnel has two ends, generally triangular, about eighteen inches each outside. These are covered with any sort of coarse timber on all sides, so as to prevent their being filled with the bean sheaves pressing into the opening. They may be placed at different heights from the bottom of the stack, and they will create such a suction as to keep both corn and straw safe *.

4. In regard to the management of wheat injured by a bad harvest, and preparing it for consumption; it is certain, that though wheat as well as other grain, if put up when in proper condition, will keep better in a large than in a small stack; yet, in damp seasons, it will dry sooner in small stacks, and consequently will be sooner fit for grinding into flour and baking. Wheat that is stacked in a damp condition, should never be threshed sooner than the summer afterwards.

When wheat is sprouted, it improves much by being kept long in the straw, and mixed with sound old wheat.

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* Mr John Shirreff explains the operation of the funnel, in the following manner. The air in the funnel being heated by the evaporation from the raw beans, the haulm *ascends*, and is supplied by cool fresh air from the atmosphere from below, from the opening in the middle of the stack.

Good bread, in general, cannot be made without a mixture of old wheat, (unless the season has been uncommonly good), for at least two or three months after harvest. In common years, one-fifth part is necessary till the month of March for loaf-bread, but not so necessary for rolls.

Wheat, if not in good condition, is improved by kiln-drying. There are two kilns belonging to the Corporation of Bakers of Perth, for that sole purpose; but this does not render a mixture of old wheat unnecessary, although it improves the grain that was damp when threshed. The wheat should not be used until some time after it is kiln-dried. It will then improve the colour of the bread.

The Corporation of Bakers at Perth, have a wooden tub for cleaning smutted wheat, which it does effectually in the course of three washings, however black it may have been. It resembles a potatoe-mill. The wheat is afterwards kiln-dried. More attention on the part of the farmers, to the pickling of their seed wheat, might surely render such an operation unnecessary.

It may not be improper to add, that formerly, and even within these twenty-seven years past, it was thought necessary to mix some English flour with the Scotch, in baking bread of superior quality; but though Scotch wheat is still inferior to the English, and will probably remain so, from the defects of the climate of Scotland, yet the wheat even of the Carse of Gowrie and of Strathearn is so much improved in quality, that such a mixture is no longer required, and the bread of Perth in particular, where those wheats are alone used, equals any in the united kingdom.

Sect. X.—*On Threshing Grain.*

Having already given a very particular detail of the advantages of a threshing-mill, (See Chap. I, Sect. 7, p. 72), it is not necessary to trouble the reader with many additional observations on this branch of the subject. It may be proper, however, to state the expence of a machine to go by steam erected by a respectable farmer on the borders, (Mr Thompson of Chillingham Barns), as communicated to me by Mr Bailey, as it is desirable that those, who propose having threshing-mills, should be able to compare the expence attending the different sorts.

Expence of the engine and house, -	L. 325	0	0
The threshing part, - - -	100	0	0
Total,	L. 425	0	0

The drum and rollers are six feet long each. It has two rakes, and two winnowing machines: The quantity of coals sufficient to keep the engine going six hours, is from 20 to 24 bushels; the work performed is from 1000 to 1200 sheaves *per* hour.

It requires one man to attend the engine in addition to those usually employed, where water or wind is the power. The expence of coals will vary according to circumstances; in this instance, 24 bushels cost about 10 s.

This engine was calculated to be equal to a five horse power, but will do more business than six horses, which,

requiring a driver, will balance the man attending the engine, and of course the difference of daily expence will be between the value of 24 bushels of coals and six horses.

Mr Thompson's was made by a steam-engine maker at Newcastle: any steam-engine wright can make them. There is little difficulty in managing them, no more than for a colliery, and Mr Bailey thinks much less than those driven by wind. Steam also is a much steadier and a more certain power than wind or horses. The annual expence of repairs, it is supposed, will be nearly the same, at any rate will not much exceed that of a wind machine. I am informed, however, that a greater quantity of oil and grease is required for a steam machine, than any other.

In regard to horse machines, Mr Brown of Markle calculates, that a six horse-machine, without interfering materially with the other business of the farm, will, in two days *per* week, thresh the produce of 600 Scotch or 762 English acres, whatever the nature of the grain may be; but if the crops are either oats or barley, or the wheat straw short, the produce of 900 Scotch, or 1143 English acres, may be threshed, and dressed for market, by such a machine.

It is observed, that where threshing-machines are wrought by horses, and only the same number of horses kept as before the erection of the mill, it will be necessary to give the work-horses hay instead of straw; as the mill causes additional labour to the horses, perhaps for five months in winter, to the amount of from one-sixth to one-eighth more.

Sect. XI.—*Of Soiling.*

By *soiling*, is meant, the feeding of stock with cut green food, instead of pasturing them.

The origin of the word soiling is unknown. Mr Young supposes it to be a mere farming barbarism *.

The introduction of soiling into England is also unknown. Hartlib mentions it, as a practice in Kent about the middle of the seventeenth century. It was very general in Hertfordshire about seventy years ago. It was probably derived, like many other useful practices, from the Flemings †. It certainly has been long known abroad, and several interesting communications regarding it, will be found from its foreign correspondents, in the earliest publications of the Board of Agriculture ‡.

The soiling of horses was known in Scotland about fifty years ago. It was practised, however, but by a few, and it was not till about the year 1778, as Mr Brown of Markle informs me, that the system of regular soiling took place in East Lothian §. Before that time horses generally

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* Some imagine that *soiling* means *making soil*, that is, according to Johnson, "*filth or dung.*"

† Cromwell gave L. 100, a great sum in those days, to establish the husbandry of Flanders in Hertfordshire.

‡ See Baron D'Alton's Letter, annexed to the Middlesex Report, and Dr Thaer's paper printed in the second volume of the Communications to the Board.

§ Lord Kames has given a curious description of the old mode of feeding horses in the summer season, in Scotland. He de-

received a small quantity of clover during the night, but were herded in the forenoon and the evening on the pasture lands, by the boys then employed as plough drivers. After two-horse ploughs were introduced, soiling was generally resorted to, and has been more or less followed ever since the introduction of clover into general husbandry. A few farmers, however, still think it beneficial to run their horses in an inclosed field through the night.

Lord Kames, in his Gentleman Farmer, published in 1776, has strongly inculcated the advantages of soiling, and boldly declares, " I despair not to see all the corn-farmers in Scotland depending on red clover for the summer food of their cattle *." His hopes are fortunately now in a great measure realized.

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scribes them as being fed in balks between ridges of corn, and often reduced to thistles, the time of the men being consumed in collecting, and that of the horses in eating them. This was a kind of soiling. Sometimes, what was called *hained grass* was reserved for them: but how often did it happen, that the man appointed to attend them fell asleep? and the horses then trespassed on the corn;—dogs were employed to chase them from it; the horses were driven about, and their fatigue was little less than when they were at work. If they were tethered on the hained grass, the half of the produce was lost, being trodden under foot; the horses also often broke loose, and destroyed the standing corn. Even in inclosures much of the produce was trodden under foot; the horses were pestered with flies in hot weather; they could not feed with ease; they had no time for resting; and much time was lost in laying hold of them for the yoke. Besides, few inclosures were then in sufficient good order to keep in horses when they saw corn; and, if they once broke out, it was in vain to think of imprisoning them afterwards.—*Kames's Gentleman Farmer*, p. 172.

* Gentleman Farmer, part 1, chap. 9, sect. 1.

I propose to explain this important subject under the following general heads: 1. On the articles used; 2. On the different sorts of stock thus fed; 3. On the advantages of the practice; and 4. On its disadvantages.

1. The articles principally used for soiling are, red clover, (with a mixture of rye-grass), and tares. Sometimes lucern, barley, oats and beans, are resorted to; but sainfoin, though cultivated in many parts of England, is unknown in Scotland *.

Red clover, with a mixture of rye-grass, is the article by far the most generally cultivated in Scotland for soiling; nor is that to be wondered at, considering the facility with which it is raised, and the luxuriance of its produce. Lord Kames calculates that a horse of a middling size will eat ten Dutch stones of clover and rye-grass daily; some, however, will go the length of sixteen or seventeen stones. An ox or cow will eat about eight stones †. Even at these rates, a good crop of red clover will feed a number of animals.

White clover is but a small plant, and not easily collected in heaps for food, but it is astonishing the quantity it has produced, when frequently cut, and manured with coal ashes.

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* One of my correspondents states, that he thinks soiling with rye might turn out well, as the surest and earliest growth known in this country, more especially if cut with the sap, before it shoots. But this idea has not been justified by experiments.

† Gentleman Farmer, p. 178. Mr John Shirreff remarks, that no conclusion can be drawn, as to quantities of herbage necessary to support the different animals, unless their weights be specified. An ox of eighty stones will eat as much as two of forty stones each; and a London drag horse would probably consume as much clover as ten Shetland ponies.

Lord Kames strongly recommends sowing a mixture of yellow clover with rye-grass and rib-grass, but cocksfoot would probably answer better. These plants are earlier by a fortnight than red clover, may be cut about the middle of May, and if the season is favourable, they may be again cut as late as even the middle of November.

Lucern has been tried in Scotland, on a small scale, and has completely answered. An account has been already given of the success attending the culture of tares. It may be proper to add in this place, that it has been found highly useful to mix some oats among the tares, to keep them from the ground in wet seasons.

One of my respectable correspondents, (George Culley, Esq.) informs me, that he has known barley and *seeds*, (that is clover and rye-grass), frequently sown together and cut before the barley shoots, when it produces a great crop, and afterwards a good second cutting, affording an excellent food when soiled, either for horses or cattle. Winter barley may be cut once, and will afterwards produce a crop of grain.

Some cow-keepers near Edinburgh soil their cows with cut barley. Finding that clover was apt to fail on the rich lands near Edinburgh, owing to the heavy crops of barley which these lands produced, they resolved, instead of keeping the barley to be ripened, to cut it for their cattle young, a practice that has been found to answer. The first crop is equal to clover, and the cows are as fond of it; the second crop is not so good as the second crop of clover, but is far from being deficient, and would be more abundant if they would only cut the first crop earlier. At the same time, the greater the proportion of clover the better, as grain crops cut green are harsher than clover, tares, and other leguminous crops, and have not so feeding a quality.

Instead of tares, an intelligent correspondent soils four or five acres of Tartarian oats, commencing about a fortnight after Midsummer. He finds this plan to answer uncommonly well, but he begins soiling with clover and rye-grass. The oats should be sown at different periods, to come in succession.

In Ayrshire, whenever the crop of beans is not likely to be productive of pods, Mr Blane of Blanefield informs me, that they are mown down as green food for horses, who are fond of that food, after being a little accustomed to it. This, however, at least, is but a rare practice. It has been tried with stall-fed oxen, and they throve, it is said, better on that food, than on any other.

2. We shall next proceed to consider the different kinds of stock soiled: 1. Horses; 2. Cattle; and 3. Pigs; and the manner in which they ought to be respectively treated.

1. *Horses.*—There cannot be a doubt of the advantage of soiling working horses, a practice which Mr Rennie of Phantassie considers to be almost indispensable, upon all corn farms, as it enables the farmer to make his summer-threshed straw into dung, and to procure a greater quantity of work from his servants and horses. It is thus indeed that a large quantity of valuable and rich manure is produced, by which alone he is enabled to carry on his rotation of cropping to the same advantage. The following is a short sketch of Mr Rennie's practice of feeding horses through the year He generally gives them cut grass about the 10th of June, or when the grass is forward for cutting. He employs one man during the summer season to cut and bundle the grass, which he will do for twenty to twenty-four horses, with a little assistance occasionally; and having an interest in making as little

waste as possible, he takes care to give no more than what is absolutely necessary. The horses are kept on the first crop until it begins to get hard and dry, when, if the second crop of clover is not ready for cutting, they get tares, of which he always takes care to have a plentiful supply, with which, and the second crop of clover, they are carried on until the end of October, a week or two sooner or later, according to the season. During all this time they get corn, more or less, according as they are wrought. When the second crop of clover and tares is consumed, he then begins to feed with his best hay and corn. Good feeding, at that season, he finds of the greatest importance: as much of the horses' future health and strength, for the next year, depend on the good management of them when taken from green to dry food. After a month's good feeding with corn and hay, by which time the hardest of the labour is generally over, he puts them on pease and bean straw, with a feed of boiled beans mashed up with a little ground barley, and which they get every evening; this keeps their belly open, and in a great measure prevents the bad consequences that often arise from damp pease or bean straw. In this way he feeds them, until the first or second, or perhaps third week in April, according to the quality of the bean straw, and then puts his horses again on hay, on which they continue until they get cut grass. Besides the advantages already mentioned, he remarks, that if his twenty plough horses were to be grazed, it would require a field of at least thirty to forty acres of extent, in order that the grass might be sufficiently good to allow the horses time to fill themselves, and to have time to rest. Think of the waste that must be occasioned by these horses trampling over it, besides what must also be wasted in the pursuit of catching them for the yoke. Mr Rennie has no doubt that one half the quantity of ground, when soil-

ed, will feed the same number of horses. He adds, that a horse that is from nine to ten hours a-day in the yoke, has no time to gather his meat; he therefore ought to have it laid down ready for him in the stall, to begin to eat when he comes in from his work, so that he may instantly fill his belly, and retire to rest.

An intelligent correspondent informs me, that he keeps for the cultivation of his farm twelve horses, and for their maintenance he appropriates twelve acres of broad clover, with a mixture of rye-grass: this, when a full crop, he calculates will serve them five months, and will admit of four acres of the first crop being made into hay: the whole of the second crop they will be able to use green, even although twelve double cart-loads of good stable-dung *per* acre should be applied immediately after the first cutting, which will always secure a good second crop, and in a moist season will produce a very heavy one. The dung so applied, however, ought to be very short, and well made, otherwise, it will be liable to mix with the clover, in cutting and raking *. My correspondent reckons it also one of the best preparations for a wheat crop with one furrow after the clover: much nicety, however, is required in spreading the dung, and a heavy stone-roller, drawn by two horses, will be applied with great advantage, as soon as the dung becomes dry after spreading; for without having recourse to this expedient, much of the dung would be raised in the second cutting, and a considerable quantity of the grass would be lost, from the ine-

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* It is said, that the clover produced by new dung, must be rank and unpalatable, and that it would be more advantageously applied to the turnip crop. But where there is no land fit for turnip, that objection is obviated.

qualities formed by it on the surface, which would prevent the application of the rake; and it also has the advantage of incorporating much sooner with the soil, without any waste. He generally commences cutting broad clover for the stable, in the last week of May or first days of June, and continues until about the end of October; after that time the horses are put on hard food.

The principal objection to the practice of soiling horses is, that it is difficult to provide them with young grass *; but that is completely obviated by the practice adopted in Roxburghshire. The clover that is intended to be cut early, is always saved in the winter and spring months; but such as is meant to be cut in the last half of July, and the second and third weeks of August, is always eaten down by the

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* Mr Somerville states, that among the disadvantages attending soiling, one is, that before the second crop is fit for cutting, the first gets often so tough, stock do not eat it well. The objection, however, is easily removed by the cultivation of as many tares as will supply the interval between the first and second cutting; a practice now very generally followed. Indeed, Mr Hume of East Barns informs me, that he is accustomed to cut down five or six acres of his young crop on which he pastures 14 horses from the 15th of April to the 1st of June, when the other grass is ready for cutting, and it never fails to give a good crop when the first crop begins to turn too hard for the horses. This plan saves many horses' lives, and a great deal of more work will be got from horses thus fed, with two feeds of corn, than from the same horses that get three feeds and the best hay. There cannot be therefore a greater improvement, as without following it, or sowing a considerable quantity of tares, no farmer can be sure of having green food for his working stock in August and September, if severe drought occurs during these months.

sheep in the spring, by which means it is in a good state when the other becomes hard and unpalatable. This method is also followed by Mr Brown of Markle, who thereby seldom fails of obtaining green food of the best quality for his working stock, not only at the critical period here alluded to, but also to the very conclusion of the grass season.

Mr Nisbett of Mersington, in the spring, puts in ewes and lambs on the new grass, in the proportion of two pair *per* acre, and sometimes more. He occasionally also eats the herbage of a part of his hay land *, in the spring, with his fattening sheep, when he wishes to keep them back for a good market; and that part he cuts for the horses before the second crop can be ready. This insures to the horses a succession of young grass, on which they thrive much better than when it gets dry and stalky.

It is certainly desirable, by following this practice, to keep the clover young and nourishing, even though a greater quantity of ground should thereby be rendered necessary.

In regard to soiling, a respectable correspondent makes this distinction, that where there is grazing land of good quality annexed to the farm, it is, in point of convenience, of less consequence; where that does not take place, it seems both profitable and necessary to soil with red clover

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* It is remarked, that there is certainly a risk in spring, eating a part of the herbage of the land intended for hay; as in proportion as it is eaten, so in proportion is it exposed to the influence of the sun and cutting winds, and more liable to the injury of drought. It so seldom happens, however, but there is a powerful supply of moisture at or about Whitsunday, Old Style, that the injury dreaded can rarely happen. At all events, it is desirable not to eat the young grasses too bare.

and tares. If the rich grazing land, however, can be cut for soiling, would it not be desirable to adopt the soiling system, if one acre will go as far as two ?

Mr Somerville of Athelstonford Mains, is decidedly in favour of soiling, thinking it scarcely possible that the labour of a farm, according to the present system, could be well carried on, if horses were fed otherwise ; besides, in that way, one acre of grass will go as far as two eaten on the field, whilst the straw threshed in spring and summer is thereby rapidly converted into rich dung.

Mr Somerville gives the following estimate of the expence of soiling horses, and of the manner in which it ought to be conducted. He estimates, that a Scotch acre, is, in usual seasons, consumed by a pair of horses.

Two horses nine weeks, first cutting at 10 s. *per* week, - - -	L. 9	0	0
Two ditto four ditto, second cutting, at 10 s.	4	0	0
Total value of the produce, - -	L. 13	0	0
Deduct for cutting and carrying home, -	2	0	0
Clear profit *per* acre, after paying expences,	L. 11	0	0

Such a crop, if made to hay, will rather exceed 200 stones *per* acre Scotch, of 22 lb. avoirdupois to the stone. If the same were depastured and allowed to get well up, an acre would keep one horse for thirteen weeks; hence Mr Somerville considers, that one acre of clover and rye grass, according to the soiling system, will feed the same number of animals that two will do, when the soil is depastured.

He generally begins cutting for soiling in the first week of June, though at first he goes over much more ground than afterwards, yet the second crop is much better, and

what is early cut, comes in succession when the first crop gets old and tough. He never has grass that will cut a third time with advantage. His horses get water twice a-day, which he thinks indispensably necessary for working stock * ; if water is in the court, where they can take it at pleasure, so much the better.

Milch cows give more milk when soiled than when pastured, provided due attention is bestowed in furnishing them with a regular supply of grass at stated periods, say six times each day, and keeping them clean and free from nastiness. The very trouble that is saved by milking the animals in a *byre* or cow-house at hand, instead of going to a distant field, is of considerable importance.

Lord Kames stated, that many a summer, for seven or eight weeks running, his horses had been daily employed in bringing lime from a quarry fifteen English miles distant, *fed on red clover only ;* and at the end of the season they were as plump and hearty as at the beginning : but all intelligent farmers are now of opinion, that it is necessary to give horses a feed of oats *per* day, when they are carrying lime, coals, or other heavy articles to or from any considerable distance.

Mr Wilson of Simprin, in Berwickshire, approves of soiling in the middle of the day, in hot weather ; but he states, that it is not generally practised in Berwickshire, where the work-horses are accustomed to move quicker than in the Lothians. He does not think that it would answer in every situation; and is of opinion, that cut grass is too soft a food for horses used in driving lime. By

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* It is found by experience, that even posting horses do well soiled, but then they must get no water. When fed on moist and succulent herbage, the less water, in general, the better.

giving a feed of oats, however, that objection would be removed.

It is also contended, that horses are much better to be out a few hours on pasturage every day, instead of being kept constantly in a stable, in consequence of which, they are apt to turn stiff, and never thrive so well. But this objection is obviated by the practice of a number of respectable farmers, who, when they soil their horses, give them their green food in binns in the yard, instead of feeding them in a stable; and Mr John Shirreff remarks, in regard to the idea that horses, when soiled, are liable to become greased, it is not well founded. There are few greased horses in East-Lothian, where cut clover is constantly used for soiling. Indeed, the idea of horses becoming greased when regularly fed, and wrought with moderation every day, is absurd. Exercise is the surest preventive. It is in winter that draught horses are most apt to become greased, from wet roads, and want of exercise.

Mr Somerville of Athelstonford Mains is convinced, that young draught horses may be reared much cheaper by soiling, than in open pastures;—a point of considerable moment to industrious farmers.

2. *Cattle* *.—Though many are of opinion, that it is profitable to soil horses, yet this practice is not so generally approved of in regard to cattle. Mr Brown of Markle, however, has with his usual ability given a very satisfactory account of an experiment he tried, which seems deci-

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* Mr Curwen strongly recommends soiling milch cows. He says, that a cow of the short-horned breed will require eight stone, (14 lb. each), of cut clover, in the twenty-four hours; but with smaller breeds, I have no doubt, that a less quantity will suffice. Report to the Workington Society, *anno* 1810.

sive of the question *. In 1805, he soiled twenty-four Aberdeenshire cattle, and after giving a full detail of the expence and profit, computes the gain to be fully 50 *per cent.*, when grass is consumed in that manner, even when no additional sum is stated as the value of the large quantity of fine dung thereby manufactured. From his account, it appears, that these twenty-four cattle were completely fed, from the first of June to the first of October, upon eleven acres of clover and tares; and he now informs me, that he is quite satisfied, it would have required eighteen or twenty acres of the same grass to have fed them had they been pastured upon the field. This is a decisive fact in favour of the system, especially as Mr Brown had an equal number of cattle in an adjoining field, which did not sell one halfpenny higher than the soiled ones, though they consumed or destroyed a great deal of more grass. With the exception of one season, when his clover field was at a great distance from the farm-yard, Mr Brown has regularly soiled cattle since the above period.

It is contended, that the soiling of cattle is of more importance upon clay-land farms, than where the turnip soil prevails, as in the former it is difficult to use the straw to advantage in any other way; whereas upon a turnip farm, it is hardly possible to reserve straw for the purpose of soiling, and it cannot be done without straw, or some other substitute. On the other hand, it is maintained, that sometimes half the turnips may be eaten on the field, without any straw being used; that a considerable saving of straw may be effected, by bottoming the yard with moss, earth, ashes, and other such articles; and that if straw be economically applied in littering turnip-fed stock, there will be abundance to litter a good many soiled in

* See Farmer's Magazine, vol. vi, p. 460.

summer, where good and luxuriant crops of grain are raised.

A detailed account has been transmitted to me, regarding the proper mode of soiling cattle, by Mr James Cuthbertson of Seton Mains in East-Lothian. He recommends, that cattle, intended to be kept in this way during the summer, ought to have some succulent food given them, at least four weeks before they are entirely confined to eat green clover, and for the first fortnight, a flake with oat straw, or a little hay, should be kept in the court, because at that season of the year, the grass being strong, its laxative effects are so powerful as to prevent feeding. Plenty of water ought to be constantly kept in the court; an open shed also for the cattle to retire to, in hot weather, would be a great comfort to them, and very materially aid their feeding; and if it is found that they do not frequent it, he would recommend keeping them at the stake during the heat of the day: recourse likewise ought to be had to the *byre* or cow-house, during any continuance of wet weather. Their food ought to be given them four or five different times a-day, so that it may be always fresh, and new cut, which will prevent the waste that would otherwise be occasioned by giving them large supplies at a time, and will also induce them to eat more plentifully. Regular litter should be given them, and the court kept as smooth as possible, in order to preserve them from being overheated when they lie, which they ought to be encouraged to do as much as possible.

It is also of much consequence, that regular attention should be given to keep them clean, so as to prevent a foulness of the skin, which may happen if the weather is warm, and litter not plentifully and regularly supplied. When the soiling of cattle is intended to any extent, it ought to be adverted to, in sowing the grass for them, that less rye-grass than is commonly used for hay should be

sown with the clover; likewise, that when the clover begins to get hard, some tares, sown early in the spring, ought to be substituted in its place. In East-Lothian, it rarely happens that the weather will permit the cattle to lie out after the month of September; but as this in general is too early for commencing feeding with turnips, unless the weather is dry and warm, it would be better to feed them at the stake, upon the second crop of clover, which at this time will be in its best state for feeding. Some recommend a few oats on the straw to be given, for the first month after the cattle are changed from the clover to turnips; but in my opinion that expence is not necessary.

Mr Hope of Fenton found that young cattle, tied to the stake, improved much to his satisfaction. From their age he could not expect them to fatten for the butcher. He would prefer, at the same time, allowing them liberty to feed in an open yard, with a proper shed into which they might retire when they thought proper, to the stake. He thinks, however, that cattle will thrive better constantly tied up in a well-aired house, than confined in an open yard, without having an opportunity to take refuge from the heat of a summer's sun, and the vermin that harass cattle at that season of the year. Water was brought into two yards, where he tried his experiments, for the use of the cattle; those in the house were let out once or twice a-day, according to the nature of their food, to drink, upon doing which they were immediately tied up again. He found it of the utmost consequence to have them always well supplied with water, especially when the grass begins to turn hard, as he observed once or twice, when the servant had neglected to supply them in proper time, (although for a very short period only), that scarcely a beast thought of putting his mouth to the grass, but all stood looking with the greatest earnestness till relieved by a proper supply of that necessary element; wherever soiling, therefore, is to be practised, he

holds it of the first importance, that a plentiful supply of water should constantly be at hand, completely independent of a servant to supply the yard, either by a pump or other manual operation *.

Some farmers in Berwickshire, who long persisted in the system of soiling their young cattle, have now abandoned it, from the idea of its insufficiency to raise stock, to the same weight and size as they would have been raised to, had they been grazed in the common manner. They admit, however, that beasts, by being soiled, may be well prepared for being laid on turnips in October; and they ought to consider, that it is not the weight or size of any individual animal, but whether *more value* can be raised on an acre soiled, compared to one of a similar nature pastured, that must determine the question.

An intelligent correspondent, (Mr Stewart of Hillside), informs me, that he has been in the use of giving cut clo-

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* Mr Low observes, that though an abundant supply of water is, in general, proper for cattle, yet that less is necessary, when fed on such moist and succulent food as cut grass. He has learned from good authority, that young horses and cattle have been known to thrive very well in a pasture field, without a drop of moisture more than they obtained from the dew on the grass in damp mornings. This, however, is not to be imitated; and where the water is not conveyed to the court by troughs or otherwise, the cattle must be driven to it at least once a day, and allowed ample time to drink. If the water be near at hand, it may perhaps be advisable to water them twice a day. It is remarked, that calves should never be allowed any water during the first six months they are turned out to pasture; for when they are allowed to drink much water at an early age, they will become big-bellied, and otherwise mishapen. Grown cattle, however, cannot do without a sufficiency of water, more especially when living on dry and coarse food.

ver to milch cows in the months of July and August, when the weather is hot. At that season they come in from their pastures between eight and nine in the morning, and are not put out again till four in the afternoon; in that interval they get a full feed of clover. The advantages of this, to the pasture, the cattle, and their produce, are evident. He reckons, that an acre of ordinary clover, will serve fifteen cows for this purpose, for two months. Others have tried giving cows clover in the yard, but found that they did not give so much milk as when they were at pasture. That, however, is not inconsistent with the advantage of soiling them in the middle of the day.

Mr Park is of opinion, that a supply of water is very requisite when cattle are put on clover; and if a running stream cannot be obtained where they are kept, a pump-well, with attention, may supply its place. On the whole, he is of opinion, that there is more advantage to be derived from soiling horses, than cows. That, however, is a point that has not yet been so fully ascertained as, I trust, will soon be the case.

Mr John Shirreff has suggested the following practices in regard to soiling, which seem to me peculiarly valuable: 1. That in hot weather the herbage should always be given them in sheds; and, 2. That a supply of the *best old hay* should be given them in wet weather, else the stock must fall off much in their condition, for there is only a certain quantity of moisture, which an animal can take into its stomach with safety, and if that is exceeded, the consequences must be fatal.

8. *Pigs.*—Mr Church of Hitchill also soils pigs on clover, and finds it an advantageous practice. Where cottagers have gardens, and keep pigs, it might be expedient to have a small spot of clover in their gardens to cut for them. In regard to soiling pigs, a discovery has been made of

considerable moment. It is, that pigs may be soiled on cut green beans, with great profit, and that they are ravenously fond of them. The Windsor sort is preferred, and the beans should be planted at three different times, for the sake of a regular succession. The feeding may commence in the beginning of July, and may terminate about the end of September. When pork is worth 7¼d. *per* pound, the profit, besides a quantity of most valuable manure, is calculated to be about L. 10 *per* English acre.

We shall now proceed to state the advantages of soiling, and the profit to be derived from it.

1. Soiling is peculiarly calculated for *clay-land farms*, more especially if they are situated at a distance from any town where there is a demand for straw. By means of soiling, that straw can be converted into rich dung, which otherwise would hardly be of much value. Upon turnip land farms, where cattle are fed, the straw is consumed during the winter, and little, if any, can be reserved for soiling.

2. Another circumstance strongly in favour of soiling, is mentioned by Mr Hume of East Barns. He states it as a positive fact, (though it may seem extraordinary), that all the lands in his neighbourhood will produce a better crop of oats, the year after the grass is taken up, if the grass was cut for hay, or for soiling, even twice in one season, than if the grass had been pastured, even with sheep; and that this takes place, not only on land full of manure, but even where inland districts are managed in the four-course shift of turnips, white crops, grass, and oats, and receive no manure but a thin dunging in the turnip drills. The same circumstance is stated by Mr Brown of Markle, who has made trials of the cutting and pasturing processes upon soils of almost every description, and uniformly found that oats taken after cutting grass, were superior to those taken upon the pastured field. The produce of the land,

however, must be consumed upon it, and not sold off, unless a fair proportion of putrescent manure is purchased back.

3. The saving of land is a most important consideration. Mr Walker of Wooden is of opinion, that one acre of cut grass soiled, is equal to three used as pasture. But in turnip land farms, where sheep are partly fed in the fields, much straw, as has been already noticed, may be reserved for summer soiling. Mr Somerville states, that one acre of cut clover is equal to two pastured, even of the same field, and sown with the same grass, the clover not being trampled upon, and growing so much faster than if it were often corroded by the teeth of an animal: and another correspondent is of opinion, that 16 acres of clover and tares, will feed as many horses and cattle, as 36 acres of the same kind of grass would do if used in pasturage.

4. There is also a great saving of food; for animals, when pastured, destroy a great deal of keep in various ways, not only corroding the herbage by their teeth, but by trampling upon it, poaching it, particularly in wet weather, lying down upon it, dunging, and staling. All these are prevented by cutting the herbage, and carrying it from the field.

5. It has been justly observed, that by soiling, a great quantity of rich and valuable dung is produced, when none could otherwise have been procured*, which may be used

* It is said, on the subject of the muck produced by soiling, that it is not perfectly correct to state all the profit derived from that article to the acres soiled, as the land producing the straw must likewise be taken into consideration. This, however, cannot be carried to the full extent, as without soiling the straw might not be convertible into dung; at least into dung one half so valuable as when it is manufactured by that process.

upon the cultivated fields, with far greater advantage than could be obtained from the portion of dung left by the animals upon the same field, in the event of its having been depastured; for in this case, much of it would have been scattered on the grass land; much of it wasted by evaporation, dissipated by the sun and air; and much of it carried away by insects. This advantage alone is sufficient to compensate for any trouble or expence attending the practice, more especially on farms lying at a distance from towns, and where manure cannot by any other means be obtained: besides, as the dung and urine of cattle are much stronger in summer than in winter, it is possible, by this means, to procure a species of manure of a very superior quality. Before soiling was introduced, a large quantity of straw always remained after the cattle were turned out to grass, which never could be made half so valuable as under this system *. Under the old system, horse dung, in a pasture field, was almost totally lost, for it was soon eaten by flies, or dried, and withered away. Indeed, by its heat, it burnt the grass it fell upon, instead of improving it.

6. Another advantage is, that cattle and horses are not liable to the same accidents as under the pasturing system. They are not so apt to be *hove* or *blown*,—a misfortune by which many farmers have suffered considerably †. When

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* Communication from Mr Brown of Cononsyth, by Arbroath.

† A beast that chews the cud, takes in at once a large quantity of green food, especially of red clover, which is extremely palatable when young. So large a quantity is apt to ferment with the heat of the stomach, so as sometimes to make the creature burst. This is considered as a formidable objection to the feeding horned cattle on red clover; but it is easily obviated by feeding them in the house: servants will not readily give more than sufficient, when cutting and carrying is a work of labour.—*Kames' Gentleman Farmer*, p. 176.

milch cows are soiled, it is remarked that they escape the *gripes*, which is a great enemy to them when out, more especially in wet seasons. In the fields also, cows, when pasturing, are often frightened, when in a thriving state, and prematurely slip their calves, to the great loss of the proprietor. Besides, it is well known, that pasturing horses and sheep together is extremely injurious to the sheep stock going on the same land, which, by the process of soiling, may be obviated *.

7. This practice is also of great use in preventing damage, not only to fences, but to underwood, corn, &c. by breachy cattle; and it prevents all the danger of cattle being staked, or otherwise hurt by breaking fences †.

8. It is likewise contended, that the practice is advantageous to cattle in a feeding state, as they require that a sufficient quantity of food, to satisfy their wants, should be given them in a short space of time, and they fatten quicker by lying much at rest ‡.

9. Working horses or cattle are saved all the fatigue of collecting their food after their work is over; they can fill themselves consequently much sooner, have more time to rest, are protected from the heat of the sun and the attacks of insects, can be kept in higher condition, and are able to do much more work. In regard to horses, in particular, after having worked nine or ten hours each day, they must stand in need of rest during the cessation of their labour, and this can be better obtained in a cool stable, or open shed, with plenty of litter, than in an open field, where they are exposed to the weather.

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* Kerr's Berwickshire, p. 272.

† See Sir C. M. Burnell's paper in the Communications to the Board of Agriculture, vol. vi, p. 2.

‡ Adam's New System of Agriculture, p. 11 and 12.

Lastly, Working animals are rendered much more tractable, take a liking to those who furnish them with food, and, instead of being sought for in the fields, and being caught with great difficulty, they are always ready for their work. Besides, in the stable, they are not tormented with flies as in the fields, nor are they induced to stand in brooks, or ponds of water, nor under the shade of spreading trees or hedges, by which much valuable manure is lost.

It is likewise to be observed, in the words of Mr Brown of Markle, that the real test of the utility of soiling is not, whether cattle can in that way be so completely fattened as by pasturage, but whether or not an acre of clover grass, can be consumed with more profit to the farmer, by soiling, than if cattle were allowed the liberty of pasturage upon it. This is the true view which ought to be taken of such a question.

We shall now proceed to state the profit derived from this practice.

Profit from soiling.—There is certainly no mode by which artificial grasses will pay so well, as by soiling. In the neighbourhood of towns, from the necessity that cow-feeders and carters are under for such food, the value of clover is immense. Indeed, according to a communication from Mr Low, L. 25 or L. 30 *per* Scotch acre, are no uncommon prices, for the produce of land cut for soiling, which, if it had been let for pasture, instead of being cut, would not have brought more then L. 9 or L. 10 *per* acre. Mr Bruce of Grangemuir in Fife, makes the value of cut grass *per* Scotch acre, deducting the expence of cutting and leading, L. 9, and the profit from dung L. 3, 10 s.; consequently the total value of one Scotch acre he calculates to be L. 12, 10 s. Mr Somerville states the produce at L. 13, the expences L. 2, leaving the value *per* acre, where the produce is consumed

by soiling horses, L. 11 *per* acre, besides the dung. Mr Kerr, in his Report of Berwickshire, p. 262, states, that an English acre is worth from six to eight guineas, (besides the dung,) according to soil and seasons, which does not differ materially from Mr Bruce's statement, whose calculation refers to the Scotch acre. It is said, that an acre of clover and rye-grass, cut and used green, is of equal value with the produce of the same acre made into hay; and that there is much less risk, whilst at the same time a great quantity of excellent muck is procured *. But Mr John Shirreff remarks, that this point must depend upon various circumstances; as the price which the various articles will fetch, or the purposes to which they can be applied. This must vary in different situations and districts.

It must not be imagined, however, that this practice, however excellent, is not liable to some objections. These I shall endeavour to enumerate.

1. It is first objected, by those who disapprove of soiling horned cattle, that in close coverts, the benefit of good air

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* Mr Somerville calculates, that a crop of clover and rye-grass, when made into hay, will rather exceed 200 stones *per* Scotch acre, of 22 lb. avoirdupois to the stone. If the same were pastured, and allowed to get well up, an acre would keep one horse for thirteen weeks. This produce, however, Mr Curwen considers to be very low for land in condition. It may be regarded, however, as a full average of the hay crops of Scotland in general seasons. It is to be remarked, at the same time, that the crops of clover will be much greater, when first introduced into any district, as that of Cumberland, than they will prove afterwards. In the experiment made by Sir Charles Merrick Burrell, the produce of nineteen acres and three quarters was saved by soiling fifteen acres and a half, or L. 88, 10 s. in all, which was *additional profit* on the extent soiled, of L. 5 : 14 : 2¼ *per* acre.

and cooling breezes is exchanged for putrid effluvia, and a noxious heat from different sources; and that the annoyance from insects and vermin, in such a situation, must be greater than in the fields. Here I must however remark, that where proper sheds are erected, the latter part of the objection is altogether groundless. I may also add, that the daily experience of cattle thriving, though confined, sets aside the whole of this objection. Besides, horses or cattle might be kept in *hammels* (as they are called in Berwickshire), or small folds, with covered sheds to resort to in hot or in bad weather, where they would not suffer from confinement. Indeed, covered sheds alone, when properly constructed, are much cooler in hot weather than the open atmosphere, and are not infested with insects or vermin. By the same plan of hammels, another objection is obviated, namely, that if animals of different strength are confined together, the weaker cannot obtain an equal share of food with the stronger; for by the hammel system, the weak and the strong may be separated.

2. The second objection is, that the chances of accident and disease *are greater*, than when the cattle are allowed the natural way of seeking their own nourishment: but it is evident, that they are liable to many more accidents without doors, than within, and, besides, are exposed to the inclemency of the seasons.

3. It is also objected, that in wet soils or seasons, fields are much injured by carts and horses going upon them, to take away the cut grass. They cannot, however, do so much injury, as a number of horses pasturing upon the field; and by adopting the plan recommended by Mr Walker of Wooden, that of using broad wheels, (see page 61), the objection is completely obviated.

4 Another objection to soiling is, that in thin dry land, especially in a dry season, it does not produce grass, of weight and quantity sufficient, as to render it worth while

to cut it for soiling. The answer to that is obvious, that in such a case the land must be pastured, and that it is impossible to make any arrangement that will suit every soil and every season.

5. Another objection is, that it is difficult to know what to do with a large wintering stock, from the middle of April till, some years, the 10th of June; cattle, during that period, if living on dry straw, would be so much reduced, as that it would be dangerous to give them any thing like a full supply of new grass, for several weeks, and before the constitutions of the animals have undergone the requisite change, the best part of the feeding season is expired. But there are few farms on which some ruta baga or yellow turnips may not be grown to a sufficient extent for supplying an ordinary stock of cattle for six months; but if these do fail, the alternative remains of pasturing for a week or two a part of the grass land till the forwardest fields are fit for cutting.

6. The only material objection to the soiling system is, the expence of erecting and keeping in repair the necessary buildings, and the care, trouble and expence, which are required for the due supply of food and water *: expences, however, which are amply compensated by the numerous advantages already detailed. In regard to covered sheds indeed, which Mr John Shirreff considers to be indispensable where soiling is attempted, he remarks, that this *extra* expence is imaginary where winter-stall feeding is practised, because the same sheds will answer for soiling, that serve for the consumption of turnip. Where milch cows or fattening cattle are soiled, an additional servant and horse may be necessary, to cut and carry home their grass; but in regard to working horses, no additional expence need thereby be

* The propriety of giving water with such moist and succulent food as clover, is much doubted.

incurred, as the servant who works his pair, has plenty of time, midday and evening, to find them grass, if the field is not far distant *.

With a view of lessening the expence of carrying cut grass from the field to the stable, the only circumstance that weighs against cut grass in competition with pasture, Lord Kames has proposed to carry the cattle to their food, instead of carrying food to the cattle. For that purpose, he proposes erecting a moveable shed in the field, all of wood; and he adds, that it is possible to set a little shed on wheels, to be moved from place to place, without being taken down. This plan has lately been revived by Mr George Adams, a farmer in Worcestershire, who has taken out a patent for what he considered to be a discovery, the importance of which had not previously occurred to any other individual; and, not being conversant with books on agriculture, was not aware that the very same idea had been recommended to public attention, as far back as the year 1776, when Lord Kames first published "The Gentleman Farmer †."

I have thus gone through the important question of Soiling, and have availed myself of all the information I have been able to collect upon the subject, in order to bring it more fully under the consideration of the reader. The practice is now thoroughly established in all the improved districts of Scotland; and I trust that it will soon be universally adopted in every other part of the united kingdom.

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* Communication from Mr Charles Alexander.

† One of my correspondents saw a shed of this kind, as far back as 1772, on the farm of Wark, but it did not answer.

SECT. XII.—*On the System adopted in Scotland with regard to permanent Pasture.*

THERE is perhaps no particular, in which the systems of husbandry adopted in England and Scotland, differ more, than in regard to what is called old turf, or permanent pasture. It is admitted, that by letting land lie in grass for several years, the expence of cultivation is greatly diminished, and that from even indifferent soil, tolerable crops of oats may be raised for two, or even three years, on what, in some parts of Scotland, is called the *out-field*, and in the more northern districts, *afterwal-land;* but that practice, so contrary to every judicious principle of husbandry, has fortunately become obsolete. In regard to land of any considerable value occupied by tenants, when a question was asked regarding old turf, in a district distinguished for its fertility and produce, (the Carse of Gowrie), the answer was, "We do not understand in this part of the kingdom, what is meant by *old turf*."

As this is a point, which seems to me of very great moment to the farming interest, I shall state, 1. The observations which have been transmitted to me in favour of old turf; 2. Those which have been urged against it; and 3. Shall endeavour to draw the practical result from both; to which may be added, some observations on the breaking up, and the laying down of old pastures.

1. *Arguments in favour of old turf*—Mr Robertson of Ladykirk very ably maintains the advantages to be derived from permanent pasture. He contends, that it is of

the utmost importance to have some old grass or meadow land attached to every farm, even where the plough is the principal object of attention. Where the finer sorts of sheep are bred, as the Leicestershire, it is absolutely necessary *; but even in farms strictly arable, it will be found in the highest degree advantageous. The reason is obvious. Where artificial grasses, as clover, are alone relied on for feeding the stock of the farm, in dry seasons, the farmer may be almost entirely deprived of that resource; old grass would in that case be of infinite value, from the superior nutriment which, when properly kept, it always furnishes. The land should have a sound bottom, and be rather of a moist and loamy quality. It should never be cut for hay, but always pastured; it should not be top-dressed, so as to deprive the ploughed land of any part of the manure produced on the farm; the land should be situated near the farm-house and offices; and it may be in the proportion of about eight acres in a hundred. It is of great consequence to landlords, to preserve such an extent of old turf on every farm, untouched by the plough.

Mr Robertson is also of opinion, that when grass land, from age or other circumstances, gets into that state commonly called rich meadow or grazing land, it should not be opened *almost* on any account. It would be much for the ad-

* Mr Robertson says, that he does not see how it is possible to keep breeding ewes through winter without permanent grass, unless by means of a very great expence of turnip and hay. New grass, he adds, will not have above a fortnights start of real rich turf, if it has been saved in winter. The value of the winter pasture of such turf is also considerable. Besides it ought to be calculated, that artificial grasses run the risk of being smothered by strong crops, or destroyed when new sown by dry or wet weather.

vantage of every farm in Great Britain, were a field of that sort attached to it. No convertible land ought to remain above three years in grass at most. In the neighbourhood of towns, or in a situation where a sufficient supply of dung can be procured, one year in red clover will probably be sufficient; the best rotation, perhaps, 1. Potatoes or turnips; 2. Barley; 3. Red clover, and a little rye-grass; 4. Potatoe oats; 5. Beans; 6. Wheat. It is evident that this system only can last, where there is street manure, and dung to be procured in sufficient quantities, otherwise, in the course of a few rotations, the clover crop will become precarious, and would often fail.

In the last place, Mr Robertson states, that rich old grass or meadow land is of infinite value to pasture stock ewes in winter, and to give them their turnip on in spring, previous to their dropping their lambs. It is also of the greatest consequence to sheep of all kinds in Midsummer, especially in extreme dry weather, when the grass on the convertible lands is burnt up. To cattle and horses, at that season, and in that kind of weather, it is a matter of the first necessity. Sheep do pretty well, but the others cannot thrive without green food in the manner of soiling, or old rich turf. Nothing is so destructive to the feet of horses, as confinement on a hard field of new grass at Midsummer. The same thing may be said of cattle of all sorts *. Even the richest of land, when sown down, does not come to real perfection in less than thirty years; and after that period, if properly managed, it may be said to be in a progressive state of improvement; so that it may be a matter of serious consideration for any landlord to allow such land to be opened, if he has a just proportion of it on his property. If he has more than that, he may securely reckon it as a good fund to raise money, by a proper rotation of tillage.

* Where soiling is practised these objections are obviated.

In a farm of 500 acres, one field of 30 to 35 acres of old meadow land is highly desirable; and so on in the same proportion in other sized farms. Old grass certainly feeds large cattle better. In Northumberland it is called the *ox pasture*, tending to prove that it was formerly considered to be better calculated, or more necessary for cattle than for sheep. At the same time, it is said, that new grass feeds cattle better till Lammas, than even old grass. The best mode of laying down land to grass is, Let the land be quite clean, full of lime, and all kinds of manure; let the seeds be, one bushel of real perennial rye-grass, five pounds of red clover, and ten or twelve pounds of white clover.

Mr Low of Woodend observes, that the value of a portion of old grass is not to be considered intrinsically, but in relation to the farm of which it forms a part. Calculations concerning the comparative profit of land in tillage and permanent pasture, he considers, therefore, as of no value in this argument; since it is not contended that land in old pasture is of greater or equal value with the same land if under tillage; but that it is convenient and profitable to have a small portion of a farm so occupied; in short, that it is not the value of the grass itself, but the greater value it gives to the rest of the farm, by its many important uses, that is to be considered.

Mr Logan of Fishwick, who carried on farming to a great extent, (occupying at one time about 2000 acres of land of various qualities, one half of which he kept always in grass, and the other half in tillage), concurs in these doctrines. When he let Fishwick to Mr John Clay, he would not suffer one particular field to be ploughed up, which had been in grass above fifty years, and which, when properly treated, produces such a great variety and abundance of rich herbage, as soon brings the fattening stock to great perfection. He has also an old grass field

at Edrom, where he resides, which has been 100 years in grass, and is supposed never to have been limed; it is a rich black loam, on a gravelly bottom; he top-dressed it with lime in the months of November and December, and had turnips laid on it for his feeding sheep afterwards; it made a most astonishing improvement, both in quality and quantity of food; the grass was darker in its colour, smaller in the pile, and more luxuriant in its growth.

Mr Logan considers it to be a great advantage to top-dress old grass lands with a compost of earth or moss, lime, and dung, properly prepared; and the best time for laying on that compost is in the beginning of winter, the field being previously eaten very close in the autumn, and left untouched till May for pasture. Old grass land that is constantly cut for hay, requires dressing, as it is annually robbed of a crop without receiving any thing in lieu of it. In counties where turnips are grown, he thinks it would be of great use to those meadow lands, to have sheep fed with turnips upon their surface in the dry weather, which would be a profitable, and not expensive top-dressing; feeding cattle on the sward, with turnip, has not the same good effect that sheep have; cattle sink too deep in the soil with their feet*.

Mr Wilson of Simprin, another Berwickshire farmer, is likewise of opinion, that in every farm a part of it ought to be old grass, even though it should be in a dead or unproductive state. He is such an admirer of old grass,

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* On this subject, Mr John Shirreff remarks, that though sheep, when fed on old turf, certainly do not sink so deep in the soil, and though the heavy treading of cattle may injure the grass, yet such treading may be of great use in destroying *musci*, with which old grass lands abound, severe poaching being the best cure.

that he keeps a proportion of it on his farms, though he has the liberty of breaking it up. Land, when grass is sown for permanent pasture, ought to be laid down in the very highest order; if that is not the case, it should never be suffered to remain.

Mr Wilson reckons old grass of equal value as tillage land, and equally productive for man and cattle, with the exception of lands in the neighbourhood of large towns, where there is a great command of dung.

Having had the experience of feeding a number of the best oxen that ever were fattened in Berwickshire, it is Mr Wilson's opinion, that large oxen cannot be fed to advantage, after the first or middle of June or July, without old grass; before that period, artificial grasses will answer equally well, with the double advantage of allowing the old grass to get up,—a great acquisition in ox pastures.

As to the quantity of old grass on different farms, he thinks, that from 35 to 40 acres on a 300 acre farm, and from 45 to 50 acres on a 500 acre farm, and so on, is a fair proportion. The time of breaking up ought, in his opinion, to be regulated by its grazing well or ill. It is farther his opinion, that if the land is laid down in the best possible order, the longer it lies the better, or, in other words, it should lie for ever in grass. As to artificial grasses being pastured, the sward will always be too weak for large oxen, and they can never lie so comfortably on it as on old grass; besides other disadvantages, as not standing drought or wet. Nothing indeed but age, can produce that fine variety of plants, so ornamental and valuable in old pastures.

It is contended likewise, that old turf is peculiarly advantageous for feeding, in consequence of the variety of the herbage which it produces. From that variety, the grasses must appear at different seasons; in consequence also of that variety, cattle must be tempted to eat the herbage in

greater quantities, and it may not only be more nourishing, but also more easily digested.

The rents at which old grass parks let for in Berwickshire, justify these arguments in their favour. I am informed by that intelligent surveyor of land, Mr Low, that they fetch from 40 s. to even L. 5 *per* acre. These rents vary much in different seasons, rising or falling according to the demand for grass, which last is determined by the proportion of stock in the county. Very frequently, farmers, to consume their straw, find it necessary to winter more cattle than they can graze; but rather than dispose of their stock in the spring to disadvantage, they run the risk of taking these old grass fields at very great rents. It is only where these fields are secured at fixed rents, by lease or otherwise, that any profit is to be made by this system *.

Mr Hope of Fenton is likewise of opinion, that it would be desirable to have a certain portion of old grass upon every arable farm. He considers the want of pasture grass, as the point on which the great bulk of Scotch farmers are most defective; and from the advantages

* It is remarked by Mr Kerr, in his excellent Report of Berwickshire, p. 330, that when good soil, properly improved, has been laid down to grass, and has once become rich feeding land, it appears to the Reporter, that no rent can be afforded for it in tillage, which will compensate to the proprietor, for the after defalcation of rent which must take place when it is again laid down in grass; at least, so long as good pastures produce the rents which they have given in Berwickshire for many years past. This doubtless has induced some proprietors to throw more of their land into grass, and may operate in time to overstock the market with that commodity: but should that happen, the evil will naturally cure itself; and when grass rents fall permanently off, proprietors will readily see their own interests, in letting a portion for tillage.

which he has seen derived by a few of his most intelligent neighbours, from pasturing their lands, he is decidedly of opinion, that if a full third of the county of East-Lothian were kept in grass, as much grain would be raised as is at present, with the advantage of all the additional stock that would be maintained upon such an extended pasturage. He desires to be understood as meaning, that this grass should form a part of the farm under the convertible system, not permanent pasture, which he looks upon as little better than the present system, where pasturage is too little attended to *.

2. *Arguments against old turf.*—The advantage, however, of permanent pasture, is denied by many of the most intelligent farmers in Scotland. Mr Rennie of Phantassie contends that none is requisite, and that whatever proportion of it is kept, occasions one-fourth loss of rent to the proprietor, besides the injury sustained by the farmer and by the public. Though artificial grasses, he observes, may not produce milk, butter, cheese, beef, and mutton, of so rich a quality as old pasture, he is satisfied they will produce a larger quantity; the best proof of which is, that artificial grasses, upon land of equal quality, condition, and situation, always let in East Lothian at more rent than old pasture under similar circumstances. The great advantages of artificial grass is, that it produces food for stock at least one month earlier than old pasture, by which the stock upon it get such a start, that they keep their superiority throughout the whole season, and it is chiefly by stock fed in this way that the early markets are supplied. As to feeding large oxen on old grass, he has had no prac-

* On many farms in Berwickshire, the proportion of grass, I understand, is often nearly one-half.

tice, though he has fed cattle, from thirty to forty stones Dutch, upon artificial grass. Indeed, full three-fourths of the cattle fed in East Lothian are fattened on pasture of this kind; and he knows that cattle so fed, will come one month sooner to market than those of equal condition will from old pastures under similar circumstances. Artificial grass is also preferable for early ewes and lambs, sick horses, &c.; nor does he think it more liable to suffer from dry weather than old grass on similar soils, if properly managed. On these accounts, there is not, in his opinion, the smallest necessity for old grass, neither is it practised in East Lothian, except perhaps in a few cases, where there happens to be some hilly or rocky pasture, there it may be for the interest of the tenant to let it lie in permanent pasture, but not otherwise.

Mr Brown of Markle adheres to the statement of Mr Rennie, and observes, that the difference of value betwixt *turf land*, and land kept under convertible husbandry, must vary much, according to soils and other local circumstances; but in such a farm as the one in his possession, he would not have the slightest hesitation of giving 20 s. *per* Scotch, or 15 s. 8 d. *per* English acre, more for land, if freedom of management were allowed, than he would, were the landlord to say, "You must keep it constantly under grass." He farther adds, that he would make the like difference upon the number of acres proposed to be kept exclusively in grass, whether the number was limited to one-half, one-fourth, or one-eighth of the farm in his possession.

Mr Brown, considering the question as meant to elucidate the superiority of convertible husbandry, further observes, that it is not an easy matter to calculate the difference of produce in twenty-one years, where land is kept under permanent pasture, instead of being broken up and cropped in a regular way, as it is not only the direct loss upon the turf land, but likewise the indirect loss sustain-

ed by the arable land, which must be held in view, when that difference is taken into consideration. So far as the question is limited to the quantity of land kept in permanent turf, he would answer generally, that the public loses three firlots of grain for every stone of beef or mutton that is obtained by feeding cattle or sheep upon that turf.

Now, under the supposition that equal quantities of wheat, barley, oats and beans, were cultivated, these three firlots would, according to Winchester measure, be somewhat more than three bushels and three-fourths of a bushel; and their value, at the round average of 50 s. *per* quarter, would be about L. 1 : 3 : 6, from which sum falls to be deducted 11 s., the estimated value of seed and labour for raising that quantity of grain, leaving a balance of 12 s. 6 d. as an offset against the value of each stone of beef or mutton obtained by feeding cattle or sheep upon the old turf land. On the other hand, Mr Brown estimates twelve stone of beef or mutton to be a full average of the annual produce *per* acre from old turf, (in a few cases it may be more, but in many others it is less); and as he considers half a guinea *per* stone, avoirdupois weight, to be a higher price for beef or mutton than 50 s. *per* quarter is for grain of all sorts, it follows from these calculations, that L. 1, 4 s. Sterling *per* acre, is annually lost by adhering to the system of keeping land exclusively in old turf, independent of the manifest injury done to the old tillage land, from the necessity thereby occasioned of persisting, in consequence thereof, in a similar exclusive system of management.—But taking the question in another point of view, the result is similar. Supposing five quarters of all grains to be the average of arable crops, and every man who knows the old turfs of England will allow that a low average is taken, the value thereof at 50 s. *per* quarter is L. 12, 10 s. Deduct from that sum L. 5 Sterling, the estimated value of seed and labour, and L. 6, 6 s. the value of beef or mutton produced

from an acre of turf, there remains a balance of L. 1, 4 s. Sterling in favour of convertible husbandry.—Mr Brown, however, does not contend for constant tillage. He only advocates the cause of alternate husbandry, considering that system to be the best one for promoting the interest of the proprietor, the tenant, and the public.

Artificial grasses, Mr Brown adds, will certainly feed oxen of an ordinary weight during the period of their growth, and answer equally well for dairy purposes. No doubt there is a period of the year when young grass will not feed, say from the middle of July to the middle of August, because the first growth has then come to maturity, whilst the second has not commenced; but these things need not hinder the farmer from having a fresh bite of older grass for his cattle till the season furnishes a fresh supply of artificial grasses. This may be obtained from a field of three or four years old *hained* grass, as well as from a field which has remained in grass for ten times that period.

It is admitted, that a field of perennial grass is beneficial on every farm; though the advantages of such a field, for the stock of breeding ewes in spring, are rather problematical, unless it is regarded as a proper place for giving them turnips till the grass season arrives. In fact, upon all well-managed farms, where stock and corn husbandry are conjoined, turnips are the chief food given to ewes, in the months of January, February and March, after which a supply of grass is generally obtained.

The extent of perennial pasture, (not old turf), necessary in a farm of 500 acres, must differ in almost every different situation. In Mr Brown's case, 60 acres answer very well, though with others a greater quantity may be necessary. But this grass, with the exception of a field unfit for ploughing, is regularly broken up by the plough when four years of age, to the great benefit of the rest of

the farm; yielding then heavy crops of corn, and requiring little manure for several years.

Mr Hume of East Barns, and Mr Hunter of Tynefield, concur in these observations. They state, that one acre of sown grass will not only in general afford more keep the first year, than can be procured from it the two following years, but also comes much earlier in spring; and that grass, let for pasture at L. 7 or L. 8 *per* acre the first year, would not give above L. 5 or L. 6 the second year. The oat crop, they are likewise of opinion, is not better for the land remaining longer than one year in grass,—an opinion generally entertained, unless in cases where the ground remains longer in grass than is consistent with the length of modern leases.

Mr Hood, a most intelligent farmer near Kelso, remarks, that people will think very differently upon the subject of old turf; and before any satisfactory answer can be given, the age of the grass, size of the farm, and the nature of the soil, should be stated; for, upon a small farm, old grass is neither necessary nor profitable; upon a large farm, a small proportion of old grass *may be very convenient.* Upon the whole, however, he does not think it is either necessary, or for the advantage of a farmer, upon a lease of twenty-one years, to keep any part of his land in old grass; nor is he convinced, that it would be for his interest to do so, even upon a lease of longer endurance. The generality of soils, if properly laid down, will produce more grass the first year than they will do in any subsequent one, for ten years at least. He has a field of originally good land, which has been pastured for thirty years, and he is satisfied, that it neither produces more grass, nor feeds better than it did fifteen years ago; he can see, therefore, no advantage to a tenant, by allowing any part of his farm to remain so long in grass. His opinion regarding old turf, may appear singular in some districts, but it is founded upon experience.

Dr Coventry also is of opinion, that inferior lands should not remain long under pasture. Light, open, sandy or gravelly soils, or lands full of vegetable mould, may be kept in grass longer than the poorer clayey grounds; and very light lands may, for a time, even improve when under grass; but in the course of three, four, or more years, in consequence of the clay soil sinking down, and becoming over close and cohesive, the commonly cultivated herbage plants, (clover and rye-grass), depart, and the native plants slowly form a sward, which is often, in poor soils, of a bad species, and is never of much value.—If these lands were once put into good condition, and well laid down to grass, they might remain perhaps four or five years in pasture without disadvantage; but even then, a longer period might increase their tenacity, and bring back all the evils arising from over-closeness of texture, producing over-wetness and infertility.

Mr Walker of Mellendean is confident, that no farmer in Roxburghshire, upon a nineteen or twenty-one years' lease, can lay down land to remain permanently in grass, without being a loser thereby to a very considerable extent. He does not know what might have been the difference in the weight of his old cattle, had they been fed upon such pastures; but after working them to the month of August, and continuing them on pastures of one and two years' old, while there was grass in the fields, he has sometimes sold them in the spring following, at the weight of 120 stones English, and his wedders and draft ewes generally average about 20 lb. English *per* quarter.

Mr John Shirreff seems to me to refute several of the arguments used in favour of old turf. He states, that new pastures are much fitter for sheep than old, because they are much earlier in spring, and much more vivid and fresh during the winter months. It is admitted, he observes, by some of the most strenuous advocates for old

turf, that clover and rye grass has at least a fortnight's start of old pasture in spring; though it will often actually have near a month's, on similar soil, in the same situation, whether both have been eaten, or both saved during the preceding winter, unless the clover have been eaten so close as to injure the plants. This, he observes, is a circumstance of the greatest moment, as the salvation or destruction of a flock may depend on a few days' keep, instead of a fortnight's, at that critical season of the year, the spring months.

In regard to the cattle fed on old turf, he maintains, that very large oxen are but unprofitable stock, in most situations, and always easier and cheaper fed at the stall, than in the pasture field; also, that it is contrary to a farmer's interest, either to breed, or feed cattle so heavy that they cannot pasture at their ease on any land, but the soft carpet of an old turf field. As to giving turnip to stock ewes in spring, previous to dropping their lambs, he contends, that pasture of two years' standing, or even what had been pastured for one season only, namely, the year immediately preceding, will equally well answer that purpose as old turf will. Moreover, that drawing turnip, and giving them to sheep, or any other stock on old turf, *never broken up*, as recommended by the friends to that system, is cheating the rest of a farm of manure, and occasions a heavy loss, as this old turf does not carry grain crops, turnips, &c. as it would do, if under convertible husbandry, and so return its due proportion of manure to the other fields of the farm, while it allowed them to be refreshed with pasture in their turn.

As to the objection, that in seasons extremely dry, the grass on convertible land is burnt up, he alleges, that if land be well prepared and laid down with plenty of good seed, particularly white clóver, and be not too hard stocked, that is, too close eaten down, early in the season, clo-

ver and rye grass will bear nearly as much drought on the same, or similar land, as turf will; at least he ventures to think, that when a field of good clover and rye grass is burnt up, old turf, on similar soil, will at least be singed. In an extremity, some oats or barley might be cut green, to carry on stock till rain restored vegetation. And he thinks, a very small sacrifice of this sort would bring good clover and rye grass to *the par* of old turf, on the only occasion on which they do not rank above it in this country, for any really useful, profitable, known purpose, to which either species of produce can perhaps be applied.

In regard to the variety of grasses in old turf, Mr Shirreff observes, that this mixture is a palpable loss. There is, thus, a quantity of the rotten herbage of noxious and rejected plants always mingled with the fresh and edible, which certainly can neither be so palatable, safe and nutritive to the stock, or so economical in consumption, as when a few plants only are cultivated, which are *known* to be grateful, salubrious and nourishing to the animals intended to consume them, and which consequently make no waste in doing so. And this is perhaps the reason that new pastures are in general more equally eaten than old. Where noxious or rejected plants abound, we find the herbage rank and little touched, while particular parts of the field, free of this trash, are eaten to the bone.

Mr Shirreff adds, that there are few, if any of the plants which constitute the cultivated herbage of the Scottish husbandry, which do not spring again immediately, and vigorously, as soon as cut or cropped over, provided they be not allowed to run to, or towards full bloom; or, which is still worse, to form seeds. The case is different with many of the plants in old turf, several of which are puny, and also slow of growth. Some have a short paroxysm, as the *cinosurus cristatus*, which, when the stem and panicle withers, stands an unsightly object the whole autumn,

and even winter after; and being as tough as wire, must annoy the cattle in mouthing the fresh herbage with which it is mixed.

Many plants, which are found in all old turf, are rejected by cattle, sheep, and horses, as the common daisy, *(bellis perennis)*, common crowfoot, *(ranunculus repens)*, &c.; this last indeed, when in seed, is so pungent, that were any considerable quantity of it, taken into the stomach of an animal, violent inflammation and death would inevitably follow; and, probably, many cows that are said to be witched, or die of the woad-ill, &c. may suffer from this very plant. He farther asserts, that old turf is full of various fungi or mushrooms, many of which are deleterious, and some of them, when taken into the stomachs of animals, the most deadly vegetable poisons in nature.

Ragwort *(senecio Jacobæa)*, is *only* eaten *by sheep* when it is very young. This is a plant that covers many old turf fields. The meadow-sweet *(ulmaria)* is a beautiful, fragrant plant, common in old meadows, if inclined to peat; but horses and cows reject it; sheep will eat it.

On the whole, Mr Shirreff is satisfied from experience and observation, that, admitting always that the soil and climate is nearly the same, a field of clover and rye grass well laid down, will, on the average of the two first years, keep, or feed more stock, than one of old turf, of the same extent will do, in the same years, and as the flush of herbage of the clover, &c. will be much earlier as well as greater, more profit must be derived from its consumption.

One of the principal disadvantages of old grass lands kept for hay, and occasionally pastured, is, the quantity of manure that is wasted in top-dressing them. There can hardly be a question, that dung should be covered with earth, so as to derive the full benefit from it. How absurd then must not the practice be, of laying such quantities of

rotten dung on the surface of grass land, so frequently the case in England! Dr Coventry most justly condemns this practice as the bane of good husbandry, though it is necessary to follow it where the exclusive grass system is maintained. He observes, that there must always be great waste, wherever putrescent manure is spread on the surface, instead of being covered in by a portion of the soil. In the decomposition of putrescent matter, every one must be sensible of the ascent of a part of the materials. Animal and vegetable substances, if exposed to the atmosphere in a putrifying state, will almost entirely dissappear. The loss may be greater or less in different cases; but every hour the manure lies spread on the surface of the ground, it must of necessity suffer waste. On the contrary, if ploughed in towards the end of a summer-fallow, or with a horse-hoed crop, it will be most effectually blended with and covered in by the soil, and all that essential part which, becoming volatile, is dissipated into the atmosphere, will be retained for the nutriment of the after crops *.

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* There is no instance in Berwickshire, where the farmer is bound to manure his grass land; perhaps the most injurious system that could be devised in a tillage or arable district. Of this practice, as a system in husbandry, there is hitherto no experience in Scotland, where there does not exist that vast demand for hay, which claims such extraordinary protection for meadows in some parts of England; neither is meadows or old grass land, hay, so much in repute in Scotland. Round gentlemen's residences, perennial grass land is occasionally mown, for supplying hay to their own stables. But sufficient rest and recruit is always allowed, by several years' pasturage, to repair any waste of fertility that may have been occasioned by the hay crop. See *Kerr's Berwickshire*, p. 136.

It may be observed, as an additional proof in favour of the convertible system, that though in East Lothian the meadow lands are all converted into arable land, and there is hardly any portion of natural grass, yet, as Mr Curwen remarks, the rents paid in that county, are higher than in any part of Great Britain, and have been progressively increasing ever since that system was established. Hitherto, therefore, no deterioration of the soil has been felt, which, after such a period, may fairly be taken as conclusive, that the soil, so managed, will yield at all times with equal productiveness.

Being anxious to bring this important subject to the test of calculation, I prevailed upon some of my farming correspondents, to direct their attention to this mode of investigation; and Mr Thomson of Bewlie, in Roxburghshire, having stated it as his opinion, that though old grass, if let at a moderate rent, might be of some advantage, yet that no farmer could afford to pay as much rent for land in grass, as he could do, under the alternate husbandry of white and green crops, I was thence induced to inquire, what would be the fair difference of rent, if one-eighth part of a farm of 500 acres, were kept in permanent pasture, compared to the rent that could be paid for the rest of the farm. Mr Thomson's answer is, "I think that the rent ought to be one-third less *per* acre than the rest of the farm." According to this doctrine, if a farm of 500 acres was worth L.2 *per* acre, one-eighth part thereof, or 62½ acres would only be worth L. 1 : 6 : 8, *per* acre; the difference being 13 s. 4 d. *per* acre would amount, on 62½ acres, to L. 41 : 13 : 4, which, on a lease of twenty-one years, would be a loss to the landlord of L. 875, besides periodical interest.

But that is nothing, compared to the detriment sustained by the public, when land, fit for the convertible system of husbandry, is retained in permanent pasture. The fol-

lowing is the calculation made by Mr Thomson, of the difference in the value of the produce of the two systems, in the course of a lease of twenty-one years.

Produce of an acre for four years, cropped according to the four-course shift husbandry, and as applicable to the soil and climate of the district in which Mr Thomson's farm is situated, namely, the upper part of Roxburghshire.

1. Turnips, value of crop,				L. 5	0	0
2. Wheat, value of ditto,				10	0	0
3. Grass, value of ditto,				3	10	0
4. Potatoe oats, value of ditto,				7	10	0
			L.	26	0	0
To expences for ploughing, sowing, and hoeing turnips,		L. 1	15	0		
To ploughing, sowing, harvesting, &c. the wheat,		2	15	0		
To grass seeds,		0	12	0		
To ploughing, sowing, cutting, &c. oats,		2	0	0		
	L.	7	2	0	7	2 0
Value of produce for four years,				L.	18	18 0
						5
Twenty years,				L.	94	10 0
One year,					4	14 6
Produce of one acre for 21 years,				L.	99	4 6

The produce of two acres in old grass, for 21 years, will feed five sheep *per annum*, leaving a profit of 15 s. each, that is, L. 1 : 17 : 6, *per* acre *per annum*, which for twenty-one years, (on the

Carry forward, L. 99 4 6

Brought forward,	L. 99	4	6
principle on which the profit on the turnips should be stated), amounts to * -	L. 39	7	6
Balance *per* acre, in favour of the convertible system of husbandry, - - -	L. 59	17	0

But if it were admitted, to obviate any objection to these calculations, that the profit of a sheep *per annum*, including the fleece, is 21 s. each, yet still the balance *per* acre, during a lease of twenty-one years, would be L. 44, 2 s., which sum, according to the above statement, may be placed to the credit of convertible husbandry.

* On this subject, Mr Trevelyan of Nether Witton remarks, that a real good pasture, will carry and feed four Southdown sheep *per* acre, the fleece alone of which is worth seven shillings, and if turnips are given the sheep in the winter, the calculation is five sheep *per* acre; from the profit of which, however, the expence of the turnips is to be deducted. Another zealous friend to old turf observes, that the species of land to be continued in old grass, seems not to be properly understood; land that would only keep two and a half sheep *per* acre, and the profit of these only 15 s. *per* sheep, is not the soil for which the warmest advocates in favour of old grass would contend. The soils that are generally found most advantageous to keep in permanent grass, are strong loams, or clayey soils, improper for turnips, and which improve the longer they are kept and depastured in grass; such lands as will carry six or seven sheep *per* acre through the summer, and one and a half, or two sheep of the store flock, through the winter. Upon farms of clayey soils, it is contended, that a breeding ewe flock could not be kept without a certain portion of old grass land, and soils of this description are in much greater proportion than turnip soils. But where land will keep more sheep than Mr Thomson calculates, the arable crops will be proportionally more productive,

On a farm of 500 acres, let for twenty-one years, the loss of value in produce, would therefore amount to the enormous sum of L. 29,925, in the one case, and L. 22,050 in the other; and where the land was more valuable, the loss both of rent and of produce would be still more than the sums above calculated.

It may be observed, that the straw produced on the farm, and the turnips, when eat off by sheep, will fully answer all demands for dung that is wanted by the farmer.

Mr Thomson's system of retaining a part of his land in grass, for four or five years, and then throwing it again into the rotation, has already been described, in the section of Rotations, under the head of Double Rotations.

Mr Brown of Markle, some of whose calculations, respecting the profits of convertible husbandry, upon soils such as those of his own farm, (which are chiefly of a clayey nature), have been already noticed, has also favoured me with his sentiments upon the same subject, as applicable to soils naturally qualified for carrying turnips. According to the views he has taken of the question, it appears, that were old grass land, calculated for turnips, to be broken up by the plough, and brought under a regular course of husbandry, the quantity of live stock which might be fed upon turnips and clover, during a-six course shift, of turnips, barley, clover, oats, beans and wheat, would not be much inferior to what is fed at present upon these lands, whilst they are exclusively kept in a state of pasturage. But, allowing the bean crop to make up for that deficiency, he considers the disposable produce of the other three corn crops, that is, what remains after the home consumption is supplied, as an entire acquisition to the national stock, and he estimates the value of that disposable produce at L.21, or L. 3, 10 s. upon each acre of land, regularly cropped and cultivated, according to the rotation above mentioned. Hence, it appears, that a sum not less than L. 73, 10 s. Sterling, is lost

during a twenty-one years' lease, upon every acre of land, naturally qualified for carrying turnips and clover, that is retained as old turf, or kept in a state of permanent pasture,—a sum which exceeds the fee-simple value of many of these lands, were they brought to the hammer, and exposed to sale by public auction.

These doctrines are amply confirmed by the calculations of Mr Murray of Kirkland-hill, who makes the following statement of the produce of lands in cultivation, compared with lands in permanent pasture:

	Produce per annum.		
100 acres in fallow and wheat, -	L. 1000	0	0
100 acres in oats and clover, - -	1125	0	0
100 acres in beans and wheat, - -	1500	0	0
Divide by 3)	3625	0	0
Average produce *per* 100 acres,	1208	6	8
Produce of 100 acres in permanent pasture, at L. 3, 10 s. *per acre, per annum.* -	350	0	0
Difference in value of produce *per* 100 acres,	858	6	8
Loss *in produce, per* acre, *per annum*, by neglecting convertible husbandry, -	L. 8	12	6

From the above sum, however, the expences of cultivation are to be deducted; and if it were admitted, that such expences may, in some cases, amount, to even 50 *per cent.* of the gross produce, a deduction to that extent, would reduce the loss, from neglecting convertible husbandry, to L. 4 : 6 : 3 *per* Scotch, or L. 3, 9 s. *per* English acre.

I do not recollect any agricultural subject, where the arguments on both sides are more fully stated, than in the preceding extracts from the communications which I have received from so many intelligent correspondents; and it is with great diffidence that I venture to submit to the reader's consideration, what seems to me the result of the whole investigation.

1. I certainly think, that it is highly desirable to keep one or two moderate-sized inclosures, containing from 10 to 20 acres, according to the size of the farm, near the residence of the farmer, in grass, for the feeding of cattle and sheep, provided the soil be naturally calculated for it, or is thoroughly drained, and improved by manure and cultivation. The utility of this measure is acknowledged by almost every one of my numerous correspondents, without admitting at the same time, that such field or fields should never be broken up, or that the same part of the farm should always remain in grass.

2. Where the finer sorts of sheep are bred, it is contended, that it is necessary to have some old turf, where the ewes may drop their lambs, and where they may be fed with turnips, or any other article in the spring season. But old turf is quite unnecessary for either of those purposes; Mr Rennie of Phantassie, and Mr Brown of Markle, having ascertained by experience, that on dry land, which is the only proper kind of soil for ewes to lamb upon, grass of two or three years old is as good as that of twenty.

3. It is likewise contended, that it is necessary to have some old turf, as a resource for the stock to go on, in case of any spring or summer uncommonly dry, such as happened in the year 1810, when it was a long time before the artificial grasses made their appearance, or could be either cut or pastured. On loams, however, artificial grass may always be pastured earlier than old turf, unless in sea-

sons when uncommon wet weather prevails; and other substitutes have been already suggested.

4. Lands apt to be overflowed, or which have been converted into water-meadow, it is evident, cannot be cultivated for grain crops; and there may be *some very rich old meadows*, which it would be desirable to preserve in the dairy districts *; but with these exceptions, there seems to be no doubt of the infinite superiority of the convertible husbandry, to the landlord, the tenant, and the public; and it can hardly be questioned, that there are many hundred thousand acres in England, now in permanent pasture, which might be advantageously subjected to that system. Old grass lands also, may be broken up, and if judiciously and moderately cropped, may be laid down again in grass without loss †. Indeed Mr Shirreff observes, that where calcareous matter has not previously been applied to such lands, he has no doubt, that with the assistance of that most powerful manure, both the quantity and quality of their herbage would be much improved.

It is ascertained by experience, that by feeding sheep with turnips on old grass, a perpetual crop of hay may be obtained, without injury to the land thus treated, by giving to the sheep, the produce of as many acres of turnips, as the grass field consists of. The land, of course, receives their droppings, which never fails to raise a good crop of hay. This plan, however, is objected to on various grounds. It is in

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* Many would go farther in regard to the preservation of old meadows, thinking it a pity to touch them, on any account. It has been ingeniously remarked, that a similar reason might be given for continuing to plough with four horses, that it would be a pity to spoil so pretty a team.

† It has often occurred to me, that much land, under permanent pasture in England, might be applied to the production of lucern, the most valuable of the grass tribe.

particular observed, that though eating drawn turnip on old pasture grass, very much improves the quality of the herbage, by the droppings and urine of the sheep stock, as well as by the effects of compression from treading, which destroys the tribe of musci, and encourages the growth of trefoil or white clover, and also of any of the finer species of the perennial grasses which may have possession, yet that such a plan can only be adopted, as the means of restoring the beauty and luxuriance of a *favourite field* of pasture, (for instance a lawn, or gentleman's park), and not as a *profitable* mode of consuming turnip; for the succeeding crop of hay, will exhaust the fertilizing effects of the sheep manure. Were the field on which the turnips are eaten, broken up for oats, to be followed by turnip, a grain crop, then clover, &c. more justice would be done to a farm *in general*, and more valuable produce raised. Mr Mitchell of Balquharn likewise observes, that the above mode of obtaining a crop of natural hay, must be greatly to the injury of the arable parts of a farm. In situations where dung cannot be purchased, he is fully persuaded, that every acre of good turnip, consumed in straw yards, or in *byres* (cow-houses), adds to the value of a farmer's dung-hill, L. 6 Sterling.

Suppose 250 stones, at 7d. (being inferior to clover and rye-grass hay,) the value would be	L. 7	5	10
Deduct, for expence of making, and all other charges, - - -	1	5	10
	L. 6	0	0

Thus the produce would only pay the manure yearly bestowed on it.

It is remarked also, that these droppings of the sheep, would produce a crop of wheat, which would be a much better and more profitable application; and that it is a

most exceptionable practice, to apply manure in any way, for the purpose of raising hay from the grass land, at the expence of the arable.

In regard to the breaking up of land, and laying it down again to grass, I have already given my sentiments at large, in a paper to the Board of Agriculture *. Mr Logan is of opinion, that the best method of breaking up old grass land, where it is supposed grubs may injure the crop intended to be sown, is to lime on the sward, after being very bare eaten, at the rate of 25 or 30 bolls of shells to the acre, and then to have a thin furrow before the winter: the lime and frost will destroy the grub, and make the land harrow well †. Mr Trevelyan of Nether Witton, however, strongly recommends paring and burning, as the most effectual means of destroying all the variety of grubs with which old pastures abound. If lime be cheap, 100 bolls *per* acre may assist in the destruction of grubs, and will insure an abundant crop of turnips, if the land be suitable; but liming alone, he thinks, will not destroy the grub effectually. Many farmers prefer breaking up land with the plough, during the winter, for a crop of oats in the spring; beans next, and then wheat or oats, if the land is of that quality to stand it, but if not, oats, turnips, barley, and clover. Others contend, that a good crop of beans is seldom or ever raised after oats from old pasture, although the occupation of the land in grass has not exceeded three or four years, except the soil is upon a tender deep loam.

As to laying down strong land, (that is to say, soil on a clay bottom), to grass, Mr Logan advises, and, indeed, has

* See Communication to the Board of Agriculture, vol. iii, p. 6.

† It would appear, from Mr John Shirreff's remarks, Addenda No. 5, that lime has not the effect of destroying grubs effectually.

found it the best and most profitable plan, after summer fallowing, and manuring the land with lime and dung, to ridge it up for the winter, and to sow it with barley in the spring upon a fresh furrow, by which system, a good crop of barley, and a plentiful growth of grasses, may be obtained; whereas, when wheat is sown in the autumn on fallow, the land gets so hard during the winter and spring, that the grass-seeds cannot be sufficiently harrowed in, without pulling up a great deal of the wheat, by which means, the seeds are not covered, they do not vegetate equally, and some not at all; and the land always has a hardness when in grass, which it loses by the spring working for barley; after barley, the land is always more mellow, and the seeds vegetate more kindly.

When old pastures are broken up, if the soil is good, there can be no doubt, that they might be replaced in a more productive state than ever, and much profit got, by adopting the following rotation: 1. Oats; 2. Summer-fallow with lime; 3. Wheat; 4. Drilled beans with dung; 5. Wheat; 6. Drilled beans; 7. Wheat; 8. Summer-fallow with dung; and, 9. Wheat and grass-seeds.

On the whole, it appears, that the retaining of any considerable portion of a farm in old turf, or permanent pasture, is, in general, injurious to the landlord, the tenant, and the public; nor can any system be more absurd, than to bind a tenant, to lay on his grass land, the greatest proportion of the manure produced on his farm, and to reserve but a moderate quantity for his *arable*. How easy would it not be, to double the value of any estate, where such a system is adopted, by appropriating the manure of the farm, to turnips and other green crops, and by the adoption of the convertible system of husbandry?

Sect. XIII.—*On Haymaking.*

In many parts of Scotland, the farmers are not sufficiently attentive to the making of hay. They let it be too ripe before it is cut down, for the sake of the seed. Some of them thresh the seed of the grass hayed, sometimes for their own use, and sometimes to sell. After the hay is cut down, they suffer it to lie on the ground, as the scythe left it, for ten, twelve, or more days, when often the side next the ground is damaged, and discoloured, the upper side over-withered, and the fine juices of the hay evaporated, being often literally bleached with sun and rain, like flax; by means of which, much of the substance is lost. In a great many instances, after it is ricked, they let it stand on the field for many weeks, when it receives much damage, often from rain, and the too long exposure to the atmosphere of the surface of so many ricks; and a great space of land is also damaged by the long continuance of the hay upon the ground. A great many do not thatch their hay-stacks sufficiently to keep out the winter rain and snow, and the consequence often is, that the rains penetrate the stack, and sink far down, by which the hay is damaged.

The following improvements, in regard to the management of the hay crop, are recommended from several respectable quarters. 1. After the grass has arrived at its full growth, but before the seed is formed, it should be cut down; by this means the full juice and strength of the plants will remain in the crop. 2. The hay ought never

to be threshed, for there is no strength or substance in threshed hay; but wherever seed is wanted, a particular part of the field should be reserved for the purpose of furnishing it. 3. After the hay is cut down, Mr John Shirreff recommends, that it should be cocked as soon as the state of the herbage will admit of it, for reasons to be afterwards explained. He knows at the same time, from experience, that there are few seasons in Scotland, where it is possible to rick clover immediately after the scythe. There is almost always a dew or dampness, on a luxuriant crop of red clover, fit to be mowed, even in the finest weather, till the afternoon. It is impossible to get mowers to sacrifice half their time to the convenience of another, and it is impossible to get rid of this dampness, but by turning, or even in some cases tedding, or rather spreading it out. 4. After it has been a short time in small cocks, it ought to be put up in what are called tramp ricks; and this to be done in a fine sunny day. The sun and air gradually win it, and, if the weather is favourable, it may, in ten or twelve days, be put up in the stack, after which it ought to be immediately well thatched. In rainy weather, it may be difficult to prevent hay from being somewhat damaged; but much may be done, by embracing every fair day to turn the hay, or spreading out the small ricks, and putting them up carefully in the evening. After it is in the tramp rick, it may be said to be safe, unless the rain continues long; and whenever it is thought to be in such a dry state as to keep, no time should be lost to put it into the stack.

Dr Anderson, in his Essays on Agriculture, has given several useful directions for making hay from artificial grasses, which has been practised with much success. According to his system, the hay ought to be tedded as little as possible, as the leaves of red clover, in a rainy day, are

so brittle, that they break off, and are lost. It is better to turn the swathe over as whole as possible *.

Dr Coventry has published some most judicious observations on haymaking, in his Treatise on Live Stock, printed *anno* 1806, the substance of a part of which, it may be proper to submit to the reader's consideration.

The cultivated herbage in Scotland, he remarks, which is generally composed of rye-grass and red clover, with small proportions of other species, as white clover, yellow clover, rib-grass, &c. should be cut *much more early than it commonly is*, especially if it abounds with a great propor-

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* The form of the rick is a point of great moment in haymaking. In Wensley-dale, in Yorkshire, they seldom make long ricks, but round ones, nearly cylindrical, till they are about two-thirds of its height, when a conical form takes place; the rick is then carried up to so regular a point, and roped so closely and nicely, that neither wind nor water can penetrate. In short, the ricks thus formed, are less injured by time or tempests, than those that are covered with straw, which is the common practice in most counties *. The reason is obvious, because the stacks that are covered with straw, are seldom carried regularly to a top; they are generally too broad there, and the straw is then laid on very injudiciously, and without method; the rick consequently in time takes water, and a considerable part of it becomes putrified litter. By the carelessness of servants, and the want of a judicious and philosophical knowledge in most farmers, respecting the figure and finishing of ricks, their losses cannot but be considerable. The true figure of what is generally called a round stack or rick, is at the bottom part the lower frustrum of a spheroid; nearly at the middle, the diameter is about one-eighth greater; then it is gradually raised, and finished in a neat conical manner.

* It is said, that if the ricks are equally well built, thatching with straw must be preferable. But, on the other hand, it is contended, that if straw is at all admitted, the tops will be carelessly done, as its defects will be concealed.

tion of the first-mentioned species. It matters nothing, though many stablers and grooms, prefer rye-grass so far advanced as to have its seed mostly ripe; for as the horses under their charge, usually receive, at the same time, a good allowance of corn, the hay does often perhaps little more than divide the other food, bear bulk, and comfortably fill the stomach. Such hard fodder is reckoned a more lasting bait: and certainly it is, if one shall judge by the time required to eat it, and perhaps to digest it, and not by the time it supports the animal, or the degree of nutriment it contains. Grooms having the refuse seed as a perquisite, are sometimes led to prefer the ripened produce, from motives which overmatch their virtue *: a ton of ripe rye-grass hay, has frequently yielded a quantity of seed, worth 30 *per cent.* of its own price. For the husbandman, however, it is of great consequence to be aware, *that the under-ripe grass is*, for his purpose, by far the most valuable, a fact not so generally understood, or attended to, as it ought to be. Old stale rye-grass, made into hay, is not greatly superior to the straw of corn; while the young herbage, so prepared, is very fattening—a thing quite analogous to what takes place with several other sorts of vegetable produce. The stems and footstalks of the leaves of many plants, as coleworts, cauliflower, asparagus, &c. which afterwards harden into a stringy, dry, hard, or insoluble substance, *is originally* a soft, nutritious mucilage. Another instance, shewing the advantage of cutting herbage of

* Mr John Shirreff remarks, that not only grooms, but stablers who take horses at livery, prefer wiry hay; for two reasons, 1. Horses eat less of it, and, 2. The seed it yields puts money in their pockets. The fault lies with the consumers. Let them put a *proper value* on fine, fragrant, delicate hay, and the farmers of Scotland will soon supply it. Till then, it is not for their interest to do so.

different sorts *in its early state*, occurs in the case of pigs *, fed on clover, rye, and buck-wheat, (*polygonum fagopyrum*), they thrive on these articles, particularly clover, if cut sufficiently early, *i. e.* when considerably moist and succulent. But *after* the flowering period, and even long *before* the seed is ripe, much of the produce is rejected by them; or, if they are obliged to use it, they pine over it, or make small progress; and such an application of the vegetable produce becomes then not economical. Indeed all gramineous and other plants, given as food to cattle, should be cut, in a duly young, but not in a very young state. The difference in the value of the hay, from rye-grass, &c. produced in one district, compared to another, would appear to be principally owing to the plants, in one situation, being less ripe and hard, when mown, than in others. Cultivators in different quarters, are not uniform in their mode of practice as to this matter. The conduct of some, however, in respect to the early cutting, and the careful and speedy drying and securing of their hay, is commendable.

Besides these considerations, several advantages attend an early cutting. It contributes to preserve the plants in vigour, not only for the after part of the same season, but for succeeding seasons and crops, and it retains them in the ground longer than they would otherwise continue. Most gramineous plants, which have been long under culture, seem little capable of recovering themselves, when they are cut down only after their stalks are full grown. In every species of corn, and in the annual grasses, (of which description rye-grass, probably, has a tendency to become, after some years' cultivation in certain grounds), when the seed is filling, the entire plant becomes somewhat hard and dry; then fewer and feebler buds spring, to form new roots and

* The same observation may be extended to horses and cattle.

stems, and at length the dwindling produce ceases to survive.

Mr John Shirreff has remarked, that if it were possible to make any considerable quantity of hay, under an actual shed, there could be no doubt of obtaining it of superior quality to that made in the sun. The flavour of grain, and its straw, when put into sheaves immediately after being cut, is very different from, and superior to, in colour and smell, that which has been allowed to lie exposed to the atmosphere for one night, or even a few hours, especially of hot sun-shine, or damp weather, after being reaped; and the middle of the sheaf of grain, thus treated, is invariably the fairest and sweetest grain, and the straw of that part of the sheaf the finest.

The whole art of haymaking, as Mr Shirreff justly observes, resolves itself into two parts: 1. Cutting early; and 2. Drying the herbage as much as possible in the shade.

In regard to the first point, he insists, the more luxuriant the plant, and the quicker its growth, the more succulent, fragrant, finer, and consequently the more nutritious and valuable will be its herbage, in a young state, whether green or dried. Nature and principles are the same every where, and the same results will follow from *haying*, (if that expression may be more generally applied than it commonly is), the tea plant of the East; the tobacco of America; and the clover and other herbage of Great Britain, or of any other European country.

As to the second point, Mr Shirreff defines hay, properly speaking, to be, "the juice of plants or herbage dried in the leafy and fibrous part of that herbage." It is not, therefore, he maintains, the fibrous matter, palpable to the touch, that constitutes *any part of the hay;* it is the inspissated juice, condensed in the dried fibrous matter of the herbage, that really constitutes that article. In order that those juices may be preserved in their greatest abundance and perfec-

tion, it is essential, that the herbage in which they are contained, should be dried as much *in the shade*, as is consistent with the expence attending that mode of curing. By drying herbage for hay in the shade, is meant cocking or ricking that herbage. The outer exposed surface is always bleached and insipid. That which is below, and *in the shade*, is grateful to the palate, and fragrant to the smell.

Mr Shirreff further adds, that if the inspissated juices of dried herbage, be extracted by infusion from the fibrous matter, the hay passes into the infusion, and the fibrous matter itself is nothing but the straw of the plant. Hence *hay tea*, given to calves, is a nourishing diet, whilst the fibrous matter that remains is of no value.

These observations seem to me so just, that I was glad to find, that a plan had been adopted by Mr Church of Hitchill, by which such important objects might be obtained. It was originally practised in Lancashire, where it is called *tippling*, and is carried on with great success; and Mr Church has ascertained, that it may be executed in Scotland with equal advantage. He considers it to be not only a cheap, but a superior mode of making hay, more especially in precarious seasons, or for making a second crop of clover. It is proper to make *the tipple* as soon as the grass is mown, if dry; if not, it is better to wait till it is so. If the crop is strong, there is a row of tipple placed on each swathe; if light, two of these are put into one row. In making one, a person with the right hand rolls the swathe inward, until he has a little bunch, then the same is done by the left, until both meet and form 8 to 12 lb. weight or thereabouts. This bundle is set up on end against the legs or between the feet. A rope is twisted of the grass, while the bundle is supported in this manner, which is tied round the bundle near the top of it; and from the top are drawn up a few

straggling stems, which are twisted to make the tipple taper into a point, and give it as much a conical shape as possible. After standing a few hours, they become so smooth on the outside, that the heaviest rains seldom wet them through, and when wet they are soon dried again. As soon as ready, they are put into the summer rick, or even the winter stack, if very dry; but are never opened out, or ted, to make them dry, as they never require it. By this method not a leaf is lost, and the hay is nearly as green as a leaf dried in a book. In a moderate crop, one woman will tipple to one mower, and a woman will rake to two tipplers or two swathes. But where the crop is strong, it may require three women to keep pace with two mowers. After the hay is put up in this manner, the crop may be considered as secure, though it may continue wet weather for a considerable length of time.

I HAVE thus laid before the reader, the substance of the numerous communications transmitted to me, regarding the practical details of the Scotch System of Husbandry, which I trust will be found to contain, a number of valuable hints, and more minute information, regarding some particular points, than has hitherto been communicated to the public.

The Author has always been of opinion, that however mysterious the art of agriculture may have formerly been considered, yet that it might be reduced to a few simple principles, and, in regard to some particulars, brought to almost mathematical precision. The reason why that has not yet been effected, to the extent of which the subject was capable, is, either that real practical men have rarely published the result of their experience and observations on agricultural questions, or that those who have written their senti-

ments, have seldom entered sufficiently into detail, so as to explain those minute operations, on the due execution of which its success must in a great measure depend. Besides, it is only within these few years that a judicious and economical system of agriculture has been extensively carried into practice, or the principles on which it ought to be conducted thoroughly ascertained. By the improvements, however, lately introduced into that art, (which the minute inquiries carried on under the auspices of the Board of Agriculture have fortunately brought to light), the principles are at last established, on which the territory of any country, at least of one possessing a soil and climate similar to Great Britain, may be cultivated with profit and success.

I trust, that the preceding details, will contribute to the elucidation of this most important subject; in which case, the attention bestowed in collecting materials for this work, and the preparing it for publication, will be most amply compensated.

CONCLUSION OF PART I.

It may be proper to conclude this extensive inquiry, by, 1. Giving a general view of the improved System of Husbandry established in Scotland; 2. Pointing out the improvements of which it is still susceptible; and, 3. Explaining the means by which that system can best be disseminated in the less improved districts of England and of Scotland, where, from its simplicity and productiveness, joined to the economy with which it is carried on, it may be introduced with great public and private advantage.

I. *General View of the Improved Husbandry of Scotland.*

In a communication from my respectable friend, Sir Joseph Banks, he stated, that "agriculture has derived, is deriving, and will derive, more benefit from Scotch industry and skill, than has been accumulated, since the days when Adam first wielded the spade."

I hope, that the following general view of the improved System of Husbandry as established in Scotland, will justify that observation.

The foundation of improved agriculture is certainly laid, in the best cultivated districts of Scotland, in as great perfection as it possibly can be in any country. The farms are usually of a proper size;—the farmers, in general, have capitals adequate to their cultivation;—they are bound to pay the landlord such a proportion of the value of the produce, as renders it necessary for them to be industrious and economical, and to acquire all the skill in the art of husbandry to which they can have access;—their leases are commonly of such a duration, as to encourage judicious expenditure in the improvement of their lands, with the prospect of an adequate return;—the covenants contained in their leases are sufficiently fair, being almost, in every case, well calculated to promote, and not to retard improvement.—A liberal system of connexion is established between the landlord and the tenant;—and the characters of those, by whom the labours of agriculture are carried on, whether farmers, apprentices, farm-servants, or common labourers, cannot be surpassed by those of the same description of life in any other nation. The experience of Scotland, has likewise proved, the superior advantages of having married servants on large farms; by means of which, the population of a country is increased, and the

kingdom filled with sober, healthy, and industrious subjects *.

The various points which require to be attended to, previous to the actual cultivation of an arable farm, are in general ascertained, by the practice of Scotland, with a degree of precision hitherto unexampled.

The farmers of that country have established it as a principle, that the position of a farm-house and offices ought to make a material difference in the rent of a farm;—they have ascertained the best construction of farm-houses and offices, uniting economy and convenience;—they have pointed out the best size and shape of fields, by means of which, much land is rendered productive, that would otherwise be wasted in useless fences, and much labour in their cultivation saved, insomuch that where the fields are large, five ploughs will do as much work as six can in small fields, and every other part of the cultivation of a farm will be executed with less power, in nearly the same proportion;—they have likewise pointed out the inconveniences attending expensive fences, which are more ornamental than useful to a country;—they are fully aware of the importance of draining, and have practised it with success;—they have ascertained, that by the introduction of good roads, the value of a country will be greatly increased;—their instruments of husbandry are cheap, and well constructed; their ploughs excellent, and peculiarly well calculated for general use; and their carts superior to any other for agricultural purposes;—their live stock are valuable, well calculated for their soil and climate; and their horses, not only well adapted for the labours of husbandry, but maintained in such a manner, as to render them capable of performing a great deal of la-

* These particulars are explained in the three dissertations of Part II.

bour ;—in some cases they have tried a partial use of oxen with success, more especially in threshing-mills ;—nor do they neglect to pay a proper degree of attention to the articles that ought to be raised upon a farm, according to its soil, its climate, its elevation and exposure, and its situation in respect of markets.

In regard to the actual cultivation of an arable farm, many points of infinite importance have been ascertained by the experience of Scotch farmers, in a manner the most satisfactory. They have ascertained the proper length, breadth, and shape of ridges ;—in the use of putrescent, and still more of calcareous manures, they have made great improvements ;—they have proved, beyond the possibility of doubt, the advantages of deep ploughing ;—they have completely ascertained the advantages of summer-fallowing, where soils are either of a clayey nature, or are incumbent on wet subsoils ;—they have carried on with success, some essential improvements in the cultivation of various crops, in particular in regard to those important articles, turnips and potatoes ;—they have also brought to a high degree of perfection the course of crops calculated for different soils ; and the rotations for which each description of soil is respectively best adapted ;—they cultivate in drills, beans, turnips and potatoes, in a manner not to be surpassed for its excellence, and they have laid it down as a maxim, that crops of grain should be drilled, where the land is sown in spring, particularly where it is subjected to annual weeds* ;—they have also made some improvements in harvesting grain ; in particular, the plans of cast-iron pillars and bosses, are admirable inventions for a wet climate, by means of which, the harvesting of grain,

* It must be admitted, at the same time, that the drilling grain crops, is more generally practised in England, than in Scotland, but that is not the case in regard to beans, turnips, and potatoes.

and of pulse in particular, may be completed in half the usual time;—they have brought the cleaning and threshing of grain to the highest degree of perfection; almost every individual, who has any claim to the character of a farmer, having fanners in his possession, and threshing-mills having become almost equally general;—they have carried to a great extent, the practice of soiling horses, and even cattle; and have proved, by decisive experiments, the superiority of that plan;—they have restricted the practice of preserving permanent pastures within reasonable bounds, and have proved, that the convertible system of husbandry, may be generally adopted, to the great benefit of the landed proprietor, and of the public.

These are circumstances connected with the improved system of husbandry established in Scotland, the existence of which, I trust, is abundantly proved in the course of the preceding observations; and though many of these practices are brought to as great perfection in some parts of England as they are in Scotland, and though some of them have even been derived from England, yet there are few districts in the southern division of the island, where they are carried to the same perfection, or where they are so systematically established.

The result of this system is in the highest degree satisfactory. In all the corn districts, or those in which convertible husbandry is attended to, greater crops are raised, and higher rents are paid *, than in any other part of the British dominions, and, what is equally remarkable, the

* Mr Curwen, in his report to the Workington Society, for the year 1810, p. 86, states the rent of land in East Lothian, at L. 6 *per* acre, and the produce, 40 bushels of wheat, 60 of barley, 90 of oats, excellent beans, weighty crops of turnips, and most luxuriant crops of clover.

condition or circumstances of those engaged in agriculture, evidently bear the like marks of abundance. Without enlarging upon these matters in this place, I may only add, that the produce of crops, in good seasons, and in fertile districts, is calculated to be from 32 to 45 bushels of wheat, from 48 to 55 bushels of barley, from 60 to 75 bushels of oats, and from 30 to 35 bushels of beans, Winchester measure, *per* statute acre. As to green crops, 30 tons of turnips, 3 tons of clover, and 8 tons of potatoes, *per* statute acre, are no uncommon crops. Any system that can produce crops of so superior a description, even on fertile soils, is well entitled to imitation, more especially when it is accompanied with great economy in the expence of cultivation.

Forty-four years have now elapsed, since one of the ablest writers on agriculture in modern times, (Lord Kames), pointed out the imperfection of Scotch husbandry; and it is singular, that, with hardly any exception, these imperfections have since been removed. Had it not come from such high authority, it is hardly possible to credit, that within the memory of so many persons now living, our agriculture could have been so miserably deficient as it seems to have been at that time. The learned Judge represents, our instruments of husbandry as sadly imperfect; —our draft-horses as miserable creatures, without strength or mettle;—our oxen scarcely able to support their own weight, and ten going in a plough, led on by two horses; —the execrable husbandry of infield and outfield generally established;—the ridges high and broad, in fact enormous masses of accumulated earth, that would not admit of cross-ploughing, or of proper cultivation;—shallow ploughing universal;—ribbing, by which half the land was left untilled, a general practice;—summer-fallow, though common in three or four counties, yet only creeping on in others;—over the greater part of Scotland, a continual

struggle for superiority between corn and weeds;—the roller almost unknown:—no harrowing before sowing, and the seed thrown into rough uneven ground, where the half of it was buried;—imperfect rotations of crops;—little skill in harvesting;—no branch of husbandry less understood than manure;—potatoes in general propagated in lazy-beds;—swine but little attended to;—and very few farms in Scotland justly proportioned to the skill and ability of the tenant *. What a contrast to the description I have just given, of the husbandry of Scotland at the present period!

Among the circumstances which have occasioned so extraordinary, and so rapid a change, in the husbandry of Scotland, that turn for reading, by which the Scotch farmers are so peculiarly distinguished, though already pointed out, ought to be more fully dwelt on. Nothing can be more absurd than to imagine, that the communication of information by printing, which has promoted the advancement of every other art, should be of no use in agriculture. It is not recommended, that a practical farmer, should take for gospel what he reads in print, and should alter his whole system accordingly; but let him reflect on what he reads, let him try, on a small scale, useful experiments, and let him extend them when they are found to answer. At any rate, he may find in books a number of useful hints, which may be entitled to further inquiry. Hence the writings of Kames, and those of Anderson, Dickson, Home, Wight, &c. in Scotland, and those of Arthur Young, Marshall, and others, in England, gave a great spur to the improvement of Scottish husbandry, by directing the attention of the farmer to the principles of that art to which their lives were devoted.

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* See Kames's Gentleman Farmer, Appendix, Art. 1, On the imperfection of Scotch Husbandry.

The practice adopted by the Scotch farmers, of travelling to England, and in some cases even to foreign countries, removed a number of prejudices, which could only be speedily, and completely eradicated, by ocular inspection.

No circumstance, however, had a more powerful influence in promoting a spirit of improvement, in the northern part of the kingdom, than the formation of a Board of Agriculture; and from that æra, in the opinion of the best informed agriculturists in Scotland, may be dated that wonderful change which has taken place in Scottish husbandry. In consequence of that establishment, as remarked by an intelligent Scotch farmer *, " a general desire seized all ranks to promote internal improvement. By means of that institution, great numbers of new men were brought forward to public notice, whose names otherwise would probably never have been heard of; and these being chiefly practical people, in other words, persons professionally concerned in farm management, agriculture, by their endeavours, was rescued from the hands of theorists, and a revolution, of no small extent, accomplished in rural affairs. Before the Board was instituted, the bond of connection amongst agriculturists was slender, and served few useful purposes, each standing on his own strength and information, and unless in the case of those who travelled about to collect useful information, (and the number of those, at that time, was not great), they knew little more about the practices of conterminous districts, than those of China, or the most distant countries. The establishment of the Board did away at once all those evils and difficulties: a common fortress, erected for the benefit of all agriculturists, and to which each might resort for advice and protection, was immediately recognised. It made farmers,

* See Brown of Markle's Treatise on Rural Affairs, vol. 1, p. 20.

who resided in the most distant quarters of the kingdom, acquainted with one another, and caused a rapid dissemination of knowledge amongst the whole profession. It did more—the art of Agriculture was brought into fashion; and this being the case, old practices were amended, new ones introduced, and a degree of exertion manifested, which had never before been exemplified in this island. The numerous surveys of husbandry, executed under the authority of the Board, were of singular advantage also, because they brought to light the practices of every country; and whilst they pointed out the obstacles which lay in the way of improvement, stated the most effectual methods of removing them. The very collision of argument which such discussions occasioned, was of advantage, causing agriculturists to investigate the principles of the art which they professed, and inducing them to search after new channels of improvement. In a word, the Board, in a few years, collected a mass of agricultural information hardly to be equalled, and not to be exceeded, by the accumulated stores of every other nation."

Mr John Shirreff likewise attributes the rapid improvement of Scotland, to the interesting information communicated by the Board of Agriculture, at a time, when the minds of men were qualified, from education and observation, to put a proper value on it, and whilst their capitals, arising from that powerful stimulus to improvement, leases, enabled them to execute those improvements which this interesting and various information suggested.

In a communication from Mr Charles Alexander, a respectable farmer near Peebles, it is observed, that the publications of that Board, and other recent works on farming, in particular "The Farmer's Magazine," printed for the express purpose of promoting the views of the Board, were read with avidity; that a spirit of inquiry was thus excited, and that improved agriculture was universally con-

sidered to be, *a sort of coining of money.* Hence a large share of capital, that did not originally belong to agriculture, and never was acquired by it, was thrown into the scale; an unprecedented competition arose, for purchasing and leasing land; an increased spirit of agricultural improvement was the result, the effects of which soon became almost universally conspicuous.

The exertions of many other public-spirited institutions, in particular those of the Highland Society of Scotland, were of the greatest service; and a number of provincial societies, in their several districts, propagated the spirit with success *.

But information and skill would have been accumulated in vain, had it not been that, by the extension of paper currency, and the establishment of banks and branches in almost every county in Scotland, the farmers were furnished with credit, and supplied with the readiest means, of converting the produce of their farms, into the circulating medium of the country, and were thence enabled, not only to continue their exertions, but to lay out considerable additional sums on the improvement of their several occupations.

These circumstances combined, in addition to those already pointed out, will, I trust, account, in a satisfactory manner, for the great advancement that has been made in Scottish husbandry.

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* The advantages of provincial societies are ably explained, by Sir George S. Mackenzie, in the Ross-shire report, p. 332.

II. *Improvements of which the Husbandry of Scotland is susceptible.*

Let us now consider some particulars which may be entitled to the consideration of Scotch farmers, for the improvement of the systems they have adopted. It must not be imagined that they have nothing to learn; and it has been well observed, that though the Husbandry of Scotland, in general, has recently been so much improved, as naturally to suggest very high notions of its peculiar excellence, yet if the farmers of that country were to entertain an idea, that the system is already nearly perfect, it would be attended with mischievous consequences. I am convinced, however, that the farmers in that part of the united kingdom, instead of a blind adherence to any system, however plausible, will always be ready to listen with due attention, and, where it is proper, will be willing to adopt, any new improvement that can be suggested in the art of husbandry.

1. The ablest farmers in England have laid it down as a rule, that all the straw of a farm should be converted into dung, by the live-stock feeding on something much better than straw; and this opinion is founded, not on theory, but on the practice of common farmers, whose scale of business is great, and whose success is decisive. They maintain, that when stock is fed upon straw alone, they are always lean, and the dung they produce of little value; whereas, when they are fed on rich food, there is no end to the fertility of which such a system might be productive. One of the great advantages which the corn distillers derive from the possession of farms, results from this circumstance, that the refuse of the distillery, enables them to feed a number of cattle, and to employ their straw principally as litter to be converted into dung. With the same view, the farmers of Norfolk have

bought oil cake at 16, 17, 20, and once at 22 guineas *per* thousand, for the purpose of feeding cattle, and converting straw into dung. There is reason to believe, that when the farmer can sell beef at the price of 8 d. *per* lb. and has a proper quantity of litter, that he can safely give, 12 guineas *per* thousand for oil cake *.

There are various other ways, by which putrescent manure can be increased, as, by cutting the crop as low as possible; cutting and gathering the stubble; collecting weeds, and converting them into manure, &c.; but augmenting green crops, so as to convert the straw into dung, is unquestionably the most important.

Dr Moodie of Clackmannan, with a view of increasing putrescent manure, recommends employing boys and girls with baskets, or light wheel-barrows, and a small shovel, to gather the dung that is dropped on fields in pasture. It would in this way be done at a small expence. He calculates, that each cow or ox, would produce from five to ten cubic yards in a summer, and that of the richest quality, the greatest part of which would have been totally lost by evaporation, and the remaining part would have injured the pasture, at least for that year. But where the soiling system is adopted, all this trouble is rendered unnecessary, and the whole dung is not only obtained, but at much less expence.

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* In Norfolk, they frequently buy what are called foreign manures. One individual, who occupies a light land farm of 1500 acres, had, at one time, a compost heap for turnips that cost him L. 900. That exertion, however, is surpassed by Mr Walker of Mellendean in Roxburghshire, who, in one year, limed 304½ English acres, at the rate, on an average, of 43 bolls of shells *per* acre, (4 Winchester bushels each boll); the price, *per* boll, at the kiln was 1s. each; the expence of carriage 3s. *per* boll, the distance being twenty-four miles; and the total expence, in one year, amounting to no less a sum than L. 2552, 10s. Sterling.

2. The proper management of dung is also a subject of great importance not yet perhaps fully understood. When dung is ploughed in shallow, the air, rain, sunshine, and wind, alternately act upon every portion of it that is exposed, or that becomes so by successive surface operations. Hence, it is of importance to cover the dung sufficiently, and not, by repeated tillage, to expose fresh portions of it to the action of the atmosphere. Where fresh dung is used, it is contended, that it should be deposited at the depth of eight or nine inches from the surface. It is thus safe, from the immediate action of those agents, which rob it of the substance most nutritious to plants. It may be placed at such a depth, as will render it accessible by the roots of the crops; at the same time it has been ascertained, that the roots are fed by dung thus deposited, even before they reach it; a doctrine confirmed by Mr Scott's mode of cultivating carrots above detailed *. Mr Parker of Munden in Hertfordshire, also, ploughed in his dung, nine inches deep, and has found by experience, his crops improve under that system. These are circumstances well entitled to the consideration of intelligent farmers.

3. The use of scufflers might be extended in Scotland with great advantage. It would save ploughings, when the land is worked in autumn for the reception of crops in spring, as, in that case, it should not be ploughed again, but merely scuffled. If the ridge is narrow, the scuffler might be made to fit its breadth; and by one horse going in each furrow, the farmer can get on to wet land much sooner, than if, in ploughing, one of the horses were permitted to tread on the ridge itself. Some scufflers are light, and calculated for two horses, but others, much heavier and stronger, are used to save ploughings in summer fallows, and also for

* See p. 282.

working bean stubbles, when they are in such condition as to be fit for wheat or spring corn.

4. The skim coulter, invented by the celebrated Ducket, is another instrument by which the expence of cultivation may be diminished; for by its means a single ploughing is more effective than several, more especially where weeds or any sort of stubble are to be turned down. No plough ever yet invented will effect this object so well as a skim coultered plough; by means of which, all weeds, stubble, fragments of mown tares, and clover, as well as long dung, are so completely buried, that succeeding shallow tillage does not disturb them; and they are consequently left to dissolve, without the gaseous effluvia of fermentation escaping into the atmosphere. This is a point of the greatest consequence, and a neglect of it has in many cases destroyed the effect of ploughing down green crops as manure *.

5. Spring sowing, without spring ploughing, is a favourite practice in some of the best cultivated districts of England. On strong land in Suffolk, after scarifying merely, they sow barley, or oats, after fallow, or beans, pease, or tares, after what is called a bastard fallow. In all these cases, the tillage is given in autumn, and the crops are put in so early, that they are infinitely cleaner and

* Mr John Shirreff remarks, that the advantages of a skim coulter, for the purposes above mentioned, are evident; but it must not be supposed, that these can be obtained, without additional power of labouring animal, or more exertion from the same animals, which, if oppressive, will be the most expensive of the two. If two horses can draw a plough raising a furrow-slice six inches deep, if you attach the skim to bury the surface, say two and a half inches of it, the labour of the animals will be increased at least 50 *per cent.*, when the stiffness, and consequent resistance of the lower part of the furrow-slice are taken into account. In most cases, Mr Shirreff thinks that it would be better to use two ploughs.

earlier, than if a spring ploughing were given them, which would have considerably prolonged the sowing. For beans, this practice has been found peculiarly excellent, and has been attended with such success, that it has spread from Suffolk to Essex, where they have not hitherto tried it much with barley and oats. In so far as regards oats, this plan has long been the uniform practice in all the more improved districts of Scotland, where the farmers are accustomed to sow their seed on the winter furrow, or on a furrow that has received the benefit of frost.

6. The late Mr Scott of Craiglockhart lamented much, that in some parts of Scotland, the improvement of land was often executed but imperfectly. In many instances the liming was done sparingly, and the ploughing was shallow and superficial; in consequence of which, many fields, after being to a certain extent improved, rapidly reverted to as bad a state as ever, and, in some cases, were rather worse; whereas, had these fields got a full dose of lime, and been thoroughly ploughed and cultivated, and laid down for pasture, such a sward of grass might have been procured, as, with proper management, might have kept the land in a fertile state in all time coming. These observations, however, are only applicable to the less improved districts of the kingdom.

7. A plan has occurred to me, which may be entitled to the attention of the Scotch farmers, and of those who may be inclined to adopt their system. It is admitted, 1. That by soiling, one acre of the same land, under a crop of clover, is equal to two pastured. 2. That the crop of oats, after soiling, is better than after pasturing, even with sheep. And, 3. That it is desirable to cultivate a proportion of tares, to fill up the interval between the first and the second crops of clover. If one acre soiled, is equal to two pastured, and if the succeeding crop of oats is better, it would certainly be advisable to soil two years in succession,

even though more grass could be got by pasturing the second year of clover. But an excellent crop for soiling might be secured in two ways: 1. By feeding sheep with turnips, on the field soiled, after the second crop of clover is cut; or, 2. By dibbling tares in the following spring,—a practice which some Norfolk farmers have successfully adopted on lands in grass. The expence of seed and labour would be inconsiderable, compared to the benefit that would be derived from the practice; and tares, so essential for the soiling system, would thus be secured. The tares, not wanted for soiling, might be converted into valuable hay. Where this plan is tried, the winter tare ought to be preferred, being the hardiest, and consequently it may be dibbled as early in spring as may be judged necessary. In some soils and climates, applying gypsum the second year might improve the crop.

I cannot conclude this Section, without earnestly entreating the peculiar attention of the Farmers of Scotland to these hints; which are principally intended, with a view of exciting discussion, and of promoting inquiry and experiment. The Farmers of Scotland have already materially improved the art of agriculture; and it will not be difficult for them, with the skill and capital they have already acquired, and the abilities and persevering industry by which they are so eminently distinguished, to render their system of husbandry as perfect, as the nature of their soil, and the circumstances of an unfavourable climate, can possibly admit of.

III. *On the Means of disseminating the useful Practices of the best Scotch Farmers, in the less improved districts of England and Scotland, and on the public and private advantages thence to be derived.*

Throughout the greater part of England, until about the commencement of the American war, there was but little inducement to make any great exertions for the improvement of agriculture. The rents were low; the markets good; the climate favourable; and, in many extensive districts, leases were almost unknown, and, strange to tell, were not even wished for by the farmer. The landlord and the tenant jogged on together; the one satisfied with an inferior rent, and the other with his share of a moderate produce*. Indeed, so long as the common field system exists, by which alternate ridges are occupied by different tenants, and sometimes belong to different proprietors, improvements are impracticable upon all land that comes under that description; and though Bills of Inclosure, or, more properly speaking, regulations for the local division of common property, have, in some degree, alleviated the evil, it is far from being completely removed.

In so extensive, and taking it on the whole, so fertile a country as England, many branches of agriculture, in the course of successive ages, must have made considerable progress, and some of them, more especially the management of stock, and of grass lands, are most successfully attended to. The Flemish husbandry, first established in Hertfordshire, under the auspices, and at the expence of Cromwell, extended itself into the neighbouring districts:

* The average produce of wheat in England, is calculated at 22 bushels *per* statute acre. There can be no difficulty, under a proper system, in raising it to 30 bushels, and even more.

the culture of turnips was introduced into Norfolk; regular rotations of crops were pretty generally adopted; information was spread, by the examples of intelligent landlords, and by the publication of many valuable works on agriculture. The spirit, however, was still languid and inert, and agriculture was scarcely considered by our statesmen *, as any material source of national prosperity, until its utility and importance were publicly recognised, by the establishment of a national institution, for the purpose of promoting its improvement.

In Scotland, improvements commenced later; but they were carried on with more spirit. Every part of England was ransacked to collect information; examples of good husbandry were not only introduced, but improved upon; the farmers were encouraged to industry and exertion by long leases; their farms were properly arranged, and that system of agriculture was established, which I have endeavoured to describe, and which has already extended itself over all the most valuable districts in that part of the kingdom.

To those who will take the trouble of examining the account I have given of the Scottish system of husbandry, it will probably appear, that there are a number of particulars therein contained, which are well entitled to the consideration of English farmers; and though it is impossible to specify all those which might be adopted, (for they must vary in different districts), yet it may not be improper, briefly to point out some of the most essential, whether applicable to the landlord, or the tenant.

In regard to the landlord, the following particulars will require his attention:—The farm ought to be of a proper size, and not less than from 300 to 500 English acres;—The rent

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* See Appendix, No. V.

ought to be such, as to enforce industry and exertion, and not so low as to encourage indolence;—The leases *, to a farmer in actual possession, ought to be granted for 21, and to a stranger for 25 years; for the latter is entitled to expect additional encouragement, if he comes from any distance;—The covenants contained in those leases, ought to be fair, and even liberal;—The farm-buildings should be placed in as central a situation as possible, and the house and offices should be made convenient and comfortable;—The formation of good roads, to be considered the most essential of all improvements, and as the surest means of adding materially to the value of an estate.

As to the tenant, it may be proper to keep the following particulars in view:—The farm should be divided into fields of a proper size, and the ridges formed of a proper length and breadth, suitable to the soil and climate, and to the nature of the course of crops to be adopted;—The lands should be ploughed as deep as the staple of the soil will admit of;—The ground should be kept thoroughly clean, by fallowing or drilled crops;—Turnips, potatoes, and beans, ought always to be drilled, hand-hoed and horse-hoed; and some intelligent Scotch farmers maintain, that pease, and all crops of grain sown in spring, should be drilled also;—Two white crops of grain in

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* Mr Pringle of Ballencrief observes, that the English proprietors ought to have it pressed upon them to grant leases; without them it will be in vain to look to the farmer for any substantial improvement. An addition of rent may have the effect to quicken a tenant's industry: this, however, may be pushed too far. Improvements, and the ability to bear them, ought to precede the great increase of rent; and he apprehends that in this case, as in many others, the cause is often mistaken for the effect. Sometimes, perhaps, they change places, and become alternately one and the other.

succession not to be permitted;—A threshing-mill and fanners ought to be considered as indispensably necessary on every farm;—Two-horse ploughs ought to be preferred, and swing-ploughs, (without wheels), except in so peculiar a soil as that of Norfolk;—Single-horse, or even double-horse carts, ought to be used, in preference to waggons, as infinitely better calculated for the purposes of a farmer *;—To lessen the expence of farming, economy in the feeding of horses ought to be particularly attended to; and where circumstances will admit of it, the breeding of horses necessary for the use of a farm, instead of purchasing them at high prices from other districts;—The system of soiling horses and cattle, ought to be adopted, which diminishes the expence of their maintenance, and increases the quantity of dung;—A greater extent of land, ought not to be kept in permanent pasture, than is absolutely necessary for the uses of the farm;—The dung used on a farm, ought either to be put in the furrows, or centre of a drill, or so deep, that it will not be liable to be exhaled by the sun.

It is hardly necessary to add, that the practices above enumerated, are not peculiar to Scotland, and that many of them even originated in England; but, on the whole, they are more systematically pursued, and more deeply rooted, in the more improved districts of Scotland, than

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* Mr Church of Hitchill remarks, that he has often been astonished at the extravagant waste of labour, by the use of that unwieldy machine, the waggon. He has seen a large waggon, drawn by four gigantic horses, traverse a field for a few scattered sheaves, which could easily have been drawn by a one-horse cart. The celebrated George Culley observes, that he has long been a great advocate for single-horse carts, and is sanguine enough to believe, that the time is not far distant, when they will become nearly general, and waggons totally or nearly disused.

in any part of the united kingdom, with which I happen to be acquainted.

I shall now proceed, to give some account of the introduction of the Scotch systems of husbandry into various parts of England, where, though it has certainly not uniformly succeeded, yet the exceptions are but few, and can easily be accounted for.

A public-spirited and intelligent country gentleman, (James Brougham, Esq. of Howis, near Penrith), informs me, that he has farmed entirely on the Scotch system for four years, his bailiff and most of his ploughmen being from Scotland; and he is satisfied, that he has done more work, and to better purpose, than he could have done, had he followed the mode of farming adopted in many parts of the same county, where a different system is pursued. His predecessor in one of his farms told him, he could never get turnips to grow; that he never had potatoes sufficient to supply his family, and quite scouted the idea of sowing grass-seeds. This was the opinion of all the neighbourhood: they now see, however, that it only required the turnip and potatoe crop to be properly cultivated, and the land to be clean, and in *good heart* when sown with grass-seeds, to grow as fine crops of turnips and of clover and rye-grass, as can be seen in any part of the county.

Among the advantages of the Scotch system, Mr Brougham remarks, that the farm-buildings in Scotland are in general much more convenient than those in England. In a large farm, there is the difference of at least the labour of one man throughout the year, between a convenient and an inconvenient set of offices. Threshing-machines are also a very great saving, and would certainly be erected wherever leases are given. Considering the high price of horses, servants' wages, corn, hay, &c. he is convinced, that there would be a saving of above 10s. *per* acre, on

the average of the arable land of England, were the Scotch system of working and feeding horses introduced, and the buildings, &c. on a more convenient plan*.

Mr Brougham adds, that the system adopted by him has, in several instances, been imitated by others. Some of the gentlemen farmers near him, seeing that his horses did so much more work than their own, have got some of the same breed. He intends to get a good stallion, and to shew him in the county next year. The farming horses in his neighbourhood are of a small size, having been crossed with a sort of half blood, until they are become the most useless cross-bred animals to be seen any where.

The Scotch system of husbandry has also been established, on a great scale, in Oxfordshire, on the estate of Mr Stratton. Mr Wood, who had taken Tracy farm, near Enstone, sent me the following contrast of agricultural economy between his system, and the one practised by a neighbouring tenant. The English farmer had going, at the same time, in one field, six ploughs, with five oxen in each; four ploughs with horses, three of which had four horses in each, and one had five. The whole oxen and horses were particularly good, and all going a-head of one another in the furrow, of course each plough had a holder and driver, making 20 men and boys, 30 oxen, and 17 horses; in all 20 people, and 47 cattle and horses, to yoke 10 ploughs. Mr Wood had on his ground adjoining, eight ploughs going, employing in all eight men and 16 horses. Surely such a difference of management as this speaks for itself! One farmer was so much convinced of his error, that he borrowed a Scotch plough for a trial, and has since given an order for six to be sent to

* Were long teams prohibited, the saving would probably be a great deal more.

him from Scotland; perhaps his example may, in time, be followed by others *.

Admiral Bentinck has successfully introduced some branches of the Scotch system into that district of Norfolk called Marshland. In October 1809, he invited some farmers to see a Scotch plough worked; and seven of those present, immediately ordered one each. Lord William Bentinck has taken a farm in that neighbourhood into his own hand, and has established there a young Englishman as his bailiff, who is well acquainted with the Scotch system, and convinced of its advantages. By his means liming, (a practice totally new in Marshland), will be introduced, which, with drilled green crops, and stall-feeding cattle, will be the first experiments tried.

The late Mr Wolstenholme, who resided near Weymouth, to whom I had recommended a Scotch bailiff, informed me, that the new system answered incomparably well in Dorset. He ploughed strong land with two horses a-breast, with reins, and no driver, and the plough worked much easier with two horses, than the country plough did with four; the expence of a driver and two horses is thus saved; the horses turn at the land's end, in half the compass; the mould-board turns the furrow cleaner and more completely over, consequently buries the surface better, leaving no green edge to grow; it saves more

* The prejudices in some parts of England, against the introduction of swing-ploughs, with two horses a-breast, are astonishing. A gentleman who had tried one, could not prevail on a neighbouring farmer to imitate his example. He could not afford, he said, to try such experiments. Many farmers suppose, that wheels are necessary to keep the plough out of the ground, as if that could not be effected by a skilful ploughman, with an instrument properly constructed.

than half the expence of harness, as, exclusive of two sets, instead of four, the harness is made much lighter, with hempen traces and hempen halters.

Mr Wolstenholme considered the Scotch system as certainly cheaper, and that it raised better crops, the ground being better tilled, and in better season. He was of opinion, that the Scotch husbandry ought to be considered as enabling the farmer to meet *new rents*; without it, he was certain that many of these rents could not be paid, where the poor-rates, tithe, and revenue-tax, joined to the rise on land, fall so heavy; and even now, if corn were to fall to its former prices, he much doubted if they could stand it. His neighbours had all been frequently over to examine his implements, and to see how they were used, and he had no doubt, would (at least the most liberal) follow the example. He farther observed, that one cause of the miserable farming now seen is, the poverty of the tenants, and their taking farms four times too great for their capital. Now the Scotch system, lessens the expences at least half, while it raises the produce; the result is obvious. It also has a strong tendency to increase knowledge on this most useful subject, to excite emulation, and consequently to encourage and promote new discoveries.

Major Dallas of Tremanney near Welchpool, has established this system in Wales, where he is carrying it on most successfully. He has been the means of introducing, into that part of the kingdom, the two-horse ploughs, Scotch carts, and threshing-mills, and, on an average, about fifty of each are now annually made, by a Welch carpenter and smith, from the models given them. The Cheviot breed of sheep has also been introduced, and, above all, the Scotch mode of drilling turnips, by following which system, a neighbouring farmer raised, to his great astonishment, 40 tons *per* English acre.

In some places, Scotch farmers may not have succeeded,

owing to the want either of skill or capital; but wherever they have been properly encouraged, and have not been deficient in those two most essential articles, they have in general shown the most convincing proofs of the utility of their system.

If it is admitted, that in some districts of England, the Scotch system of husbandry might be introduced with advantage, the next question is, what is the best mode of effecting that object? With that view, I have drawn up the following

Plan for transferring the Husbandry of Scotland into England.

If any proprietor of land in England, is convinced that it is for his own, and for the public interest, to alter the system of husbandry adopted on his estate, the following plan is submitted to his consideration.

To the young and active landlord, it might be expedient to examine upon the spot, the real state of Scotch husbandry, in the more improved districts, to see the manner in which it is conducted, and the effects that have resulted from it, and to ascertain how far such a plan is applicable to the estate he possesses.

If an excursion to Scotland is either inconvenient or impracticable, it would be necessary to consult with those who are thoroughly acquainted with the system proposed to be adopted, cautiously avoiding such as are more likely to attend to their own interest, than the advantage of their employers.

If the proprietor has a farm in his own occupation, it might be proper to procure a superintendant or bailiff from Scotland, whose example might tend to remove the prejudices of the farmers in the neighbourhood, against the new system which it was proposed to establish.

If any farm, from 300 to 500 acres of arable land, were accessible, it might be proper to let it to some industrious Scotch farmer, with a view of opening the eyes of the other farmers to the advantages of the new system.

The proprietor must necessarily make up his mind to the granting of leases for twenty-one years, to the natives of the county, and of twenty-five years, to any stranger brought into it, otherwise he need not expect that an improved system will be introduced.

The leases should be granted on liberal terms, with regard to covenants, but with a proper increase of rent, partly perhaps depending on the price of grain, to prevent any material defalcation in the relative income of the estate.

The outlays of the proprietor, must depend upon his ability to expend money on the improvement of his estate. What is executed by a tenant, is in general done with economy and judgment; but it is not right to cripple the exertions of a new tenant, by compelling him to lay out, on permanent improvements, that capital, that ought to be devoted, to the purchase of stock, &c. and to the cropping and manuring the soil.

If these measures were generally adopted, there is every reason to believe, that the income derived from at least ten millions of acres in England, might be doubled, and the produce considerably increased.

Some recommend the plan of sending the sons of farmers, for one or more years, to be taught the art of husbandry, in the districts where it is most skilfully practised. This is a slow, but, at the same time, a sure mode of obtaining the object in view, provided the young men are obliged to put their hand to labour of every kind, and are not suffered to ramble idly about the country.

But, on the whole, the introduction of new farmers, where they can be procured, is the best plan to be adopted. There must be an example of a new system exhibited,

and that on a large scale, before any important alteration can be effected. The example of a landlord will not do alone, for a farmer will always attribute his success, to profusion of expence, rather than to superiority of skill or management. But when a brother farmer succeeds, the case is otherwise; and if he proves the possibility of raising as good, and even better crops, with less expence, his example will, in process of time, be imitated by his neighbours, and an extensive district will be gradually improved. No proprietor will ever think of dismissing his old tenants, if they are disposed to adopt practices, the superiority of which has been established in their own immediate neighbourhood, and who will give a fair rent for the land they occupy. When new tenants are introduced, great care should be taken, to select men who are provided with capital sufficient to go through with such undertakings. By neglecting this precaution, some well-meant attempts have turned out unsuccessfully, which would not probably have been the case, under different circumstances.

The principal difficulty in establishing the Scotch system of husbandry in England, relates to servants. The farmer, as Mr Brougham has well observed, must bring ploughmen with him; they will soon find their consequence, and presume upon it, which may lead to a great deal of mischief, unless very skilfully guarded against by the master. Binding servants to a certain term of service, and to good behaviour, &c. is worth nothing: if a master and his servants come to an actual quarrel, the sooner they are sent off the better for both parties; and from what Mr Brougham has seen, he can easily conceive, that a cross-tempered master, or one who does not understand the way of managing servants, may be left without any, at a critical time, in a strange country, where all the neighbourhood, instead of helping him in his need, would enjoy the prospect of getting rid *of the new settlers in the parish.*

Owing to these circumstances, Mr Wood of Tracy

Farm, recommends employing English servants: they are by no means averse to hold the Scotch plough, and indeed are rather fond of it, and soon acquire all the knowledge which it is necessary for them to obtain.

In regard to the advantages which may be derived from such a change of system, there is every reason to believe, that if the simple and economical mode of agricultural management of Berwickshire, the Lothians, &c. were adopted in the less cultivated districts of England and Scotland, it would not only enable the proprietors of land, in several most extensive districts, to pay without difficulty the taxes to which they are now subjected; but a new source of income would thence arise, whence the public treasury might, through various sources, derive a most important benefit.

By means of this improved system of agriculture, extensively established, there would be such an addition to the produce of the country, as to render the importation of foreign articles, for the subsistence of the people, perfectly unnecessary *. The mischiefs which have resulted from that importation, have been incalculable; *and the prosperity of this country, can never be insured, until it can feed itself* †.

It is impossible that such a change can be effected in a moment, though it may be brought about much more speedily than persons can be aware of, who are not accustomed to carry on improvements on an extensive scale. Indeed, any delay ought now to be avoided. The period

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* For above seventy years, at the commencement of the last century, we fed ourselves, though the price of grain was so low, as greatly to promote population; a sufficient practical refutation of several visionary doctrines, which have been circulated on that subject.

† These opinions are strongly corroborated by the sentiments of several intelligent correspondents in England. Admiral Bentinck states, that the *private advantages*, from the introduction of

has at last arrived, when we must rely, more and more, on our internal resources, than hitherto has been the case; and dreadful as the contest is, if we avail ourselves of those resources, we shall suffer but little by the war, if it is ably conducted, though we should be unfortunately compelled to continue it for some years longer.

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the Scotch System would be, increase of income, and larger produce. The *public advantages*, an increasing revenue, and an augmenting capital, employed in productive industry. Mr Brougham observes, that the public, as well as the private advantages to be obtained, were the Scotch system generally adopted, must be very great: more corn would be brought to market, and more rent would be paid to the landlord. A spirit of emulation would, in the course of a short time, be created between the old and new inhabitants, " and we might see " the East Lothian and Berwickshire husbandry, which has been " so long cast in our teeth, left behind, by the improvers of De- " von and Herefordshire." Mr Brougham adds, it is extremely likely, that a great influx of Scotch, added to the increased demand for agricultural labour, which always accompanies new plans and improvements, might have the effect of materially altering the poor's rates, principally by introducing a better and more adequate rate of wages than at present exists. Mr Wolstenholme was of opinion, that the national advantages resulting from such an improved system as that of Scotland, were great and manifold, as well as obvious, more especially as it would enable us to grow sufficiently for our own consumption, instead of being dependent on others. By the Scotch system, with a proper rotation of crops, that is, never allowing two white corn crops to succeed each other, as much, or more corn, might be produced, than at present, and the intermediate green crop would support and feed a far greater stock, so that the meat market will be better supplied; and the infinitely greater quantity of manure raised by this system would ultimately bring the land into the highest possible condition. This being once effected, all the now poor and waste lands would be ultimately brought into cultivation, to the great increase of the wealth and population of the country.

I HAVE now finished a most laborious undertaking, which the solicitations of a respectable friend, and a sense of public duty, induced me to attempt. However anxious to promote the cause of agriculture, I could never have hazarded such a publication as the present, without, not only a general knowledge of husbandry, and a minute examination of several thousand acres of the best cultivated land in Scotland, but also with the advantage to be obtained, from frequent discussions on the subject, with many of the most intelligent farmers in Scotland. I had also the satisfaction, of receiving from them, the most distinct and valuable statements, of the systems they had respectively adopted, of the principles on which these systems were founded, and of the benefits which had thence been derived, by themselves and the public*.

* Mr Church of Hitchill informs me, that he has made a second trial of the plan of sowing turnip seed on moist dung, when put fresh into a drill, and that the trial was attended with all the success he could reasonably expect. The turnips were fully larger than those sown in the ordinary way, and vegetated as soon as when seed is sown in rainy weather. When the turnip seed is sown upon moist dung, he finds, that the slightest covering of earth is sufficient. It is well known, that it is the steam or effluvia evaporating from dung placed in a drill, which makes drilled turnips vegetate more rapidly than the broad-cast. This gives the drill a decided preference over the broad-cast, independent of other considerations; and it would appear, that the more immediately the steam or effluvia can be applied to the seed, the more likely is the crop to be productive.

ADDENDA.

SINCE the preceding pages were sent to press, some additional information has been transmitted to me regarding several important particulars, which I have thought it necessary to annex, notwithstanding the size which the work has already reached. In order to diminish the bulk as much as possible, a smaller type has been made use of.

No. I.

COMPARISON BETWEEN THE ADVANTAGES OF FEEDING CATTLE WITH POTATOES AND TURNIPS.

BY ROBERT SPEARS, ESQ. DYSART.

THE average produce of potatoes may be taken at 40 bolls, 4 cwt. *per* boll, or 8 tons *per* Scotch acre. Mr Spears has had 55 bolls *per* acre.

The average of an acre of turnips in fertile soils, and under a good system of management, may be stated at about 35 tons.

One acre of turnips will keep the same number of cattle three months, which an acre of potatoes will keep only about

from six weeks to two months, giving the cattle as many of each article as they will eat; but still the cattle will fatten fully more on potatoes in two months, than on turnips in three. By far the best way, however, is to feed with both at the same time: in this way the cattle require no water, which they do when fed with potatoes alone *, and when kept close on the latter, they are apt occasionally to lothe their food, which is never the case when fed with part of each. It is of great importance to have potatoes always at command, particularly in the event of a severe storm, or if cattle are kept on, in a fattening state, late in the spring, when turnips will have run to seed, and when he has no ruta baga. Both impoverish the soil when kept too long in it, and become very indifferent feeding. The following mode of feeding has been practised by a brother of Mr Spears, who is an extensive farmer, and who has at present a number of cattle feeding according to that plan. By seven in the morning, (against which time they are all properly cleaned out), every pair of cattle get one peck and a-half of potatoes *raw*. As soon as these are eaten up, they get as many turnips as they will eat, and then some straw, of which they only eat a small quantity: all this is over by ten o'clock, when the doors of the place where they are kept are shut, and the cattle allowed to remain quiet till two in the afternoon, when the same mode of feeding again takes place, and by five o'clock they are littered up for the night. With this mode of feeding they are growing to fat and weight in a most wonderful manner.

The quantity of manure from the potatoes and turnips will be nearly the same, but that from the potatoe feed will be the strongest. In fact, the richness of dung is regulated by the quality of the article from which it is produced.

The kinds of potatoes mostly used in the neighbourhood of Dysart, are called Doñs and Shanwell Red, said to have been

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* Mr John Shirreff remarks, in regard to no water being required, that that only saves the trouble of giving it, which will always be compensated with the chance of its being wanted, which is oftener the case than is commonly imagined. Besides the water will add to the urine, which is the primum mobile in converting straw into manure.

lately imported from Ireland by Dr Coventry. In deepish loam, and when the season is not over dry, the red produce a very great crop, and are a solid good potatoe, but they don't do so well in lightish dry soils.

The Swedish turnips have been only very partially tried in this quarter of the kingdom. The general opinion regarding them is, that they are fully as valuable as potatoes, but it is a just objection to their being extensively cultivated, that they require an additional quantity of manure, and are of a more scourging nature for the soil. They will only thrive also in a very fine loam. The potatoes have likewise this great advantage, that they are generally out of the ground in full time for insuring a good crop of winter wheat; whereas, after Swedish turnips, the ground can only be prepared for a barley or an oat crop, unless the crop is taken up and stored. Mr Spears's brother raises the greater part of his wheat crop after potatoes, and has nearly the same return as after summer-fallow, a certain proportion of which, however, he always finds it necessary to have on strong soils. Indeed, every farmer occupying a heavy soil will find it for his interest to summer-fallow regularly his land for wheat, as there is no other management by which such soil will turn out so much to his advantage.

No. II.

ON THE CULTURE OF RAPE, INSTEAD OF A SUMMER-FALLOW ON THIN CLAY SOILS.

BY GEORGE CULLEY, ESQ *.

RAPE may be sown from the 24th of May to the 8th of June; but comes to the greatest growth if sown in May. If sown earlier, it is apt to run to seed. From two to three pounds of

* There is a short account of this process in Part I, p. 237, and 238.

seed is required *per* acre, sown by a common turnip-seed drill. But as rape-seed is so much larger than turnip-seed, the drill should be wider. When hoed, the rape should be set out at some distance as turnip plants. The drills should be 26 to 28 or 30 inches, according to the quantity of dung given. As many ploughings, harrowings and rollings, &c. should be given, as may be necessary to make that kind of poor soil as fine as possible, and cleared of twitch, &c.: the produce will be from 25 to 50 *per* acre or upwards. But it is not so much the value of the green crop, (although the better the green crop, the better will the wheat be), as the great certainty of a valuable crop of wheat. The sheep are put on from the beginning to the middle of August; they must have the rape consumed by the middle, or at latest by the end of September, so that the wheat may be got sown on such poor damp soils before the autumnal rains take place. The number of sheep must depend upon the goodness or badness of the crop. But as many sheep must be employed as to eat the rape, by the middle of September, or end of that month at the latest, for the reasons formerly given. The Burwell red wheat, (so called from a village in Cambridgeshire), is always preferred. Poor clays will not allow deep ploughing, consequently that operation must be governed by the depth of the soil. The land must be made as clean as any naked fallow *. There is scarcely an instance known of a crop of wheat, sown after rape, and eat off with sheep, being mildewed, and the grain is generally well perfected. Mr Culley has known a crop of wheat after rape, upon a poor muirish thin clay soil, worth much more than the fee-simple of the land that produced it. He has frequently known land both after rape and after naked fallow, in the same field; and invariably the rape wheat was better in every respect, than that after naked fallow.

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* This can hardly be done, without the aid of a powerful scarifier.

No. III.

FARTHER INFORMATION FROM WILLIAM HUNTER, ESQ. OF TYNEFIELD, REGARDING THE EXPERIMENT HE TRIED OF FOLDING SHEEP, AND FEEDING THEM WITH TURNIPS. SEE PAGE 262.

THE number of acres of turnips given to the 300 sheep were from 20 to 22, and the average produce from 42 to 45 tons *per* Scotch acre, tops included. The quantity of straw used was nearly as follows: 1. The straw of about 75 Scotch acres, the preceding crop of wheat, which had been stacked on purpose for the experiment, say 120 stone tron *per* acre, or 26 cwt.; and the like quantity of the crop of the year in which the experiment was made. The sheep were folded the last week of October and first of November; they were sold in March, and the last of them were sent off in the first or second week of April, so that they were about five months in the fold. During the wet months of November, December and January, any quantity of litter may be thrown in, but regard must be had to proportion it on the whole to the droppings from the sheep, as, in case of there not being enough of droppings disposed in the mass, the fermentation wanted, when put into the dunghill at the end of the season, will not be strong enough. Where saving of straw is an object, a covered penn will be required. Mr Hunter's object was to get as much straw converted into good manure as he could. The manure was given to about 51 or 52 Scotch acres; but had he been aware of its powers, it might have gone farther. In regard to the value of the manure, it may be observed, that manure got at Dunbar, the nearest place where it can be had, but five miles from the farm, costs, carriage &c. included, 8 s. or 9 s. *per* ton.

It is proper, however, to remark, that the above quantity of

straw and weight of turnip would have produced a very considerable weight of manure used in the ordinary way; but the sheep eat much less of the straw than cattle in proportion to their weight and weight of straw and turnips, and that the manure produced is very superior to any that he ever had on his farm.

Last year, (1811), Mr Hunter's sheep, (ten score), were kept in the straw fold, and fetched 2 s. *per* head more than those in the field, sold the two following weeks after they were disposed of. This might in some measure depend on the state of the market at the time, but the sheep in the fold were fatter than the others. Had it been otherwise, and had they even sold for 2 s. less, he would not have inclined to drop the plan of making so much straw into the best of manure. He has always as many sheep in the fold as he can spare litter for. This year he bought upwards of fifty small Highland cattle, worth only L. 4, 7 s. each, which he is soiling in a fold in the turnip field, in the same way as the sheep. They are thriving apace. He proposes to keep them there on turnip until the clover is fit to cut, and he will send them to another farm to be soiled, having little clover on the farm where he resides; he is reserving straw for the purpose. By summer soiling the cattle, he thinks they will be fat in August. He cannot help thinking, that where the land, on an average of years, produces seven or seven and a-half bolls *per* Scotch acre, that it may with attention to soiling be manured once in every four years at least, by the manure arising from its own produce; at least that may be done where there is a due proportion of turnip land, and where that is not the case, perhaps the soiling in summer with green food will do as well.

Mr Hunter adds, that by the practice of soiling, he has now a sufficient command of manure on his farm. In the year 1810, not being so well provided with straw, he had only eight score of sheep in the fold, and in place of giving 320 yards to the score, allowed only 160: whether from want of room to move about, or some other cause which escaped his notice, many of them turned lame before the end of the season; they fattened, however, very well. Last year, he had ten score in the fold, giving 340

yards to the score: the whole surface was covered very thick with straw, not less than ten or twelve pound to the yard; the sheep were turned in, and treated as formerly; none proved lame, and they fattened as usual. The average quantity of straw the same as before; on the whole, from six to ten stone *per* score, according as the weather happened to be moist or dry. Taking every thing into consideration, from seven to eight stone *per* day for each score may be nearly an average. If the spring months are very dry, a little watering added to the droppings of the sheep may be required, or less straw may be thrown in. The two last seasons, when the manure of the fold was carted to the dung-heap, which was never done till the sheep were sent to the butcher, he had three or four inches of the surface of the earth of the fold shoveled up and mixed with the dung, as the soil is always fully impregnated with the moisture oozing through the straw to that extent, and it readily fermented with the rest, if not rather assisting it, and increasing the quantity of manure in proportion. He has not weighed the manure for these two last years, and cannot therefore state the quantity exactly, but he thinks it not far from six large cart-loads, for every acre of straw expended.

The degree of fermentation he allows to take place in the dunghill, when all is thrown up and mixed, is just what he finds sufficient to destroy the vegetative powers of grain left on the straw, or any seeds of annuals that may lie in the mass. He would here observe, that any greater degree of fermentation than the above, in his opinion, takes away not only a proportion of the quantity, but also from the quality of the heap.

No. IV.

A MORE PARTICULAR DESCRIPTION OF MR CHARLES ALEXANDER'S DUNG-PIT.

MR ALEXANDER begins to collect the earth to the pit the first opportunity after its former contents are carried to the turnip field. The place designed for getting the earth is carefully and deeply ploughed the winter before, and again in the spring, and all the stones carefully picked out. As soon as the turnip sowing is finished, and the horses spared, he takes two horses, and two drivers, and two coup carts, with a labourer to assist the drivers in filling their carts, beginning at one end of the place where the earth is to be taken, and proceeding regularly taking off a spade deep, (about eight inches), the carts always alternately filling and emptying, and laying on the earth in the pit, each cart-load laid close to another, until a layer of a foot deep is laid over the area of the pit, then beginning in the same way with another layer, until the whole is brought to the level that corresponds to the sewer that conveys the urine from the dung court. The earth, at that season, being generally dry enough so as to prevent the carts, in laying on the upper layers from sinking; and if that is not the case, it is often let to consolidate a week or two before finishing it: in a word, no other necessary business is stopped on its account. If the whole is finished before the cattle is put up on turnip, which afford the principal supply of urine, great care is required in laying on the last layer, that the whole surface is perfectly levelled, so that the urine is equally distributed over the whole mass. The calculation of the whole expence is nearly as follows: The dimensions of the pit is 12 yards square and 4 feet deep, the solid contents 192 yards. The distance, at an average, being

200 yards, 2 yokings of five hours each day, and 14 rake at each yoking.

3 Men at 2s. each, *per* day, - -	L.	0	6	0
2 Horses at 4s. each *per* day, each cart carrying one-half square yard, or 28 yards *per* day,		0	8	0
Total expence *per* day,	L.	0	14	0
Each cart carrying half a square yard, or 28 yards *per* day, the expence is at the rate of 6d. *per* yard, and the total expence of collecting 192 yards of earth, is - -	L.	4	16	0*

As the compost, when carted to the field, although heavier by being drenched with the urine, yet loads better in the carts than when brought in loose and dry into the pit, produces about 288 cart-load; he allows forty of these cart-loads to an acre, consequently the urine produces dung sufficient for seven acres. The way he applies it is as follows: In dunging the turnip field, he begins with the dung taken from the dung court and straw yard, the greatest part of which has been carted out and put in dunghills on the field, except what has been gathered in the spring: as that is rougher and less rotted, he uses it in the same field for planting potatoes: and therefore beginning at the most distant part of the field with planting the potatoes, after the field has got the ploughings and harrowings necessary for cleaning the ground, and reducing it to a proper mould for receiving the seed; with a double mould-board plough, he lays out the drills, and carts on the dung, laying a row of small heaps on, provincially called *huts*, in every third drill, whether for potatoes or turnips. In this way he applies all the dunghill and farm-yard dung; and when all that kind of dung is applied, he begins with the compost from the pit, but instead of laying it on in open drills like the former, he gives the ground a close ploughing and

* In many parts of the kingdom, the expence would be still higher, and probably two fillers would be thought necessary.

harrowing, and carts on the compost on the level surface, spreading it carefully and equally on the ground, which it does more readily than dunghill dung, and then drills up the ground for receiving the turnip seed; and as the ploughs, in forming the drills, turn the compost perfectly into the middle of the drills, and do not bury it too deep, the young plants sooner get the benefit of it than the other dung, which by being put in the opened drill, and the drill again turned over it, the roots of the young plants are longer in striking into it.—He finds, therefore, that in the first stage, the plant is more vigorous in the former, than in the latter; nor did he ever observe, in the after periods, that they fell short on the other; nor in the subsequent crops, which, if otherwise, would have been perfectly obvious, as the practice of both is carried on in the same field or fields, as the methods have been carried on now for ten years, and, as he must have known the part of the field where the compost was applied, he certainly must have discovered the difference, if any difference had been discoverable *.

No. V.

ON GRUBS AND CATERPILLARS.

Mr John Shirreff doubts much if either frost or lime will destroy the grub. It can easily avoid frost, by going deeper into the earth. The coats of insects, that destroy young grain, when in the grub state, are hard, *dry*, and as tough as leather, so that they would most probably resist the effects of

* It is objected to this plan, that the dung heap in the yard is thus deprived of the urine which it ought to receive; and it is contended, that it would be better to mix the earth with the farm-yard dung, (instead of placing it in a separate pit), and to saturate *the whole* with the urine of the live stock, carefully collected for that purpose.

any small quantity of quicklime that might happen to come in contact with them; and calcareous matter is destructive to insects in a caustic or hot state only. How soon exposure to the atmosphere deprives lime of this quality is well known. As to killing grubs by rolling, unless accidentally squeezed between two stones, he should doubt the fact. It is difficult to break or cut their skin with the thumb nail pressing them against the forefinger; their bodies are so elastic, that they defy a very strong obtuse pressure, such as that of a roller.

Slugs may certainly be killed by quicklime and by rolling, if they be attacked *when on the surface of the ground*, where they are every soft morning in search of food, which consists of the most delicate and tender parts of young vegetables.

Mr Shirreff informs me, that Mr Alexander Tait, a most intelligent and respectable man, who rented the old orchard and garden of The Byres, the ancient seat of the Lindsays, now the Earl of Hopetoun's property, in the vicinity of Haddington, was so much tormented with slugs eating his young pease in spring, that he tried various plans to destroy them. He even gathered them in such numbers as to fill earthen jugs with them, in a single morning, turning out his whole family to pick them up. Still, however, they ruined valuable crops. He, at last, brought some lime from the kiln, and getting up before day-break, had a quantity immediately slackened, and carried in a wheel-barrow to the place where he had sown his early pease. As soon as day dawned, to allow him to see the state of things, he put some of the hot lime into a sieve, and going to the windward side of the pease, he gently shook the sieve. The hot caustic powder instantly pervaded the surface of the ground to leeward. In this manner he went along the whole windward side of the plot. He observed that a particle of lime did not kill a slug, for the insect had the faculty of throwing off a slimy slough, and disengaging itself from the particle, but if, in the progress to its hole, which it immediately made for, it came in contact with a second atom, however small, which it was almost certain to do, it had not the power of extricating itself as in the former

instance, but, wreathing about in a thousand contortions, it soon expired.

By persevering in this way of killing slugs, Mr Tait prevents them from ever doing him material injury.

The most effectual mode of killing grubs, Mr Shirreff conceives, is, by perfect aration of the soil, in the convertible system of husbandry. By this means, the insects and their nidi, are frequently exposed to the attacks of small birds, and rooks, which are very fond of them. Moles are great enemies to them also; but the cure is as bad as the disease.

Mr Rennie of Phantassie, has made a most useful discovery, regarding the best means of destroying the caterpillar, so destructive to gooseberry plants, which Mr Curwen has very properly inserted in his Report to the Workington Agricultural Society for the year 1810. Mr Rennie has ascertained, that the caterpillar deposites her eggs in the earth, below the gooseberry tree. These are ready to hatch just at the time the young leaves are budding, so that they immediately afford food for these destructive reptiles. The method he has adopted for destroying them is, previous to the gooseberry bushes coming into leaf, to have a portion of the upper mould raked off, and mixed with hot lime, which destroys the eggs. Mr Rennie made an experiment that has put the matter beyond doubt. He kept a part of the soil exposed to the air, and brought leaves and placed upon the earth. The caterpillar hatched, and immediately attacked the leaves. This remedy against an enemy that frequently destroys this most valuable and profitable crop is so easy, that those who suffer, can have no right or pretence to complain.

No. VI.

ON THE ADVANTAGES THAT WOULD ARISE FROM THE DISCOVERY OF A REAPING MACHINE.

The following estimate has been drawn up by Mr Donald Cumming, to prove the advantages that might be derived from the discovery of a reaping-machine, which he flatters himself he has invented.

The general price of reaping, with the sickle or hook, is about 12s. *per* English acre. The expence of reaping, by a well-constructed machine, cannot exceed 4s. so that there would be a saving of 8 s. *per* acre in the expence of labour alone; to which may be added 8 s. more on an average, as saved by the expeditious mode in which the work would be performed, by means of which the crop would be speedily and effectually secured against the effects of shaking winds and rotting rains. The total benefit, therefore, would be no less than 16s. *per* acre,—a saving so great, as even to equal the whole rent of much arable land in the kingdom. Besides, by the machine cutting so low, much additional straw would be obtained, a point of considerable moment. Two reaping-machines would be able to reap 40 acres *per* day, or 240 in six days. The expence of each machine, it is supposed, will be from L. 18 to L. 20, and the only additional expence would be the mere repairs of the knives, which are the only part exposed to wear. It is supposed, that a machine would last for twenty years, if carefully laid by, when the reaping is over. One machine may serve several small farmers, if made at their joint expence.

The discovery of such a machine, therefore, might be considered as an object of the greatest national importance. It may be proper, however, to observe, that in the opinion of a most respectable correspondent, of all the improvements hi-

therto attempted, that of the Reaping Machine seems to him the most hopeless. The varieties of soils, surface and situation of the crops it has to contend with, appear to him almost unsurmountable bars to any machine of the kind ever proving useful. It is well known to every agriculturist, that the difficulties attending the reaping of laid and twisted crops, requires not only eyes, hands, fingers and feet, but also a moderate share of judgment. Now, even suppose a machine to possess all these qualifications, and shut its eyes, what could it do? If the eyes of a human being were to be shut, he could not reap one handful of a crop twisted together. As all these qualifications therefore are required, he despairs of any ever being invented that can be generally useful. These very difficulties, however, render such a discovery, if it can he accomplished, the more important.

No. VII.

ACCOUNT OF MR HUNTER OF TYNEFIELD'S SYSTEM OF FARMING, ON THE PRINCIPLE, OF CONVERTING ALL THE STRAW OF A FARM INTO DUNG.

Since these papers were sent to press, Mr Hunter of Tynefield has favoured me with the following account of his farm, explanatory of the system he has adopted, which seems to me peculiarly advantageous for the management of a turnip-land farm.

Mr Hunter's farm consists of 350 Scotch, or 437 English acres. The stock of horses for labour are sixteen. The other stock cannot be stated, varying according to the quantity of green food that is there produced. It is only necessary to observe, that about ten sheep, weighing from twelve to fourteen pound *per* quarter, require from thirty to thirty-two tons of turnips,

(the average produce of an English acre), to fatten them for market. Mr Hunter also keeps some cattle for winter *soiling**, (if that expression can be made use of), which are bought in October and November, and sold in March. The sheep are fattened sometimes sooner, but the above weight of turnip will keep them till that time. The cattle are sold as soon as fattened, if the market offers, and are sooner or later ready, in proportion to the condition they might be in, when put up to feed †.

Mr Hunter raises four or five acres of turnips, for one of ruta baga; but ruta baga requires one-third more manure to produce a full crop.

The crops Mr Hunter raises of turnips and of ruta baga, are as follow:

1. Turnips.

	Per Scotch Acre.	Per English Acre.
Greatest crops, turnips 38 tons, tops 6 tons, - - -	44	35
Smallest crops, - -	32	$25\frac{1}{5}$

2. Rut baga.

Greatest crops, - - -	32	$25\frac{3}{5}$
Smallest crops, - - -	23	$14\frac{2}{5}$

Mr Hunter was accustomed to make the intervals of the rows, from twenty-seven to thirty inches. He found, at that time, the crops to average about three or four ton less *per* acre

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* Soiling is commonly understood to mean giving *succulent herbage* to live stock; but if it properly means *making dung*, it may also be applied to the giving *of roots* for the purpose of feeding animals, *and making dung*.

† It is calculated, that an acre of good turnip, would feed two and a half cattle of 30 stones Amsterdam each, $17\frac{1}{2}$ oz. to the pound, and 16 lbs. to the stone; but say that only two cattle are fed *per* acre, in that case, it is contended, that 440 lbs. Amsterdam more beef than mutton, would be produced from equal weights of turnips, provided that the turnips be consumed *at the stall by the cattle*.

than he now does, when he makes the intervals twenty-four to twenty-six inches *.

Mr Hunter begins to sow winter wheat after turnips, whenever the weather will permit in January, and continues sowing, when the weather is dry, till about the 12th of March. He afterwards sows the whole of his turnip break or shift, with summer wheat, of that sort recommended by Sir Joseph Banks. He had it from Lincolnshire seven years ago; and has sown it at all times, during the spring months, but he has now ascertained, that the proper time of sowing it, in the climate of his neighbourhood, is the two last weeks of April.

The weight of hay, from clover and rye-grass, may average 150 stones of twenty-two pound each, *per* English acre.

Mr Hunter sows wheat after clover, about the middle of January, if the season will allow, if not, as soon after as possible. He ploughs his clover stubble early in December, so that the snails bred among the clover may be turned up and destroyed. Formerly, he used to plough and sow in November, but these vermin, not being then effectually destroyed, crept into the ground again, and coming out in spring, thinned the wheat materially. Ploughing in December, and sowing in January, or February, has answered his purpose of destroying these vermin effectually.

The produce of wheat after clover is eight bolls *per* Scotch acre, or twenty-seven bushels *per* English acre; that of oats, is ten and a half bolls *per* Scotch acre, or fifty-two bushels *per* English acre.

Mr Hunter pastures very little with cattle or horses; indeed he proposes giving it up altogether, unless in barren soils where the plough cannot be introduced; and means to convert, any clover that may be left from soiling, into hay, for his horses in winter and spring; and by giving fourteen pound of oats *per* day to a horse, with ruta baga, he has been able to save a third

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* This can only be the case, however, where the land is in very good condition. Intervals of from twenty-eight to thirty inches are to be preferred, with land not in good condition, or where abundance of manure cannot be given.

part of the allowance of oats given to his horses, when no hay or ruta baga were used. On the above allowance, Mr Hunter's horses are worked nine hours every day, when the weather will permit.

The manure hitherto given to turnips by Mr Hunter, has not been so great as he wished; but as the quantity on the farm increases, a greater quantity has been applied. Mr Hunter is quite clear, that the land can never be over-manured for turnips.

The depth of the first furrow for the turnip fallow is from nine to twelve inches, where there is a depth of soil; the after ploughing about six or eight; after the turnips have been eat off, the ploughing ought only to be about three inches for wheat, to prevent the seeds of annual weeds being brought up; after the clover, four or five inches is a proper depth for oats or wheat.

The stock kept upon turnips or clover, have the refusal of water at all times when soiling; *cattle in summer must have it.*

When turnips are taken up to the extent of a half, four rows are left, and four taken up alternately; if a third part is to be taken, six are left, and three taken alternately. As soon as the turnips or ruta baga, begin to run or shoot in spring, they are taken off the field, when the tops and roots are cut off; they are then piled up in some place sheltered from the sun or too much air; and being covered with a little straw, and kept moist, they may be preserved as long as they can be wanted; the ruta baga will be perfectly good to the first of June.

Mr Hunter sows no more barley than is required for paying his farm-servants their wages in kind, which are partly paid in barley; having from experience found, that wheat after clover, sown with barley, often fails. When he began farming, he suffered severely by not attending to this important rule in agriculture *.

When circumstances permit, Mr Hunter limes once in fourteen years, at the rate of 60 barley bolls *per* English acre. Lime

* It is an old Scotch maxim, "He that saws wheat after bear, had need of meikle gear;" or, He should be a rich man, who sows wheat after barley.

ought to be applied to all lands under a rotation of four, where white and green crops are sown alternately.

The weight of potatoes *per* English acre, under good culture, and a proper soil, is from eight to ten ton. Mr Hunter was in use, before he found that horses throve on ruta baga, to give them potatoes occasionally, though they did not thrive so well on them, even when steamed, as he could have wished. He has now laid potatoes entirely aside, unless those raised for swine, finding ruta baga far superior for horses.

It is proper to explain the system adopted by Mr Hunter, for cultivating light land. The basis of that system is, 1. Alternate white and green crops; 2. Converting nearly the whole of the straw produced on his farm into dung; 3. Ploughing deep at particular periods; and 4. Soiling both summer and winter.

1. The rotation he follows is, 1. Turnips; 2. Wheat; 3. Clover; 4. Wheat or oats; half of the clover being pastured with sheep, whilst the other half is used in soiling work-horses. The clover stubble is broke up for wheat or oats, generally in the proportion of two-thirds for wheat. Under the above rotation, the crops, on an average, have increased in produce considerably.

2. Mr Hunter's object is, invariably to convert almost the whole of his straw into manure; for by giving plenty of green food, very little of the straw is eaten by the cattle or sheep, either in summer or winter. The horses alone require some straw, along with the ruta baga at all times; but during the first months of winter, November more especially, when ruta baga has not reached its growth, a few of these roots are given, and a greater proportion of straw or hay is wanted. If any considerable quantity of clover can be converted into hay, the straw will be perfectly unnecessary, unless for litter.

3. Soon after Mr Hunter began this system, he thought that the turnip, and other crops, were rather falling off, but fortunately he discovered a remedy, which was, to plough very deep the first furrow given to the turnip fallow. This he did, whatever was the depth of the soil, sometimes using three or four horses in the plough. Since he adopted that practice, all

the crops are more certain, seldom if ever failing, and never from being often repeated, unless owing to the inclemency of the season.

4. Mr Hunter makes it a rule to soil both summer and winter, preserving as much straw from the winter soiling-fold, as will be sufficient for littering horses, young cattle, and swine, during the summer, giving always plenty of green food, chiefly clover. Soiling in an open fold, with cut clover in summer, does not require so much straw, as winter soiling with turnip. He has not ascertained the proportions exactly, but thinks that one-half will suffice in summer that is required in winter.

The stock are fed in the following manner: They have always abundance of green food or roots. One-half, or sometimes one-third of all the turnips produced upon the farm, are carted to the fold or straw-yard, to sheep, young cattle, and swine. The swine have at all times clover in summer, and turnip or ruta baga in winter, together with potatoes for those meant to be fattened. The working horses have also half a bushel each of ruta baga during winter and spring, so that all the stock are soiled, the milch cows excepted, who get the whole chaff, and other refuse from the threshing-mill, and the sheep, when pastured on clover, to consolidate the ground.

Mr Hunter is decidedly of opinion, that any soil adapted for turnips, and that will produce seven bolls of wheat *per* Scotch acre (or 24 bushels *per* English acre), or 9 bolls of oats *per* Scotch (or 44 bushels *per* English acre), cannot be put under a more profitable system, or rendered more productive, than in the way he has suggested. By the frequent ploughings given to the turnip break or shift, the land is made perfectly clean. Turnip is the only crop, for which, according to Mr Hunter's experience, land cannot be over-ploughed. So much ploughing for turnip, would, in his opinion, be hurtful to the after crops, were it not that one half or more of his turnips are eaten on the ground with sheep, which brings it to a proper consistence for the succeeding crops of wheat, &c. Where land has been over-cropped, or it may be rather said *over-ploughed*, farmers will find two or three years' pasture necessary to allow the soil to consolidate; but he is so partial to soiling, that he thinks

two years' soiling, preferable to two years' pasturing, even though the second year's crop should be greatly deficient; as he is certain, during his whole practice, of constantly having oats after cut clover, as well as the other crops, fully equal to those after pasture, and that the like will take place during the whole after crops in the rotation.

This idea of soiling two years in succession, instead of pasturing the second year, is justified by the opinion, that one acre soiled is equal to two pastured.

PART II.

DISSERTATIONS

ON

QUESTIONS CONNECTED WITH THE AGRICULTURAL IMPROVEMENT OF A COUNTRY IN GENERAL,

BUT MORE ESPECIALLY AS APPLICABLE

TO THE

STATE OF SCOTLAND*.

* The two parts, for the sake of greater expedition, being printed at the same time, it was necessary to page them separately.

DISSERTATION I.

ON

THE SIZE OF FARMS, AND ON THE VARIOUS MODES OF OCCUPYING ALLOTMENTS OF LAND, FOR FARMING, AND OTHER PURPOSES OF A SIMILAR NATURE.

HAVING visited the districts in Scotland most distinguished for the knowledge and practice of agriculture, it appeared to me, that their improved state greatly depended on the Size of the Farms. That is a point on which volumes have been written, and respecting which a considerable diversity of opinion obtains. It is impossible, however, to lay down any precise or universal standard regarding the size of farms, as so much depends upon the nature and situation of the soil, the character, skill, and capital of the farmer, and a variety of other particulars. It is contended, indeed, that there should be occupations of various dimensions, and that possessions of a small, or at least of a moderate size, are desirable, for the following reasons: 1. That persons engaged in other employments, besides that of farming, may be accommodated with small portions of land, so as to raise many articles which they cannot otherwise readily procure, on account of their distance from a market; 2. That industrious in-

dividuals, possessed of small capitals, may have an opportunity to follow the profession of a farmer, to which they would do credit, but from which, unless some small farms were to be had, they would necessarily be excluded; 3. That young men may be enabled to commence farming on a moderate scale; for though possessed of sufficient capital, and regularly bred to the profession, they are so apt to fall into errors, that they ought not at first to undertake the management of too extensive concerns; and, 4. Because in poor countries farms must be small, sometimes in proportion to the small extent of cultivated land lying contiguous, and sometimes to the limited capital of the occupiers; whilst in more fertile and wealthier districts, the skill, spirit, and opulence of the farmers, enable them to do justice to farms of larger dimensions. How far such reasoning is to be assented to, will appear in the course of the following investigation.

In discussing a subject of such vital importance to the agricultural interests, and indeed to the general prosperity of a country, it is proposed, for the full elucidation of the various questions therewith connected, to divide farms into the following classes: 1. Small farms, or possessions under 50 acres of arable land; 2. Dairy farms; 3. Farms adjoining to towns; 4. Clay-land arable farms; 5. Turnip-land arable farms; 6. Commercial farms; 7. Pasture farms; 8. Farms for the accommodation or amusement of the proprietor; and, 9. Farms for experiment, and connected with objects of public utility.

1. *Small Farms, or inferior Occupations.*

Occupations under fifty acres may be treated of under the same general head. This is a subject which it is necessary fully to enter into, as it is of the utmost importance to examine the various modes of holding, and of managing, portions of land, whether small or great, that the advantages and disadvantages of each may be duly estimated.

We shall commence this branch of the inquiry with considering, whether labourers employed by large farmers ought to have lots of land attached to their cottages.

It will appear in the third dissertation, that in all the more improved districts of Scotland, a large proportion of the farm-servants are married; for whose accommodation the farmer undertakes to keep a cow, (the property of the servant), during the whole year, without making any charge for its maintenance. No land is specially allotted for that purpose, as the servant's cow usually accompanies those of the master. This system has been so long established, and is productive of such benefit to the servant, more especially if he has a large family, and, (as will be afterwards explained), is so advantageous to the public, that it were to be wished it could be extended to other districts, rather than abolished in those in which it is already established.

In regard to the idea of giving any number of acres to day labourers, to be held independent of the farmer, and immediately of the proprietor, such a system is objected to on the following grounds: That day labourers have no leisure for attending to the cultivation of any extent of land: That a small garden for potatoes, cabbages, and other vegetables, is perfectly sufficient for their accommodation, and that any greater quantity would break in

upon the time they ought to devote to the assistance of the farmer in carrying on his operations : That in an improved district, there is always work sufficient, at all seasons of the year, for those who are industrious : That if the labourer were thus rendered in some measure independent of the farmer, to whom he must otherwise look up for his subsistence, and were led to consider his being hired to labour as a secondary object, he would soon become idle and useless to the neighbourhood, and would either live in constant poverty from indolence, or both he and his family would refuse to work, unless paid much beyond the fair average rate of wages * : That these labourers are extremely apt to commit depredations on the property of their neighbours : That whether they have leases, or possess their land from year to year, they are likely to prove troublesome to the neighbouring farmers ; but if they have leases, the nuisance can hardly fail to be-

* This subject is very ably discussed in Kerr's valuable Report of Berwickshire, p. 104, 105, &c. It has also been observed, that if labourers, by receiving an allotment immediately from the proprietor, were to be placed in such a situation, that their hiring themselves to the farmer would be optional, the very object of the institution, namely, that there should be on the farm *an adequate number of servants always at the command, and under the controul of the occupier*, would be defeated ; and whilst the labourer might, (if unwilling to work for the farmer), derive a scanty subsistence from his own small occupation, it would neither enable him to educate his family, (which industrious labourers, under the present system, are able to effect), nor ever to emerge from his original sphere of life, in which he may live as comfortably and happy, as the most opulent individual in the kingdom. Thus, it appears, that on the whole, it is neither conducive to the interest of the farmers, nor the advantage of the labourers themselves, that the latter should possess any land immediately from the proprietor.

come almost intolerable: And, lastly, that their situation, in point of real comfort, can never be compared to that in which the hinds or ploughmen of Berwickshire, of Roxburghshire, of the Lothians, and of other improved districts in Scotland, are placed, who have abundance of the necessaries of life for themselves and their families, without any trouble or anxiety, and nothing to abstract their attention from their regular duty to their masters.

These observations are sanctioned by the authority of many of the ablest farmers in Scotland, with whom I have had an opportunity of discussing this interesting subject; and I have every reason to believe, that the same ideas are entertained by the most intelligent farmers in the more improved *arable* districts of England. Both are of opinion, that day labourers ought to hold their occupations immediately of the farmer, and that the land they possess ought to be restricted to portions capable of being cultivated by the spade.

By some it is contended, that no land should be occupied by any description of persons excepting those whose sole business is farming. There are, however, various exceptions to that general rule, as in the case of, 1. Labourers by the piece, carriers, millers, and mechanics; 2. Gardeners and nurserymen; 3. Villagers; and, 4. Farmers with moderate capital, or who reside in remote parts of the kingdom, where extensive tracts of fertile land are rarely contiguous.

1. A gentleman distinguished for information and ability, regarding all questions connected with husbandry, the late Robert Barclay, Esq. of Ury, in a paper addressed to the Board of Agriculture *, has stated it as his opinion, that, though labourers by the day ought not to have land

* Communications, vol. i, p. 91.

beyond what is requisite for a cottage garden, yet, that labourers *by the piece*, who are hired occasionally by different farmers, should not be subjected to the same restriction. There are also a superior sort of labourers, who contract for making and repairing roads, and other undertakings of a similar nature, or who act as carriers *, to whom the possession of a small portion of land is a great convenience. This description of persons has materially contributed to put an end to a very burdensome species of bondage, by which the tenants of many estates in Scotland were bound to convey a certain quantity of fuel to the mansion-house of their landlord; a practice which, some years ago, could hardly be dispensed with, as fuel was not procurable by any other means; but wherever villages, with carriers as above described, are to be met with, it is no longer necessary. Millers have likewise occasion for small farms. Such lots of land also, are of much use to mechanics in the country, as cart and plough makers, &c. who may not always have a demand for the articles they manufacture, and who may consider such a possession as subsidiary to their other occupations †. Lord Kames like-

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* Industrious persons, possessed of small capitals, who wish to become farmers, ought to set out as carriers, &c. to which their funds may be adequate, and by activity and industry they may in time realize a capital, which may enable them to stock farms of a proper size.

† On large estates, and in situations distant from villages, it is a great accommodation to the adjacent district, to have mechanics in the various necessary branches established in some central place. The Duke of Montrose, in this view, has broken down a farm, on a remote part of his estate, into cottaries of two acres arable, with two cows grass each, for mechanics, viz. a smith, a carpenter, a weaver, a shoemaker, a carrier, &c. The

wise contends *, that weavers residing in the country, should have lots of four acres each, weaving being a sedentary occupation, and requiring at times field labour for the sake of health. This is peculiarly necessary where there is no market at hand for the purchase of provisions.

2. The advantages of having land appropriated for kitchen gardens in the vicinity of towns, are too obvious to be dwelt on. The produce is great, and the vegetables thereby raised are of infinite benefit by coming early to market. The rent given for this description of land, near Edinburgh, is high. A lease for four years, of eight English acres of land, was lately sold for £. 200, subject to a rent of £. 8 *per* acre, which, at compound interest, makes the rent paid to be at the rate of £. 15, 12s. *per* acre *per annum ;* and a field of seven acres, near the Grange, at no great distance from that metropolis, is partly sublet for the same purpose, at the rate of 2s. *per* fall, or £. 16 *per* English acre. Nurseries also fetch a rent little inferior to garden ground. To a well-employed nurseryman, the profit of his ground is astonishing, in one year exceeding considerably the fee-simple of the same quantity of land in situations remote from a town. Nurseries *for sale*, however, ought to be encouraged, for the sake of persons who cannot afford to form, nor to keep up nurseries of their own. Besides, intelligent persons, who make it a business to raise trees, are more apt to have a greater variety, and to try useful experiments, than private individuals, who have other pursuits to distract their attention. Nurserymen also, will often undertake to plant extensive tracts,

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innkeeper, for the accommodation of the public, possesses nearly as much as all the rest put together.

* Gentleman Farmer, p. 202.

and to keep up a sufficient number of trees in them, at a moderate expence, which is a great inducement to the formation of plantations.

3. There is no circumstance connected with this inquiry, to which I am more anxious to call the attention of the reader, than to the numerous advantages to be derived from giving allotments of land to the inhabitants of villages and small towns; and as this subject is not so generally understood as it deserves, it is the more necessary to dwell upon it at some length.

In the western districts of Scotland, where coal abounds, and manufactures have been introduced, a number of villages have been erected, (generally two or three, or sometimes more in every parish), containing from twenty to two or three hundred families. Around each village, a range of land, proportioned to its size, is occupied by the inhabitants. Such of them as keep horses, and such farmers also as have retired from business, generally take more or less land, and their example is followed both by the tradesmen and labourers. When the village comes to contain from 400 or 500 inhabitants, the anxiety to obtain such possessions increases, and the land fetches, from the greater demand, a higher rent. In most of the parishes in the counties of Lanark, Renfrew and Ayr, a number of acres, in extent greater or less, according to the population of the town or village, is rented at from £. 4 to £. 6 *per* English acre, and in some instances still higher. The size of these village possessions held by each individual, varies from 2 to 25 English acres, but the greatest part are from 4 to 12 or 14 acres.

As milk, potatoes, and oats, form the principal means of subsistence among people of that rank in Scotland, the ground around these villages is generally devoted to the raising of these articles of food. A person who possesses four acres, will have nearly one acre in potatoes, one, or

one and a half in oats, or sometimes in wheat, and the remainder in hay and pasture; but in some places a still greater proportion is kept in grass.

Such a mode of occupying land is beneficial in various respects. There is no plan by which a landlord can expect to obtain so high a rent, hence many intelligent proprietors have erected villages for that special purpose. John, Earl of Loudoun, for instance, founded the village of Dervel, about the year 1760, on liberal terms, with the view of increasing the value of land in that neighbourhood; and that expectation has not been disappointed, for there are about 250 acres round that village, now yielding from £. 2, 6s. to £. 4 *per* acre, while the neighbouring farms, the soil of which is equally good, are rented only at from 15s. to 19s. *per* acre.

If the health, the comfort, and the morals of the inhabitants, be taken into consideration, land cannot be better occupied than in this manner. Such villages are certainly more healthy than large towns. Labourers and mechanics must feel themselves and their children much happier in the former than in the latter; and their morals, and those of their families, are not in such danger of being contaminated, as if they resided amidst a greater population. They are also much better supplied with wholesome food, as milk and vegetables, when they cultivate a piece of ground for themselves, than when they are at the mercy of the neighbouring farmers for these necessaries of life; and not only is their health improved, but they become more industrious, by performing in the evenings, and other intervals of their labour, the little offices about their cows, their horses, and their small possessions; whereas those who are deprived of that profitable and rational mode of spending their leisure hours, are in danger of devoting them to improper objects. There is no mode also, by which a greater produce can be raised from land,

than by erecting a village, and letting the adjoining ground in small lots to the inhabitants. The high rent demanded compels them to be industrious, in order to turn the land to the best account, and in particular to pay great attention to the collecting of manure, in so much that every corner of their little occupation is improved to the highest degree.

The milk of their cows being either used in their families, or sold as it comes from the cow to their neighbours who keep none, it goes much farther as an article of food, than when manufactured into cheese. It is calculated, that from 50 to 60 Scotch pints of milk, (or from 100 to 120 English quarts), may be converted into a cheese of from 16 to 20 lb. English. But if that cheese could be again restored to milk, in such quantities as might be from time to time required by the family of a labourer or tradesman, it would be much wholesomer, and would nearly go twice as far towards maintaining the family, than the cheese made from it, and the pork produced by the whey *. It can hardly be questioned, therefore, that the interest of the proprietor, the labouring class of the community, and of the public at large, cannot be better promoted, than by encouraging the villages on this principle, particularly in those districts where coal abounds, and where, of course, manufactures have been, or may be introduced †.

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* Dr Franklin, when living on bread and milk, was the stoutest person in the printing office where he worked.

† These facts regarding the villages in the west of Scotland, are communicated to me by Mr Aiton of Strathaven, the intelligent reporter of Ayrshire.

If this beneficial system of erecting villages, and furnishing the inhabitants with land, could be extended over every district in the kingdom where it could be established with advantage, it would promote more the health, the comfort, and the happiness of several numerous classes of the community, than any other measure that could be adopted.

Nor is it in the western parts of Scotland alone where this practice prevails. It exists in a greater or less degree in every other district of that country with which I am acquainted. A Scotch acre of ground will supply the family of a tradesman with vegetables and some grain. Where a cow is kept, three Scotch acres, (nearly four English), are thought sufficient, if the cattle are of a moderate size. At Peterhead in Aberdeenshire, the lots usually consist of about four Scotch or five English acres, and they are now divided into four equal parts. The rotation is, 1. Fallow, Turnips or Potatoes; 2, Bear or Oats with grass seeds; 3. Hay or Pasture; and, 4. Oats. The rent has been lately increased from £. 4, 10s. or £. 5, to even £. 6, 10s. *per* Scotch acre, according to the situation and nature of the soil. The profit, after paying all expences, is calculated to be about £. 3 *per* Scotch acre.

There are other modes of managing the cow system in the neighbourhood of villages. In Berwickshire, it is a common practice for the inhabitants, instead of taking separate allotments, to form clubs or copartneries, and to rent any adjoining grass fields for pasturing their cows and horses. Fields of that description are annually set up to auction, and from the high rents given, may always be hired where the villagers wish to have that accommodation. But as the profit of keeping cows, according to this system, depends upon the sale of milk, and is necessarily limited by the consumption of that article, it has frequently happened, from the supply exceeding the demand,

that village cows have not paid their expences *. Near the village of Leslie in Fife, some grass fields are annually let by auction, and the inhabitants pay a certain sum for a cow's grass. The consequence is, that great attention is paid to the breed, in particular to their being excellent milchers, as the same sum is paid for the pasture of a cow that produces a small, as for one that yields a great quantity of milk †.

In the case of newly erected fishing villages also, some ground may be allotted for those who settle there, to carry on the precarious profession of fishermen. A market cannot always be obtained for the quantity of fish that may be caught, and they may often be prevented from going to sea in stormy weather; the fishermen therefore must have much time that can be devoted to other purposes. By the additional inducement of lots of land, a hardy peasantry may be tempted to settle in situations calculated for carrying on the fisheries. The landlord may thus increase the value of his estate, and may obtain the aid of the wives and families of the fishermen in carrying on his improvements.

4. In many parts of Scotland, arable farms must be of a small extent, sometimes because no great quantity of fertile land can be had contiguous, and sometimes because farmers cannot be met with, possessed of sufficient capital to do justice to large occupations. The best size of a farm for persons so circumstanced, is generally from 40 to 50 acres of arable land, affording employment for a pair of horses. It is admitted, that such farmers are rarely so skilful or so intelligent as their wealthier brethren, who have better means of acquiring knowledge in their profession. The former, however, are more economical, which in some degree compen-

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* Kerr's Berwickshire, p. 105.

† Statistical Account of Scotland, vol. vi, p. 41.

sates for that disadvantage. These farmers, it is said, hold their plough, feed their cattle, repair and even make some of their farming implements, are contented with a humble cottage, receive the assistance of their wives and families both in cultivating the farm, and harvesting its produce *, and, living at less expence, can afford, it is contended, to pay even a higher rent than the more opulent farmer, whose accommodations and mode of living are so different. On the other hand, it is asserted, that such farmers and their families are mere drudges; that they live more uncomfortably than the servants on a great farm; that they are tenacious of old customs; that they are prejudiced against any alteration, even when obviously beneficial; that in proportion to the extent of land they occupy, they must keep a larger stock; that their cattle and implements of husbandry being of an inferior description, they can never work their land to equal advantage; and that if they can carry on the cultivation of land already in an arable state, yet in the case of waste lands, they rarely, if ever, possess spirit, skill, or capital to carry on any considerable improvement. It is in dairy farms alone, as some maintain, that the small farmer has an evident advantage over the great one.

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* On this subject Mr Brown of Markle very justly remarks, that the share which a farmer's family takes in the cultivation of a farm, will never save a halfpenny of the outgoings; on the contrary, his expences will be greatly increased by having any part of his labour executed by the branches of his own house. They cannot be supported cheaper than hired servants, and rarely will work so much, especially if the labour of the whole season is taken into consideration. Perhaps, upon some particular occasions, a temporary exertion may be made, greater than what is commonly displayed by hired labourers, but it generally happens that a proportionable relaxation will immediately afterwards occur.

Some of the particulars above enumerated regarding small farms, may not be considered as strictly coming within the principal scope of this publication. At the same time, they are of such infinite consequence to so many numerous and valuable classes of the community, that he must be a fastidious critic indeed, who would object to the discussion, or who would regret that they have been thus brought under his review.

2. *Dairy Farms.*

In Ayrshire, where the dairy system is carried to greater perfection than in any part of Scotland, the farms are of a moderate size, in general from 50 to 150 Scotch acres, though there are some of a larger description. About 100 Scotch acres (127 English) is reckoned a good size. On such a farm, from 10 to 12 cows (a number capable of being managed by one family with ease and economy) may be kept, and it will also produce other articles besides what is necessary for their maintenance. In hard soils, and dry climates, grain husbandry is preferable; but in soft soils, and moist climates, whenever farms are of a moderate size, the dairy ought to be the principal object of the farmer. It furnishes regular and profitable occupation during the whole year to himself and his family. Cleanliness, so essential in this branch of husbandry, is more likely to be better attended to on a small scale than on a large one, and by persons interested in the sale of the commodities produced, than by hired servants or labourers. Where is this system indeed more likely to answer, than with the small farmer, whose cows are his pride, who takes a delight in shewing his stock to his friends when they visit him, in detailing the history of their lives, in dwelling on the condition to which he has brought them,

and in pointing out the beauties of their progeny, and the excellence of their produce * ?

In dairy farms, four objects may be attended to: 1. Selling the milk fresh from the cow; 2. Making butter; 3. Manufacturing cheese; and, 4. Feeding the calf for sale. It will be proper to give a general account of the nature and profits attending each of these branches of the dairy system, as thence the proper size of a dairy farm may, in some degree, be ascertained.

1. In the immediate neighbourhood of towns or large villages, milk is sold in small quantities fresh from the cow, and in this way more profit is derived from it than in any other mode. The price, when sold in villages, is commonly from 3d. to 4d. for two English quarts, or Scotch pint, and from 4d. to 6d. for the same quantity when sold in towns. Fresh milk is used with porridge or hasty pudding, with bread, or potatoes, and in this way it is not only much wholesomer than when used in any other mode, but goes much farther as food, one gallon of milk used fresh being equally nourishing as the cheese produced from two gallons, and the meat from the whey given to hogs †. No wonder then that labourers are anxious to have milk for their families.

2. Where milk cannot be sold fresh with advantage, it is generally converted, within any moderate distance of a town, into butter and butter-milk, the first for the consumption of the upper ranks, the second as an important article of food for the labouring classes of the community. The art of making butter has of late been much improved in Scotland. In the western districts, it is generally made of the entire milk, and not of cream alone. By the adoption of that plan, the butter is not so rich, but is sound

* Aiton's Report of Ayrshire, p. 430. † Ditto, p. 445.

and good, and the butter-milk is rendered peculiarly palatable and wholesome *. Seven Scotch pints, or 3.18 English gallons, make a pound of butter, (22 oz.), which sells at from 1 s. 6 d. to 1 s. 10 d. *per* pound; and when one pint of water is added to three or four pints of butter-milk, the whole will sell for 1 d. *per* pint.

3. Ayrshire has long been famous for a mild and palatable species of cheese made from sweet milk, commonly known under the name of the *Dunlop* cheese, from the parish where it was originally manufactured. Mr Aiton, in his excellent Survey of Ayrshire, informs us, that from 50 to 55 Scotch pints of milk, (from 100 to 110 English quarts), with the cream, will generally yield one stone of that cheese, Ayrshire weight, (24 lb.), which sells at 14 s. *per* stone†. Taking the average of 22 stones of cheese from 1200 pints (or 2400 English quarts) of milk, the return will be about £. 15 : 0 : 8 *per annum*, besides the value of the calves, and what can be made of the whey. This last article is used as food in the farmer's family, and is given as drink to the working people. It is also given both to horses and cows for drink; the cows give more milk when they get it. It is sometimes sold in towns at a penny *per* Scotch pint. When boiled, the float-whey at the top resembles curd. In country places distant from towns, it is now generally used in feeding swine. The whey produced from the milk of three or four cows, with a few vegetables and other offals, will rear a pig in one season from the value of 8 s. to 10 s. to the weight of 14 or 15 English stones. Butter is rarely extracted

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* Aiton's Ayrshire, p. 449.

† The price of the Dunlop cheese has recently fallen as low as 10 s. *per* stone, but it is supposed will soon return again to its former standard.

from the whey in Scotland, as is the case in some of the English dairies. It is said that this can only be done when the milk is too much heated in the process of coagulation. Whatever is so obtained is robbed from the cheese, and that is not the best way of making butter.

Skimmed-milk or common cheese, is also made to a considerable extent in Ayrshire. The cream of the milk is converted into butter. It is well worth trying, whether it would not be more profitable, instead of making the cream into butter, to mix the cream of the skimmed milk with a quantity of sweet milk equal to that from which the cream was taken, by which means Stilton cheese might be made, for in that consists the whole secret of manufacturing that high-priced article.

4. The feeding of calves for veal is another mode of deriving profit from a dairy. This practice has been brought to great perfection in the counties of Ayr and Lanark. The calves receive no other food but milk as it comes from the cow, and which they are taught to drink from a dish, in general not being permitted to suck. The young calves are fed on the first-drawn milk, which abounds with serum or whey; the older ones get the last drawn, which is much richer. It requires this rich part of the milk, of at least two or three cows, for several weeks, to bring a calf to the greatest pitch of fatness. The highest price given for a calf thus fed in Ayrshire, is from £. 5 to £. 6, to which value it may be brought, by proper management, in eight or ten weeks. In Lanarkshire, particularly in the parish of Strathaven, which is celebrated for its veal, calves have been fed to the value of £. 10; but that may proceed more from ostentation than prudence, as the milk, after the calf has been brought to a certain degree of fatness, may be applied to more profitable uses *.

* Aiton's Ayrshire, p. 442, &c.

Mr Aiton estimates the value of the produce of these cows, in different circumstances, at the following rates:

	£.	s.	d.
1. Value of 1200 Scotch pints, or 2400 English quarts, sold in villages, at from 3 d. to 4 d. *per* pint, or 2 English quarts, average 3½d.	17	10	0
2. Value of ditto, sold in towns at from 4 d. to 6 d. *per* pint, or 2 English quarts, average 5 d.	25	0	0
3. Value of the same quantity employed in making butter and butter-milk, at 4½ d. *per* pint, or two quarts, - - -	22	10	0
4. Value of the same quantity made into sweet-milk cheese, at 3½ d. £. 15 : 8 : 4, with £. 3 for the calves, and the profit to be derived from the whey, - - -	18	8	4

5. In regard to feeding calves, he calculates, that when the calf is of the most thriving kind, and properly managed, milk will bring a better return, when disposed of in that way than in any other, except when the milk is sold fresh in large towns.

Besides this profit, a dairy farm, when properly regulated, produces a variety of other articles. One-third, or at least one-fourth of the farm ought to be cultivated as arable land, and a sufficient quantity of young cows ought to be reared to keep up the stock. The custom of providing clover, tares, &c. for early summer food, and some turnips or cabbages for winter food, and some potatoes as spring food, is becoming more general in Ayrshire, greatly to the improvement of the dairy system.

Mr Aiton, who has paid particular attention to the subject of dairy farming, considers small farms as peculiarly advantageous for that branch of husbandry, because it is in the power of the farmer's wife or daughters to perform,

or at any rate to superintend, the whole concern. No branch in agriculture requires such constant and unremitting attention as the dairy. If a few spoonfuls of milk are left in the udders of the cow at milking; if any one of the implements used in the dairy be allowed to be tainted by neglect; if the dairy house be kept dirty or out of order; if the milk is either too hot or too cold at coagulating; if too much, or too little rennet is put into the milk; if the whey is not speedily taken off; if too much or too little salt is applied; if the butter is too slowly or too hastily churned, or if other minute attentions are neglected, the milk will in a great measure be lost. If these nice operations occurred only once a month, or once a-week, they might be easily guarded against, but as they require to be observed during every stage of the process, and almost every hour of each day, the most vigilant attention must be kept awake throughout the whole season. That is not to be expected from hired servants. The wives and daughters of farmers, therefore, having a greater interest in the concern, are more likely to bestow that constant, anxious, and unremitting attention to the dairy, without which it cannot be rendered productive*.

Another advantage derived from small dairy farms is, that cows are much injured if they are compelled to travel far from the place they are milked to their pasture. It is found advisable, therefore, when a farm exceeds 200 Scotch acres, to erect two sets of dairy houses to suit the different parts of the farm.

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* It is a practice in some parts of the country, to let cows by the year; the farmer furnishing merely the cows and their food, and the person who bargains for them attending to their feeding and the management of their produce; but that occasions frequent disputes between the parties.

3. *Farms adjoining to Towns.*

In the neighbourhood of towns, farms are commonly from 100 to perhaps 200 acres, which is found abundantly sufficient for such occupations. It is well remarked by a most intelligent correspondent, (George Rennie, Esq. of Phantassie), that farmers in the vicinity of large towns, may be compared to *retail shopkeepers*, whose attention must be directed to small articles, by which a great deal of money may be got, the greater part of which would be lost, without the most unremitting attention. The farmer at a distance from markets, who cultivates on a great scale, may be compared, on the other hand, to *a wholesale merchant*, who, as his profits are less, requires a greater extent of land, for the purpose both of engaging his attention, and of enabling him to support that station of life in which he is placed. There is this difference, also, between farmers in the neighbourhood of towns, and those who reside at a distance from them, that the former find it more profitable to sell their produce, even such bulky articles as turnips, potatoes, clover, hay and straw, than to fatten cattle for the butcher; and they are enabled to do so, without injury to their farms, as they can procure dung in return, when these articles are sent to market.

As this is an interesting part of the investigation, it is proposed shortly to inquire into the following particulars:

1. What rents are paid for lands in the neighbourhood of large towns?
2. What rotations of crops will enable the farmer to pay such rents?
3. What are the advantages which farmers possess in the neighbourhood of towns? And

4. What political effect may result from such high rents being exacted from them ?

1. I have received from various quarters, statements of high-rented lands, not only near Edinburgh, but in the neighbourhood of other towns. The farm of Lairwell, for instance, near Perth, on the estate of Lord Gray, amounting to 100 Scotch, or 127 English acres, is let as follows :

Money rent,	£. 5	7	6
1 Boll (4 bushels) of wheat, supposed to be worth at an average 40 s. *per* boll, or 10 s. *per* bushel,	2	0	0
Poultry and other articles paid in kind, supposed in all to be worth £. 10, or *per* acre,	0	2	0
Total,	£. 7	9	6

Which is equal to £. 5 : 17 : 1 *per* English acre.

Within such a moderate distance of Edinburgh, as from three to seven miles, £. 7 *per* Scotch, or £. 5, 10 s. *per* English acre is not an unusual rent; and the farm of Coats, consisting of 80 Scotch acres, situated about one mile from Edinburgh, some parts of it even nearer, is let at about £. 8 *per* Scotch, or £. 6 : 5 : 10 *per* English acre.

The farm of Clearburn, about one mile from the suburbs of Edinburgh, consists of 77 Scotch acres, and is let for £. 9 : 16 : 8 *per* Scotch, which is equal to £. 7 : 13 : 7 *per* English acre. It has the advantage of a good house, to which any person, taking such a farm, at such a rent, is well entitled. Such farms are often rented as a convenience by persons of property, who wish to live, at least occasionally, in the country, and who take land, more as an accommodation and amusement, than for profit.

A respectable proprietor near Edinburgh has recently let 33 acres, adjoining to the Water of Leith, at £. 10, 10 s. *per* Scotch, equal to £. 8 : 5 : 1 *per* English acre, without any house, and was offered £. 12, but preferred a tenant whom he knew to be unexceptionable; and he lately let about four Scotch acres at £. 12, 12 s. or £. 9, 18 s. *per* English acre. These sums are chiefly paid by cowfeeders and butchers, which they can afford to pay, from the nature of their business, and their contiguity to the Edinburgh market, which no farmer, who had nothing but the cultivation of his farm to rely on, could offer. Notwithstanding these high rents, some of these cowfeeders, by selling milk, have, within these few years, realized from £. 1000 to £. 3000 each.

2. Let us next proceed to the second head of the proposed inquiry, namely, the rotation of crops usual near Edinburgh, where the system of town-land farms is brought to the highest perfection, and where the highest rents are paid for land.

Within a mile of the suburbs of the metropolis, the ground is principally occupied in gardens and grass parks. Beyond that space, to the extent of about two miles and a half, some grain is raised, but the land is chiefly devoted to the production of such green crops as are generally consumed in the town and its environs, as clover, turnips, potatoes, cabbages, &c.; the expence of carriage making it less profitable to raise them at a greater distance. A species of garden culture seems to be best calculated for rendering the ground productive, in situations where markets are near, and manure at command, though it requires a degree of superintendence rather inconsistent with a farming on a great scale. It is probable, indeed, that the common vegetables, necessary for the consumption of the inhabitants of towns, will soon be raised by farmers, instead of gardeners, (early crops alone excepted), as by farmers

they can be produced at half the rate, owing to their less expensive mode of cultivation.

The most approved rotation, where land lies at from two and a half, to four or five miles from Edinburgh, is, potatoes *, wheat, and grass; and sometimes, after grass, oats. If the farm amounts to 60 acres, its average produce, and the value thereof, at the prices these articles now fetch, may be stated as follow:

1. 20 Acres of potatoes at £. 19 *per* Scotch, or £. 15, 4 s. *per* English acre, - -	£. 380	0	0
2. 20 Acres of wheat at 40 bushels of Scotch, or 32 bushels *per* English acre, at 10 s. *per* bushel, - -	400	0	0
3. 20 Acres of clover, sold for being cut twice, at £. 21 *per* Scotch, or £. 16 : 16 : 4 *per* English acre, - -	420	0	0
	£. 1200	0	0
4. Wheat straw, at 10 kemples (317 pounds Troy) *per* Scotch acre, or one kemple for four bushels, or one boll of wheat, at 9 s. *per* kemple, is £. 4, 10 s. *per* Scotch, or £. 3, 10 s. *per* English acre, -	90	0	0
Total value of the produce,	£. 1290	0	0

Which is at the rate of £. 21, 10 s. *per* Scotch, or £. 17, 14 s. *per* English acre. In 1809, the produce of this extent of land was estimated at £. 26 : 12 : 2 *per* Scotch, or £. 20 : 18 : 4 *per* English acre.

* Ruta baga would also be a profitable article occasionally to cultivate in the room of potatoes; not only for the consumption of cows and horses, but as an excellent culinary vegetable; a very moderate average crop may be estimated at 20 tons, or 3200 English stones; and valuing the stone, consisting of 14 lbs, at 2d

It is to be observed, however, that in many cases, the crops of wheat in the neighbourhood of Edinburgh, and in fertile soils under the more improved systems of Scotch husbandry, produce more than 32 bushels *per* English acre. Sometimes 12, 14, and even 16 bolls *per* Scotch, or 38, 47, and even 55 bushels *per* English acre, have been obtained: 55 bushels of wheat at 10s. *per* bushel, is L. 27, 10s.; and if every 4 bushels produce six shillings worth of straw, (for the straw is proportionably less when the quantity of grain is great), the produce *per* English acre, in straw, would be L. 4 : 11 : 8, and the total produce L. 32 : 1 : 8 *per* English acre. But as wheat is cheaper when the crop is abundant, let the wheat be stated at 8 s. *per* bushel; the value of the produce will then amount to L. 26 : 11 : 8 *per* English acre.

When oats are taken after clover, the average produce is from 12 to 14 bolls *per* Scotch, which is at the rate of from 57 to 67 bushels *per* English acre. The value may be stated at from L. 11, 8s. to L. 13, 8 s. *per* English acre. To these sums must be added the price of the straw, which is more valuable than wheat-straw, being reckoned more nutritious and palatable for cows and horses. It sells at above 12 shillings *per* kemple, and consequently may be stated at L. 9, 2s. *per* Scotch, or L. 7, 3s. *per* English acre, making a crop of oats in all worth L. 20, 11s. *per* English acre.

In light soils, where turnips can be raised, the crop, in common seasons, is reckoned worth L. 20 *per* Scotch, or

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each, a crop of ruta baga, near Edinburgh, would be worth £. 26 : 13 : 4 *per* English acre. A much larger crop, however, is often obtained. The yellow turnip is also entitled to the particular attention of the farmers near Edinburgh; also podded peas and beans, and *collards*, that is young cabbage, plants of which, (the sweetest of greens), are bundled together for spring use.

L. 15 : 10 : 6 *per* English acre; but the value of a crop of turnips was greatly increased during the stoppage of distillation from grain, the cowfeeders being thereby compelled to try other articles for the maintenance of their stock during the winter season. The price then rose from L. 26 to L. 36 *per* Scotch, or from L. 20, 9s. to L. 28 : 6 : 3 *per* English acre.

In regard to the clover crop, it is to be observed, that there are a description of persons called grass-dealers, who buy from the farmers whole fields of clover. They cut it down gradually, according to the demand, making it up into small bunches, eight of which make what they call a load. The bunches, which have been of late greatly diminished in point of bulk, sell at 1½d. each, and consequently the load is a shilling.

3. We shall now proceed to state the circumstances which, in addition to such great produce, enable the farmers, in the immediate vicinity of Edinburgh, to pay their rents. In the *first* place, The turnips, potatoes, and the grass crop, are frequently sold *on the ground*, without any further trouble or expence to the farmer. In the *second* place, farmers near Edinburgh can purchase great quantities of manure, at a cheap rate, considering the crops they raise, and the prices they obtain for them. Compost dunghills indeed may be procured as low as four shillings *per* single-horse cart-load, thirty of which is reckoned sufficient to manure, not only a Scotch acre for potatoes, but also the succeeding crops, in the common rotation of potatoes, wheat and clover, sometimes with the addition of oats. The total expence is only at the rate of L. 6 *per* Scotch, or L. 4, 16s. *per* English acre, besides the expence of carriage*. In the

* This must vary much, according to the distance, in so much that it may become 130 *per cent.* dearer to one farmer than to another. If it is driven eight miles from town, a man and two

third place, Since the extension of Edinburgh, and the more luxurious mode of living adopted by its inhabitants, there is a ready sale, and a high price, for every article a farm can produce; in particular, such great numbers of horses are kept, not only for carts and carriages, but at the Artillery and Cavalry barracks erected in the neighbourhood of the town, as to occasion a great demand for hay, straw, &c. And, in the *last* place, The vicinity to the town is a great convenience to the farmer, as corn and fodder, and every other article to be disposed of, can be carried more expeditiously to market, and consequently at less expence, and the payment is immediate.

4. It may be proper, in the next place, to consider the political effect which results from the high rents paid for lands near towns. Such rents, and the great competition, where produce can, with certainty, be disposed of, evidently tend to diminish the size of such occupations. There are few who would wish to have above from 100 to 200 acres in their possession, upon the short leases usually near towns, and when the farmer must pay at the rate of from L. 7 to L. 10, or even as high as L. 12 *per* acre, and must frequently be disposing, in small quantities, of the articles produced on his farm. Hence it is that in Flanders, which is full of large towns and villages, from the existence of similar circumstances, the farms are small.

In less populous parts of the country, it can hardly be questioned, that large farms are necessary, to furnish sufficient occupation to industrious, opulent and intelligent

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single-horse carts can do no more than bring home one turn in a day. Allowing, therefore, 16 s. for the man, the two horses, and the two carts, and 8 s. for the dung, the total is 24 s., or 12 s. *per* single-horse cart-load laid down on the land; whereas, farmers within a mile of town can lay down at 5 s. 4d. a-cart, at six turns a-day.

farmers; but near towns, from the greater produce, the constant cropping, and the more rapid sale, farms of a smaller description will answer the same purpose; and it is certainly for the advantage of such towns, that the farms in their neighbourhood should be of a moderate size. When there are a great number of farmers, there will be more competition; lesser objects will be attended to, and the markets will be more regularly, and better supplied.

4. *Clay-land Arable Farms.*

In a valuable work on agriculture, recently published, it is justly remarked, that where agriculture is followed as a distinct profession, a farm ought to be of such a size, as to furnish regular employment, not only to the farmer himself, but also to the servants and labourers employed by him, in order that the greatest possible profit may be derived from their labour, at the least possible expence. It is evident, that this can only be accomplished on a farm of considerable extent, where judicious rotations of crops can be adopted, and where the economy of the farm is so conducted, that too much work does not occur at one season of the year, and too little at the other; in short, where that division of labour, from which manufacturers have derived such essential benefit, is extended to husbandry *.

To manage a strong land, or clay farm properly, requires great attention, and the almost constant personal pre-

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* See a treatise on rural affairs, in two volumes octavo, by Robert Brown, farmer at Markle, county of Haddington, so justly characterised by Mr Curwen as an excellent theoretical, as well as a practical farmer. Report to the Workington Society, *anno* 1810, p. 87.

sence of the farmer in superintending the various operations which must necessarily be carried on.

There are four circumstances on which its size ought in a great measure to depend, which, though not peculiar to this description of farms, it may not be improper, from the importance of the subject, here to enumerate: 1. The situation of the farm-house and offices, from which no part of the land ought to be too distant; for it is desirable that no time should be wasted, either in conveying manure to the remotest part of the farm, or in carrying home the crop. Where the house and offices are in a central situation, the farm *may* consist of 500 or even 600 Scotch, from 635 to 762 English acres, without much inconvenience in that respect; but where a farm is of smaller dimensions, say from 300 to 400 Scotch, or from 381 to 408 English acres, the operations may, in general, be carried on under the more immediate inspection of the farmer. 2. It seems to be universally admitted, that no farmer, on such land, ought to have less than six two-horse ploughs, to give full occupation to which, 50 Scotch, or 62½ English acres, may be assigned, which would make in all a farm of 300 Scotch or 381 English acres. 3. A clay-land farm ought also to be so large, as to justify the expence of erecting a threshing-mill, on a proper and substantial construction, to go by water, by wind, by steam, by oxen, or by horses. 4. The size of such a farm ought likewise, in some degree, to depend on the state of the roads in the neighbourhood, its distance from markets, and above all from lime, that most essential article for the proper cultivation of strong land.

Taking all these circumstances into consideration, though an active and attentive farmer, with a large capital, and with other advantages, may be able to manage a clay farm of 600 Scotch, or 672 English acres; yet, on the whole, 300 Scotch, or 381 English acres, is, in general, sufficient; and it has

been remarked, that those who grasp at having farms of a greater extent, where servants are not immediately under the master's eye, oftener lose than gain by extending their concerns. Such a farm as 300 acres may, with propriety, be divided into six, seven, or eight fields. The establishment requisite for it will be sufficiently extensive for carrying on every operation, (reaping excepted), without additional assistance, and the fields may be so laid off, as not to extend beyond a reasonable distance from the farm-house and offices. On the other hand, where a greater quantity of ground is combined into one farm, the fields must be more extended, and the expence of labour increased, from the distance between the farm-offices and the ulterior divisions, by means of which a greater establishment will be required to bring home the produce, and to take out manure; much time also will be unprofitably consumed in going to, and returning from the fields, and as in rainy weather, the ground will be greatly cut up by these operations, much additional labour will therefore be required, from the necessity of taking lighter loads.

In regard to clay farms, consisting of less than 300 Scotch acres, they do not afford sufficient employment for a person possessed of capital, abilities, and activity. The farmer therefore generally employs himself as a working grieve or overseer; and servants accustomed to his presence and aid, when they happen to be left to themselves, idle away their time, or commit blunders. There is still a greater objection to the smaller size of farms, that the stock of men and horses kept is not equal to execute, by themselves, any hurried piece of extra work, such as the delivery of a cargo of lime, the carriage of a dunghill from town, the delivery of a large quantity of grain upon a spurt, the leading grain into the stack-yard after bad weather, also keeping the proper season of ploughing, sowing, or harrowing any ticklish field upon the farm; all these difficul-

ties can be surmounted, if the stock and farm are large, and the other operations of the farm go on smoothly at the same time. It may be laid down, therefore, as an axiom regarding clay-land occupations, that a farm of a proper size can be cultivated with considerably less stock, and every way at less expence, in proportion to its size, than one of smaller dimensions.

5. *Turnip-land Arable Farms.*

Where the soil of a farm is of a light description, a larger extent of land is necessary, as, in such soils, sheep and cattle are not only fed off in greater numbers than in the clay-land districts, owing to the quantity of green food they produce, but also because stock is sometimes bred in considerable quantities. On such soils, therefore, a farm of from 600 to 1000 Scotch, from 762 to 1270 English acres, has not been considered too large; and where it is intrusted to a skilful and active farmer, such an extent is not disadvantageous either to him, to the landlord, or to the public. In some instances indeed, persons of uncommon abilities, have successfully held even larger occupations of turnip soils.

It has been much contended, whether it is necessary, on such extensive farms as those of 1000 Scotch acres, to have two sets of offices. They certainly ought to be avoided if possible; and if the farm-yard is fortunately situated in the centre of the farm, one set may be sufficient, though, in that case, the more remote fields of the occupation are seldom so properly attended to, and consequently are less productive and valuable.

6. *Commercial Farms.*

If the idea be well founded, that agriculture should not be under more restrictions than manufactures or commerce, but that any extent of land should be occupied, in proportion to the skill, abilities, and capital of the farmer; in that case farms of still greater extent than even 1000 acres of arable land, cannot, in particular instances, be objected to, though such extensive occupations are not in general to be recommended. To such farms, the name of *Commercial** may be given, as they often resemble more the bold speculations of a merchant, than the cautious undertakings of a mere practical farmer. Such farms, more especially in turnip-soils, may extend from 1000 to 2000 Scotch, or from 1270 to 2540 English acres.

7. *Pasture Farms.*

Where farms, as is usually the case in hilly districts, are almost entirely employed in pasturage, or in the breeding of sheep or cattle, there can be no precise limits to their extent. A proprietor of an estate in the north of Scotland, had once a farm in his own hands, which he was converting from the rearing of cattle, to the breeding of sheep, on which he had above 6000 Cheviot sheep, and the farm amounted to above 25,000 English acres. In some parts of the Highlands of Scotland, sheep walks still more extensive are to be met with.

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* The term *Commercial* may be objected to; but why not the commerce of land, as well as that of corn? And may not the raising of corn be called a species *of manufacture*, and the most important of any?

8. *Farms for Accommodation or Amusement.*

It is not only a healthy, but a useful employment, for gentlemen residing in the country, to have some land in their own possession, for the purpose of occupation or amusement, and to provide themselves with the various articles which their families may require. Perhaps those articles might often be purchased fully as cheap at market; and it would be more profitable to the proprietors, to let the land at a fair rent; but it would be highly unpleasant for any gentleman, to have the servants of another, over whom he could have no control, working constantly near his own house, and to have scarcely a spot he could call his own, on which he or his family could take air or exercise *. What the extent of such farms should be, it is not necessary to discuss, as so much must depend upon the establishment kept by the proprietor, the time he resides in the country, and the degree of attention which he can give to his farm.

9. *Farms of Experiment and Public Utility.*

Since the attention of the public has been so much directed to agricultural pursuits, many respectable proprie-

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* Mr Kerr, in his Survey of Berwickshire, p. 51, justly observes, that there cannot be a more rational, or more continually varying and amusing occupation of time, for the retirement of a country gentleman, than the detailed superintendence of agricultural pursuits, united with attention to the improvement and embellishment of his estate, by inclosing and planting.

tors of land in England, among whom I with pleasure enumerate the Duke of Bedford, the Earl of Egremont, Lord Somerville, Mr Coke in Norfolk *, Mr Western in Essex, Mr Curwen in Cumberland, and many others who might be named; and several in Wales, as Sir W. W. Wynne, Sir Robert W. Vaughan, &c.; have cultivated extensive tracts of country, with the view of trying useful experiments, and disseminating a knowledge of agriculture in their respective neighbourhoods.

Nothing can be more laudable than such exertions, and the spirit of improvement which they have thus excited in all the adjoining districts, and the important facts thence brought to light, is the best recompence for all their labours. At the same time, even such efforts cannot compensate for the want of "Experimental Farms" under public patronage, and devoted exclusively to the ascertaining of useful facts by accurate experiment, continued as long as may be necessary. The establishment of even one farm of that description, on a proper scale, would be more valuable to this country than the conquest of many provinces.

On the whole, leaving out the three last descriptions of farms, as it is so difficult to assign any particular limits to their extent, the proper sizes of the other sorts may be stated as follow:

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* Some Scotch farmers went to examine the husbandry of England. On their return they declared, "That after having "visited all the principal counties in England, they returned per- "fectly satisfied in their own minds, that every thing that an "agriculturist could wish to see, was to be met with at Holk- "ham, where every branch of husbandry was conducted with "the greatest regularity, and on the most improved principles." What an eulogium on the intelligent owner of that noble property.

English acres, omitting fractional parts.		Scotch acres.
62	1. Small farms, under	50
62 to 127	2. Dairy farms, from	50 to 100
127 to 254	3. Town farms, from	100 to 200
254 to 762	4. Clay-land farms, from	200 to 600
762 to 1370	5. Turnip-land farms, from	600 to 1000
1270 to 2540	6. Commercial farms, from	1000 to 2000*.

Some are apt to consider large farms as hostile to population, and in other respects prejudicial to the public interests. Let us consider how far such objections are well founded.

With regard to large farms having a tendency to diminish population, such an idea has no just foundation, and indeed can never happen under an improved system of agriculture, where a proper proportion of the land is cultivated by the plough, and where it is the practice to have *married servants*, on the footing which will afterwards be described in Dissertation III.

In Mr Robertson's valuable Survey of Mid-Lothian, printed in 1795, it is distinctly stated, that upon the farm of Granton, then possessed by himself, containing about 250 English acres, in consequence of the junction of three farms *into one*, the population had increased from 40 to 70 souls. It is remarked by the same intelligent farmer, that on small farms, there are seldom any houses or cottages but the farmer's own, all his assistants being unmarried. Where there are great farms, on the other hand,

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* Some would recommend the division of arable farms into three classes. 1. Small farms under 200 English acres; 2. Moderate sized farms, from 200 to 500; and large farms from 500 to 1000. Such is the diversity of opinion on this most interesting subject.

cottagers abound; all the labourers are married, and have families: hence population must increase.

As it is seldom, however, that the former state of the population on a farm can be exactly ascertained, it may be sufficient to consider its actual amount on some great farms at this time, which will furnish data to calculate the amount of agricultural population in a well-cultivated district, under a proper system of management.

Mr Brown at Markle in East-Lothian, on a farm of 535 Scotch, or 670 English acres, had, in 1802, a population of 102 souls, which in 1809 was reduced to 91; entirely owing to the families of some of the servants growing up, and removing to other places.

Mr Somerville at Athelstanford-Mains, in East-Lothian, has, on his farm, containing 608 Scotch or 772 English acres, a population of 92 souls, occupying twenty separate houses. His servants have a number of children, some of them seven or eight, all of whom are usefully employed in agricultural service.

On the farm of Mr Rennie of Phantassie, in East Lothian, amounting to 553 Scotch, about 702 English acres, the population amounts to 163 souls. Six of the hinds have six children each.

Mr Nisbet, on his farm of Redden, in Roxburghshire, which amounts to about 1000 English acres, has 150 souls, and some of the hinds have seven, eight, and nine children.

But the most striking instance reported to me of agricultural population, and of its increase owing to a great extent of land being in the possession of one individual, is on the farms possessed by that intelligent and respectable farmer, Mr Walker of Mellendean, in Roxburghshire, of which he gives the following most satisfactory statement:

STATE of the Population of the Farms occupied by Mr Walker, when he entered into possession, on the supposition that each family consisted of five persons.

Entry.		Families.	Souls.
1787.	Caverton and Backedge, -	16	80
1789.	Mellendean, - - -	13	65
1803.	Softlaw and Middlemost walls, -	8	40
1808.	Rutherford, Broomhouse, &c. -	30	150
		67	335

The same rule for calculating the number of souls is applied to ascertain the present state of the population on Mr Walker's farms, though in many cases it is higher.

Present STATE of Population on these Farms.

	Families.	Souls.
Mellendean, - - -	27 -	135
Caverton, &c. - - - -	16 -	80
Softlaw, &c. - - - -	19 -	95
Rutherford, &c. - - -	44 -	220
Total population, *anno* 1811, -	106 -	530
Total former population, - -	67 -	335
Increase,	39 -	195

If it were contended, that the number of unmarried servants kept on the different farms should not be enumerated, 15 on that account might be deducted, leaving, on that supposition, an increase of population on the farms of one individual, to the enormous amount of 180 souls.

It is proper, however, to state, that the population on the farms occupied by Mr Walker, amounting in all to 106 families, are not exclusively employed in their cultivation. Upwards of one half of them consist of weavers, masons, and labourers of various descriptions, who, except in time of harvest, (when all turn out who are able to wield the sickle), only furnish a young girl or lad, when wanted, for every kind of field-work, at 1 s. *per* day in summer, and 10 d. *per* day in winter. The number of families who are constantly employed on the farms, and who thence exclusively derive their maintenance, may be stated at 50. The liberal encouragement given to the remaining householders, every one of whom has a garden attached to his house, and likewise a considerable quantity of potatoes and flax raised in the fields, also coals carriage free; all these articles, with the victuals they receive in time of harvest, and the wages of the girl or lad at other seasons of the year, may be considered as equal to one-fourth part of their annual maintenance.

It appears on the whole, from these returns, that the extent of land possessed by these five farmers, amounts to something more than 6000 English acres, and that the population is 1026, or about one soul for every six English acres, (rather more than 106 *per* square mile), without any common being attached to their farms, as is frequently the case in regard to small farms.

It would likewise have been extremely desirable to have ascertained the surplus produce, or the quantity of human food sent to market, after feeding the population on these farms; but various circumstances render it hardly possible to make such a calculation with any thing like minute accuracy, especially when it is to be applied to different farms, of different soils, and under different management. I shall therefore content myself with presenting to the read-

er an abstract of a return transmitted to me by a respectable farmer, Mr Brown at Markle, who possesses 670 English acres of land, chiefly kept under arable husbandry, and the population of whose farm amounts to 91 of all ages. Such an abstract, I trust, will answer every useful purpose, in regard at least to the surplus produce of that important species of occupation, clay-land farms.

" According to the most accurate calculation in my power, the produce of ninety English acres, of tolerably good land, is required to support the population of this farm. These acres are appropriated in the following manner:

1. Twenty-two acres in grass for milch cows.—*Note.* The produce of forty-four acres, besides straw in winter, is consumed by milch cows; but as one half of the cheese and butter manufactured from the milk of these cows is carried to market, only twenty-two acres are charged.
2. Twenty-five acres in oats, the produce of which is consumed as meal, in the shape of pottage or hasty-pudding, by the servants of the farm and their families, or by the shearers, (reapers), in harvest.
3. Twelve acres in barley, the produce of which is used upon the farm, either as pot barley, or manufactured into meal, or malted and used upon the farm in harvest time.
4. Six acres in pease and beans, the produce of which is manufactured into meal, and used with part of the barley as bread by the servants.
5. Six acres in potatoes.
6. Three acres in garden ground.
7. Six acres in wheat.—As wheat bread is purchased, not only for my own family, but also by the married ser-

vants upon the farm, I am inclined to think that the produce of six acres may be charged on that account.

8. Eight acres in grass for feeding beef and mutton, mostly used by my own family, with a small quantity by the married servants.—I here estimate that eighty stones of beef and mutton, Amsterdam weight, are annually consumed upon the farm, and that it will require eight acres of grass to produce that quantity of beef and mutton, over and above the original weight of the animals when purchased."

" From the above it appears, that the produce of 90 English acres of ground is required to support the population of this farm. It may be proper next to add, that the produce of the like number of acres is consumed by the working, supernumerary, and saddle horses, viz. 40 in grass, tares and hay, and 50 acres in oats; and that on an average of years, the produce of 45 acres is used as seed-corn. About 100 acres or thereabouts are annually unproductive, that is in summer fallow, in grass upon which young horses are reared, or occupied by fences, roads, water-runs, stack-yards, and other purposes, from which no direct produce is returned. These, with four acres in flax, given to the servants as a part of their wages, amount in all to 329 acres, which, deducted from 670, the total number of acres in the farm, leaves a balance of 341 acres for raising surplus produce."

" Of the acres carrying surplus produce, 22 have already been accounted for, as devoted to the feeding of milch cows, one half of the cheese and butter manufactured from their milk being estimated as going to market. About other 70 acres are kept either in pasture grass for sheep, or used for soiling cattle in the yard, and 30 acres in turnips. Thus the number of acres in grass and turnips for feeding cattle and sheep, is 122; and if this is substracted from the above balance of 341 acres, it will ap-

pear that there remains 219 English acres upon which disposeable grain can be cultivated."

"With regard to the produce of these acres, it is difficult to speak with the slightest precision, because it varies from year to year according to the goodness and badness of the seasons; while at the same time it deserves attention, that every deficiency of produce, in the acres set apart for supporting home population, and raising food for horses, and seed-corn, must be made up from this surplus. Generally speaking, the surplus corn may be estimated at something more than four quarters *per* acre, or 900 quarters altogether, after the acres appropriated to home consumption and fattening live stock are deducted."

"As a part of the turnip crop is consumed by my own milch cows, and by breeding ewes in the winter months, the return from feeding stock may be stated at 800 stones, Amsterdam weight, *per annum* of beef, mutton and lamb, over and above the weight of the cattle and sheep when purchased, and about 150 stones of pork, fed in the straw-yard upon the offals of corn, &c. I have no *data* for estimating the quantity of butter and cheese sold, as most of the butter belongs to the servants; but if the whole is rated at 70 Scotch stones, of 22 avoirdupoise pounds, I suppose a great error will not be committed."

The above return is very satisfactory, as it throws so much light on the internal economy of arable farms, respecting which so little hitherto has been communicated to the public. It required indeed a degree of intelligence, of ability, and of public spirit, which are rarely to be met with combined in the same individual, to draw up such a statement, and to induce the author to agree to its publication.

On the farms of Mellendean, &c. which are principally of a light turnip soil, the produce of land in cultivation, is proportionally less, not being so fertile; but as naked fallows are unnecessary in turnip soils, there is a greater proportion of land under grass or green crops, and the produce of meat is higher. According to Mr Brown's calculations, his farm, containing 670 English acres, would produce a surplus produce on an average of 900 quarters, or, at eight bushels *per* quarter, 7200 bushels. It would also produce 950 stones, Amsterdam weight, of beef, mutton, lamb and pork. This is at the rate of nearly ten three-fourth bushels, and about one stone seven pounds of butcher meat of surplus produce for every acre on the farm. On the other hand Mr Walker, on 2866 English acres of turnip soil, calculates, that there is a surplus produce of 3551 quarters of grain, and about 7000 stones of butcher meat; consequently the surplus produce, *per* acre, is nearly ten bushels of grain, and about two stone eight pounds of butcher meat, English weight, or fourteen pounds to the stone, and sixteen ounces to the pound.

When all these circumstances are taken into consideration, can it be questioned whether large farms, under an improved system of cultivation, instead of being hostile, are not even favourable to population, furnishing, at the same time, an immense supply of surplus produce; and I should be glad to know, whether any branch of domestic industry, or of foreign commerce, can, in any other respect, be compared with THE CULTIVATION OF THE SOIL, AND THE IMPORTANCE OF ITS PRODUCTIONS?

We shall now proceed to state the various advantages resulting from large farms. These may be classed under the following general heads: 1. When the farm is of a proper size, (from 300 to 600 Scotch, or from 381 to 762 English acres), less expence is incurred in building houses

and offices, and in keeping them in repair, than if the farm were divided, and two sets of houses, &c. were erected for the accommodation of two or more farmers; at least that is generally the case, though some large farmers go beyond all bounds in the accommodations they require. 2. The inclosures on a large farm are on a larger scale, and are originally made, and afterwards kept in repair, at a less expence; much ground is thus added to cultivation, and less shelter is given to the vermin with which hedges and walls abound. 3. There is also a saving of expence in housekeeping, when two farms are united into one, the amount of which must vary according to circumstances. 4. The saving in the expence of cultivation is considerable. When a farm of 200 English acres is united to one of 330, the work of a pair of horses, and a ploughman will be saved; fewer instruments of husbandry are also necessary; in particular, one threshing-mill will be sufficient. 5. The land is much better cultivated, more effectually drained, and more improved by extraneous manures, which small farmers cannot afford to purchase to any extent, or to convey to any distance. 6. A much greater quantity of disposable produce, as appears from the preceding statement, is sent to market. The small farmer and his family, indeed, consume so much of the produce they raise, and raise so little, that the surplus is inconsiderable. It is only by means of large farms, that great towns, or populous districts, can be supplied in sufficient quantities with such articles of primary necessity, as grain, butcher meat, &c.; in regard to butcher meat in particular, it is generally sold by the large farmer in a fattened state, which is seldom done by the small farmer. 7. The live stock on large farms is confessedly of a superior quality, because a large farmer can afford to purchase the best sorts, and to maintain them afterwards; the instruments of husbandry are likewise of a more

improved description, and capable of performing their work in a better manner. 8. The labour on a large farm can be better subdivided than on a small one *, by means of which critical periods may be caught, more strength of labour can be applied to particular parts of the farm when wanted, and the work may be done better, and with more expedition in an adverse season. 9. The large farmer has full employment, independent of manual labour †. He has enough to do, superintending others, instead of working with his own hands; for whilst he is busily employed himself at a particular job at one part of his farm, his servants may be completely idle at another. It is in consequence of having full employment, that he is not under the necessity of engaging in other undertakings, which not only abstract his attention from his farm, but may also be attended with real loss ‡. 10. A farmer with

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* In the cultivation of turnips, for example, the first forming of the drills, the carting, spreading and ploughing in of the dung, and the sowing of the seed, ought all to be going forward at the same instant, in order to insure success. But on very small farms, these different operations must of necessity be accomplished in succession; hence, in a droughty season, not only is the soil itself robbed of its moisture, but the dung, from lying spread along the drills, is exposed to the rays of a scorching sun, and is frequently rendered so dry, as to be of very little service to the plants, during the first stage of their growth; nay, may even operate against the vegetation of the seeds, by keeping the soil immediately under them too open.

† Men of genius and enterprise will not be confined to small farms, such as those which prevail, for instance, in some parts of Stirlingshire, &c. They speculate on something else, as black cattle, horses, grain, &c. &c. and look upon their farms as a secondary and unimportant concern.

‡ Since rents, and the expence of cultivation and of labour, have so much increased, a person of education and character can-

a large capital has enlarged ideas, which expand with the extent of his possessions: He has a superior education, and understands better every branch of his profession: He has more enterprise, and having fewer prejudices to subdue, he is more ready to adopt new improvements: He is able to travel about to obtain useful information, to educate his family better, and in every respect to render them more useful members of society. 11. On a large farm a greater variety of practice can be introduced, such as pasturing a proportion of the farm alternately; and whilst the large farmer may be both disposed and enabled to change his intended system, should an unfortunate season, or some other incident, render it necessary, the farmer on a limited scale must continue in the trodden path, often in opposition to the true principles of his profession. 12. Large farms are favourable to the improvement of land in an inferior or waste state. The small farmer generally leaves it as he found it, whereas, when a great farmer, with a considerable capital, gets such land into his possession, on an improving lease, he soon renders the waste nearly as valuable as the old cultivated soil*. 13. Large farmers, when they are active, spirited, and intelligent, are the fittest persons to try experiments, and to prosecute them to the necessary extent; small farmers cannot afford it, and gentlemen farmers, though there are exceptions to the rule, seldom give that unremitting attention so necessary for insuring success. 14. Many operations

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not live respectably, or even with comfort, on a small farm, and must look out for some other means of subsidiary occupation.

* When persons can be prevailed upon to take small portions of waste land, (from two to six acres), to improve, they often do it effectually; but small farmers rarely add to the arable land in their possession.

on a large farm can be done better, and, in proportion to their importance, at a cheaper rate, than on a small one. For instance, where a large flock of sheep are kept, or a number of cattle, careful and intelligent servants may be hired for attending them, which no farmer on a small scale can afford. A large farmer can also sell at market, in the same space of time, and with little more expence, ten times the number of cattle or sheep, or ten times the quantity of grain, that any small farmer can have to dispose of. 15. The large farmer, possessed of all these advantages, can in general also afford to pay a higher rent, and, from the capital or credit he possesses, with more punctuality, than the small farmer, from whom the rent he agreed to pay, cannot often be exacted without compunction. 16. The large farmer pays more taxes to government for his house, and every article of his consumption. Indeed, farmers whose rents are under £. 50 a-year, are considered by parliament, and justly too, to be in so wretched a state, that they are not made liable to the payment of the income tax*,—and if all the farms in the kingdom were under £. 50 *per annum*, government would not draw a single shilling from the occupiers of land. In the last place, Respectable farmers, possessing that species of independence which a lease furnishes, are a most important link in the great chain of society, not to be found in any country in the universe,

* The following description of the situation of a small farmer, by Mr Walker of Wooden, will fully justify this exemption.—"In every instance I have met with, where a person occupies such a quantity of land as 50 acres, merely as a farmer, without any other employment, I have uniformly observed, that the occupier could with difficulty live by his profession; that his lands were always in a wretched condition, and of course very unproductive; and that he and his family drag on a very uncomfortable existence, in constant trouble and perplexity."

Great Britain alone excepted,—a class, whose habits of industry, intelligence and spirit, and the extent of whose capital, which it has required centuries to accumulate, form a species of bulwark, materially tending to preserve the existing order of society; but if that bulwark, which it might be difficult now to overthrow, were once laid prostrate, it would baffle human policy, without the existence of similar circumstances, ever to renew.

When all these particulars are considered, and when to them it is added, that population, as well as produce, is in general increased by large farms, under an improved system of agriculture, there seems to be little doubt, which description of farm is best entitled to encouragement, and is the most likely to promote the public advantage.

There is an important subject of discussion, connected with the size of farms, of which it is necessary here to take notice, namely, Whether it is proper that any farmer should be suffered to occupy more than one farm, or to possess what in England is called an off-farm, and in Scotland a *led one?* There is much to be said in favour of the practice. Though a farm of a moderate size may be sufficient for a person possessed of moderate talents, and of a small capital, yet where great talents and a great capital are united, there is no reason why ample scope should not be given for the exertions of which such an individual is capable, and why he should not be permitted to extend his pursuits. Such additional farms are rarely taken but by able and spirited cultivators; and it would be bad policy to limit such men to the cultivation of the single spot on which they happened to be originally set down, to curb or palsy their exertions, or to fetter their free agency, where their actions do not endanger the happiness of society. It is also said, Why should agriculture, in point of extent, be more limited than commerce? And in regard to led or off farms in particular, it is contend-

ed, that it is hardly possible for farming to be carried on with spirit, or to any great extent, where they are prohibited. A person, for instance, possessed of £. 10,000 of capital, is desirous of following agriculture as a profession. He takes a farm of 500 acres, on a lease of 19 or 21 years. He lays out £. 5000 of his capital in stocking and improving that farm; but if he has no other land in his occupation, as a place of refuge, he is entirely dependent on his landlord, who, at the termination of his lease, may deprive him of his farm on very short notice, and when it may be impossible for him to provide himself with another. Unless, therefore, he is in the actual possession of another farm, he may be under the distressing necessity, of selling off the whole of his stock, and abandoning his profession; whereas with a led, or off farm, he may still retain the stock on that part of his occupation, though he may be obliged to sell off the rest *.

These led or separate farms are generally intrusted to farming stewards, and being usually at no great distance from the farmer's residence, are managed under his inspection, and in general advantageously. Hence, though it is certainly desirable, that every farm of a proper size, should have a separate possessor, yet there are cases, at the same time, where a departure from that general rule may be admissible †, more especially when farmers go from well-cultivated

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* Mr Bailey of Chillingham remarks, that a tenant, who has a farm of strong loam, upon which he cannot grow a sufficiency of turnips, can afford more rent for a farm of turnip soil, than any tenant who had to reside upon it, and had no other farm.—It is likewise obvious, that a high sheep farm is not safe, and far less commodious, without a low farm, or at least winter pastures annexed to it.

† One of my farming correspondents has explained his sentiments on this subject, in the following terms:

districts, which is sometimes the case, to improve the barren; or where opulent sheep farmers, in the more southern districts, take extensive tracts of country in the north, for the purpose of breeding more improved kinds than were formerly to be met with there, by means of which the value of these distant regions is greatly increased. Peculiar

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" I now beg leave to give my humble opinion respecting the resolutions which some proprietors have entered into, of insisting on *residing tenants*, which I am of opinion is very much against their own interest, as well as a check to farmers of enterprise and capital; for instance, a farmer has a farm of 100 acres, but has a capital to stock another farm of 100 acres more, which is in his neighbourhood, and which he could manage equally well as his own, and of course could give a greater rent for it than any other person who might be obliged to reside upon it, having no family to keep. But as residing tenants are insisted on by both landlords, it is out of the question. The farm is therefore let to a farmer, probably 10 s. or 20 s. *per* acre cheaper, than the other farmer would have given. The person that gets it, perhaps hardly maintains his family upon it, whereas the other would have made money, not having a family to keep; the landlord would have got more rent, and the residing tenant would have turned himself to some other useful employment, or got another farm. Nor is this all. The farmer with the accumulated stock, may perhaps embark it in a business that he knows nothing about, or perhaps lends his money to the residing tenant, who, from the smallness of the farm, is unable to make any thing of it; and in either case, a heavy loss is sustained by an industrious farmer, who might have made, on different principles, a moderate fortune." There is a difficulty in this case regarding keeping up the buildings, where they are erected on separate properties. If none exist, it is certainly for the interest of the landlord to avoid that expence. *Care however must be taken, that one farm is not enriched at the expence of the other, by the conveyance of produce, unless a fair proportion of manure is returned.*

attention is necessary to enforce improvements in regard either to stock or culture, in cases of that nature; but where that is properly adverted to, the farm may certainly be brought into a better, rather than into a worse condition. Nor can any serious mischief arise from the practice, for the evils, if any, will correct themselves. If a man rents more land than he can advantageously manage, either by himself or others, he suffers of course, and his business is of necessity contracted to that scale, which his capital, industry and abilities are adequate to embrace*.

In regard to the idea, that if farms in general were of a large size, it might frequently be difficult to get men of capital to take them, and that it would establish a kind of monopoly: It is to be observed, that where leases are granted, persons quit other lines of life, as the army, the navy, the law, commerce and manufactures, and become farmers, thinking it a liberal, creditable, and profitable profession. Hence, in prosperous districts, there can be no want of candidates; and where there is any deficiency of capital, the payment of the rent may be postponed, till the sale of the crop can produce it, and the buildings and other substantial improvements may be made by the landlord. On such a system, large farms may be introduced, even into poor countries, and persons possessed of even a moderate capital, may be enabled to take them. As to the objection, that large farmers are apt to get above their profession, and to become, like gentlemen-farmers, luxurious in their mode of living, careless about their business, and trusting every thing to their stewards; that may happen in particular cases, but can never become general. The exaction of a fair rent, and the pressure of taxes, is a sufficient stimulus to *economy*, as well as to industry and exertion.

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* Remark by Mr John Shirreff.

It must not be imagined, however, that no arguments can be made use of in favour of small farms, though those in favour of large ones seem greatly to preponderate. There are, it is said, numbers of people, tolerably well skilled in improved agriculture, who have not capital for what is now considered to be even a moderate farm. The share which these farmers, and their families, take in the cultivation of the farm, saves considerable outgoings in the wages and maintenance of servants *, and superior care may be expected, where the whole family are personally interested in the success of the undertaking. It is admitted, that the greater tenants, either as breeders or graziers, will in general produce proportionably the greatest quantity of animal food; but there are two exceptions even to that rule, in the cases of pigs and poultry, which thrive better, and are more profitable, under the minute attention of the cottager or small farmer.

It is also remarked by Mr Stewart of Hillside in Dumfries-shire, from whose return the preceding observation is taken, that when a young man sets out in the world as a ploughman, without patrimony, or any thing but what is to be acquired by his own exertions, he may possess, not only worth and industry, but also invention and genius, fit to show an example to all around him, had he an opportunity to do so. But if farms are all large, or even of moderate sizes, such deserving people may never get above the servile state in which they set out in the world †. Many

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* This advantage is ideal. See note, p. 15.

† It is found, in well-cultivated districts, that persons of this description, who have industry and talents, become stewards or barn-men to large farmers, then overseers to gentlemen, and, latterly, get farms themselves: and thus a spirit of industry and ambition is fostered in that class of men. Besides, it is not the business of the political economist to find situations for the display

now in the highest class of agriculturists, as well as of store farmers, exemplary and beneficial improvers of their country, must still have remained in the employment of herding, or at the stilts of the plough, were it not for the progressive size of farms, which enabled them to commence their career in agriculture.

There was a time, says Mr Robertson of Muirton, not yet long past, when the little tenant was unfit for his profession, from want of knowledge. That is rarely the case in these days. Agriculture is now understood by the little tenant of 40 acres, as well as by the great farmer of 400 *. The threshing-mill, indeed, is not adapted to the lesser class of husbandmen; but it would be better, it is said, to reduce the power of that complicated machine, to the ratio of the little tenants, than to raise all tenants to the present level of that useful instrument. On the other hand, it is contended, that a threshing-mill can never be employed with profit, if it is built on *a very small scale*, as

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of individual worth, industry, invention, and genius; these, when left at liberty, will always find a field for themselves. The political economist can only point out such arrangements, as are the most likely to promote the general benefit of the community.

* On this subject Mr Shirreff very justly remarks, that though the tenant of 40 acres may naturally be as able as the tenant of 400 acres, he has not had an opportunity of gaining the same quantum of knowledge, by *a sufficient latitude of experience*. A medical man gets more knowledge by walking the hospitals of a great city in a few months, than another from country practice for many years. Many serious blunders may be committed by persons of limited experience and education, particularly in the choice of feeding, and, above all, breeding stock; also in the choice of corn, clover, turnip, seed, &c. which would produce consequences fatal to his prosperity, if he farmed on an extended scale.

it does its work indifferently, and as the hands employed in working it will be almost half idle.

It is known, however, by experience, that it is impossible that any country can be improved, where small farms prevail, from the difficulty of finding servants and labourers to carry on the necessary improvements. No sooner does any one save a little money as a farm servant, than he resolves, instead of working for others, to take a farm for himself; and the consequences are, not only a want of labourers, but a race of very indifferent servants, above servitude, expecting soon to be masters. This mischief was fully experienced, when improvements began in a remote district of the kingdom, (the county of Caithness) *, and thence it became necessary, to bring as many labourers as could be procured, from those districts where large farms had been introduced, and, consequently, where numbers of people were compelled to look out for work, and to become industrious. The greater number of industrious labourers in England, is in a great measure owing to large farms having been earlier introduced into that country, than was generally the case in Scotland; in consequence of which, a greater number of individuals, were compelled to depend on their daily labour for their subsistence.

Besides, when the inhabitants of any district, into which improvements have been introduced, are removed, which, to a certain extent, must be the case, until a proper system is established, they are not lost to the community, for unless induced to emigrate to foreign parts, they settle in the neighbouring towns and villages, and become useful and industrious members of society. Many towns in the western parts of Scotland were peopled by the introduc-

* This will be fully explained in the agricultural report of Caithness.

tion of sheep farms into Argyleshire, which are not so favourable to population as farms under an improved arable culture; but so far from lamenting that circumstance, these emigrants look down with pity on their former miserable state, and are enabled, from their successful industry, to remit sums of money to their relations, who continue to reside in poverty, in the vales of their ancestors *.

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* On the subject of the public advantages derived from the introduction of the system of sheep farming into the Highlands, the evidence to be met with in the Statistical Account of Scotland seems to be conclusive. Mr Dugal M'Dougal, minister of Loch-Gail-head in Argyleshire, (Statistical Account, vol. iii, p. 182), after stating that the great decrease in the population of that parish was owing to the introduction of sheep, proceeds to observe, 1. That the produce of the district, since sheep became the principal commodity, is at least double the intrinsic value that it was formerly, so that half the number of heads, produce more than double the quantity of provisions, for the support of our large towns, and the supply of our tradesmen and manufacturers; and, 2. That the greater part of those who were dispossessed of their farms, betook themselves to a seafaring life, or settled in the populous towns upon the Clyde; and thus were taken from a situation, where they contributed nothing to the wealth, and very little to the support or defence of the state, to situations in which their labour is of the greatest possible utility, where they have an easy opportunity also of training up their children to be useful and valuable members of society.

The following statement is extracted from the statistical account of the parish of Dunoon in Argyleshire, (Statistical Account, vol. ii, p. 391).—The number of farmers, by the introduction of sheep, and other causes, have certainly decreased, but many of the subtenants, with a cow's grass, &c. find themselves easier and better off, than when they occupied a larger possession; and even those who have been obliged to emigrate, have in general settled in Greenock, where they seem better fed and clothed than when they resided in their original parish.

On the whole, there seems to be a regular progress in the size of farms. At first, when the art of agriculture is in its infancy, farms must be small, because there is neither capital to cultivate, nor skill to manage, large occupations. As capital increases, and skill improves, farms become larger, and indeed attain a size, which appears calculated, (unless where it is the practice to have married servants), materially to diminish the population of the country. But if that were to be the case, we must not seek for a criterion of the strength of the country in the number of people inhabiting any particular insulated portion of it. Some have rashly concluded, that because in some districts population has diminished, the whole strength of the country has also been reduced; but whoever will give himself the trouble to consider, that enlarged means of subsistence must give rise to a multiplication of numbers, and that this multiplication, and the efforts employed to provide for its maintenance, are in a manner reciprocal, will soon discover, that partial depopulation, by the enlargement of farms, is only the consequence of a demand for a greater quantity of sur-

In the statistical account of Inverchoalan, (vol. v, p. 472), it is observed, that the former possessors, who neither understood grazing nor tillage, and could hardly, by their poor unskilful efforts, gain a miserable subsistence for themselves and their families; happily for them, they were mostly removed to the neighbouring towns, where they found sufficient employment, and where many of their children, by the advantages of education, (which they could not enjoy in their own country), have raised themselves to independence, become useful members to the community, and a support and comfort to their parents in their old age.

plus produce in another quarter, where an increasing population is more usefully and profitably employed. It appears, too, that in the vicinity of towns, in which a variety of articles are required from the farmer, he has so many profitable minutiæ to attend to, that a large farm becomes unsuitable. In such a situation, the farms are consequently smaller, than those at a greater distance, where articles of a wholesale description are the proper objects of attention.

DISSERTATION II.

OF

THE CIRCUMSTANCES CONNECTED WITH THE ESTABLISHMENT OF A LIBERAL SYSTEM OF CONNEXION BETWEEN THE LANDLORD AND TENANT.

THE nature of the connexion, between the landlord and the tenant, has greatly altered, with the progress of political society. In ancient times it was of a military description. The proprietor of an estate was himself a warrior, and those who possessed land under him were his soldiers, who were bound to military service, and who paid him hardly any rent, with the exception of some articles in kind, for the maintenance of his family.

When the feudal system was abolished, the landlord, at first, still considered himself as the patron of those who were placed under him. The rents continued low; the occupiers of the estate claimed, from generation to generation, under the name of "*Kindly Tenants*," a sort of tacit patrimonial interest in their respective possessions *; and paying very inadequate rents, and having no permanent security in their possessions, nothing could exceed their indolence, their ignorance, and of course the poverty of their condition.

* See Aiton's Survey of Ayrshire, p. 175.

The connexion between the two classes is now of a description totally different. The landlord considers himself as the owner of an estate, of which he must make the most he can, for the benefit of himself and family; he lets it for a certain number of years, to persons possessed of skill, integrity, industry, and capital, under the obligation of paying him a specific sum *per annum*, out of the annual produce, besides being bound, if not to improve the value of the property, at least that it shall not be deteriorated during the currency of the lease. The contract becomes more of a mercenary nature, without however totally destroying ties of a more pleasing description; for the landlord, on the one hand, must still feel himself deeply interested in the success of his tenant, on which his own income and prosperity materially depend; whilst the tenant, on the other, looks up to his landlord as a friend, whose interests are necessarily incorporated with his own, and who will naturally be inclined to give an industrious and improving tenant a preference, when the farm is to be re-let.

Under this new system it is essential, both for the landlord and the tenant, to take various particulars into their consideration, in order that the connexion between them may be established on just and liberal principles. That connexion is one of the most satisfactory, as well as the most important, that exists in political society. It does not depend upon the mere covenants of a lease, but upon a conviction, that the interests of the two parties are interwoven together, and that it is necessary for both parties to take into consideration the following circumstances, as the basis of their future connexion: 1. The extent of Capital which the farmer may require to carry on his operations; 2. The Expence and Profit of farming; 3. The Proportion of that Profit to which the landlord is entitled under the name of rent; and, 4. The Duration of Leases, and the Covenants which they ought to contain.

Sect. 1.—*On the Capital necessary to carry on Farming Operations.*

A proprietor ought to ascertain, when an individual offers to take his farm, not only the character of the person who offers, in regard to professional knowledge and ability, to industry, and to integrity, but also whether he is possessed of a capital adequate to its due cultivation. No prudent landlord will ever think of giving the possession of any part of his estate to a needy adventurer, who may bid a high rent, without the means of fulfilling his engagements. It is incumbent upon the tenant also to calculate what capital the farm he offers for will require, and whether he can command that capital. The tenant, indeed, unless in times of great national prosperity, when credit abounds, is not safe, without a surplus, in case any untoward circumstance should occur. A general idea has been entertained, that a farmer should be possessed of a capital, according to the extent of the farm he takes, at the rate of £. 10 *per* Scotch, or about £. 8 *per* English acre. This estimate is properly applicable only to arable lands. In pasture districts, the common mode of estimation is, according to the amount of rent to be paid; and it is calculated, that in ordinary pastures, every farmer ought to have, at his command, from three to five times the rent he has agreed to pay *. In regard to arable farms, however, the actual sum required must vary, according to a

* In the more fertile grazing districts, carrying stock worth from L. 30 to L. 40 *per* acre, as is the case in some parts of England, five rents is evidently insufficient.

number of circumstances, which it may be proper to enumerate.

The *first* point to be considered is, Whether it is necessary for the farmer to expend any sum in the erection, or in the repair of his farm-house and offices. In some cases, a large sum is required; for landlords are not always able to lay out much money in providing their farmers with such accommodation as they may require, and they will rather give the land on advantageous terms to the tenant, than undertake that expence. 2. A considerable sum must always be necessary, for purchasing a proper stock, and instruments of husbandry, which, according to the Scotch system of husbandry, unite cheapness* and simplicity, and, as will afterwards appear, (see the list in the subjoined statement), are not very numerous. 3. The capital required must also greatly depend on the condition of the farm, at the commencement of the lease, in regard to drainage and inclosure, whether the ridges are high and crooked, or must be levelled, and whether there are any waste lands to be brought into a state of cultivation, during the currency of the lease. 4. Much also depends on the circumstance, whether it is necessary to purchase lime, or any extraneous manure, to any great extent. The sum laid out on lime alone, when the improvement of a farm commences, has often been from £. 5 to even £. 10 *per* acre. 5. An incoming tenant has also, in many cases, a considerable sum to pay to his predecessor, for the straw of the crop, the dung left upon the farm, the proportion of fallow he has executed, &c. so that much depends on the conditions obligatory on the way-going tenant. 6. The capital required must also depend upon the period when the rent becomes payable. If the farmer enters in May,

* The threshing-mill is not an exception, considering the work it executes.

and pays one-half year's rent in November, and the other half in the May following, (which in Scotland is called a forehand rent), it is certainly a hardship that he should be liable for rent, before he has had any return from the land, out of the actual produce of which it ought to be paid. 7. In the last place, a tenant, on entering on a farm in May, has to maintain himself, his family, and his servants, for eighteen months, before he can draw any profit from the land, excepting from the cattle kept during the winter, which he may perhaps sell in the spring, or the summer following. No rent therefore should be paid on an arable farm, where the farmer obtains possession of only the houses and grass in May, and has not a corn crop till the year which succeeds his entry, until at least a year and a half after that entry. He has not the means of paying any rent at an earlier period, unless it is taken from his capital, which would tend to cripple his future exertions. It is a better plan, therefore, both for the landlord and the tenant, that the entry should always be at Martinmas, and that the payment should commence at the Martinmas following. The fixing of a judicious term for the entry into farms, is a subject of more importance than is commonly imagined.

Regarding the capital required by an arable farmer, returns have been transmitted to me by a number of intelligent farmers, and after forming a calculation of the sizes of the different farms, and the sums required for each, the result was, that £. 8, 9s. *per* Scotch, or £. 6 : 12 : 9 *per* English acre, was, on an average, supposed to be sufficient *, and that where a larger sum is laid out, the farmer must have

* In England, it is considered to be an established fact, that arable land worth 30 s. *per* acre, requires L. 10 of capital *per* acre. But, where attention is paid to economy, a less sum will suffice, according to the Scotch system, as fewer horses are required, and the instruments of husbandry are simpler and cheaper.

in view some advantages to counterbalance the additional expence. Even in Berwickshire, the sum required, under proper management, does not much exceed the above estimate. A farmer in that county took on lease a farm of 600 acres of turnip soil. It had been rented at only 10 s. *per* English acre, and he agreed to give 31s. 6d. Much was to do in regard to manuring, liming, draining, purchasing stock, &c.; but at the end of the four first years, upon balancing his books, the farm owed him only £. 4400, or about £. 7, 7s. *per* English acre, making a fair allowance for the annual maintenance of the farmer and his family.

It is evident that any estimate of the sum required to stock a farm must be fluctuating, depending upon the prices, at the time, of the various articles which the farmer requires. As it is desirable, however, to have some idea of the articles necessary, and of the total amount, the following estimate, drawn up by an experienced and intelligent farmer, (Mr Dudgeon of Prora in East Lothian), is submitted to the reader's consideration, as applicable to a district in a high state of cultivation, and where the farmers are opulent.

Estimate of the Sum required to stock a farm of 300 Scotch, or 381 English acres, of clay land.

12 Plough horses, at L. 50,	L. 600	0	0
1 Supernumerary,	30	0	0
1 Saddle horse,	50	0	0
6 Ploughs, at L. 3, 10 s.	21	0	0
13 Harrows, at L. 1, 7 s.	17	11	0
1 Roller,	5	5	0
6 Close carts, at L. 15,	90	0	0
6 Long ditto, at L. 4,	25	8	0
2 Wheel-barrows, at 21 s.	2	2	0
2 Hand ditto, at 5 s.	0	10	0
	L 841	16	0

Brought forward,			L. 841	16 0
Forks, graipes, &c.			3	8 0
72 Corn bags, at 4 s.			14	8 0
2 Firlots, at 20 s.			2	0 0
Barn looms, rakes, &c.			3	10 0
Threshing machine, with appendages,			200	0 0
2 Hand-fanners,			5	0 0
Furniture for horses,			60	10 0
Smith one year, for every thing *per* plough and cart,			24	0 0
Wright, ditto,			21	0 0
Property and assessed taxes,			97	10 0
One-half statute road-money, at 40 s. *per* plough *,			6	0 0
		L.	1278	17 0

Servants Maintenance.

72 Bolls oats, at 25 s.	L. 90	0 0	
18 —— barley, at 30 s.	27	0 0	
12 —— pease, at 25 s.	15	0 0	
½ —— wheat stacker,	1	0 0	
One pair of shoes, ditto,	0	10 0	
		133	10 0

Horses.

240 Bolls oats, at 24 s.	L. 288	0 0	
7 Acres grass, at L. 8,	56	0 0	
6 —— tares, at ditto,	48	0 0	
1200 Stones of hay, at 10 d.	50	0 0	
		442	0 0

Seed Corn.

	acres.	bolls.				
Fallow,	50	0		0	0 0	
Wheat after fallow,	50	37½	87½ at 40 s.	L. 175	0 0	
Ditto after pease & beans,	50	50				
Clover,	50	0		50	0 0	
Oats,	50	50	at 25 s.	62	10 0	
Beans,	50	50		62	10 0	
	300				350	0 0
			Carry forward,	L.	2204	7 0

* Some contend, that the whole road-money should be charged; but it is the common practice for the out-going tenant, and the successor, to pay each one-half of the statute road-money.

Brought forward,	L. 2204	8	0
Lime for one-sixth part of the farm, say 50 acres, -	500	0	0
4 Extra servants, at 12 s. a-week for 9 months, - -	86	8	0
Dung for 1200 cubic yards, at 3 s. *per* yard, the price to an outgoing tenant, - - -	60	0	0
Filling and spreading same, 266 cart-loads, at 3 d, -	3	6	8
Shearing and leading first harvest, viz. 200 acres, at 28 s. 6 d.	285	0	0
25 Wintering cattle, at L. 10 each, - - -	250	0	0
4 Milch cows, at L. 12, 10 s. each, - - -	50	0	0
Interest on money expended for one year, - -	135	0	0
Add, a supernumerary horse, L. 20 ; a poney, L. 14 ; horse-furniture, L. 8, - - - -	42	0	0
L. 3616	1	8	

This is at the rate of L. 12, 1 s. *per* Scotch, and L. 9 : 12 ; 10 *per* English acre.

In this calculation no allowance is made for the first year's rent, nor for furniture, nor the maintenance of the family, which would add considerably to the preceding estimate; but the amount of which must depend on a great variety of circumstances.

It is evident that there must be a great diversity of opinion regarding the various articles above enumerated. Some recommend having fourteen instead of twelve horses, and giving a higher price for them, as L. 55 *per* pair *. Others insist on more economy in the first expenditure: they say, that a prudent farmer, if he has not a large capital at his command, will purchase eight horses, past their prime, which he may buy for L. 25 each, together with four breed-

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* In regard to the price of horses, that is perpetually fluctuating. More than even fourteen horses would be required, were no carts hired to drive lime ; but in the estimated price of that article, the expence of carriage is included for a tolerable distance from lime.

ing mares, and in five or six years he would be fully supplied with good stock, and may sell his old horses without much loss. In many cases such shifts must be resorted to, where there is any deficiency of capital.

Some object to the idea of having only one roller, considering four as necessary on a large farm, two of stone and two of wood, as two must frequently work together, and one of stone and one of wood would not suit. This would increase the expence of rollers from L. 5, 5 s. to L. 20.

Others contend, that it is necessary to have 1200 cubic yards of dung for such a farm, to dung the fallow wheat *, and the oat stubble for the beans: but to that it is answered, that no such quantity can ever be obtained from an outgoing tenant, and it is only what can be bought in such a situation, that can be included in the expence of stocking a farm.

It is also said, that the quantity of oats given to the horses is more than is necessary, and the quantity of hay and grass too little; and that many farmers in the Carse of Gowrie feed their horses entirely on clover throughout the whole summer; but, if they are well worked, particularly in driving lime, substantial feeding is necessary.

It is also observed, that the rotation proposed, makes the return of crops of wheat too frequent; and hence it arises, that the grain is so often blighted, or the quality inferior; by such severe cropping, the condition of the ground is reduced, so as to render it unfit for producing good grain.

It would be tedious to insert in this work, all the various calculations which have been transmitted to me, of the capital necessary to stock an arable farm; but I shall endea-

* The propriety of dunging wheat after fallow, will be afterwards considered.

vour shortly to state some of the most interesting observations, which I have received upon the subject.

In the county of Moray, it is stated, that where the tenant has to build houses, and inclose the farm at his own expence, it would require L. 3000 to stock 220 Scotch acres, that is at the rate of nearly L. 13, 13 s. *per* Scotch, or L. 10 : 18 : 6 *per* English acre; but it is observed, at the same time, that half that sum would be sufficient, if the proprietors were to build the houses, inclose the farm, and allow a sufficiency of lime. For these expences they would be amply repaid, as tenants of small capital would then embark in farming, and more candidates would present themselves, which would tend to the increase of rent. Besides, the capital of the farmer, if laid out in buildings, is locked up in permanent works, yielding him no annual return, and in which he has only a temporary interest; whereas, it would be more beneficial for both parties, that the farmer's capital were to remain at his command, for improvements that would yield him some yearly profit, or which might meet the failure of crops, and other casualties to which he is exposed.

In the Mearns or Kincardineshire, the capital employed in agriculture, over the whole county, amounts to about L. 675 *per* 160 English acres of arable land, including in it the stock required for the uncultivated land. This is at the rate of L. 4 : 4 : 4 *per* English acre.

In Forfarshire, it is estimated, that a farm brought under regular rotation, may be stocked sufficiently with horses, cattle, implements, threshing machine, and all necessary expences for the first year, for about L. 6 *per* Scotch, or L. 4, 16s. *per* English acre.

In the Carse of Gowrie, where the farmers in general enter at Whitsunday, and then get possession of the houses only, it is calculated, that it will require L. 10 *per* Scotch, or L. 8 *per* English acre, of capital, exclusive of rent, of

payments for fallow done, or the manure to be purchased. Besides, the family and servants must be maintained for eighteen months, and the stock for about twelve months, before the farm produces any thing to the new-coming farmer. This however is greatly owing to the injudicious term at which he enters.

In Fife, it is observed, that on all soils, poor or rich, the least sum that is necessary is two years and a half rent of the farm, free of debt. Three or four years' rent is still better; and five years' rent can be profitably employed in stocking a farm, but not more, unless great and expensive improvements are to be executed.

In the county of Clackmannan, about L. 1600 is required to stock a farm of 180 Scotch acres. This is at the rate of nearly L. 8, 18 s. *per* Scotch, or L. 7 : 2 : 5 *per* English acre.

In Stirlingshire, it is observed, that the sum required for stocking a farm, must vary according to circumstances, and the condition of the farm; in general, however, upon entering on a new lease, a farmer requires to be possessed of from L. 8 to L. 10 of capital for every Scotch acre he means to occupy. This is at the rate of from L. 6, 8 s. to L. 8 *per* English acre.

An intelligent farmer in Mid-Lothian informs me, that in the year 1754, he stocked a farm of 110 Scotch or 132 English acres, which in those days required ten horses, for two four-horse ploughs, and for one two-horse cart employed in collecting manure, &c. He kept a minute account of the whole expenditure, which amounted to a trifle more than L. 400. This is at the rate of L. 3 : 12 : 8 *per* Scotch, and L. 2 : 18 : 2 *per* English acre. It would now require above triple the amount to stock the same farm; notwithstanding, that the number of horses is so much diminished by the introduction of two-horse, instead of four-horse ploughs, according to the improved system of modern husbandry.

Without going through the various other communications which I have received upon the subject, I shall content myself with adding an estimate, drawn up by a farmer in Roxburghshire, of the sum it actually required to stock an arable farm of 200 English acres, which he entered to at Whitsunday 1810.

To one year's rent, at L. 1, 18 s. *per* acre,	L. 350	0	0
To four work-horses, at L. 35 each,	140	0	0
To keeping four horses for one year,	110	0	0
To two carts, at L. 15 each,	30	0	0
To two ploughs, at L. 3 each,	6	0	0
Two pair of harrows,	3	0	0
To harness for horses,	15	0	0
To 20 Highland cattle, at L. 5 each,	100	0	0
To two hinds, for one year, at L. 35 each,	70	0	0
To a boy,	8	0	0
To grass-seeds, for sowing down 40 acres,	24	0	0
To seed wheat, for 20 acres, 10 bolls at L 3, 10 s. *per* boll,	35	0	0
To seed barley, for 24 acres, 12 bolls, at L. 2, 5 s. *per* boll,	27	0	0
To seed oats, for 40 acres, 28 bolls, at L. 1, 15 s. *per* boll,	49	0	0
	L. 967	0	0
Deduct from this 40 acres of grass, at L. 1, 15 s. *per* acre,	70	0	0
	L. 897	0	0
Add for maintaining farmer's family, taxes, &c.	230	0	0
	L. 1127	0	0

The above is the sum it will cost in general to stock a farm of that extent, varying more or less according to circumstances. It is at the rate of L. 5 : 12 : 8 *per* English acre.

Industrious tenants, therefore, even with moderate capitals, ought not to be discouraged by any idea, that an overgrown capital is necessary for taking a farm; at least

where the rents are moderate, and the landlord is disposed to give them every reasonable encouragement.

As a considerable capital, however, is necessary, it is well worth consideration, whether some means might not be devised, that will enable the farmer to procure the use of capital, on as easy terms as the manufacturer or the merchant. He ought to gain 15 *per cent.* on the capital he lays out. He can easily therefore pay 5 *per cent.* for the money he may have occasion to borrow. Let him then be furnished with the means of giving adequate security; let the tenant have the power of subletting his farm, or assigning his lease, always securing to the landlord the preference on equal terms. A prudent farmer, of respectable character, would in that case never want credit when necessary, and all difficulties regarding the capital required, would in a great measure be done away. This important subject will afterwards be resumed, at the conclusion of this dissertation.

Sect. 2.—*On the Expence and Profit of Farming.*

This is a subject of great importance on various accounts. It is necessary to check as much as possible, by authentic statements of the expence and profit of farming, a spirit of speculation and rivalship, which has a tendency to raise the rent of lands too high, a circumstance which would prove equally injurious to the tenant and to the landlord. The rent should only be carried to such a height, as may be sufficient to enforce industry and improvement, and to promote economy in management, without discouraging exertion; and wherever there is

the least doubt, in regard to probable produce, markets, &c. the cast or balance should always be in favour of the tenant.

In offering for a farm, the tenant should take into serious consideration the innumerable risks to which he is subjected, from defects in the soil, inclemency of the seasons *, improvident laws, want of sale for the articles he raises, mercantile failures, want of health to attend to his business, deficiencies of crops, and various other contingencies.

In accepting an offer for a farm, the landlord ought to consider the character of the person who offers, the capital he is possessed of, his skill in farming, the probable produce under medium management, and the average amount and value of that produce, on a medium of yeers, so that after paying the rent, and all expences, the tenant may have a fair share of the produce, a handsome interest for the capital employed, and an ample competence to enable him to live comfortably, to maintain and educate his family, and to lay up a surplus for contingencies. The rent of the farm, however, should always be such as to promote exertion and improvement †.

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* Whilst writing this sentence, I received a letter from Muirton, in Kincardineshire, dated 20th November, in which there is the following paragraph:

"The rain is pouring on in tubfuls, and nearly all the beans still in the field; also much oats and bear. It has rained incessantly for four weeks."—A miserable prospect to a farmer, if he is liable to a very high rent.

† On the subject of rent, Mr Aiton, in his Survey of Ayrshire, p. 176, &c. has pointed out the injurious consequences resulting from rents when too low. He observes, that formerly the tenants claimed, from generation to generation, a sort of tacit patrimonial interest in their respective possessions, known in Ayrshire by the right of "*Kindly Tenants.*" The rejection of their claims, which

There is another point of view in which a discussion on the expence and profit of farming is of the utmost importance, as it is necessary to ascertain to what extent arable cultivation ought to be extended. Land that will not produce 30 bushels of oats, 24 bushels of barley, and 18 bushels of wheat, *per* statute acre, under the best management that circumstances will admit of, had better remain in pasturage.

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excited loud and reiterated complaints among the tenantry, has been notwithstanding productive of much good, not only to the proprietors, but even to the tenantry, as well as to the public. While the former tenants and their heirs were continued in their possession, and the rents not much raised, their indolence and bad habits were also continued; but by laying the farms open to public competition, the proprietors have had a choice of tenants; the most active and industrious were preferred, which operated as an incitement to others to become more industrious; and every advance in the rent, called forth a greater stretch of invention, and served as a *stimulus* to industry.

The rent of any farm may be stretched to a pitch which no industry can reach; but if not carried too far, the raising of rents will do more to excite industry, than ever so many lectures upon the subject. A fair increase of rent, where that has not hitherto taken place, it is contended, would be productive of the following advantages.—1. There would be more economy in the management of farms.—2. There would be more industry and exertion to raise a greater produce, and to bring it to a better market.—3. There would be a disposition to try experiments for the purpose of acquiring more knowledge in farming; and farmers would go about to acquire knowledge, instead of remaining sluggishly at home.—4. The proprietors, receiving a better income, would be enabled to live more comfortably, and to do more good.—5. The revenue of the country would be greatly increased, more especially while the property-tax continues on its present footing.—6. Fair rents may be called the best *stimulus* to improvement.

With a view of communicating data, on which calculations may be made of the expence and profit of farming on a large scale, I shall subjoin estimates, with which I have been furnished by two respectable practical farmers. It is evident, at the same time, that these calculations are only applicable to improved districts, where the soil is fertile, the farms are of a proper size, and where the tenant enjoys these most important advantages, a favourable climate, a fertile soil, good roads, and vicinity to market.

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1. Statement by Mr Murray, lately residing at Kirkland-hill, in East-Lothian.

Mr Murray supposes a farm to consist of 400 Scotch acres of good hard clay soil, divided into eight fields; six of the fields under a rotation of six courses, and two of them old pasture; when these are taken up, two to be laid down for pasture.

Nos.	acres.				
1.	say 50 of fallow to have 4 or 5 furrows and harrowed, &c.				
2.	50 of wheat, at 10 bolls,	500 bolls, at 40s. *per* boll,	L. 1000	0	0
3.	50 of clover, at	200 stone *per* acre, L. 10,	500	0	0
4	50 of oats, at 10 bolls,	500 bolls, at 25s. *per* boll,	625	0	0
5.	50 of beans, at 8 bolls,	400 bolls, at 25s. *per* boll,	500	0	0
6.	50 of wheat, at 10 bolls,	500 bolls, at 40s. *per* boll,	1000	0	0
7. 8.	100 in 2 fields for pasture,	at L. 3, 10s. *per* acre,	350	0	0
	400 to produce	1900 bolls, and 100 acres pastured,	L. 3975	0	0

As land lets at present, this farm should rent at L. 1600 *per annum*, or L. 4 *per* Scotch acre. The produce is at the rate of L. 9 : 18 : 9 *per* Scotch, and L. 7, 19 s. *per* English acre.

The following is an abstract of the expence of cultivating such a farm.

Abstract of the Work of Men and Horses.

Nos.	acres.	days.		
1. Fallow	50	325	of a man and two horses,	L. 162 10 0
2. Wheat	50	171½	ditto,	85 15 0
3. Clover	50	125	ditto,	62 10 0
4. Oats	40	169	ditto,	84 10 0
5. Beans	50	285	ditto,	142 10 0
6. Wheat	50	171½	ditto,	85 15 0
7, 8. Pasture	100	4	ditto,	2 0 0
Acres	400	1251 days		L. 625 10 0

Six two-horse ploughs might do the work upon the farm, though many would prefer seven.

Abstract of Labourers on each Field.

Nos.	acres.		
1. Fallow	50	100 days spreading dung, at 2s. 6d.	L. 12 10 0
2. Wheat	50	328 days' work,	72 14 0
3. Clover	50	*per* account,	56 18 0
4. Oats	50	328 days,	72 14 0
5. Beans	50	*per* account,	78 5 0
6. Wheat	50	328 days,	72 14 0
7, 8. Pasture	100	the expence of a herd,	30 0 0
Acres	400		L. 1021 0 0

General Statement.

1. Total expence of labour,		L. 1021 0 0
2. Rent $\frac{40}{100}$ of the produce,		1600 0 0
		L. 2621 0 0
3. Balance, for seed to add to sow the crop, 100 acres wheat, 50 acres oats, 50 acres beans, 50 acres clover, Labouring utensils upholding, Manure to the farm, above what the straw produces, Interest of L. 4000 of stock, Per centage on the perishable stock and lost time, The necessary maintenance of the farmer's family, taxes, &c.		1354 0 0
		L. 3975 0 0

It may be proper now to give the same estimate in English acres, without inserting fractional parts.

Nos.	acres.			
1. Fallow	63 of fallow, to have 4 furrows and harrowed.			
2. Wheat	63 of wheat, quarters 255, at L. 3 : 18 : 3½,	L. 1000	0	0
3. Clover	63 of clover, at L. 7 : 17 : 4½. -	500	0	0
4. Oats	63 of oats, quarters 372, at L. 1 : 13 : 6½,	625	0	0
5. Beans	63 of beans, quarters 204, at L. 2 : 9 : 11,	500	0	0
6. Wheat	63 of wheat, quarters 255, at L. 3 : 18 : 3½,	1000	0	0
7, 8. Pasture	127 in 2 fields for pasture, at L. 2 : 15 : 0½,	350	0	0
	508 acres. Produce, 1087 quarters.	L. 3975	0	0

Abstract of the Work of Men and Horses.

Nos.	acres.	days.			
1. Fallow	63	325	man and two horses,	L. 162	10 0
2. Wheat	63	171½	ditto,	85	15 0
3. Clover	63	125	ditto,	62	10 0
4. Oats	63	169	ditto,	84	10 0
5. Beans	63	285	ditto,	142	10 0
6. Wheat	63	171½	ditto,	85	15 0
7. 8. Pasture	127	4	ditto,	2	0 0
	508	1251 days		L. 625	10 0

Abstract of the Labourers on each Field.

Nos.	acres.			
1. Fallow	63	100 days spreading dung, 2s. 6d.	L. 12	10 0
2. Wheat	63	328 days' work, -	72	14 0
3. Clover	63	*per* account, -	56	18 0
4. Oats	63	328 days, - -	72	14 0
5. Beans	63	*per* account, -	78	5 0
6. Wheat	63	328 days, - -	72	14 0
7, 8. Pasture	127	expence of a herd, -	30	0 0
	508		L. 1021	0 0

General Statement.

1. Total expence of labour, - -	L. 1021	5	0
2. Rent $\frac{40}{100}$ of the produce,	1600	0	0
Carry forward,	L. 2621	5	0

Brought forward,	L. 2621 5 0	
3. Seed to add to sow the crop, 100 acres wheat, 50 acres oats, 50 acres beans, 50 acres clover, -		
Labouring utensils upholding. -		
Manure to the farm above what the straw produces,	1354 15 0	
Interest of L. 4000 of stock, -		
Per centage on the perishable stock and lost time,		
Necessary maintenance of family, taxes, &c.		
	L. 3975 0 0	

2. Statement of the Produce, Rent, and the Expence of cultivating a Farm in East Lothian, of 533 Scotch, or 702 English acres, by George Rennie, Esq. of Phantassie.

1. *PRODUCE.*

Rotations.	Fallow.	Wheat.	Hay.	Oats.	Beans.	Pasture.	Price.			
I. On a Clay Soil.		Bolls	Stones.	Bolls	Bolls		*s.*	*L.*	*s.*	*d.*
1. 42 acres fallow,	42	—	—	—	—	—	—	—		
2. 42 —— wheat,	at 10 bolls *per* ac.	420	—	—	—	—	40	840	0	0
3. 42 —— hay,	200 stones ——	—	8400	—	—	—	1	420	0	0
4. 42 —— oats,	10 bolls ——	—	—	420	—	—	25	525	0	0
5. 42 —— beans,	8 —— ——	—	—	—	336	—	24	403	4	0
6. 42 —— wheat,	8 —— ——	336	—	—	—	—	40	672	0	0
252		756	8400	420	336	—	—	*L.* 2860	4	0
II. On a Light Soil.			Barley.							
1. 62 acr. turnips,	—	—	—	—	—	—	10*l*	620	0	0
2. 31 — barley,	10 bolls *per* acre,	—	310	—	—	—	30*s.*	465	0	0
2. 31 — wheat,	8 —— ——	248	—	—	—	—	40*s.*	496	0	0
3. 62 — grass pastur.	—	—	—	—	—	62	140*s*	434	0	0
4. 62 — oats,	10 bolls *per* acre,	—	—	620	—	—	25*s*	775	0	0
5. 53 — pasture, old,	—	—	—	—	—	53	90*s.*	238	10	0
301 turnip land and grass. 252 clay land.		1004	310	1040	336	—	—	*L.* 5888	14	0
552 acres.	Average produce, *per* Scotch acre, in six years, L. 11 . 7 s. or *per* English acre, L. 9 : 1 : 7.									

It appears from this interesting statement, that winter wheat, sown in spring after turnips, yields within two bolls *per* acre of the produce on strong land after summer-fallow; so that, considering the expence of the fallow, and the loss of rent for one year, wheat is raised at a cheaper rate, on this plan, after turnips, than after fallow. It also appears, that it is more profitable to sow winter wheat in spring, than barley; for that grain, at ten bolls *per* acre, and 30*s.* *per* boll, produces only £. 15; whereas the wheat, at eight bolls *per* acre, and 40*s.* *per* boll, yields £. 16 *per* acre. The straw of the wheat also is much more valuable, and the succeeding crop of grass (the wheat crop not being so apt to lodge) is better. The advantage, therefore, of raising winter wheat in spring, and after turnips, fed by sheep on the ground, cannot, in the whole, be stated at less than *L.* 3 *per* acre. It must be admitted, that the land is left in better condition after barley, than after wheat, and the difference would probably be made up by the after crops in the course of future rotations; at the same time, if wheat must be raised in greater quantities, to prevent an injurious dependence upon foreign powers for bread-corn, we are thus furnished with the means of raising it *.

* On this subject Mr Rennie farther remarks, that when wheat is sown after turnip, it is sown upon the land from which the turnip is first taken off, which is generally the best in the field: barley, on the contrary, is sown upon the last eat off, and is frequently much hurt by the growth of the turnips in the spring months. After attentively taking the whole circumstances into consideration, therefore, though there may be some lands on which, from soil, climate, and situation, winter wheat may be sown in spring with advantage, yet, on the whole, he is of opinion that barley is the most advantageous crop of the two.

2. *EXPENCES.*

	Wheat.	Barley.	Hay.	Oats.	Beans						
I.						*L.*	*s.*	*d*	*L.*	*s.*	*d.*
1. Rent of 553 acres Scotch, at 90*s.*	—	—	—	—	—	—			at 90*s.* 2488	10	0
2. Wheat for 42 acres, at three firlots *per* acre,	31½	—	—	—	—	at 40*s.* 63	0	0			
3. Hay for 42 acres, seeds,	—	—	—	—	—	42	0	0			
4. Oats for 42 acres, at 3 firlots, 2 pecks,	—	—	—	42	—	25*s.* 52	10	0			
5. Beans for 42 acres, at 1 boll, 3 pecks,	—	—	—	—	50	24*s.* 60	0	0			
6. Wheat for 42 acres at 1 boll,	42	—	—	—	—	40*s.* 84	0	0			
									301	10	0
II.											
1. Turnips for seed, at 2 lbs *per* acre,	—	—	—	—	—	6	6	0			
2, Barley for seed, 2 firlots, 1 peck,	—	18	—	—	—	30*s.* 27	0	0			
3. Wheat for seed, 1 boll,	31	—	—	—	—	40*s.* 62	0	0			
4. Hay for seed,	—	—	—	—	—	62	0	0			
5. Oats for seed, 3 firlots, 2 pecks,	—	—	—	54	—	25*s.* 67	10	0			
									224	16	0
Expences, -	104½	18	—	96	—	—					
Horse corn, -	—	—	—	350	—	25*s.* 437	10	0			
—— hay, -	—	—	2000	—	—	10*d.* 83	6	8			
—— grass, 10 acres,	—	—	—	—	—	160*s.* 80	0	0			
—— tares, 5 acres,	—	—	—	—	—	160*s.* 40	0	0			
									640	16	8
Smith and wright-work, - - -						100	0	0			
Servants, 17 men. at *L.* 36 a year, - -						612	0	0			
—— 3 men and a boy, - - -						80	0	0			
Turnip work, &c. - - - -						50	0	0			
Harvest work, &c. - - - -						300	0	0			
Taxes and incidents, - - - -						190	0	0			
Six cows kept for the family, after deducting what is made into butter and cheese, produce, - - - -						30	0	0			
									1362	0	0
									5017	12	8
						Profit,			871	1	4
						Total produce,			*L.* 5888	14	0

If the total profit is L. 871 : 1 : 4, that is, at the rate of L. 1 : 11 : 6 *per* Scotch, and L. 1 : 5 : 2½ *per* English acre. From that profit, the family of the tenant is to be maintained, and the interest of the capital employed, which cannot be calculated at less than L. 6000, must be paid. The profit on the capital is only at the rate of about 14 *per cent.* an interest hardly equal to that to which a farmer is justly entitled, considering his toil, and the hazards to which he is liable from the seasons, the markets, &c. On this subject it is well observed by Mr Dudgeon of Prora, that if something decent is not made by skilful and industrious farmers, it would injure both the proprietors of land and the public. Adventurers of a different stamp would occupy the farms, and the genius and spirit of agriculture would become languid, and perhaps expire.

The preceding estimates shew the great importance of having farms of a proper size. On a farm of 100 or 200 acres, a farmer, who paid a high rent, could hardly exist; whereas, on a farm of 500 acres, even paying a high rent, he may live comfortably, without requiring an additional capital, in the same proportion as if the farm had been divided into several small ones *, and without much more additional risk or labour.

In regard to the farm of Phantassie, in particular, the intelligent author of the preceding estimate adds, that this farm ought to be considered as connected with a pretty large distillery, from which abundance of rich dung is procured. There is also a lime rock on the premises, from which that valuable article is easily obtained,—advantages which are hardly ever to be met with.

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* For instance, having only one house, one set of offices, one threshing-mill, &c.

On the whole, though in compliance with the request of the President of the Board of Agriculture, Mr Rennie made a return, according to the present value of land and produce, it is by no means his opinion, that a farmer is warranted in risking his capital, by taking land at such a rent as the present prices of corn seem to justify. It has always been his firm and decided opinion, that the only fair and just criterion to judge of the value of land, is, by making an estimate, according to the prices by which the export and import of grain are regulated. The present prices of corn may be attributed to the very peculiar state of Europe, owing to which, for these several years past, our connexion with the Continent has been greatly impeded, and of course importation from foreign countries made at a vast increase of expence. A continuation of high prices, therefore, depends upon the continuance of war, the corn laws being in fact completely annihilated. Of late, Government has found it necessary to encourage importation of grain from every quarter, though it is perfectly plain that, so long as the war continues, prices cannot be reduced to their former level, unless very full crops are obtained at home. Keeping these matters in view, he is firmly of opinion, that no man is warranted in renting land at higher prices than these rates of import and export will enable him to pay. If his conjectures are well founded, a deduction ought to be made from the above statements, in exact proportion to the difference between the prices by which these statements are made out, and the prices at which the ports are opened and shut; it being on these grounds only, that he considers any man warranted in risking his capital on land, until new corn laws are obtained *.

* At the same time, it is to be observed, that as in the highest years of importation, the quantity of grain imported, forms but a very inconsiderable proportion of the grain necessary for the con-

Such statements as these above inserted*, sanctioned by the authority of intelligent practical farmers, must throw great light on the important question of the produce and the expence of farming; also on the rent that land should yield, and the profit to which the farmer is entitled. They are certainly too high for any farm that is not situated in the most fertile districts of Scotland, for it is difficult any where else to get such an extent of land, as from 400 to 500 acres, of equal fertility, and without any muir or bog, or any other sort of inferior land, being intermixed with it.

Sect. III.—*On the Proportion of Produce to be exacted as Rent, and on the mode of Payment.*

It has been already observed, that it is essentially necessary to exact a fair, but not an oppressive rent, from the tenant; such a sum as will have the effect of exciting him to activity and exertion. Without dwelling

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sumption of the inhabitants of the country, even in bread, (probably not a week), independent of the consumption in beer, in spirits, in feeding cattle, &c. the force of these ingenious arguments is therefore greatly diminished. Had it not been for the great improvements which have taken place in agriculture, we could never have fed such an increasing population so amply, without tenfold additional importation.

* Many farmers in Scotland, more especially those who cultivate a great extent of land, keep regular accounts; but the practice is not so general as it ought to be. Every farmer should annually make up such a statement as Mr Rennie has given.

on the high rents exacted for lands in the neighbourhood of large towns, which are no precedent in other cases, it is proposed to consider, what sum may be fairly demanded for land, under a regular system of arable or convertible husbandry.

Before entering, however, into any detail, it may be proper to observe, that though the rent paid by the tenant is in general no bad criterion of his skill and industry, yet, at the same time, much must depend, on a variety of other circumstances; as, 1. The soil of the farm, and the means of remedying its defects *; 2. The subsoil, a point of much more importance than is commonly imagined †; 3. The climate; 4. The situation as to markets; 5. The vicinity to coal and to lime, or other extraneous manures; 6. The means of conveying the produce of the farm, (for good roads make an essential difference in the value of a farm); 7. The size of the farm itself; 8. The position and construction of the house and offices; 9. The length of lease; 10. The covenants; 11. The encouragement given to improvement; and, 12. The amount of other payments, besides the rent, to which the tenant is liable. Every farmer, before he engages in a new lease, ought to take all these, among a variety of other circumstances, into his consideration.

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* Clays are improved by a mixture of sand, and sandy soils by clay, which are frequently at no great distance from each other.

† Mr Robertson of Ladykirk observes, that the subsoil of a farm should even be more attended to than the soil. It seldom happens, in a good climate, that the land is unproductive, when the subsoil is dry and good. It is wonderful what even a thin soil will do, when full of manure, and on a good and sound subsoil.

On the subject of rent in general, there are two points which require peculiar consideration: 1. What proportion of the produce should be paid to the landlord; and, 2. Whether it should be paid in money, or in kind, or partly in both.

1. The following are the particulars of the rent paid for a farm amounting to 280 Scotch, or 350 English acres.

1. Money rent,	£. 4	15	0
2. Half a boll of wheat, (2 Winchester bushels) averaged at 40s. *per* boll, or 10s. *per* bushel,	1	0	0
3. Half a boll of barley, (2 Winchester bushels) averaged at 30s. *per* boll,	0	15	0
Total *per* Scotch acre,	£. 6	10	0

Which is equal to £. 5 : 2 : 3 *per* English acre.

This farm, however, is situated in the Carse of Gowrie, which is certainly one of the most fertile districts in Scotland: It is not far distant from the Frith of Tay, a navigable arm of the sea, by which lime may be imported, and the produce of the farm exported, with great facility: The climate of the Carse also, as well as the soil, is uncommonly well calculated for arable cultivation, and less liable, than almost any part of the kingdom, to any agricultural disaster.

There is an instance of a still higher rent in East-Lothian, amounting to L. 1710 *per annum*, for only 240 Scotch, or 288 English acres. This is at the rate of L. 7 : 2 : 6 *per* Scotch, or L. 5 : 14 s. *per* English acre.

The total annual produce cannot be estimated at more than L. 3200, which would be at the rate of L. 13 : 6 : 8 *per* Scotch, or L. 10 : 13 : 4 *per* English acre.

These rents totally destroy the old maxim, that every arable farm ought to produce three rents, one for the land-

lord, one for the expence of cultivation, and one for the maintenance of the farmer*. It might be founded in truth, when first thought of; but since the introduction of two-horse ploughs, and threshing machines, it has not the slightest affinity to the situation of the farmer. Besides, since roads and markets have been so much improved, the sale of every article more certain, the number of horses and servants necessary for an arable farm so much reduced, and every branch of agriculture so much better understood, the landlord is entitled, *at least in fertile districts*, to a larger proportion of the produce.

What proportion of the produce of arable land, ought to be paid as rent to the landlord, is a question that has long been considered as abstruse, mysterious, and very difficult to resolve. In the year 1753, it was recommended to the attention of the public, by the Edinburgh Society for the improvement of Agriculture, but no person ventured to discuss it, until after the lapse of twenty years, when the late Alexander Wedderburn of St Germains, father of the celebrated Chancellor Wedderburn, Earl of Rosslyn, published his essay on that subject, in the year 1766. In that work Mr Wedderburn justly observes, that no blind bargain ought to be concluded between the landlord and tenant; for there are rules and principles, by the fair application of which, the rent that ought to be justly demanded, for arable land, may be ascertained with tolerable precision. It is a bad system, he remarks, when parties, whose interests are so clearly interwoven together, meet rather like enemies than friends: the natural consequence of which is, that he who is most skilful in the arts of deceit, obtains a disgraceful victory. As a foundation for a proper system on this subject, Mr Wedderburn con-

* It was an old Scotch adage, "Ane to saw, ane to chaw, and "ane to pay the laird with a'."

tended, that land producing on an average 8 bolls of wheat, 3 of pease, 6½ of barley, and 4½ of oats, or at the rate of 5½ bolls *per* Scotch acre overhead, together with 165 stones of hay, might be considered as a standard; the value of which, on the average of twenty years preceding 1754, produced £. 300 *per annum*, which admitted a division of its produce into three parts, one for the landlord, one for the tenant, and one for the expence of cultivation. Where the produce was less, the expence continuing the same, the estimated surplus, he proposed, should be equally divided between the landlord and the tenant; but when the produce was more, the surplus, beyond the one-third part of 5½ bolls *per* acre, he affirmed, should go to the landlord, as explained by the following Table.

Bolls per acre.	Value of product.	Expence.	Rent.	Farmers profit.
5½	300	L. 100	L. 100	L. 100
6	340	100	140	100
7	381	100	181	100
8	436	100	236	100

Such calculations, however, were only suited to the miserable state of agriculture at the period when Mr Wedderburn wrote. At that time, 126 Scotch, or 144 English acres, of arable land, were reckoned the proper size of a farm, and the capital required to stock it was estimated at only L. 200, or at the rate of L. 1 : 13 : 4 *per* Scotch, and L. 1 : 7 : 9 *per* English acre *. Had the capital required for farming continued at the same rate;

* See an Essay upon the question, "What proportion of the produce of arable land ought to be paid as rent to the landlord;" by Alexander Wedderburn, Esq. of St Germains, printed at Edinburgh, anno 1770. Page 6. and 10.

had the expence of cultivation remained in the same proportion; had no allowance been made for erecting threshing mills, purchasing lime, &c.; and had the principle been adopted, that the profits of the farmer should not exceed L. 100 *per annum*; what would now have been the state of the agriculture of Scotland?

The French Economists adopted a mode somewhat similar, for estimating the amount of rent. They gave, what they called the *produit net*, to the landlord, by including the farmer's profit among the expences, and, deducting the total expence from the total produce, the net remainder they accounted the proper rent for the landlord to receive.

It is evident, that such *nice calculations* are not suited to the peculiar situation of the farmer, whose crops are precarious, who has no certainty of the prices he is to receive for his produce, and who may be often disappointed in his payments, from the failure of those to whom it may be sold; and it is quite absurd to apply the same rules to all situations, soils, and climates, in all the various districts of an extensive country. I am induced, therefore, to submit to the consideration of the reader, the following hints, on which some average calculation may be formed, for the mutual advantage of the landlord and tenant; the balance, whenever there is the least doubt, being always given in favour of the tenant.

Poor land cannot possibly pay the same *proportion of rent*, according to its usual produce, as the rich and fertile. The expence of cultivation is nearly the same, and indeed in some cases may be higher, and yet the produce is greatly inferior, not only in quantity, but in quality. Some land may yield, on an average, at the rate of L. 15 *per* acre *per annum* and upwards; some at the rate of L. 10 *per annum*; and some at the rate of L. 5, and even less. The expence of cultivating each will not be materially

different. The rent, therefore, ought not to be in the ratio of the produce. Perhaps a fair proportion might be, two-fifths of the produce in the first instance; one-third in the second; and one-fourth in the third.

Or,

	Per Scotch acre.	Per English acre.
1. Rent of land producing L.15 *per annum*, at two-fifths,	L.6 0 0	L.4 16 0
2. Rent of land producing L.10 *per* acre, at one-third, -	3 6 8	2 12 6
3. Rent of land producing L. 5 *per* acre, at one-fourth, -	1 5 0	0 19 8

For inferior produce, perhaps one-fifth might be sufficient *.

It is to be observed, that these calculations are intended for land in an arable state, (grazing farms must be let on principles totally different, namely, according to the quantity of stock they can maintain); and that the rent is supposed to be in full of all demands exigible from the tenant.

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* It is remarked by Mr Stewart of Hillside, that the rent ought to depend upon other circumstances as well as the proportional quality of the soil and quantity of produce. Lands of a good soil and subsoil may be so high situated as to make the crop greatly more precarious, and the grain inferior in quality, and it may be distant from lime and from markets. This will add greatly to the expence of management, and must lessen the price of the produce. In these high-situated farms, turnips will often grow luxuriant, but they cannot be depended on for the whole of the winter months, and seldom or never in spring, unless they are stored. They become the more precarious, that they must be sown early in the season, of course they are the more subject to be frosted. Ruta baga, however, or Swedish turnip, is not liable to this objection.

It has been contended, that as both the expence of cultivating land, and the value of its produce, are infinitely various, a farmer ought to calculate, what profit he can make, *on his whole farm*, without entering into details; it being of little consequence to him, whether he pays at the rate of L.10 or 10s. *per* acre, provided he makes an adequate interest *on the capital invested*. That is certainly a fair criterion on which a tenant may calculate what he ought to offer; but a landlord, in estimating the rent he ought to demand, must take into his consideration the produce that his land is likely to yield, and to what proportion of it, or its value at a fair average, he is justly entitled, under all the circumstances of the case.

2. In regard to the mode in which rents should be paid, I have no hesitation in stating, that a part of the rent ought to depend on the price of grain, not at the moment, but at the average of ten, or of twenty-one years, striking off the first, and adding a new one every year. Without some such arrangement, the tenant, on the one hand, cannot make a fair offer of rent, lest the price of grain should fall too low; nor, on the other, can the landlord grant a lease of considerable duration, lest the price of grain should, in the progress of time, rise much higher. It is for the interest of both parties, therefore, that whilst one-half of the rent should be payable in money, the other half should be converted into corn, not payable in kind, but in money, according to the average value of a number of years *.

* Dr Young of Stonehaven, an able correspondent, has sent me the following instance of the injury which a landlord received by injudiciously converting a large proportion of grain, into a money rent. A farm was let in lease previous to 1765, at which time the rent was 29 bolls of meal, 14 bolls of bear, services which would now be worth L.15, and L.5 of money. On the letting in 1765, the whole was converted into money, and a small advance

For a farm already improved, the rent payable half in money, and half in the value of a certain quantity of grain, on a continually changing ten, or twenty-one years' average, may continue indefinitely to landlord and tenant.

Instead of a corn rent, some recommend an increase of money rent at regular periods, and this plan is necessary, with a view to improvement, where longer leases are granted than for twenty-one years. In such cases, a low rent at first, enables the farmer to carry on his operations with less capital than otherwise he would require, and he is afterwards

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of rent given. In 1784, the farm was re-let, and another advance of rent given, on a lease to endure for 57 years. The rent fixed at the last letting, to continue for the long period mentioned, was L. 28. Hence there is now the following difference at a moderate valuation:

29 bolls of meal,		L. 29	0 0
14 bolls of bear,		14	0 0
Services,		15	0 0
Money,		5	0 0
		L. 63	0 0
Present rent,		28	0 0
Difference, or actual loss to the landlord,		L. 35	0 0

So that valuing grain moderately, the present rent is less than what it would have been, by more than one-half, had the same rent continued, as paid upwards of 50 years ago. This is strongly in favour of a rent partly payable at least in the value of grain. Indeed, considering the great import of corn, and the rapid increase by the culture of potatoes, by both of which the price of corn is so materially diminished, some are of opinion, that even a corn rent, unless varying every seven or ten years, is not a sufficient protection to the interests of the landlord.

enabled to pay, without difficulty, a moderate addition, as the farm gets into good order. How much better for the landlord to adopt such a plan, than to require an enormous rent from the beginning, which would crush the spirit of the farmer, deaden his exertions, check the improvement of his property, and ultimately retard its reaching its full value, and consequently its yielding an adequate rent.

It may be proper to add, that notwithstanding the high rent paid in Scotland, which renders the prospect of any additional rent more unlikely, yet land sells at a considerable price, or number of years' purchase on the improved rent, from a conviction of the superior advantages of possessing landed property in that country. The following table contains a statement of the sale of several estates in the immediate neighbourhood of Cupar, the county town of Fife, and which all took place in the course of the year 1809.

Names of the Estates.	Number of Scotch acres.	Number of English acres.	Price.	Names of the Purchasers.
Dairsie,	320	384	L. 28,500	Traill, Esq.
Spring Garden,	82	98	14,500	Coll. Don.
Cairnie,	400	480	32,000	Gillespie, Esq.
Kilmaron,	270	324	26,000	Capt. Maitland.
Hilton,	250	300	20,500	Lord Leven.
	1322	1586	121,500	

Which is at the rate of L. 91, 18 s. *per* Scotch, or L. 73 *per* English acre *. Land often sells much higher in small lots, more especially near large towns; *but to have such a number of acres*, sold at such a price, at such a distance from the metropolis of Scotland, is rather extraordinary.

* The estate of Eccles in Berwickshire was sold in 1803 at about L. 26,600. It is now resold at L. 48,000. It contains 630

Sect. IV.—*On the Advantages of Leases, their Duration, and the Covenants to be inserted in them.*

It is impossible to expect that any farmer will undertake to increase the value of the property of another, without the certainty of having the land he improves in his possession, for a term of years, sufficient, not only to repay his expenditure, but also to reward him for his skill and industry in making the improvement *.

When a farmer of spirit and capital enters into the possession of a farm, on a lease of 19 or 31 years, what a scene of industry and exertion commences! The whole neighbourhood, and even distant counties are ransacked for good stock; the best instruments of husbandry are purchased; the fields are thoroughly ploughed and cultivated;

English, nearly 504 Scotch acres. It ought therefore to be let at the yearly rent of L. 1920, to yield 4 *per cent.* for the price, the common rate of lands in this country when they are purchased. The rent would thus be brought to L. 3, 16 s. *per* Scotch, or L. 2 : 14 : 11 *per* English acre.

* Mr Curwen has very ably observed, that example, and improvements in agriculture, are of little consequence to a farmer, without a lease. He is precluded from adopting them. Whatever advances the value of his farm, beyond the state in which he took it, renders his tenure more insecure. If he wishes to keep his farm, it must not appear to be above the scale of moderate advantage. If his exertions shew it to be capable of improvement, he hazards the loss of it. How much is lost to the public by this narrow and stupid policy!

the fences are put into good order; lime and other extraneous manures are provided in considerable quantities; the necessary drains are carefully attended to; and the whole is carried on, *in the spirit of commercial speculation*, with a view of securing, not only indemnification for actual outlay, but also considerable profit before the expiration of the term. Can any plan be more advantageous to the tenant, to the landlord himself, or to the public? The tenant lays out his capital with spirit, but with more attention to economy, than if the land were his own; and when judiciously laid out, he will ultimately derive more certain profits, for the sum he has expended, than the manufacturer, or the merchant. The proprietor gets a fair rent for his land, has the satisfaction of seeing his estate in a progressive state of improvement, and has the prospect of a considerable addition to his own income, or that of his family, when the lease he has granted is at an end. The public is benefited in various ways, and, above all, in having from one-fourth, to one-third, and in some cases one-half, greater produce, than if the land had remained in its former state of precarious tenure, at the will of the landlord; in which case, the tenant has no spur to any exertion, beyond common industry, and no temptation to lay out any sum beyond what is absolutely necessary for the preservation of his farm, in a state of common, instead of superior, cultivation.

Such are the advantages which in general are to be expected from the granting of leases: we shall proceed to consider two most important particulars connected with that interesting subject: 1. Their duration; and, 2. The covenants to be inserted in them.

1. *Duration of Leases.*

The duration of leases must certainly differ, according to a variety of circumstances. If a farm is almost in a state

of nature, and requires inclosing, liming, draining, and other expensive improvements, and perhaps the expenditure of a considerable sum for erecting and repairing a house and offices, a lease of twenty-five, and in some cases even of thirty-one years, may be necessary, to allow the improving farmer, or his family, a fair and adequate return *. A spirited tenant, who takes a farm of that description, considering his risk, trouble, and expence, is well entitled to more than mere remuneration, or ordinary profit †.

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* It is objected to such a length of lease, that the improving tenant will probably have died before the lease terminates; that his heir may be a minor, and may not possess the skill and talents of his predecessor. It is more likely, however, that a son will succeed, trained up to skilful husbandry under his father's eye.

† Mr Neil Ballingal took a farm of 380 Scotch, or 482 English acres, in the county of Fife, at 15 s. *per* acre, on a lease of 31 years. The whole of it required draining, liming, fallowing, &c. at an expence, varying from L. 10 to even L. 20 *per* acre. The whole improvement, owing to the extent of the farm, and the great expence attending its improvement, which the tenant could only gradually defray, was not completed till the nineteenth year of the lease. Can a stronger proof be adduced of the absolute necessity of granting a lease of 31 years, in similar cases. The farmer was no gainer, even at the low rent of 15 s. *per* acre, for the first 19 years, expending, on completing his improvements, the profit derived from the parts already improved; but he went on with cheerfulness, expecting to be reimbursed by the possession of a completely improved farm, at a moderate rent, for eleven years, capable of being cultivated, by half the number of men and horses formerly used, actually maintaining double the number of cattle, and producing three times the quantity of grain it was capable of doing before the improvement commenced;—all this, at 15 s. *per* acre, insured a competent reward for his exertions.

As another proof of the advantages of long leases in promoting

In regard to a farm that is even considerably improved, a lease of nineteen, or perhaps twenty-one years, is also necessary; but these periods, in such a case, ought not to be exceeded. Unless specific improvements, expensive, and, at the same time, little profitable to the tenant, are stipulated, the common duration of nineteen years is enough; even though one-fifth part of an arable farm, of considerable extent, requires improvement, if that fifth be of a nature to *encourage* the attempt, and if the tenant has capital, begins in time, and goes on with spirit. The produce of the lands themselves will yield a sufficient *bonus* in the duration of a common lease of nineteen years. If it is extended to twenty-one years, the tenant is certainly safer. Such a term, however, is necessary, because no farm can be in such a state of perfection, as to require no further improvement. New modes may be necessary, in consequence of new discoveries in agriculture, or unforeseen alterations in the political circumstances of a country. Unless a farmer, however, has his possession secured to him, he can have no inducement to

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improvement, it is said that the greatest outlay of farming capital on building, inclosing, and improving the soil, has been where fifty-seven leases were granted, above twenty years ago, on the lordship of Needpath, belonging to the late Duke of Queensberry. That estate was all let for grassums or fines, which no doubt considerably reduced the farmer's capital, yet a power being granted to assign or subset it, gave security for borrowing. The expectation of a long lease afforded large scope to permanent amelioration, every species of which was executed at the farmer's expence. This, nothing but the length of the lease, and the hopes of a distant return, could have justified. The great improvements which took place in the Ormiston estate, in consequence of long leases, are too well known to require any particular discussion.

try any experiment whatever, and agriculture, in that case, must remain for ever stationary. A man who has a considerable capital also, and wishes to employ it in extensive farming, has a right to look for the comforts and conveniences of life for himself and family; and if he finds he can have no security for them in that line, (which he never can do, if he is liable to lose his farm every year, or in the course of any short period of time), he will most assuredly renounce so unpromising a profession, and employ himself and his capital in some other way. Leases of considerable duration, therefore, are to be considered a most essential requisite towards promoting the interests of agriculture, *in all cases;* and it can hardly be doubted, that, to the granting of leases, the security they give to the farmer, and the inducement they hold out to men of liberal education, enlarged ideas, and extensive capital, to engage in that profession, the present flourishing state of agriculture in Scotland is to be imputed, more than to all other causes whatever.

So forcibly do these considerations, (for which I am indebted to a most respectable correspondent, Robert Walker, Esq. of Wooden in Roxburghshire), strike my mind, that, if it were not on the whole impolitic for the legislature to interfere with the management of private property, I should think it a measure entitled to consideration, the propriety of imposing a heavier land-tax, where farms are not under lease, than where they are, as a penalty on the proprietor, for not promoting the improvement of the country, and the comfort, the happiness, and independent spirit of those who live under him *. The

* The same idea has occurred to Mr Curwen. He says, a question arises, Has the proprietor the sole and entire interest in the land he possesses? In China, most undoubtedly, the laws shew the very reverse. The principle of the law is also here against

tenant, in some cases, is as much to blame as the landlord, by not applying for a lease. Wherever the tenant does not wish for a lease, it is evident, that his object is, to remain in a state of torpor, and not to excite any expectation of additional rent, by any attempt at improvement.

On the subject of leases, nothing can be stronger than the following opinion, delivered by a most respectable and intelligent country gentlemen, (William Robertson, Esq. of Ladykirk), whose property is considered to be one of the best managed in Scotland. His words are, " When " the proprietors of land in England find it convenient to " let leases of sufficient endurance, then the rent of land " will find a just level, and the consequence will be, the " improvement of husbandry. Until that is done, all o- " ther matters, connected with the amelioration of the soil, " must in a certain degree be stationary."

It must not be imagined, however, that leases ought to be indiscriminately given. They certainly ought not to be granted, but where a farm is of a proper size, and is put into a shape for profitable cultivation, and where tenants also can be found, possessed of skill, spirit, and capital. The improvement of an estate may be retarded, instead of being promoted, if leases are given of ill-arranged occupations, and to ignorant, slothful, and needy farmers, not entitled to that honourable appellation. Nor ought leases to be granted, (being in fact, during the period agreed

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it. The law recognises, where there are two concurrent rights, that neither of them shall be exercised so as to be injurious to the other. If the withholding leases should extend so far as to become general, would it not be fully justifiable to impose such a tax as should meet and correct what would be so injurious to the community at large?

upon, a species of alienation of property), without proper covenants, protecting that property from waste.

Far less are leases of an indefinite length, as for one life, or for several lives, to be recommended. Experience has fully demonstrated, that any uncertain period is injurious to improvement, and that nineteen or twenty-one years, is a fair term, in an improved country, enabling the tenant to lay out his money with the prospect of a profitable return. When the length of a lease is fixed, the tenant makes his arrangements accordingly, and he lays out his capital early, in the expectation of having a greater return before the termination of the lease; but when the term depends upon his own life, he is apprehensive, that if he spends a large sum of money, the benefit of it may be lost to himself and family, from the uncertainty of human existence. He lays out no part of his capital, therefore, but in the expectation of immediate returns, and the longer he lives, he becomes the more negligent, and the less inclined to exertion.

2. *Of Covenants in Leases.*

When a lease is granted, more especially of any duration, it is essentially necessary for the interest of the landlord, who is properly a trustee for the public, that it should be under such covenants, as may prevent the property from being injured, instead of being improved, more especially when the lease approaches to its termination, and the tenant has no peculiar inducement to prosecute his improvements. In general, the covenants in leases, which are a species of rent, are too complicated, and too numerous. Unnecessary restrictions in a lease are a great impediment to improvements, by precluding a spirit of enterprise, and of experiment, which have proved the principal sources of new discoveries, and of prosperous agriculture. At the same time, where there are no covenants, calculated

for preserving the farm in good order at the termination of the lease, or providing for a certain proportion of grass, a certain quantity of land to be reserved for the incoming tenant, for turnips or summer fallow, nor the fodder of the last crop, in that case, the crop of the outgoing tenant, (who takes care to plough every thing he can), may be sold off by public auction, and the farm left in poverty and wretchedness. This has often happened to negligent landlords.

Among the covenants necessary for their protection, without imposing any unnecessary restraint on the tenant, the following are the most essential.

1. The lease to go to the tenant, and the heir succeeding to him in the principal part of his property, and not to be divided into smaller portions, without the consent of the landlord.

It is supposed, when a farm is let to one individual, that it is of a proper size or standard, any diminution of which might be highly inconvenient, if not ruinous to the farm. For instance, if a farm is divided into six fields, under a rotation of six shifts, or breaks, it would be in the highest degree prejudicial, to have one of them taken from the farm, and let to another. It may be proper also, in the event of the death of the original tenant, that the farm should go either to the eldest son, or to any one of his children to be named by the father, to prevent that jarring of interests, which must inevitably injure the cultivation of the land, and probably bring the whole family to ruin.

2. If the tenant or his heirs wish to give up the farm, or are compelled by bankruptcy to renounce the possession of it, in that case the landlord shall have the preference, at a surplus rent or price to be determined by arbiters mutually chosen, or appointed by the sheriff of the county; or it may be agreed upon between the parties, that the lease shall be assignable, or the farm sublet, for a

certain surplus rent, and not for any premium, 20 *per cent.* of which surplus rent shall be payable to the landlord, as an inducement to him to grant that privilege.

Such a power, of subletting, it is said, would tend to throw much additional capital into the agricultural profession, as active men, possessed of funds for the purpose, would more readily embark in a business in which they could make progressive advances in wealth, as a merchant, instead of being confined to mediocrity, as every farmer must comparatively be, who is tied down, for nineteen or twenty-one years of his life, to the improvement of any particular farm whatever.

3. All mines, minerals, metals, coal, peat, marl, limestone and quarries of all kinds, to be reserved to the landlord, with power to him, or those authorised by him, to search for, work, and take out, all, or any of these, in any part of the lands, and to carry them off at any time; and also to make roads, aqueducts, and levels, and to erect houses and machinery, when and where he may judge requisite for such purposes; the tenant being always allowed deduction from his rent, or to be otherwise paid, for any actual damage * done to his grounds, and loss occasioned to him by any of these operations, as the same shall be ascertained by two neutral persons of skill, to be mutually chosen.

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* I think in fairness to the tenant, if he gives the full value for the *land*, that it should be *actual*, and not *surface damage* alone. If the tenant does not get actual damages, he does not get *fair* damages, that is compensation for damages or loss sustained. Powers should be reserved to the tenant to quarry for stones, when they are to be employed upon the farm in building, draining, &c. to dig peats for fuel, to quarry lime, or to dig marle for manure, for the use of the farm, but not for sale.

4. Full power reserved to the landlord, to make or alter roads through the lands, for the accommodation of his estate; to form or repair boundary fences, to make embankments against injury from the sea, from lakes or rivers, and also to straighten boundaries, and exchange lands, either with any of the neighbouring proprietors, or with any of his other tenants, not exceeding one-tenth part of the farm let, and the annual value of the ground taken away, or thrown into the farm, by these means, after being ascertained by two indifferent men to be mutually chosen, shall be deducted from, or added to, the rent.

5. The landlord reserving a right to cut and carry away growing timber, and also at any time, during the currency of the lease, to assume possession of any part or parts of the lands which he shall choose, for being planted with trees, or for building houses, or for other purposes, provided the ground so taken shall not exceed acres, the situation and boundaries thereof to be described, in the most distinct and unequivocal terms, in the deed; and the tenant shall be entitled to a deduction from his rent, for the land so resumed, according as the same shall be settled by indifferent men, to be mutually chosen; the proprietor being bound to inclose, at his own sole expence, the land so planted, and to keep such additional fences in repair *.

6. The landlord reserving all fish and game on the farm, with the sole right of fishing, fowling and hunting, by himself, his gamekeepers, or others having his authority in

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* It seems unjust to throw any share of the expence of making or repairing such fences on the tenant, as the whole benefit of the plantations go to the landlord, unless where the plantations and the fences connected with them, inclose and divide the farm in a proper manner, and consequently on that account, and from the shelter they yield, are advantageous to the tenant himself.

writing *; but always so as not to injure the land, fences, or any sown or planted crop, and being liable to make a recompence for the same, at the arbitration of two neutral men mutually chosen. On the banks of rivers, the preservation of salmon and salmon-fry ought to be peculiarly attended to.

7. The landlord reserving power, if at any time the houses, fences, gates, and drains on the farm, shall be found *in great disrepair*, to cause the same to be put in proper order, and to charge the tenant with the expences thereof, unless he (the tenant) shall execute such repair within six months after being required so to do, by a notice in writing†; or denies the necessity of such repairs,

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* Perhaps the right of riding or walking in any field, more especially if contiguous to a mansion-house, ought also to be reserved. An eminent lawyer once said to his tenant: 'I cannot go, 'without your leave, into that park you rent from me, though it 'is at my own door.'

† It is impossible to limit the time for executing repairs to a short period, for instance, one month. The mechanics or labourers in the vicinity might be previously engaged. A fall of snow or intense frost may render it morally impossible even to *commence* the repair of either fences or drains, with a fair prospect of executing them economically, or even in a business-like or substantial manner, within that space of time. Harvest and seed-time should also be excepted. It is contended, indeed, that the clause should be cautiously worded, so as to prevent its being turned to the worst purposes, those of oppression. Arbiters, if necessary, should determine whether such repairs be wanted, else a tenant may be injured by the mere ignorance of a landlord, with fair intentions. But if the landlord should be *in malo animo*, what else but eternal vexation, and enormous expence, is to be expected, without benefit to either party?

in which case the necessity thereof must be settled by arbitration *.

8. The farm to be cultivated, manured, and cropped in a fair and regular manner. One-fourth in turnip soils, and one-sixth in clay lands, to be in grass, and the same proportions of the farm to be left in grass, properly sown down with clover and grass seeds, and that in regular fields or divisions, each consisting of at least acres. During the three last years of the lease, one-fourth part of the land in tillage to be under a fallow or a green crop, sown in drills, and properly manured with lime or dung, and no two crops of white grain to succeed each other, without a fallow or green crop intervening, unless justified by peculiar circumstances, or some unforeseen necessity; in which case it may be permitted, for one year, if the required proportion of land in grass, and green crop and fallow, is to be found.

9. All the hay, straw, and artificial grasses, growing yearly on the farm, to be consumed on it, and the dung made therefrom to be regularly laid on the lands; but in case a certain quantity of dung has been brought in the course of any one year to the farm, from any neighbouring town or village, a certain quantity of hay or straw may be sold from it, either the succeeding year, or the one after.

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* Some recommend, that in addition to this general power, there should be fixed periods when the proprietor, either by himself or others, should ascertain the state and progress of improvements, with respect to inclosing, &c. By this means he will see whether the conditions of the lease are fairly fulfilled, and will have it in his power to stimulate the exertions of an indolent tenant, and regulate and correct the injudicious operations of an unskilful one. But this can only be necessary where the tenant is of a doubtful character.

10. The tenant, in turnip soils, to leave at least a third of the lands in grass of one, two, and three years old, all laid down with the crop after summer fallow or turnip, with liberty to sow grass seeds among the whole of the last grain crop, to be covered according to the custom of the country; to prepare, at a reasonable price, a sufficient breadth of ground for turnips or summer fallow; and the stable-yard manure, made during the winter preceding the last crop he grows, to be left, and paid for at a fair value. On rich arable land, one-sixth part to be in grass of one year, and one-sixth of two years, and one-sixth prepared for fallow or turnips; and if the soil is clay, one-sixth in beans may be fairly stipulated, for the three years preceding the termination of the lease.

11. The straw of the last crop belonging to the tenant, to be left on the farm, and sold to the incoming tenant, at the average price of the district, provided the straw was paid for when the tenant entered into possession.

12. The tenant to make good any damage that may be occasioned by fire; and for the greater security of the landlord, the tenant to keep his houses and offices constantly insured, in some respectable insurance office, to the extent of at least . Such insurance to be at his sole expence, the documents thereof to be produced when required; and in case of neglecting the same, for the space of six months, after due notice in writing, the lease to be void.

13. The rent agreed upon, to be payable by equal portions, half yearly, at the usual terms in the months of May and November.

These terms are fixed upon for the better security of the landlord, and to prevent embezzlement of the crop;

but three months additional time is in general allowed to the tenant, to dispose of the produce of his farm *.

14. All personal services to be abolished, but the tenant to become bound to make or to repair, a certain extent of the roads belonging to the farm, if necessary.

15. All disputes between the landlord and the tenant to be settled by the arbitration of one or two men mutually chosen, and, in case of variance, the arbiter or arbiters, if they judge it necessary, shall submit the case to the judgment of some eminent counsel, at the mutual expence of both parties, whose opinion shall be final.

These hints, (some of which are extracted from the articles of lease recommended by the intelligent Professor of Agriculture, in the University of Edinburgh, Dr Coventry), will sufficiently explain the covenants which seem to me essential, in almost every lease. Peculiar circumstances may render additional ones necessary; for instance, not to break up old pastures, without paying a very considerable additional rent, &c. There is nothing however less to be desired, than to make such a deed or instrument too long, or the restrictions in it too complicated, or to deprive the tenant of all freedom of exertion, whilst he is carrying on his improvements. With regard to management in general, the stipulations, at the commencement of the lease, should all be of a *negative* tendency; *i. e.* the farmer should only be restricted from following a mode that is *generally allowed* to be injurious, but left to adopt any new or improved line of management that may fortunately be discovered. *Positive* directions for management, should never take place, till the three last years of the lease.

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* Where the clergyman of a parish receives grain in kind, the tenants on an estate ought to furnish the quantity to be paid, in proportion to their respective possessions, to be allowed for it as part of their rent,

Before closing this important inquiry, it may not be improper to lay before the reader, such observations of a miscellaneous nature, as have been transmitted to me on the subject of leases.

It has been remarked, regarding the restriction of selling hay, that as that article is never converted into dung, like straw in the form of litter, there should be no restriction against selling it. It is the interest of the tenant that his horses and cattle be well fed, and if there shall be any surplus of hay, he should be allowed to carry it to market. Grass, converted into hay, is not, like grain, of an exhausting nature, but is sown to meliorate the ground, and to enable the tenant to pay his rent. If a crop of hay, therefore, brings little money into the pocket of the tenant, and if one-sixth part of his farm must be in a bare fallow, how can he possibly stand in a manner the loss of two crops out of six? He may be tempted to risk a scanty crop of pease, or even a scourging crop of potatoes, imperfectly manured. In regard to the sale of hay, therefore, some latitude is necessary. This idea, however, is strongly objected to; and it is contended, that the farmer, upon a fair calculation, would make more by feeding his horses with the hay, which would make a great saving in the consumption of oats, than by sending the hay to the market and bringing back dung. In all such cases, the farmer should make *exact calculations of expence and profit;* and above all, should never be induced to attempt any plan by which the quantity of dung, (that great source of fertility), can be in any degree diminished. In this case, by feeding his horses with hay instead of straw, and littering them well with straw, a great quantity of manure would be obtained, at a cheaper rate, than by buying and carrying it from any distance.

Another correspondent observes, that in general he studies to have alternate green and corn crops, allowing

such land as has been sown off with grass seeds, (which is always done along with the first crop after fallow or turnips), to remain two or three or more years in pasture, according as the soil is more or less favourable to the growth of corn; yet when land is broken up from old ley, two corn crops are always taken. This practice, however, unless in very peculiar cases, cannot be approved of. General rules, at the same time, ought certainly to be modified by such circumstances as are often to be known only to real practitioners; and though the system of alternate green and corn crops, is beyond question an excellent rule in general, deviations from it must sometimes be admitted. In the instance above stated, the first crop of oats after grass is often uncertain, whilst the second is generally a good one; and the land, after two crops, is reduced to a finer tilth, for turnips or any other green crop *.

Another circumstance may also justify a deviation from the general rule, that two white crops should never succeed each other. For instance, grass seeds are generally sown with the fallow crop, and it will, and does often happen, that the grass seeds fail. When that is the case, what can be done? there is the usual proportion of both green crop and fallow upon the farm. To compel the farmer, therefore, to put the land, where the grass seeds have failed, under a green crop, would often be very inconvenient. The usual plan is, to plough the field, where the grass seeds have failed, for another white crop, either oats or barley,

* It is also contended, that in remote parts of the country, where green crops are not so valuable as in the vicinity of large towns, two corn crops may be allowed, after the ground has been pastured for three or more years, provided that not more than one half of the arable land is under a white crop at once, and that one-fourth of the farm, at the least, is under grass two years old. That system, however, cannot be recommended.

and to allow the grass field, that was intended to be ploughed up, to lie for another season.

In 1802, Mr Pringle of Ballencrieff, in East-Lothian, took a farm in Galloway on a lease of thirty years, for the purpose of improvement; it was proposed to leave him at full liberty to manage and crop it in any manner he chose, for the first twenty years; but for the remaining ten, a rotation of crops was proposed, respecting the advantages of which he entertained considerable doubt. He observed, that it was most fair the proprietor should put it out of the tenant's power to deteriorate the farm towards the expiration of the lease; but that it was absurd to prescribe a mode of management, and a rotation of crops to be rigidly followed at so distant a period, as from twenty to thirty years from the commencement of the lease; that rotations, like most other things, have their day and fashion; that we think lightly of rotations which were esteemed the best thirty years ago; that the political situation of the country might be changed, as well as the relative value of the different grains we cultivate, and that a better rotation of crops might yet be discovered, than any hitherto known. He therefore suggested, that at the end of twenty years, the mode of cropping, during the remainder of the lease, should be fixed by arbitrators, mutually chosen by the parties, or by the sheriff of the county. Such a clause was adopted, and has since been in several instances introduced into leases of farms in Dumfries-shire.

There is no point, however, that has been more strongly recommended, as likely to prove advantageous to the agricultural interests of the country, than to authorise the subletting of land. It is maintained, that until leases become disposable property, the utmost value can never be obtained for an estate, because people who know how to make the most of their capital, hesitate, nay revolt at the idea,

of investing their property, whence they cannot withdraw it, when they perceive another more advantageous mode of employing it. If a landlord entertains a partiality for a tenant, because he is a good cultivator, he may be almost certain that the subtenant, to whom the farm is sublet, is at least as good, if not a better one, because he must pay a higher rent. As the law now stands, there is an implied exclusion either to assign or subset, unless a permission to that effect is expressly given in the body of the lease. It would be an endless task, it is said, to enumerate the baneful consequences of this system to the community at large as well as to the landholder. It may be fairly asked, why make a freehold or feuhold estate, assignable at the will of the possessor, and not a leasehold? Does it impair the landlord's security, or endanger his right of property? Quite the reverse. He obtains the security of two or more persons, instead of one, and his farm is as likely to be improved, as the original conditions in regard to management cannot be broken through. The principal, as well as the substitute tenant still remain liable as a co-obligant to the proprietor, and he will guard against the farm being injured or deteriorated by the person to whom it is devised, more especially if an extra or surplus rent is obtained. In fact, every new occupant or devisee, contracts upon the faith of improving more highly, and raising more produce, than his predecessor, by dint of additional capital, skill, and industry. Besides, there is a class of enterprising agriculturists, whose inclination is more bent upon active improvement, than confining themselves for nineteen years to one object or farm, and who, upon being suffered to reap the benefit of their capital so expended, through the medium of a subtenant or assignee, would assiduously persevere in the same system of improving the waste or less cultivated tracts of the country; or taking, from indigent, slothful, and ignorant occupiers of farms, land, to which

they never could do justice. Thus a much greater quantity of capital, skill, and industry would be brought into the field of agriculture; a greater quantity of human food produced; the face of the country enriched and embellished; and the interest of the landholder, as well as that of the community, essentially promoted.

There is certainly much sound argument in these observations, (by many they will be considered as decisive and incontrovertible); and perhaps a system might be established, for promoting the improvement of this country, at least in its more remote provinces, in the same manner as the wilds of America are brought into cultivation. No sooner does the cultivator finish his task, than he disposes of his farm to another, and commences a new undertaking of a similar nature. In the same manner persons possessed of capital, ardent minds, and a turn for agricultural improvement, with a power of subsetting, under reasonable restrictions, might go from one farm to another, and thus be the means of bringing extensive tracts of country into a productive state.

I have thus endeavoured to lay before the reader, the result of a very extensive correspondence, regarding the circumstances on which a liberal connexion between a landlord and tenant principally depend. Their interests, when properly understood, are in general the same; and nothing can occasion any material difference between them, but a misconception of the principles on which the connection ought to subsist. When these principles are thoroughly explained, (to which I hope the preceding observations will in some degree contribute), the agriculture of the kingdom at large will derive advantages, not easily to be calculated.

DISSERTATION III.

OF THE VARIOUS DESCRIPTIONS OF PERSONS EMPLOYED IN AGRICULTURAL LABOUR, IN THE MORE IMPROVED DISTRICTS OF SCOTLAND.

THE individuals by whom the agricultural labours of any district is carried on, consist of four descriptions of persons; 1. Farmers; 2. Farm-Servants; 3. Apprentices in Husbandry; and 4. Day-Labourers, or others occasionally employed in the cultivation of the soil. It is proposed to give some account of each of these classes, and to conclude with some observations on the advantages of carrying on the operations of a farm, under a regular system.

SECT. I.—*The Farmers.*

IN the year 1776, a learned and distinguished writer on agriculture, (the late Lord Kames), published a long article, "*On the imperfection of Scotch Husbandry*," which then was at a very low ebb*; and in another part of that valuable work we find the following paragraph: "East Lothian, time out of mind, has been famous for superior skill in agri-

* Gentleman Farmer, p. 383.

culture; and yet to seek for instruction there, one would be greatly misled. That county, for the richness of its crops, is more indebted to the fertility of its soil, than to the skill of its farmers. What pity it is, that so fine a country should be possessed by men so little grateful to nature for her bounties *!" What a change has since taken place, for that very district has now become a pattern of improved cultivation. Indeed a zealous friend to agriculture, who has visited every part of the kingdom in search of useful information, (J. C. Curwen, Esq. member for Carlisle), in his address to the Workington Society, in 1810, very candidly declares, " that the beauty and regularity of the crops, and the extreme cleanness of the fallows, in East Lothian, struck him more, than any thing he had ever before beheld in any other country; that he does not know a farmer who may not learn something in that district; that in regard both to excellence of soil and management, it exceeded any thing he had ever witnessed in any other part of Great Britain; and though it costs him much to own it, that he despairs of being ever able to attain an equal degree of perfection."

So important an alteration, in so short a period as thirty-five years, must certainly, in a great measure, be attributed, to the character of the farmers, who, not only in East Lothian, but in the other more improved districts of Scotland, in respect of enterprise, information, and professional skill, are fully equal to those of any other country †. They have universally risen above the class of mere peasants, in knowledge, education, and manners, closely approaching to the character of country gentlemen‡, and filling up the blank left by the extinction of the smaller proprietors.

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* Gentleman Farmer, p. 146.

† East Lothian Report, p. 55.

‡ Berwickshire Report, p. 118.

The following observations will give some idea of the character of these farmers, and the qualifications they generally possess.

There is certainly no country in Europe, where the advantages of education are more generally diffused than in Scotland, and this is the case with the upper rank of farmers, fully as much as in regard to any other profession. Besides attending the grammar schools in their immediate neighbourhoods, and sometimes those in the more northern counties of England, their education is, in many instances, perfected at the universities of Scotland, where they acquire a taste for reading, which makes them masters, not only of agricultural information, but enables them afterwards, to make a very respectable figure, whenever literary, or even scientific subjects, become the topics of conversation *.

Their mode of living varies. In the more northern districts, such as the Carse of Gowrie, they are distinguished for economy; whereas, in the more southern counties, their mode of living unites at once, the comforts, and even the elegancies of life, suited to their station. They have also frequent and friendly intercourse with each other, both in their own families, and upon occasions when their professional concerns call them from home, either for the purpose of marketing their grain, or purchasing and selling live stock †.

Their skill in husbandry is of a superior description, partly owing to the examples set before them by their predecessors, who were well acquainted with some of the most important branches of agriculture, though certainly deficient in others, and partly owing to their personally examining the husbandry of other districts; but, above

* East Lothian Report, p. 56.

† East Lothian Report, p. 55.

all, it may be attributed to their turn for reading, either books, or periodical publications on husbandry, from which they derive the earliest information of every new improvement.

Their attention to business is characteristic. One farmer informs me, that it is a rule with him, to see his horses thoroughly cleaned every evening at eight o'clock. Another observes, how essential it is that the farmer should be commander in chief upon all occasions; in particular, he ought to be the first up in the morning, to set all the wheels of the machine a-going, by his example and directions. Impressed with the necessity of observing that maxim, my correspondent informs me, that he has not breakfasted by day-light, any time these nineteen years, *during winter*, (except by accident on any particular day), nor any individual in his house. The breakfast is all over by candle-light, by which means an hour is saved, which many farmers lose by indolence; yet six hours in a week, is nearly equal to the working part of a winter day. This is a greater object than can at first view be imagined, where there are perhaps twenty servants, at daily work, or in that proportion.

Mr Kerr, in his report of Berwickshire, has very ably described, that spirit of enterprise by which the farmers of Scotland are distinguished, which, though he has restricted his observations to Berwickshire, the county, the state of whose agriculture he was reporting, yet they are equally applicable to other districts. In the improved districts of Scotland, the farmers are every where seen, carrying on extensive and costly improvements, by draining, inclosing, liming, and marling, or by careful and judicious improvements of their live-stock, with all the eagerness and intelligence of commercial speculation. They trust to the profits of future years, to reimburse their large expenditures, with reasonable advantage. They are enabled to wait the

result, in consequence of the sufficiency of their capital, and the security of their leases: the former derived from their own successful and intelligent industry, or that of their fathers; the latter, from the good sense of the landlords, in seeing their own interests, most materially interwoven, in the security and success of their tenants.

Such is the anxiety entertained by the Scotch farmers, in regard to improvement, that many of them make annual excursions into the best cultivated districts of the united kingdom, where they have an opportunity of observing the practice of those districts, and comparing it with their own; and such is their candour and good sense upon these occasions, that though they may see much to censure, they neither withhold their approbation where it is due, nor are they backward in adopting the improvements of others, where they are likely to answer *.

The principles on which their system of husbandry is established, depends on three important particulars: 1. Economy; 2. Simplicity; and 3. Arrangement.

Their economy is conspicuous, in their two-horse ploughs, their single-horse carts, their mode of feeding their horses, &c. The simplicity of their system appears, in their avoiding breeding stock as much as possible†, but purchasing them when wanted; in their not cultivating too great a variety of articles, and in their having all their instruments, of as plain and simple a construction as possible. The arrangement of labour on their farms is also judicious, insomuch, that notwithstanding their living in an unfavourable climate, almost every day is well employed, and very few are lost. This is certainly greatly owing to

* East Lothian Report, p. 55.

† The advantages of this plan have been pointed out in Chap. I. Sect. 8. In many parts of Berwickshire, however, they prefer the breeding system.

the preference they give to married servants, who are more sober and steady, less inclined to remove, and, by their getting acquainted with the farmer's plan of working, every thing goes on like clock-work.

On the whole, the farmers, in the more improved districts of Scotland, are a most respectable and highly estimable body of men, and perhaps enjoy as great a share of that distinction and recompense, to which their skill, abilities, and capital give them so just a title, as the same number of their brethren can boast of in any other country *.

Sect. II.—*Farm-Servants.*

In all the improved counties of Scotland, a great proportion of the servants employed in husbandry are married, and rear up numerous families of healthy children. No sight can possibly be more gratifying to any individual, who can contemplate with pleasure the happiness of his fellow-creatures, than to see such colonies of hardy and industrious peasantry, as are to be found, on large farms, in the Carse of Gowrie, in East-Lothian, and in the counties of Berwick and of Roxburgh. I was thence led to pay particular attention to the state of farm-servants in those districts, the result of which I think it proper to lay before the reader, on account of its peculiar importance to a most valuable class of the community, though by some it may be considered as too diffuse, and entering too much

* East Lothian Report, p. 55.

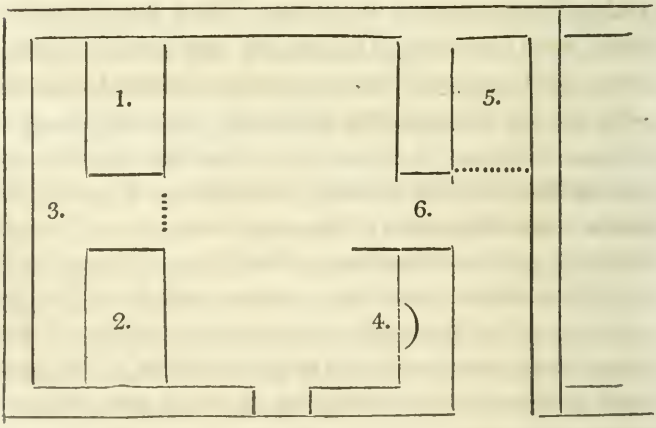
int minutiæ. The following detail is principally applicable to the counties of Berwick and Roxburgh, where the system of maintaining farm-servants is brought to the greatest possible degree of perfection * ; at the same time, observations regarding their state in other districts, when it is necessary, shall be frequently interspersed.

1. *Period of hiring.*—Farm-servants in Scotland, when married, are usually hired for twelve months; but where young men are employed, it is the practice to hire them only for half a year. When hired for twelve months, it gives an idea of greater durability to the contract, in consequence of which they are led to continue for many years in the same service. Indeed it is now a common practice in many counties, for the ploughmen who have families, when the wages are once fixed, not to think of any change, but to remain from year to year, unless any very unforeseen circumstance should occur, that might induce either the master or the servant to think of an alteration. It is the practice in some districts, to hire servants in the months of June or July, the year's service to commence at the Martinmas (23d November) following; whereas in other districts, they are not hired till Martinmas-day, and they go home the same day to service, which is thought a bad system, both for the farmer and the servant. In Berwickshire, Whitsunday is the term; and when a farmer enters at Martinmas, it is often difficult to get farm-servants worth the having.

* The account of the state of the farm-servants in the counties of Berwick and Roxburgh, is principally extracted from a most interesting communication on this particular subject transmitted to me by Mr Low of Woodend: in regard to the other districts, from the answers of several other intelligent correspondents, and from the valuable report of Berwickshire drawn up by Mr Kerr.

2. *Place of residence.*—Every hind* or ploughman has a separate house provided for him by his master. This he furnishes himself, at an expence of from L. 20 to L. 30. These houses were formerly very indifferent hovels, but they are now built with stone, covered with pantiles, and sometimes with slate. The expence, at the present rate of labour, and price of materials, may be from L. 30 to L. 40 each, according to size, and distance from materials. Some cottages, however, have cost from L. 50 to L. 60. The following sketch will give an idea of the form or area of these houses, the position of the beds, and of the fire place, which is usually placed in the partition wall.

Plan of a Berwickshire Cottage.



1, 2. Beds.
3. Recess for holding milk, &c.
4. Fire place.
5. Pig-sty and coal-house.
6. Inner door.

* The word *hind* means a married ploughman, living in a cottage, as a farm-servant; and the term *ploughman*, has a more general meaning, and may be applied, with propriety, to unmarried servants, living in their master's family, and working a plough.

It would be highly expedient, to have the houses of the farm-servants insured, as children are always fond of playing with fire; and it is well worth the attention of an enlightened and humane landlord, or farmer, who may have many married servants under him, to pay particular regard to their cleanliness and health. For that purpose, they should be induced or bound, twice a year, to have all their moveable furniture taken out, and carefully cleaned; and at one of these times, at least, to have the whole inside walls of the cottage white-washed with *lime*. For the sake of neatness, also, the outside might undergo the same operation. But for the inside, lime ought invariably to be used, as tending to destroy contagiouse ffluvia; for, after sickness, the seeds of future diseases may still lurk in the bosom of the family. The tendency and inclination to accumulate rags within the house, is astonishing. These are all huddled into a mass together. They ought, once or twice a year, to be sold to papermakers, or otherwise disposed of, being often the sources of contagion.

3. *Situation of the houses.*—The houses of the farm-servants, originally formed a wing of the farm-offices, but they are now, where circumstances admit of it, always removed to a small distance, with the exception of a house for the steward, or the *byreman*, (the servant who has the charge of the cattle), one or both of whom should be at hand, in case of any accidents happening to the horses or cattle during the night. On this plan, any temptation to commit petty depredations is done away, by the opportunities being diminished. It is also more cleanly and healthy, and the hinds and their families are much less liable to agues, than when they lived in the centre of a moist dunghill. The children, too, are thus more easily kept out of the way of mischievous amusements, and, what is of more consequence, the farm-offices can be made more

compact, and wholly devoted to their proper purposes. Besides, by removing these houses to a convenient distance, the risk of fire is avoided, which the proximity of many inhabited houses to the stack-yard, and farm offices, would necessarily occasion, when the negligence or inebriety of a farm-servant, or his wife, or a spark from their chimney, may occasion the destruction of a set of offices, with a crop recently harvested, and a stock of horses and cattle. The houses, however, should not be too far off, but at such a distance, (from 200 to 300 yards is reckoned the best), that the servants may always be within call, to attend to their stables, and various other duties.

4. *Hours of working.*—The hours of working must vary in different places *, but in general are as follow :

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* The following statement is given of the labour performed by the farm-servants, in the Carse of Gowrie, in Donaldson's account of that district. "The ploughmen get up in winter by the dawn of day, and are employed in the stable till nine o'clock, in feeding and cleaning, each his own pair of horses. After breakfast, the ploughs, or carts, are in employment for the remainder of the day, reserving only as much light as may suffice for repeating the operation of feeding and cleaning the horses. When the more busy season of the spring sets in, the plough is more diligently plied, being under yoke from nine to ten hours, with a short interval of an hour, about nine in the morning, and a similar rest about two o'clock. In the barley seed-time, and during the summer and harvest months, the ploughmen get up by four in the morning; they are in the stable by five o'clock; and, unyoking about ten, are employed in cutting grass, and taking care of the horses, until two o'clock, when they again get under the yoke until seven at night." In Roxburghshire, they never work less than ten hours, when the length of the day will admit, and

In spring, the ploughmen rise at five o'clock; after dressing their horses, take breakfast, and yoke the plough about six; at eleven they come to feed and clean their horses, and after dinner yoke at two, and unyoke again at six.

During the harvest, they often rise at four, and begin work at five, or at light; breakfast in the field; unyoke at eleven; yoke again at two, and work till the evening.

In summer, they rise at half past four, and yoke at five. They unyoke after going five hours, they then bring in clover to the horses. In hot weather they rise at four, yoke immediately; unyoke at ten, when they bring in clover; again yoke at two, and unyoke at six.

In winter, they get up before day-light, yoke as early as they can see to work, and unyoke betwixt one and two o'clock. In the afternoon other jobs are executed.

Female workers are out through the summer for ten hours, excepting at hay and corn harvest, when they work till sunset. In winter they work from six to eight hours, or from light to light.

But though these are the hours in general, yet in the busy period of harvest, or when there is a pressure of work, no limited hours of working are thought of. The servants are ready and willing at all times, by night or by day, to carry in and stack the corn, and perform every other necessary operation.

In regard to hours of working, Mr Church of Hitchill observes, that on a well-regulated farm, every person ought to work ten hours, as long as the days will admit of it, and from light to light, in the short days of winter, one half of the day before dinner, and one half after it. The

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in winter, from light to light. In harvest and hay time, and even when sowing the turnips, both men and horses, work as much as they are able, without any regard to hours.

work-horses also go two journeys or yokings in the day, excepting in the shortest days, when they are not unyoked, but have a feed in the field at noon. The plan of two yokings a-day must be equally advantageous for them, as it is found for post horses, which can go thirty or forty miles in two stages, much better than in one. This does not seem to be understood in those parts of the united kingdom, where it is the practice to go but one yoking a-day, even in the longest days of summer. This practice probably originated in the common field system, and continues, owing to the distance of the land to be ploughed from the farm offices; an additional proof of the importance of having the offices in a central situation.

5. *Wages in money.*—The hinds in Roxburghshire and the neighbourhood, formerly received almost their whole wages or emoluments *in kind*, and, in order that they might provide themselves with clothing, they were allowed to keep a certain number of sheep upon the farm. As that plan, however, could not well be continued, under an improved system, (in many cases, after the commons were inclosed, no sheep being kept by the farmer himself), it was converted into an annual allowance in money, known under the name of "*Sheep Silver.*" This amounts, in different districts, to from thirty to fifty shillings, and in Roxburghshire it is on an average about L. 3 *per annum.* To a servant of uncommon merit, it is sometimes raised to five pounds.

Servants of a higher description, who are intrusted with any charge of importance, have greater wages in money, sometimes as high as from twenty to twenty-four pounds *per annum* *.

* Farm-servants have also a small perquisite in money, about one penny *per* boll for driving grain to market, in addition to

6. *Wages in grain.*—The payment of wages in kind, probably originated, partly from scarcity of specie, and partly from the desire of the servants to be provided with meal or grain, without going to market for purchasing these articles; and the farmers would most readily concur in the plan, as a market at home was thus given them for part of their grain, without their being put to the expence of its carriage to a distance, and as it gave the servant a kind of interest in what was going forward, without his being entitled to interfere in the operations carrying on. To interest them still more in the produce, it is a rule, that the grain given to the servants, should be the best, next to the seed, that the farm produces, and better dressed than the general growth. The payment of wages in kind is almost universal in the more improved districts in Scotland, and contributes not a little to the sober and economical habits of the people, who might be tempted, if they had money in their pockets, to waste it at markets, or in alehouses, instead of expending it on the maintenance of themselves and their families *. If paid in money they are

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their regular money wages. This allowance is not unreasonable, as the servants on such occasions are often twelve hours or more absent from their homes, and have often hard work as porters, in loading and unloading.

* An intelligent farmer from Northumberland informs me, that some farmers in Tyne-side pay their servants in kind, or, which is the same thing, find them a certain quantity of corn, at a fixed price, but that is not a general practice; and two modes being followed induces the servants to change their places, hiring to masters who find corn, when it is high, and changing to those who pay money alone, when corn is cheap. Were the Berwickshire plan general, it would be better, he observes, for both master and servant. The farmer would thus exchange the produce of the farm, for the labour bestowed upon it, and the latter would not feel the effects of scarce years, and high prices. There is

miserable and necessitous, when the price of grain becomes high; whereas, when paid in kind, it is evident, that they suffer nothing in times of scarcity; and, indeed, the higher the price of grain the better for them. This prevents a great deal of discontent in such times. On the other hand, it is asserted, that a large body of the community, thus feeling nothing of the pressure of want, are too apt to consume more food than they ought to do, and even to waste it. That, however, is not the case in Scotland. Their natural turn for economy, induces the farm-servants there, to accumulate rather than to spend; and they seldom consume more than is necessary for their subsistence. In years of scarcity, sober and intelligent servants, carefully economize at home, and sell the surplus, thus laying up a resource for old age and infirmity. The only objection I have heard to such a system is, that in years of scarcity, even the husbandman ought to consume less food, which may not be the case, when he has the same quantity allowed him every year. Nothing, however, but absolute famine itself, should stint the quantity of food to be consumed by the hard-working labourer. Indeed, when the price is high, he is tempted to diminish his consumption, more perhaps than he ought to do, for the sake of the price he can obtain for it.

Besides, the husbandman, as well as others in the lower ranks, *must* consume less food, in scarce, than in plentiful

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also another plan followed by some farmers, that of supplying the labourers with whatever corn they require, at a certain price *per* bushel, which is generally much below the average price: this is found to encourage prodigality, and sometimes induces the labourer to dispose of part of what he gets privately, when it is dear, and thus he becomes dishonest. It would be well for both parties were this plan abolished. For although the masters who follow it, pay less money wages than those who adopt the other plan, yet eventually their labour costs more.

seasons; for, though he gets the same bulk or measure of grain, where his wages are paid in that article, yet there will be less *meal* in it, which is the edible part of the grain. A scarcity indeed proceeds as much from bad quality, as from small quantity of produce, the one being a necessary consequence of the other, as skinny shrivelled grain produces food weak and unsubstantial.

The grain allowed to the hinds, in several districts, is to the following amount; 72 Winchester bushels of oats, 18 of barley, and 8 of pease or beans, worth, on an average, about L. 22.

It is contended, however, that the allowances to farm-servants should consist of meal, equal to the amount of their annual consumption, and not in unmanufactured grain; and that both their wages and perquisites should as little as possible lead them to the sale of grain, or its use, (as in the case of keeping fowls), or on any other purpose but the maintenance of their families. If they have a part of their wages paid in unmanufactured grain, which they may sell, it may be a cloak to dispose of what they have not honestly procured. Besides, as the master has much to do with the sale of corn, it would appear more in his line of business, to sell the produce, delivering to the servant the meal and barley required for his family, and paying in money the remainder of his wages, for buying what other necessaries may be wanted. This is not hinted at from any idea of a general disposition in married servants to pilfer, to which the use of the threshing-mill is a great check; but because poverty should never be led into the way of temptation. If no grain were paid in kind, it would be impossible to sell any without creating suspicion *.

* Mr Kerr remarks, in his Report of Berwickshire, p. 415, that a new custom is generally creeping in, of the hinds demand-

7. *Keeping a cow.*—Among the advantages enjoyed by farm-servants in Scotland, that of having a cow kept during the whole year, is reckoned a privilege of peculiar value.

In Roxburghshire, during six months in the year, the cow is in general pastured in a field, and during the remaining six months, is kept in the house upon straw. About calving time, in some districts, she has a regular allowance of coarse hay, or turnips, or something equivalent. The cow, and her produce, is the servant's property. The milk itself forms no small means of support to the family, and, in particular, tends much to the comfortable subsistence of the children. The cheese is mostly consumed at home. Any quantity of butter, that is not used for necessary domestic purposes, is sold, in small quantities, at the weekly markets, in a fresh state, or is salted, and sold at the market price, whatever that may be, usually about 50s. *per* firkin. Good housewives generally strive to have at least one firkin for sale. The whey is generally given to the pig. The value of the cow to the cottager, depends very much on the pasture on which she may be placed. It varies from L. 6 to L. 10, and, in very favourable situations, will amount to a still greater sum. Indeed, a good cow, properly maintained, will produce at the rate of 1 s. *per* day, or L. 18 *per annum*. The calf they sell as soon

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ing money and meal, instead of grain. In some instances, L. 18 in money, and a weekly allowance of two pecks, or 17½ lbs. of meal, have been bargained for, instead of the articles, which may be denominated wages; all the other allowances or perquisites remaining as afterwards stated. This practice seems now again falling into disrepute. For two or three years the militia system had drained the country of men. But boys have since grown up to supply the demand, and men-servants are more upon their ordinary level. At that time they hardly knew what to ask, and a known good servant was never refused his demand.

as possible, being rarely allowed to keep one on the farm, and never on valuable land.

The benefit of milk to a poor family, is of such peculiar importance, (producing double the quantity of human sustenance it would do, if the milk were converted into cheese), that the practice cannot be too much recommended. An intelligent farmer informs me, that his servants have been frequently offered L. 10 *per annum* in lieu of a cow's maintenance, which they have repeatedly refused. Keeping cows is certainly attended with some inconveniences to the farmer, and, occasionally, disputes will arise between the servant and him on that subject; but it is such an advantage to a person with a family, to be able to provide his children with milk, that it would be a misfortune were such a system to be altered, where it is already established; and indeed I hope, that, in process of time, it will be introduced into other districts, where it may be at present unknown.

The idea of giving turnips to the servants' cows, is considered by some to be unreasonable *; but upon turnip farms, in the counties of Berwick and Roxburgh, and in other districts, it has become so common to give a moderate quantity, that it is almost considered to be a right; and indeed without it, the ploughman and his family cannot be supplied with milk in the winter season. It has become usual, therefore, when the cattle of the farmer get their turnips in the field, that the ploughman's cow shall go along with them, or they receive six cart-loads of tur-

* Upon all well-improved farms, where the crops are strong and free from grass, it is absolutely necessary to give the servants' cows some better food than the straw. If they have not better food when near calving, they would often be lost altogether, or would become so low in condition, before they got grass, that they would be of very little value to the owner during the summer months.

nips for each cow. In other farms, they give two cart-loads of bog hay, or one cart-load of good clover and rye-grass hay *per* cow, in place of turnips.

As the best mode of preventing disputes regarding the feeding of cows, it is the practice with some farmers, to furnish the cow themselves, and if she gets fat, to sell her, and to provide another in her place. It seems fair enough that the profit should go to him, as he has been at the expence of the feeding. This plan is also convenient for young people who get married without much stock.

In the case of unmarried servants, an agreement is sometimes made, to supply them with a certain quantity of milk, of which even the ploughmen in Scotland are fond, not being much accustomed to beer. The quantity usually given, is about a Scotch pint, or two English quarts *per* day; but some give it only during the summer months. Mr Thomson of Muirtown of Balhousie, near Perth, calculates the expence of a Scotch pint of milk *per* day, at 4d., and consequently in all, at L. 6 : 1 : 4 *per annum*. In Strathearn, this allowance is converted, at the rate of 52 s. *per annum*. Instead of giving any specific quantity of milk, Mr Rennie of Kinblethmont, keeps a cow for two or three of his unmarried servants, according to her size, and divides among them the milk she produces.

8. *Pig.*—Farm-servants are seldom precluded from keeping a pig, which can be fed on the refuse of their potatoe crop, with little additional expence. That indulgence is certainly of much consequence to them, and, when the animal is confined, of very small consideration indeed to the master. The flesh used to be regarded in Scotland with Jewish antipathy, but such prejudices are now got the better of, and the unclean beast is slaughtered without repugnance. The pork is salted, and used by the family in small portions at a time. It makes a good relish to

their vegetable diet, and serves to render their barley broth more palatable. When fattened, a pig of the ordinary sort, may be worth from 30s. to 40s. When fat, the pig may weigh about 9 stone, of 14 lbs. each, at 4d. *per* pound: this would amount to 42s. besides the lard and inmeat, from which, however, the original cost of the pig, at six weeks old, about 10s., must be deducted. Some industrious farm-servants in Berwickshire, will feed two pigs in the year, as young pork is much used in that county.

9. *Poultry.*—I was often astonished at the incredible number of eggs shipped at Berwick for the London market, amounting in value, to several thousand pounds *per annum;* but the number of fowls kept by the farm-servants, not only in Berwickshire, but in the neighbouring districts of Northumberland, and Roxburgh, (the surplus eggs of which are shipped at Berwick), and some even from East Lothian, Tweeddale, &c. fully explains it. Every ploughman is allowed to have from three to five hens, and the country abounds with travelling hawkers, who collect the eggs at from 6d. to 1s. *per* dozen, sometimes as high as 20d., and, about Christmas, even 2s.; they also purchase any hens or chickens that are not sold at the weekly markets in the neighbourhood. The farmers, afraid of having their grain embezzled, are anxious to commute this perquisite for a payment in money, of from five to ten shillings *per annum*, to which the hinds are sometimes obliged to assent, but with a degree of reluctance, which shews the high idea they entertain of the profit to be derived from this privilege.

10. *Garden.*—To every cottage, there is generally attached a small garden, in which they cultivate onions, cabbages, early potatoes, &c. This is of great benefit to the servant, but it is a considerable loss to the farmer, from the dung it requires.

11. *Potatoe ground.*—In Berwickshire, every ploughman is allowed as much ground as will plant from one and a half, to three bushels of potatoes. In East-Lothian, the allowance of ground given for planting potatoes, is about one-tenth part of an acre, or nearly 100 yards, upon a six-ell ridge about 19½ feet broad, or 900 yards of a drill in length. Dung is furnished to the potatoe crop, by the farmer; the horse culture is done by the farm horses, and the hand culture by the wife and children of the servant. The importance of this privilege is too obvious to be insisted on. This mild and wholesome root, is a prime article of food to the industrious peasant, and to his children in particular.

12. *Flax.*—In Berwickshire, each hind has the privilege of sowing about a peck of lint-seed. In East Lothian, one-tenth part of a Scotch acre is allowed for that purpose. This plan is said to be highly advantageous, as its culture, dressing, spinning, and preparation for the manufacturer, affords a useful source of industry to the wives and daughters of the hinds, and they are thus also enabled to provide themselves with linen, and sometimes to sell a small quantity of cloth.

Others view this privilege in a very different light. They contend, 1. That when farm-servants are allowed to sow a portion of flax, their houses, which are often thatched, are very liable to be set on fire, from the flax being kept near the roof; and one farmer, it is said, has had his whole farm-cottages twice burned down, within the space of a few years, owing to that circumstance; and, 2. That the manufacturing the flax, and the spinning it afterwards, prevents the young girls from getting out to assist the farmer in his operations, so much, and so often, as occasion may require; whereas nothing tends so much to encourage the breeding of healthy rustics, than the girls working out of doors, at all kinds of agricultural labour, suited to their

strength and sex. This objection, however, is not well founded, the flax being spun in the winter months, when out-door employment cannot be procured.

The culture of flax by farm-servants, has certainly much diminished in Berwickshire; and the farm-servants now, generally, take land for potatoes in its stead, in addition to their ordinary allowance of ground for that root. This may be owing to various causes. 1. The crop is very unproductive in dry soils; 2. There are few flax mills, and the dressing by hand is extremely troublesome; and 3. Spinning is a miserable employment, and not so profitable, as the more pleasant and healthy work that can be had out of doors.

13. *Bees.*—The keeping of bees is never prohibited, but the cottagers' wives and daughters, find more profitable employment in their household, and other duties, than in attending to this precarious and wandering stock. The correct modern husbandry of Scotland, has deprived bees, of that variety of food these insects formerly enjoyed, from the numberless wild flowers or weeds, both annual and perennial, which the drill and fallow systems have almost extirpated. The bloom of furz, (whins), from which they extracted a substance, either for making honey, or constructing their cells, is now more rarely to be met with; these plants being almost rooted out in the more improved districts. At an average, under the most favourable circumstances, a hive may produce three Scotch pints of honey, worth from 5 s. to 7 s. a pint; but in bad seasons, the quantity is very inconsiderable. Some question, whether the honey ever repays the owners for the time spent in watching, and hunting after this capricious stock, often to the distance of miles, and losing them after all, and this risk is certainly alone equal to a considerable percentage on the capital invested in it. At the same time,

it is a pity, in favourable situations, not to keep up a spirit of attention to the labours of this industrious insect, the total produce of which, in an extensive district, would not be inconsiderable.

14. *Fuel.*—Where coals are difficult to be procured, and where peats and turf abound, these no doubt are preferred; but in situations where the farmers consent to carry the coals, and where the supply of peats and turf is scanty, coals are used in preference. Peat and turf, when good of their kind, give a greater blaze, and diffuse warmth with a cheerful light; but they consume too quickly, and afford a less steady heat for the operations of cookery, than coals. Their ashes also, are apt to be blown into every corner of the house. Where coals are used, each hind has from three to five single-horse cart-loads, carried home to him, but the price, and the tolls, are usually paid by himself.

The following statement, communicated to me by Dr Young of Fawsyde, near Stonehaven, points out the superiority of coal over peat as fuel. A poor woman was obliged to purchase peats, during a scarcity of coals in winter; her daily consumption of peats cost her three halfpence; her annual quantity of coals was two bolls, each boll 36 stone Amsterdam weight, or containing about 212 pints. Coals generally sell at Stonehaven for about 5 s. *per* boll; the highest they have been known at was 6 s. 8 d. Her peat fire, (although at the common price of coals, more than four times their value), was not nearly so serviceable.

15. *Perquisites.*—In addition to these allowances, and some perquisites when driving grain, lime, marle, &c. where the carriage is distant; the farm-servants, during harvest, and when carrying in corn, have their maintenance, because their wives are then employed in the ser-

vice of the farmer, and also because of the extra hours in which they are employed in that busy season; but they are not allowed those quantities of beer, which occasion such an endless expence in the houses of the farmers in England, without being of any real advantage to the servants themselves. During harvest, they are only allowed in Berwickshire, one bottle of small beer to dinner; and when carrying in corn, they have another bottle, and half a loaf in the afternoon *. In regard to perquisites, in general, it has been justly remarked, that they should be considered as premiums for good behaviour, and not as a matter of right. Indeed, Mr Walker of Mellendean allows only such of his servants, as distinguish themselves by their good behaviour, to keep a pig.

15. *General View of their Wages and other Emoluments.*

	Wages.					
1. Allowance in money on an average, about				L.	4	0 0
2. Value of the allowances in grain, -					22	0 0
				L.	26	0 0
	Perquisites.					
3. Keep of a cow, at 6 d. *per* day for the whole year, -		L.	9 2 6			
Carry forward,		L.	9 2 6	L.	26	0 0

* An intelligent correspondent informs me, that in his part of Berwickshire, the ploughmen are allowed breakfast, dinner, and supper, while employed in the hay, as well as the corn harvest; and that the same allowance is given them, while their wives, &c. are employed in reaping the crop, though they themselves may be engaged at the plough, or other ordinary farm labour at that time; as their wives cannot in that case cook their victuals.

Carry forward, -	L.	9	2	6	L.	26	0	0
5. Poultry, - -		0	10	0				
6. Garden, and land for potatoes and flax, - -		3	10	0				
7. Carriage of coals, -		1	0	0				
8 Harvest food, and allowance when leading, -		1	10	0				
						15	12	6
					*L.	41	12	6

In the above statement, the garden and the land for potatoes and flax is only estimated at its worth to the farmer; but these articles are more valuable to the hind, by whom they are received.

17. *Family gains and perquisites.*—In addition to the above sum, the families of the farm-servants enjoy various sources of profit. Their wives, and their children, from the moment they can handle a hoe or weed-hook, except in the dead of winter, are never in want of *out-work*, for which they receive ample wages. In fact, a ploughman's family, after the first few years of helpless infancy are over, are his riches, and they often contribute to maintain him when he is past labour. Besides the out-door work, there is also a good deal of industry *within doors*. Spinning forms a considerable part of the employment of the females: They make also their own clothes, and repair those of the men: They knit stockings, the wool of which they themselves card, spin, dye and twine. These, with the other household cares of baking, cooking, washing, churning, cheese-

* This *per* week is 16 s. or 2 s. 3¼d. *per* day. The average of all England in 1810 was 2 s. 5 d.

making, &c. furnish ample employment to an industrious family circle.

On the whole, the following is the income which, in some cases, a hind, with an industrious family, may acquire.

1. Gains by the ploughman himself,				L.	41	12 6
2. His wife's harvest food, 28 days, at 10 d. -	L.	1	3	4		
3. One child working at turnips, &c. at 8 d. - -		4	0	0		
4. Gains of his wife and children in barn-work, and spinning through the winter,		2	7	6		
					7	10 10
				L.	49	3 4

Some profit is also derived from the potatoe ground, and from the flax sown. The rent of the cottage also, is frequently paid for by the wife's working during the harvest.

Such is the general state of ploughmen or *hinds*, as they are provincially called, in the counties of Berwick and Roxburgh; let us proceed to consider their situation in other districts.

In East Lothian, Mr Brown of Markle gives the following account of the wages he pays to no less a number than 14 married servants. They are all paid in kind, having 12 bolls, or 72 bushels of oats, 3 bolls, or 18 bushels barley, and two bolls, or 8 bushels pease *per annum*, together with maintenance of a cow, summer and winter, a piece of land for potatoes, generally worth L. 1, 10 s. a piece of land for flax, generally worth 20 s. liberty to keep a few hens, what dung is wanted for their gardens, coals driven,

and their whole maintenance during harvest, (which usually lasts for about five weeks), and if they do not receive their supper in kind, they are paid for it in money. The servants who sow the corn receive, beside the above articles, a pair of shoes, or 9 s. in lieu of them, and those who stack the grain, have half a boll of wheat on that account. Taking every thing at a fair value, the wages and emoluments of each servant, where the cow is well maintained, may be calculated, at this time, at L. 38 Sterling *per annum*.

In Dumfries-shire, Mr Stewart of Hillside has given me the following estimate of the expence of keeping a married farm-servant.

A cow kept, or her milk furnished, the calf at a month being the farmer's for the waste and risk of the cow, (this is an excellent mode of insurance),	L. 6	0	0
52 stones of meal at 2 s. 6 d. - -	6	10	0
Potatoes, from 3 to 5 cart-loads according to the number of children, - - -	2	0	0
House and firing, - - -	2	10	0
Money wages, - - -	15	0	0
	L. 32	0	0

Servants who have not a cow's milk, get a Scotch pint, (2 English quarts), of skimmed milk daily, for nine months, which may be reckoned worth 30 s. This will bring the wages to L. 28, 10 s.

Mr Boyd, of Powis, near Stirling, estimates the expence of a married servant at L. 32; Mr Blair of Montague, near Perth, at L. 31 Sterling.

In the Mearns, the following is the calculated expence:

In money yearly,	L. 10	10	0
In coals,	1	1	0
In potatoe ground,	0	15	0
In meal, 6½ bolls, at L. 1, 4 s.,	7	16	0
A cow, kept summer and winter,	5	0	0
	L. 25	2	0

In Caithness, a married man receives L. 8 of money wages, and seven bolls of meal in kind, which is calculated to be worth, on an average, 20 s. *per* boll, with the keep of a cow, which being but small in size, and perhaps but indifferently kept, consequently cannot be estimated at more than L. 3 additional, and a house and fuel, worth about L. 3 more, consequently the whole will not exceed L. 21.

Thus it appears, that the wages of servants diminish as we proceed northwards. The additional expence, however, of farm-servants, in the more southern districts, is, in general, amply compensated, by the additional skill and industry of those who receive it.

18. *Married servants.*—It is here proper to discuss the important question, whether single or married farm-servants ought to be preferred, and to lay before the reader, the evidence of several intelligent practical farmers, in support of the married system.

Mr Stewart of Hillside remarks, that married servants are generally more steady than the unmarried, and also more docile, feeling that they cannot so easily move themselves from one place to another, and if thrown out of work for a very short time, that they have more than themselves to provide for, having in general a numerous and clamorous progeny. This system is useful in various respects. If the

master is solicitous about their welfare, by attention to their wants and necessities, they are inclined to continue with him, and at length a mutual attachment springs up between the master and the servant; the servant is thus induced to attend to the manner of performing his work, so as to promote the interest of the farmer, (which rarely enters into the views of unmarried servants), and even to exceed the mere performance of the duty required of him. Besides this, the horses will be better cared for, will do their work more easily, and their lives will be considerably prolonged, by keeping the same persons long about them, so as to have become acquainted with their tempers, instead of changing every half year. There ought to be, however, always one unmarried servant, who can be depended upon, to be near the horses, in case of accidents during the night.

Mr Dudgeon of Primrose Hill states, that the necessity of furnishing a house and purchasing a cow, before they can propose entering into a married state, holds out a strong incentive to early habits of sobriety and frugality, and lays the foundation of that decency of character in after life, for which the individuals of this class (in Scotland) are so justly distinguished *.

In a communication from Mr Jack of Moncur, in the Carse of Gowrie, the advantages of having married servants are ably stated. It is there observed, that they do not remove so often, which is a great benefit; that they get acquainted with the farmer's plans of working; and that their families are useful in harvest, and among drill crops, both of which are done by piece-work. Indeed, within these eight or ten years past, the harvest work, which was

* It is a great public disadvantage attending small farms, that the servants must be unmarried, as the small farmer cannot afford accommodation to married servants.

formerly performed by people from Athol, is now executed, in that district, by the inhabitants, and a great deal of it by women and children.

Mr Ballingall, in Fifeshire, also prefers married servants, as being more steady and industrious, as well as sober, and always at home; and as their families furnish abundance of turnip hoers, who are inured to work from the time they are able to lift a hoe.

Mr Thomson, of Bewlie, in Roxburghshire, is likewise strongly prepossessed in favour of married servants. He observes, that large farms have a tendency to increase population, *as it is almost impossible to farm them to advantage without married servants:* such servants are not only the best, but their children are in general numerous, strong, and healthy.

Mr Blair, of Montague, near Perth, calculates the expence of a married servant at L. 31, 11 s., and of an unmarried servant at L. 33, making the former the cheapest.

Some farmers object to married servants, as troublesome about their cows and houses, and as being disposed to pilfer, for the sake of their cows or families; but from the observations above detailed, the superiority of married servants can hardly be questioned, and they seem indeed to be almost indispensable for large farms. Their utility also, in training up such numbers of young persons, to the labours, and to the art of husbandry, cannot be too highly appreciated.

In regard to the public, it has been well observed, that married servants not only are the best for the farmer, but add strength to the state; and indeed it is of such consequence to have a healthy and numerous agricultural population, that it might be politic to give, by way of premium, to those farmers whose ploughmen were married, a deduction of the horse tax, as a mark of public approbation of so advantageous a system.

In many of the returns transmitted to me, the ploughmen are all married, in others only two or three on a farm are in the single state; but, on an average, ten out of twelve, or five-sixths are married, forming little colonies, of a description of persons in the highest degree useful and meritorious; decent and orderly in their behaviour, and deserving every possible degree of encouragement.

Though it may be attended with some disadvantages, yet on the whole it greatly contributes to the comfort of the farmer, to have his servants married. Their victuals are prepared in their own houses, and there is no grumbling either regarding the quantity, or the quality, of their food;—a source of endless complaint where a contrary system is adopted *.

In regard to unmarried servants, most farmers keep one or two lads who live in the house, and who each work a pair of horses. Their wages vary, from L. 5 or L. 6 up to L. 12 half yearly, (the term for which they are engaged), and they have their full board in the farmer's kitchen. As soon as they earn a sufficient sum to furnish a house, and purchase a cow, they generally get into the married state.

19. *Average number of children.*—The hinds do not marry until they have accumulated some capital, to enable them to purchase furniture, a cow, a pig, &c. Some contend, that the average of a hind's family may be

* It is well known, that farm-servants, when kept in a house, are extremely troublesome about their victuals; indeed such is the perverse nature of mankind in general, that the better they are treated, the saucier they are apt to become, and the more disposed to grumble. Nor is it possible to estimate the expence of keeping an unmarried servant in the master's house, as it depends upon the extent of his appetite, as well as the mode of feeding. Some unmarried servants, however, are necessary, to be trained up to ploughing, and other agricultural operations.

stated at five children; others, however, consider that estimate to be too low; for in several cases, they rear from seven to eight, and even nine children.

20. *Whether the children are educated.*—Any neglect in so essential a duty as that of educating their children, is held to be so scandalous, that hardly an instance of it is known. Boys and girls are invariably taught to read, and, before their leaving school, their bible is made perfectly familiar to them. A thorough knowledge of their catechism is also reckoned indispensable. They are generally taught to write a little, especially the boys, and sometimes to cast accounts; and this most commendable attention to the education of their children, seems to gather strength, with the more efficient circumstances of their parents.

21. *What becomes of their families.*—Most commonly at least one lad in a family, remains in the humble calling of his father; but the greater proportion of them, betake themselves to different trades, for the successful prosecution of which, they are in general well fitted, by early habits of frugality and industry. A few become soldiers; a number are compelled by ballot to serve in the militia, or more commonly their own, or the hard earnings of their friends, are wrung from them, to provide substitutes, when the lot falls upon them. The sea being generally regarded by them with horror and aversion, the navy derives little or no advantage from this source.

The females seldom get into the state of matrimony, until they have fully attained the years of discretion; the phlegm or prudence of their country gallants, seldom favouring very early matches. Before this important era in their life, they are employed in the manner already described, or enter into service, in the houses of the neighbouring gentry and farmers.

22. *What becomes of the hinds in their old age.*—From the habitual temperance, and regular pursuits of their youth, they are usually capable of earning a scanty subsistence, as day labourers, or otherwise, until the very verge of old age. When absolutely unfitted for labour, by infirmity, or extreme old age, they are maintained by their children, or by the parish poor rates; which last, unfortunately, begin to supersede the former mode of support; for within the memory of many, the disgrace of permitting an aged parent, or near relation, to be beholden for his subsistence to this legal sort of beggary, would have stimulated the most profligate to industry.

23. *Their manners and character.*—The manners of this class of people accord to their situation in life, being simple, orderly and decent.

Though they labour incessantly during six days of the week, Sunday is to them a real day of rest, and distinguished by a peculiar attention to religious ordinances, and to the instruction of their children in the duties they have to perform. The Scotch farm-servants are fully as extravagant in the articles of clothing, if not more so, than the English. They have all their Sunday's garb, and rarely attend church, on that day, in their common dress.

24. *What would improve the situation of the Peasantry.*—Owing to the numerous families which they generally rear, it is seldom possible for them to accumulate any capital, as a provision for their old age; but there is no doubt, that they could easily afford small weekly payments, that would be sufficient to secure them a comfortable and independent subsistence when advanced in life. Nothing therefore is wanted, to complete the comfortable situation

of this most deserving class of the community, but the institution of Benefit Societies; and the person who would establish a safe and practicable plan for that purpose, would prove of infinite service to them and to the public *.

25. *Objections to the above system considered.*—It must not be imagined, however, that this system has not been objected to; but the objections urged do not seem to be material. It has been said, that it would be much better to lay down at the ploughmen's doors, a certain quantity of potatoes, than to give them the trouble of raising them by their own labour; and to furnish them with milk, instead of permitting them to keep a cow. These privileges, it is said, are attended with some inconveniences. Their potatoe land may not be so completely worked up as that belonging to the farmer; and the servant's family may not always be in a state to pay sufficient attention to the cow, who may suffer by their neglect: But the great object is, to make farm-servants and their families industrious, economical, and, above all, happy, and to interest them in the prosperity of their master, and the welfare of their country. All this is best effected, by giving them the possession of property, in the preservation and advantages of which, they must feel themselves

* Some are of opinion, that the belonging to a Benefit Society ought to be legislatively rendered compulsatory on every individual in the empire above 14 years of age, and under 40. The destructive poor rates must take care of the older till they die out. Every parish ought to assist the funds at the outset, for a few years, till well established, which will be an enormous eventual saving. The establishment of Benefit Societies universally, upon a broad and judicious basis, would immortalize any minister who carried it into effect.

deeply interested. I have no doubt, indeed, that if the farm-servants in England, were put upon the same footing with those above described, it would be a great blessing to the country. The Scotch farmer, can at all times have the command of his farm-servants; and when he wants any thing done, he knows where to find them immediately, as they are all living on the premises, with their families, in their own houses. But the English farmer, on the other hand, must go a mile or two off, or more, to find his people, and, perhaps, must go from pot-house to pot-house, before he find them; and then in a situation unfit for labour, which not only disappoints their employer, but such a way of expending their earnings, beggars their families, and compels them to apply to the parish for relief*. This is one great cause of the heavy poor rates all over the kingdom. Nothing would tend more to diminish those rates, and to reform the morals of the lower classes, than for the proprietors of landed property, in England, to build, on every farm, a sufficient number of cottages for the residence of farm-servants and their families, with small gardens attached to each. The farmer would thus, at all times, have the command of his servants; and it would be the means of keeping them out of public-houses. It would not then be necessary, to send for them in a morning, to go out with their horses, which is too often the case at present, by means of which a great deal of time is lost, not only of the labour of the men, but of the horses.

26. *Other farm-servants.*—Besides the ploughmen, to whom the preceding observations principally apply, a variety of other servants are essential on large farms, as

* Hence the advantage of paying wages in kind, as has been already remarked. When they have little money in their possession, they are not tempted to go to the alehouse.

shepherds, smiths, carpenters, and persons to do other kinds of husbandry work, unconnected with horse labour. These are necessary under an improved system, independent of day-labourers, to be afterwards mentioned. A number of female servants are also kept, particularly in the more northern parts of the kingdom, who, besides milking the cows, and assisting in weeding the crops, and taking care of the house, and the farmer's children, are employed in spinning lint yarn, to be manufactured into linen, for the use of the family *.

On the whole, it is impossible to form too high an idea, of the excellence of the Scotch farm-servants, in the more improved districts of that kingdom. It is justly remarked in the Carse of Gowrie, that notwithstanding the improved implements which have been introduced into that district, yet that farming there, would have been in a very back-

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* It may not be improper to give a general view of the system adopted in some of the southern counties of England, in regard to farm-servants, for the sake of comparison with the preceding statement.

1. The general mode of paying farm-servants (not labourers) in England, is by yearly wages in money, with board in the farmer's house. 2. In general no perquisites are allowed to farm-servants; but in Suffolk, the tradesmen with whom the farmer deals, give his men from 1*s.* to 2*s.* 6*d.* to spend at their harvest-home. 3. Servants are never allowed any emolument by working for other men than their masters. 4. Servants drink what small-beer they please; the allowance of ale is usually a pint at each of the three meals, (some only a quart a-day), except in harvest, when three quarts a-day is allowed; and whenever the farmer wants to excite diligence, it is done by ale. 5. Servants cannot *insist* on any thing that relates to the feeding of horses; but they prefer the service of those who feed well, and keep crack-teams. Servants are very apt to give more corn than their masters allow, and complaints are very common before magistrates on this head.

ward state, if it were not for the valuable servants of which they were possessed; and a respectable farmer in East-Lothian, (Mr Pringle of Ballencrieff), who has travelled even into foreign countries in search of agricultural information, represents the farm-servants in that district, as almost always sober, steady, and regular, and on the whole the best servants he ever saw *.

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6. The farmers who keep crack-teams, indulge in expensive harness, with bells in unison, &c.; and servants like to let themselves to such masters; but I never heard of any such thing being insisted on. 7. In winter the hours of work are from light to dark, but the horse-keepers are in the stable two hours before it is light. In summer the teams are in the fields at six o'clock; they plough for eight hours, or eight hours and a half, but breakfast under the hedge: this for one journey, but two journeys are common, in which case they breakfast before they go out; plough four, or four hours and a half; come home to dine and bait the horses, then out again to plough for four or four hours and a half more. Servants, not ploughmen, work from six to six, except one hour and a half for breakfast and dinner. 9. No allowance of days for fairs; if asked, which may happen once or twice a-year, it is gratuitous in the master. 10. It is not at all common for servants to refuse to work, except under certain bargains, in harvest; in which they will do no other than harvest work; but farmers are attentive to have jobs of various sorts ready, to which they can set their men, in case of weather too bad for working abroad.

* Unfortunately this character is not applicable to the servants in the neighbourhood of great towns, who, in various respects, are of a description materially different, more especially in regard to their moral character, their industry, and their zeal in the service of their masters.

Sect. III.—*Apprentices in Husbandry.*

It is much to be regretted, that the plan of having apprentices in husbandry is not more common. I have found, in the course of my inquiries, but one farmer in Scotland, (Mr Walker of Mellendean), who adopts that system. He has favoured me with the following account of the plan, which I hope others will be induced to follow, when they are made acquainted with its nature. He informs me, that the young men whom he has hitherto had under him as apprentices, have uniformly paid him ten pounds. Some of them remain two years with him, but the greater number only one. They eat in his kitchen, where they have always plenty of plain wholesome food. He takes none who are above living in that way, or who will not put their hand to whatever is going forward on the farm. He has sometimes been offered ten times the above sum to take in young gentlemen, to eat and associate with his own family, but this he has uniformly declined. These young men have an opportunity of attending to every operation of husbandry, as practised on Mr Walker's farm, and are taught to sow, to build stacks, to hold the plough, &c. Having hitherto been fortunate enough to have none but steady young men, he rather considers them profitable than otherwise, and at some seasons he finds them particularly useful.

What a pity it is, that experimental farms were not established at the public expence, where not only persons in the inferior classes of society, but even those connected with the higher ranks in life, might be instructed, as apprentices, or students, in the practical details of agriculture.

Sect. IV.—*Of Day-Labourers.*

In addition to the farm-servants of various descriptions, above described, a number of other labourers are occasionally employed in various operations about a farm, as women and children at turnip hoeing, &c.; men to cut the hay; reapers to cut the corn: many are also employed in scouring ditches, clipping hedges, draining, inclosing, &c. so that the number of persons, employed in a district, under an improved system of husbandry, can hardly be enumerated *.

The wages vary in different districts, according to the nature of the work to be performed, and other circumstances. It is well observed by Mr Church of Hitchill, that field work ought as much as possible to be tasked out, or let by the piece, or job. Were this gene-

* The hinds, and house servants have sufficient employment, in ploughing, and other operations connected with the cultivation of the farm, the labouring work of which, as hay making, mowing, hedging, ditching, draining, and the like, is performed by *hired labourers*, either by contract, or piece work, or by wages varying from 2 s. 6 d. a-day in summer, to 1 s. in winter. When hired for the whole year round, such labourers generally receive from 10 s. 6 d. to 12 s. a-week. Kerr's Berwickshire, p. 418. The hours of labour during eight months, are from six in the morning till six in the evening, with one hour for breakfast, and one for dinner, at nine and one o'clock respectively. In the four winter months, of November, December, January and February, work continues during good light, when frost allows, and breakfast is taken before work begins. Kerr's Berwickshire, p. 419.

rally done, the same number of hands would go through much more work, than they will do by day wages; and by this method also, more labour would be gained to the community, and generally at a cheaper rate to the employer.

In regard to day-labourers in general, the subject has been already so frequently discussed, that it seems unnecessary to dwell upon it at any length. The whole plan of having married farm-servants, however, according to the system adopted in the more improved districts of Scotland, having never hitherto been minutely explained, I thought it my duty, to enter into it in detail, as it seemed to me peculiarly well entitled to all the attention that could possibly be bestowed upon it.

Arrangement of Agricultural Labour.

It may not be improper here to state, some observations transmitted to me by Mr Church, on the judicious arrangement of agricultural labour, one of the most important branches attending the management of an arable farm. On it indeed, in a greater or less degree, hinges the profit or loss of the farmer. To dispose of the labouring persons and cattle upon a farm, at such work as is likely to be the most profitable, and to see that they are fully, constantly, and regularly employed, requires, at all times, the eye of the vigilant husbandman. Under a good system of husbandry, a farm furnishes regular employment, both to the servants, and to the cattle, throughout the whole year. On a considerable farm, it is proper to have servants appropriated for each of the most important departments of labour, as there is often a great loss of time, where the same persons are frequently changing their employments. Besides, as Dr Smith has so ably elucidated in his description of pin-making, the work is executed, not only more expeditiously, but also much better, in consequence

of the same hands being constantly employed in it. For that purpose, the ploughmen ought to be kept chiefly at work with their horses, in ploughing, or carting; and indeed, (as an English gentleman has well observed), in Scotland they are in a manner tied to their horses, having hardly any work to do independent of them. They are therefore as careful of, and as much attached to them, as if they were their own. Every ploughman also, besides the care of his horses, has his harness, plough, cart, &c. for which he is responsible. Common or day labourers ought to be almost exclusively employed in draining, ditching, &c.

Concluding Remarks, on the subjects discussed in the three preceding Dissertations.

On the whole, what spectacle can be more delightful, than to see a large estate, under the direction of an intelligent landlord, or of one competent to the task of managing it to advantage, where the farms are of a proper size, where they are occupied by industrious and skilful tenants, anxious to promote, in consequence of the leases they enjoy, the improvement of the land in their possession, and where the cultivation is carried on, by a number of married servants, enjoying a fair competence, and rearing large families, sufficient, not only to replace themselves, but also, from their surplus population, to supply the demand, *and even the waste*, of the other labouring classes of the community? Such a system is, I believe, carried to a higher degree of perfection, and to a greater extent, in the more improved districts of Scotland, than in any other country in the universe.

APPENDIX.

No. I.

OF VARIOUS CIRCUMSTANCES WHICH HAVE INDIRECTLY CONTRIBUTED TO THE EXCELLENCE OF SCOTCH HUSBANDRY.

In addition to the reasons assigned in the introduction, other circumstances have likewise indirectly contributed to the excellence of the Husbandry of Scotland, some of which it may not be improper briefly to enumerate, as meriting some consideration.

1. The inferiority of the climate of Scotland, compelled the farmer to pay particular attention to every means by which so great a disadvantage could possibly be counteracted *.

2. The small proportion of fertile land which it possesses, rendered it peculiarly valuable, and was a strong inducement to make it as productive as possible. Where nature is bountiful, man is too apt to become indolent.

* It is said, if inferiority of climate is a source of excellent husbandry, the best specimens of Scotch farming should be found in the Shetland Islands. This, however, is carrying the argument to an extreme. It is a well-known fact, that in warm climates, men are habitually too indolent to be good farmers; and where the soil is also fertile, they have no call for exertion: whereas, where the soil is fertile, and yet the climate is unfavourable, it requires a continued exertion to counteract its influence. This tends to promote good husbandry, for the farmer must be continually on the alert. In the same manner, in Holland, the *houses* and *furniture* are in a remarkable degree *clean*, owing to the dampness of the climate, which would destroy both, but for the perpetual attention of the people, by rubbing and scrubbing, to counteract the bad effects of so moist an atmosphere.

3. The skill and experience which the Scots had acquired in gardening, convinced them how productive land might be rendered by due attention to its culture.

4. It was in the counties which border upon England, that the improved system of Scotch Husbandry began, and there arose, at the same time, a laudable spirit of emulation, between the borderers of the two kingdoms, which tended to promote their mutual improvement.

5. It has been justly remarked, that agricultural improvements began to appear at an earlier period in England, than in Scotland, before the human mind had fully ripened, and before a knowledge of mechanics, or the habits of mercantile accuracy, had been brought to any degree of perfection; and rules, to a certain degree advantageous, having been once established, there arose a strong prejudice in their favour, which it was difficult to eradicate: whereas the improvements of Scotland commenced at a more advanced and enlightened period of society, when great progress had been made in the arts, and in the conduct of every species of business, and after a general spirit of inquiry, of industry, and of exertion, had been excited.

6. In many parts of England, more especially in the neighbourhood of manufacturing and commercial towns, the sons of farmers, owing to the uncertainty of the tenures by which farms are held, and the consequent precarious and dependent condition of the farmer, were induced to become manufacturers and merchants, instead of continuing in the farming line, and thus transferred to commerce, the capitals acquired by husbandry; whereas, in the improved districts of Scotland, the reverse very frequently takes place; and many farmers are to be met with, who have been trained to other professions, but who prefer the agricultural, to every other occupation, not only as being the most rational, but, on the whole, when conducted on a proper scale, and where leases are granted, as liberal and as independent as any other, and equally advantageous *.

* Several farmers in Scotland are worth from L. 10,000 to L. 50,000, and some even more, all acquired by husbandry. It is only where leases are

7. The clergy of Scotland have had their full share in promoting a spirit of improvement in various parts of the kingdom. Their situation is almost peculiar to that country.—They are all resident, and by far the largest proportion of them, are fixed down to their respective livings, without any reason to expect that their situation will ever be materially improved. Each of them have a small portion of land, the occupation of which they hold in the same manner as tenants on a liferent lease; and hence have an interest to improve their little spot, to which they are often induced to rent an addition, which they cultivate with equal zeal. Less prejudiced, and possessing more extensive information, than many of their neighbours, they are often the first to suggest, and even to attempt, new improvements. When these succeed in their hands, their example is naturally followed by their parishioners *.

8. The fields in Scotland, (in general from 10 to 25 acres), are of a size better adapted for arable cultivation, than the generality of those in England. The necessity of frequent turnings, by which much time and labour are lost, is thus done away. It is hardly possible, indeed, that a small field can be so completely ploughed as a large one, more especially where the form is irregular †. Small fields also, more especially if inclosed with hedges, and surrounded with hedge-rows, though calculated for the growth of herbage, are unfavourable to the production of grain. A great deal of ground is lost, the hedges are a shelter for birds and vermin, and generally a nursery for weeds; and the grain produced near the hedges is always of an inferior quality. In the improved districts of Scotland,

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granted that the farmer can exclaim, in the words of Cicero,——"Omnium rerum ex quibus aliquid adquiretur, nihil est agricultura melius, nihil uberius, *nihil homine libero dignius.*"

* One of the best works on agriculture was written by the late Dr Dickson, minister of Whittingham in East Lothian.

† A friend of mine, on a tour through England, has lately described his astonishment at seeing, within a few miles of Bath, "four great horses, turning in the narrow corner of a four-acre field, and pulling after them a huge ill-made plough, with a driver, besides a ploughman."

on the other hand, the fields, though generally inclosed, are not formed into such small divisions as in England. Hence the country is not so beautiful to the eye, but the climate is certainly healthier, and the soil more productive of corn.

9. The convertible system of husbandry, or alternate grain and green crops, including the abolition of fallows on turnip soils, is completely established in Scotland; and is by far the best mode that has hitherto been suggested, for the productive cultivation of a much larger proportion of England, than is generally believed to be adapted to it.

10. The correctness with which the following process is executed in strong soils, is one of the leading features of Scotch Husbandry. It is not repeated so frequently as it is in many districts of England, occurring, in general, but once in the course of six years; the soil of the field, however, by frequent ploughings, (six or seven times where necessary), though consisting of the strongest and most stubborn clay, is thus completely pulverised, weeds are extirpated, insects are destroyed, and fertility insured during the whole course. The depth also to which land is ploughed in Scotland, more especially when it is fallowed, is considered to be a great advantage.

11. Though Scotland cannot boast, either of the chalk-pits of England, or the limestone gravel of Ireland, yet the Scotch farmers, aware of the importance of calcareous manures, have carried the use of burnt limestone to an extent, and manage it in a manner, not to be excelled in any other district. Where shell-marl also has been discovered, it has been applied on a great scale.

12. The use of calcareous manures having augmented the crops of corn, and improved the herbage, the farmers in Scotland have been thereby furnished with an additional quantity of putrescent matter, which, in the lighter soils, instead of being mixed with them in the course of ploughing, by which much of its strength and virtue would be lost, is usually deposited, when either turnips or potatoes are cultivated, in the centre of a drill, by means of which, as much advantage as possible is derived from it, and in this way nearly half the quantity used in other districts, is found to be sufficient.

13. The instruments of husbandry adopted by the farmers in Scotland, are distinguished for their utility. The single horse-cart, the two-horse plough, the fanner, and the threshing-mill, are excellent implements for the various objects for which they are respectively destined, and by their means, the expence of cultivation and labour is greatly reduced.

14. The great attention that has been paid to the improvement of the roads, has, for obvious reasons, been of infinite advantage to the agriculture of Scotland. A farmer can afford to pay a much higher rent, where he has that accommodation, than where it is not to be met with. Canals also have, in some cases, been of use; and iron rail-ways are likely to become of considerable advantage to the more interior districts *.

15. The increasing price of agricultural produce, has, in a peculiar manner, operated as a premium to improvement; and, it is observed, that the best cultivated districts in Scotland, are either in the neighbourhood of large towns, or where there is an easy mode of conveyance, by water-carriage, or otherwise, to advantageous markets †.

If these are not to be considered, strictly speaking, as *causes* of the excellence of the Husbandry of Scotland, they are at least to be accounted *circumstances which have indirectly contributed*, in a greater or less degree, *to the fame which it has acquired.*

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* The iron rail-way, from Berwick to Kelso, which may afterwards be extended farther into the interior, will be of infinite advantage to several inland districts. Other rail-ways are in contemplation.

† What an advantage is not the Morpeth market to the farmers in the two counties of Berwick and Roxburgh?

No. II.

HINTS REGARDING THE IMPROVEMENT OF WASTE LANDS.

In the course of my inquiries regarding the Husbandry of Scotland in its more fertile districts, some useful facts and observations were incidentally transmitted to me, on the subject of improving the waste lands of the kingdom. These I have thought it advisable to annex, by way of appendix, to the preceding account of the more improved Husbandry of Scotland, to prevent the risk of their being lost. They relate to the following particulars: 1. The possibility of improving waste lands; 2. The modes of improvement by ploughing, trenching, paring and burning, or floating away sterile surface; 3. The proper breadth of ridges in new improvements; 4. The cultivation of grass on such lands; 5. The distinctions of natural meadows; and 6. The improvement of wastes in fertile districts; which may be adduced as a proof of the advantages to be derived from a General Bill of Inclosure.

1. *On the Possibility of Improving Wastes.*

The common description of a waste country, is enough to deter any individual from attempting its improvement, unless impelled by the strongest personal interest. What can be more unpropitious than an uninclosed tract, encumbered with large stones, greatly in want of drainage, overrun with furze and heath, with a sterile soil, and a weeping climate, presenting difficulties not easily to be surmounted; yet, notwithstanding these unfavourable circumstances, such lands are, *to a certain extent*, susceptible of improvement. Such a soil and climate, with proper culture, will produce roots and herbage for improving both stock and sward, though not in degree, yet in no small proportion to what has taken place on more favoured situations. Potatoes, turnips, cabbages, sown grasses, and

tares, may all be raised. Want of manure is the great obstruction; but were all the coarse herbage to be procured in such wastes, cut and preserved for raising potatoes in drills, laying it below them on land that had been but two years limed and broke up, a good crop would be obtained. The cultivation of these crops would not only improve the pasture, but afford, at all seasons, a supply of food, that would increase the value of cattle, fully in proportion to what takes place elsewhere *.

2. *Modes of Improvement.*

There are four modes which have been tried in Scotland, for improving such waste lands: 1. By ploughing; 2. By trenching; 3. By paring and burning; and, 4. By floating away the sterile surface.

1. Mr Walker of Mellendean improved a piece of high ground, situated about three miles from Kelso, and seventeen from lime, originally muir, intermixed with small spots of sandy soil, and covered with whins, in the following manner. He generally broke up from 15 to 20 acres yearly. When first ploughed, the furrow was laid as flat on its back as possible, and allowed to remain in that state from 15 to 18 months, in order to rot the sod or turf; about midsummer it was cross-ploughed, and after being harrowed 12 or 14 times, (or what is called there six or seven double tines), it received the lime, was ridged up, and sown in the following spring with rye or oats, generally the former, having found it to be a more certain crop than oats upon that kind of soil: the average crop, from three and a half to four bolls *per* acre. As soon as the rye was cut, the ground was ploughed again, and a crop of drilled turnips, (with dung), taken the following season; the turnips were eaten on the ground by sheep, and then sown down for pasture with the first crop after the turnips. After remaining a year or two in grass, innumerable shoots of young whins made their appearance. These, when a year old, or nearly so, were regularly drawn out in soft rainy weather by the shepherd, the only servant kept on the ground; and as this was

* Extracted from the communications of Mr Scott of Craiglockhart, and of Mr Dudgeon of Primrose Hill.

executed without taking away his attention from the flock, it was done at little or no expence. On the improved part of the land, which was laid down to grass, Mr Walker keeps his young sheep in summer, and his breeding ewes in winter.

Mr Blackie of Holydown has made considerable improvements on a farm called Clinton Moor, containing about 300 acres. He describes it as being a perfect waste, not so much as a house upon it, a cold climate, two-thirds of the farm a thin wet soil, with a yellow tilly bottom, the surface covered with a coarse kind of grass, a mixture of bent, ling, and some heath, the grass in spring so dead, that it would blow away by a high wind, or burn as well as any mountain heath; the other, one-third short heath, almost without the appearance of grass, and in many places quite naked.

The ground being quite open, he was first under the necessity of dividing it by hedges and ditches into suitable inclosures, such as the nature and situation of the soil would admit of. The plan he adopted was, to tear up about 50 acres annually, to rest it in that state for two years; then to cross-plough and harrow it, then another ploughing and harrowing, then to lay on shell marl, at the rate of 40 double carts *per* acre, and after that, a shallow ploughing with a slight harrowing, so as to mix the marl with the soil *. The land was thus materially reduced, and before winter, it was gathered up into ridges, ten feet broad; from the thinness of the soil it could not be mounded up into broader ridges; indeed, as it was, the furrows were left bare.

The first crop of oats was never worth more than the seed, if so much; then he took a second crop, which ripened in good time, and produced on an average four bolls. There was sown along with that crop, one bushel and a half of rye-grass *per*

* The plan adopted by Mr Barclay in Aberdeenshire, is, where heath predominates, to suffer it to remain two or three years after the first furrow, to rot and mellow before the fallow took place, at which time lime was always applied, and, if possible, dung, more or less, as it could be procured. With the first crop grass-seeds were always sown, and the fields pastured for the five or six following years.

acre, with a mixture of white and yellow clover; he then took a crop of hay, eighty or ninety-six stone average *per* acre; next winter ploughed again for a crop of oats, average four bolls; then fallow, and on some of the driest parts turnips, dressed with dung and moss, of which there was plenty; then another crop of oats or barley; sown down again with grasses fit for the soil; then pasture till it grows more solid, before opening for another course; but never two white crops afterward, without an intervening green crop or fallow. What effect lime would have had on such a soil, cannot be stated; as lime could not be had there under 10s. *per* boll, it would not probably pay the expence.

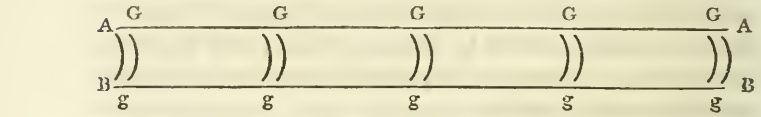
2. A most intelligent correspondent states, that he is decidedly of opinion, that *trenching* of all muir grounds, improved for corn cropping, would be the most lasting and beneficial mode of improving them. The sterile surface, which is composed of muirish earth and vitrifiable sand, should be turned down, without the reach of the roots of the crop, and the bottom soil, which is in general *a till*, turned up, exposed to the sun and air, and if manure were applied to it, would prove a kindly soil, particularly where the bottom was made free and drained, by the worthless old surface put below it. As proof of the utility of deepening surface soils, both wet and dry bottoms, look at the patches of gardens that have received the deep digging or shallow trenching, of the cottages placed on the skirts of the muirs all over Scotland, and you will observe, the additional verdure and luxuriance of crop upon these patches, more than upon the lands adjoining, the surface of which is often very little more than scratched by the plough, and the dung and other manure applied to it has not deepness of soil to operate upon, so as to produce a good crop *.

3. In regard to paring and burning, in many situations that is certainly the best mode of improvement. Where there is a rough and barren surface, over a fertile loam or clay, it is desirable to get rid of that surface, at almost any expence; but

* It is remarked, however, that cottage gardens get more dung that could be given to larger tracts.

if, in addition to the advantage of clearing the ground of such a nuisance, you can also convert it into a source of fertility, what can be more desirable? By means of paring and burning, the Author of this work raised, by the first crop, what would pay all the expence of the improvement; and then by laying it down to grass, it gradually acquired strength and permanent fertility.

The operation of paring and burning is likely to be much facilitated, by a very cheap and simple contrivance invented by William Aitchison, Esquire of Clement's Wells, near Musselburgh. It is a portable furnace for burning sods, made of old cart iron hoops, of the following shape.



The two pieces of hoops A and B are made straight to lie on the ground, and the half hoops g g g g, are fixed to them by rivet nails. They are about four feet long each, and so light, that a boy could run about with two of them in each hand. Turf being laid along the sides, and over the top, they keep an opening through the hoop for air to make the fire burn. Before this invention, it was very difficult to get the turf sufficiently dry in so moist a climate, and the process was extremely expensive and uncertain, but this simple apparatus keeps the turf always open, and ready to receive air, by means of which a few hours of dry weather makes it fit for burning. The expence of these turf kilns is but trifling, and by their means, when once the small quantity of turf is set on fire, a great deal of it may be burnt in one day *.

4. There is another mode of improving waste lands, which seems to be peculiar to Scotland; it is that of conveying away, by means of water, the moss or peaty earth, with which some-

* It is worth consideration, whether the same process might not be applied to the burning of kelp.

times the richest clay is covered, so as to render it accessible to cultivation. This method was either improved upon, or discovered by that able agriculturist, the late Lord Kames; and by his efforts, and those of his public-spirited representative and successor, many hundred acres of land have been converted, *as if by magic*, from black moss, where hardly a snipe or muir-fowl could find subsistence, to rich and fertile carse or clay-land, worth from L. 3 to L. 5 *per* acre *.

3. *Proper Breadth of Ridges, when Waste Lands are improved.*

There is nothing more essential, than to render waste lands, when improved, as dry as possible; and for that purpose, I am convinced of the superior advantage of making the ridges wide and high, not in mossy land, but where the soil consists of earth of a soft or spongy quality.

New land, (more especially where the bottom is till), is generally of that description, retaining a great superfluity of water, which prevents any manure, whether lime, dung, or marl, from operating on it successfully. But this great obstacle to the improvement of waste lands would be obviated, by the use of wide and high ridges.

By this means also, the land might be dunged, ploughed, and harrowed, and afterwards pastured on, at times, when it would otherwise be impracticable.

I have seen very good crops of corn raised on new land, in *lazy-beds*, when they could not be obtained in any other way. This was entirely owing to the height of the ridges, and the consequent dryness of the land. *To cottagers bringing in new lands, this plan is particularly recommended, not only for potatoes, but for all their other crops.*

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* There is an excellent account of this in Brown's Treatise on Rural Affairs, vol. i, p. 106. It would be desirable to have estimates made out of the expence and profit of cultivating waste land in Scotland, according to various plans that might be adopted, as being the most advantageous mode of expending agricultural capital, where the rent of improved land is so high.

But as it is impossible to cultivate large tracts by the spade, the best plan to pursue, *with the plough*, is, to widen the ridges from 16 to even 30 feet, by means of which the land would be kept dry. This was the plan adopted by ancient farmers, and is sanctioned by their experience. Some ground in this way would be lost by the furrows; but as soon as the land was brought into thorough good order, and of as firm a consistency as old land, the plan of smaller ridges might be adopted. This plan is peculiarly necessary in districts subject to all the disadvantages of a wet climate.

4. *On the Cultivation of Grass on Waste Lands.*

Though grain may be cultivated on lands possessed of great natural fertility, yet grass is the stimulating cause, and principal source of the culture and improvement of weak soils, and of barren districts. In such cases, it is from grass alone that the remuneration can be looked for by the farmer. Not that such soils produce grass in great plenty, or of very good quality, but in this way it is giving something, whilst a stop is put to farther expenditure *.

In carrying on the improvement of a farm, it is a general rule, that the best land should be first improved, as that is the only description of soil that brings immediate profit; and the farmer is thereby enabled to go forward. In regard to waste lands, the great object is, to bring them into grass. The crop of grain is but a secondary object; it is the pasture grass that may be obtained, that is the cause of its cultivation †.

When waste lands are laid down to grass, Mr Walker of Mellendean recommends to sow grass-seeds in the following proportions: about eight pounds of white, three pounds of red, and three pounds of yellow clover, and rather more than half a bushel of rye-grass, *per* English acre. Cocksfoot, however, is now peculiarly recommended for such lands.

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* Communication from Mr Barclay, Mill of Knockleith, county of Aberdeen.

† Ditto.

5. *Distinction of Natural Meadows.*

In many parts of Scotland, there is a species of bog or marsh, which is provincially called meadow. It is always overgrown with coarse grass, rushes, and various other aquatic plants, and when occupying part of tillage fields, is generally cut for hay. When these meadows are found on stock farms, in high situations, few are so ignorant of their value, for pasture to cattle and sheep in winter, as to attempt, or to desire, to render them arable; but the propriety of reclaiming them, when found in low arable farms, has been disputed. Mr Low is decidedly of opinion that these bogs, when on free subsoils, may be improved and cultivated to very great advantage; but when on a retentive till or moss, (of which last they often seem almost entirely to consist), experience warrants him in asserting, that they ought not to be disturbed by the plough. They afford a good crop of hay, as substantial food for cattle in winter; they yield a great deal of manure, without requiring any; and they are not rendered fit to bear corn crops but at a vast expence.

6. *On the Improvement of Wastes in Fertile Districts.*

Mr Brown of Cononsyth, near Arbroath, has communicated to me the following method which he has adopted, for bringing waste lands into cultivation, and which he has found to answer well.

The soil on which he tried the experiment, was a poor clay, rather stony and wet, covered with heath and furze. After clearing it of stones and other obstacles, and draining it by open ditches, he gave it as deep a furrow as four good horses were able to draw; and if the ground was very wet at the time, so much the easier done: *it was often performed when the horses would be idle in the stable*, by the rest of the farm being drenched with rain: it is allowed then to lie till the following spring, when it got a good rub of harrowing, so as to fill up the seams betwixt the furrows. Next year it was fallowed and limed, at

the rate of 40 bolls lime-shells *per* acre, and 15 or 20 loads of dung, and sown with wheat about the beginning of September; which seldom failed to give a good crop, and then it came into the rotation with the rest of the farm. He thinks that waste ground should never get the second or cross furrow, until the first furrows are grown fast together, or about two years after the first ploughing; if sooner, it requires double the labour to fallow it, exhausts the soil, and cannot possibly be got so well finished. This is one proof, among many others, of the advantage of improving waste lands, by farmers possessing arable farms in their neighbourhood, as the labour can be executed without extra stock.

It is impossible to conclude this paper, without lamenting, the little attention that has hitherto been paid to the improvement of our waste lands. Many years have now elapsed, since the necessity of rendering our barren wastes productive, was recorded on the Journals of Parliament; and yet every attempt to render those most important Resolutions effectual, has in a great measure been in vain. The consequence has been, as was foreseen, frequent scarcities, immense importations, an unfavourable rate of exchange, a high price for bullion, and all the mischiefs which have thence originated. The advantage of a general bill of inclosure is, that in every parish something may be done, thousands of farmers may each of them be improving a few acres, and in this way improvement may be carried on more advantageously to the public, and more likely to become speedily productive, than if large tracts were undertaken by any particular individual. Indeed, if the land, instead of being inclosed, was merely *partitioned* among the persons having interest therein, it would be a material object gained.

No. III.

LETTER FROM GEORGE FREDERICK STRATTON, ESQ. TO SIR JOHN SINCLAIR, BART. EXPLAINING THE ORIGIN AND PROGRESS OF THE SCOTCH SYSTEM OF HUSBANDRY, INTRODUCED BY HIM ON HIS ESTATES IN OXFORDSHIRE.

Great Tew Park, Oxfordshire,

SIR, *12th March* 1810.

In compliance with your request, I herewith send Answers to the several Queries which I received by your direction, regarding the improvements on this estate. Previous, however, to your perusal of them, I take the liberty of requesting your attention to the following particulars relative to the property in question, which will both serve to elucidate the subject of them, and may prove of use to other landed proprietors, whose situation may at all resemble mine. I shall only add, that either the whole, or any part of the information I shall have the honour of sending you, is entirely at your service, in any way that you may think proper to apply it.

In 1800, I came into possession of the Great Tew estate. I found it apparently in very high condition; its buildings, fences, &c. in very excellent repair; the whole freehold, completely in a ring-fence, tithe-free, and land-tax redeemed; well timbered, and ornamented with young plantations, in a most thriving condition, and entirely unencumbered, except by a mortgage of L.4000. Besides these advantages, and that of having the manor, the whole village, and the perpetual advowson of the living, the excellence of the soil of the whole was, as it were, proverbial in the neighbourhood, and I felt no inclination to dispute the character it had obtained, of being one of the finest estates in the county. It was under the management of an old steward of my father's, of

whose honesty and science I had the highest opinion; who superintended all the improvements and plantations which I annually made, and whose advice I followed implicitly in the renewal of leases, increase of rents, and in all other concerns relative to its internal management. It was all let on twelve years' leases, the greatest part of which were on the point of expiring, consisted of 3700 acres, and produced a rent of about L. 3700 a-year. In October 1801, the leases of 1171 acres, which were let in six farms for L. 1155 *per annum*, and consisted of as fine land as any on the estate, expired: and so infatuated was I, as to be well satisfied in renewing them to the same tenants at an increase of L. 209 *per annum*. (I must here mention, that having at the time submitted them to the inspection of an eminent valuer of land, he *actually did not rate them so high*, which confirmed me in the opinion I entertained of my steward's abilities). I could not help observing, however, that the outgoings of the estate absolutely exceeded the clear sum I received from it: insomuch, that at each rent day, instead of L. 1800 or L. 1900, I never received above L. 800 or L. 900; and charges general, charges annual, planting, repairs and taxes, consumed more than half my rent*; but having always heard of the great outgoings to which landed property is subject, and having, I may almost say unfortunately, other resources to supply my expenditure, the defalcation of my receipts, and the lowness of my rents, did not sting deep enough to awaken me from the lethargy in which I was sunk, and I only conceived, that I was suffering the lot of all landed proprietors; while I consoled myself for the smallness of my receipts, by the reports which were constantly dunned in my ears, of my goodness as a landlord. This infatuation, however, was at length doomed to cease: for being *fortunately* distressed for money, by the disappearance of a person to whom I had lent a large sum, and by the expences of a contested election, I thought it worth while to examine whether the rents of my neighbours in general were as low as my own; and I had just discovered that the rents

* I one year actually received only L. 1120 for the whole year's rent.

they received were 50 *per cent.* above mine, when Mr Young's visit into Oxfordshire, to draw up his survey of that county, and the observations he made on my estate, convinced me, that it might, under proper management, and by twenty-one years' leases, be nearly doubled in value. I applied myself, therefore, seriously to the examination of the real value of my estate. The subject became daily more clear to me, and having seen a pamphlet "On the Rents of the Landed Property of England," I was so much interested by it, that I sent for its author, Mr John Loudon, to look over my property. He completely convinced me how much I had been imposed on; and asserted, that if I would adopt on the estate, the Scotch, or Northern System of Agriculture, he would undertake to raise my rental from 4 to L. 10,000 a-year. This rise appeared so enormous, that at first I could scarcely credit its practicability: but on inquiring the rents, and the system of husbandry pursued in the northern counties of England, and in the Lowlands of Scotland, I found the former so much above even what Mr Loudon asserted my land to be worth, and was so well satisfied with the account I received of the latter, that after mature deliberation, I determined to adopt the plan he recommended in its fullest extent: and as Mr Loudon himself offered to take, in partnership with his father, who rented two farms near Stanmore, on the Scotch system, all the northern side of the estate, at the very rent which I had before thought so enormous, if I would grant him a twenty-one years' lease of it, and engaged to let the remainder in the same proportion, I resolved to submit the whole to his management, if the old tenants would not agree to continue their farms on twenty-one years' leases, which I offered to them, and at 10 *per cent.* less than the rent which Mr Loudon offered me himself, and valued the estate at. I allowed them all two months to consider of it, and on their all refusing the conditions, I set myself to adopt the Scotch system of agriculture on the whole estate, except the Park, and fields adjoining to it, which I would not allow to be ploughed up, as I intended to keep them in my own hands. At that time, (June 1808), the leases of about 1400 acres had but lately expired, and

were held by tenants at will, who were obliged to quit at a year's notice. The remainder of the estate was still on leases, the longest of which had then six years to run. But even one year was too long in my opinion to wait, so anxious was I for the introduction of the new system, and I offered to all the tenants who had leases, to purchase them at a valuation, or at a fixed sum. This all of them refused, except four, whose leases I purchased by appraisement on the following terms:

Acres.	Rent.	When Lease to expire.	Money given.
206	£. 190	5th April 1811	£. 732
87	110	10th Oct. 1813	250
136	174	Ditto	970
210	243	5th April 1814	1030
639	£. 717		£. 2982

They were to give up possession of their farms at Michaelmas 1808, and to have the use of their houses, barns, &c. till July 1809, for the purpose of threshing out their corn, and consuming their straw. The value set on the leases shews at once how much the farms were underlet; as, reckoning the interest of the respective sums paid for the different leases up to the time when each would fall in, the above 639 acres would have been worth L. 886 additional to the actual incumbents, which would have raised their rent to L. 1603 *per annum* *.

I need scarcely mention, that immediately on the leases being valued, I discharged my steward, whose mismanagement, whether it proceeded from incapacity or dishonesty, rendered

* I am now convinced, that there is no better way of finding out whether an estate is underlet, than purchasing the lease of any farm upon it, whose rent might be considered as an average of the whole, by appraisement. By adding to the sum given, the compound interest which it would have produced by the end of the lease, dividing the amount by the number of years the lease has to run, and adding the produce to the present rent, the proper rent will be found.

him equally unfit for the superintendence of an estate. I am, however, willing to think, that the fault lay more in his head than his heart, as though he had been many years steward to my father and myself, I do not believe him to be rich.

I had thus 639 acres, and luckily in a ring fence, to put into Mr Loudon's possession at ichaelmas 1808; at Michaelmas 1809, he also came into possession of about 220 acres more, which were held by a tenant at will. His whole farm, when all the present leases fall in, the last of which expires at Lady-day 1814, was to consist of about 1800 acres, all at three guineas *per* arable acre. I, on my part, was to build him a house, homestall and threshing machine, and to make other improvements on the premises, which I shall particularise hereafter, which, at a rough guess, he laid at about L. 4000. These improvements I immediately commenced, and have continued them to the present time, with great exertions, having for a long time had 132 workmen employed upon them, and they are now nearly completed: but from the astonishing rise which has taken place in the price of timber, labour and other * incidental circumstances, which we were not then aware of, they have already cost upwards of L. 9600 and will probably cost L. 2000 more †.

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* One of the principal of these was, being obliged, by unsoundness of ground, to place the threshing machine on a lower level than I had intended, by which I was obliged to excavate a great quantity of ground, to carry off the water; and another was, not being able to find any stone on that side of the estate, proper for the upper covering of the roads, as I had expected we should have done.

† It would be the height of injustice not to mention here a trait of Mr Loudon, which cannot be too generally known, and which reflects the highest lustre on his character and honour. I was bound by the lease to execute all the improvements mentioned in it, without any stipulation as to what they might cost. But when Mr Loudon found how very much they exceeded his estimate, he insisted on paying himself all that they might come to above L. 7000; and expressed his concern, that from the circumstance of his being as it were just setting out in life, he could not pay the whole of their excess above his original estimate, which he in real justice thought himself bound in honour to do.

The southern side of the estate, consisting of about 1500 acres, I let to Mr Stenhouse Wood, (with whom you have already had some correspondence), at two guineas and a half *per* acre. He commenced tenant at Michaelmas last, and came into possession of nearly 1100 acres. I am also to make some improvements, (of which hereafter), on this farm, but I have restricted the amount to be laid out not to exceed L. 2000. Besides the above expences, must be reckoned the allowances I made to the tenants at will who left their farms.

Thinking it hard upon them that they should be turned out when they least expected it, I caused all the improvements which they had made on their respective farms, whether by purchasing lime or manure, by draining or otherwise, of which they had not actually received the benefit, from their having only lately taken place, to be appraised, taking care, in each case, to pay them rather more than less than their actual value. Under this head I paid as under to the tenants at will of the following farms:

A.	R.	P.	Rent.	Money paid.
355	1	14	£.360	£.172
462	0	18	343	300
225	1	7	190	150
1042	2	39	£.893	£.622

Besides which, they gained half a-year's rent by being allowed to give up their farms at Michaelmas 1809, instead of Lady-day 1810, as I allowed them their yards, barns, &c. to thresh out their corn and consume their straw. The whole expences incurred, therefore, as nearly as they can be ascertained at present, are as follows:

Paid for permanent improvements on Mr Loudon's farm,	£. 11,600
Ditto, Ditto, Mr Wood's,	2,000
Paid tenants for their leases,	2,982
Carry forward,	£. 16,582

Brought forward,	£. 16,582
Paid tenants at will for improvements which they had made, of which they had not received the benefit, - - - - - - -	622
Total expences incurred,	£. 17,204
Deduct paid by Mr Loudon,	4,600
Total paid by me, -	£. 13,604

I have thus given a general sketch of the plan which I have followed with regard to my estate in this county; and shall now proceed to answer, as well as I can in the present early state of its improvement, the several queries which you have proposed to me.

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1. What was the state of the two farms possessed by Mr Loudon and Mr Wood, in regard to the following particulars?

1. Number of farmers?—*Answer.* Sixteen.

2. Size of their farms?—Three under 100 acres; four from 100 to 200; six from 200 to 300; one from 300 to 400; two from 400 to 500 acres.

3. Number of fields?—201; besides parks and paddocks adjoining it, and a number of small closes and orchards in and about the village.

4. Quantity of permanent pasture?—1472 acres.

5. Quantity of arable?—About 1990 acres. The plantations, village, gardens, orchards, &c. are not included under either head.

6. Course of crops by lease?—They were all twelve years' leases on six-course crops, viz. 1. Turnips; 2. Barley and clover-seeds; 3. Clover to be mowed once; 4. Clover two years old to be eaten off; 5. Wheat; 6. Oats; one fourth of the

arable land to be summer-fallowed the last year, and to be sown one half with turnips, and one half with wheat.

7. Course in practice?—They have been very much in the habit of diminishing their green, and increasing their white crops; and from not being properly attended to, have, I am sorry to say, very often transgressed in this respect; though from the great strength of the land, it has fortunately not suffered much by it.

8. Number of ploughs?—About 24 ploughs, or one to every 83 acres, with four hores or five oxen, and a man and a boy to each. They ploughed about three-fourths of an acre a-day.

9. Number of horses and oxen for ploughing?—87 horses and ten oxen.

10. Quantity of other stock?—2160 sheep, and 227 cows.

11. Number of servants?—56; 30 of whom were parishioners.

12. Population on the farms?—This I cannot exactly ascertain; most of the servants that did not belong to the parish were single. The population of the village of Great Tew, children included, consists of near 400.

13. Rent?—Average of the whole 22s. *per* acre, or L. 4070 *per annum*.

14. Tithe?—The whole estate is tithe-free.

15. Poor's Rates?—About 3s. 6d. in the pound on the actual rent.

16. Average produce?—19 bushels of wheat, four and three-fourth quarters of oats, four quarters of barley, one and one-half ton of hay, *per* acre.

17. Depth of ploughing? Three inches; though over half the estate the soil is at least twelve inches in depth, and no where less than five.

18. Manuring in general?—Most of the tenants only used the common manure made by their stock. One of them manured ten acres one year with malt-dust, which answered very well.

19. Manuring with lime?—One of the tenants manured annually ten acres with lime, 20 quarters to an acre: one ten

acres, 16 quarters to the acre; and one eight acres, 16 quarters of lime, or soap-ashes, to the acre. He considered soap-ashes to have much the same effect as lime, which, it is in this country universally agreed, is the best preparation for turnips, as they are not so likely to take the fly after that manure, as after common dung.

20. Nature of the leases?—The leases were for twelve years each. Landlord has all timber, and pollard trees, and coppices of all sorts, and the loppings of them; has a right to re-enter if the rent when due is not paid after 21 days' notice; is to keep all the buildings, gates and styles in repair. Tenants to pay L. 10 penalty for every acre of pasture or meadow land broken up, and L. 5 for every acre mowed more than once in the year: to pay all taxes and rates whatsoever, except landlord's income tax; not to sell any hay, straw, or dung, but expend it all on the land; to have the course of crops as mentioned in answer to question 6; to mow the nettles and thistles twice a-year; to level all mole-hills and ant-hills; and scour out all ditches and water-courses; to keep all the thatching, windows, and fences (except gates and styles) in repair; not to cut the hedges till they are quite fit, and only at the proper season of the year. The tenant was also bound to let the landlord have the use of his team for two days in the year *gratis*, to fetch coals, &c.; to warn off all trespassers, and lend his name to any actions against them which the landlord may choose to bring. If tenant dies during the lease, or subsets any part of the farm without leave, landlord to re-enter, and take possession without any payment for it.

21. What terms did you offer the English tenants to continue?—I offered them 21 years' leases, with full power to do what they pleased with the land, except for the last five years. Engaged to put all their buildings and fences into most complete repair, and to make any alterations in either that they could reasonably require; and at ten *per cent.* less rent than I was offered by the Scotch farmers. I gave them two months to consider of it: they all refused. After I had engaged all their farms, one of them offered me the whole new rent, which, as the farm was promised, I was of course obliged to

refuse. One of them, who had 255 acres at L. 260 a-year, and to whom, by my steward's persuasion, I had given up L. 5 a-year, as he said the *farm was valued rather high*, offered me L. 355 *per annum* to continue. His farm is engaged at the expiration of his lease in four years at L. 2 : 12 : 6 *per acre.*

Q. What is the present state of these farms in regard to the same particulars?

1. Number of farmers? When the leases expire in four years, there will be only two Scotch farmers, who will have the whole estate, except the Park, and a few fields adjoining it, and the village.

2. Size of their farms?—One about 1800, and the other about 1500 acres.

3. Number of fields?—From 95 to 100: but I cannot yet ascertain their exact number, as the fences are not all removed, on account of some part of the estate being still in lease to the old tenants.

4. Quantity of permanent pasture?—None, except about 30 acres round Mr Loudon's house, and about 200 acres in hand.

5. Quantity of arable?—About 3300 acres,—an increase of about 1400 acres.

6. Course of crops by lease?—The course of crops is entirely at the option of the tenants.

7. Course in practice?—Mr Loudon's course will be for the first four years, till he gets all his farm, 1. Turnips or fallow; 2. Wheat or barley, and seeds; 3. Clover eaten with stock; 4. Oats, or wheat. Then when he gets the whole farm, it is his intention to have a five years' course, which will be the same as the above, except that there will be two years of clover. —1. Mowed; 2. Eaten. Mr Wood's course will be a five-course crop, in the following proportions to 1000 acres:—1st, 130 acres summer-fallow; 50 acres turnips; 20 acres beans, or pease; of which, if they answer, and do not injure his clovers materially, he intends to have 50 acres, in which case the

summer fallow will be reduced to 100 acres—2d, 200 acres wheat—3d, 200 acres clover, one year old, pastured and cut —4th, 200 acres clover, two years old, pastured—5th, 100 acres wheat after clover, pastured, two years old; and 100 acres of oats after clover, one year cut, and one year pastured.

8. Number of ploughs, cattle in each, and how much they do in a day?—They reckon one plough with two horses, and one man to each, amply sufficient for 100 acres under the convertible husbandry. There will thus be 34 ploughs for the 3400 acres: each plough will do three-fourths of an acre in a day on an average.

9. Number of horses and oxen for ploughing?—70 horses: as it is as well to have a couple over the number, in case a horse should be ill. They never use oxen. There will be a saving, therefore, of 17 horses and 10 oxen, though about 1400 acres more are kept under the plough.

10. Quantity of other stock?—Mr Loudon intends fattening and selling annually 200 horned cattle and 200 sheep for 1000 acres. This must vary in some degree, as it must depend on the quantity in fallow and turnip. Mr Wood to 1000 acres, intends keeping constantly 100 head of black cattle and 100 wether sheep. He will sell of course, as fast as he can fatten them. He sometimes, however, will have a quantity bought ready fattened, which he will only keep a short time and send up to the London market.

11. Number of servants?—Mr Loudon has one man to every 75 acres. Mr Wood twelve men, six women, and two boys to every 1000 acres.

12. Population on the farms?—This cannot be yet ascertained; a great many of the servants are only temporary ones; as the farmers have not yet had time to make their arrangements.

13. Rent?—Average L. 2, 18s. *per* acre, or L. 9570 exclusive of the Park, village, &c. which will be about L. 620 more, making the whole about L. 10,250, which is an increase of upwards of L. 6000 *per annum*. The interest of the money laid out should, however, be deducted.

14. Tithe?—All tithe-free.

15. Poor's rates?—The Scotch system having been only just begun, (Mr Loudon having commenced at Michaelmas 1808, and Mr Wood at Michaelmas 1809), it cannot yet be ascertained what effect it will have on the poor's rates.

16. Average produce?—This remains to be proved. Mr Loudon's ground that has been ploughed for the first time, has yielded on an average seven quarters and a half of oats to an acre.

17. Depth of ploughing?—Mr Loudon, nine inches; Mr Wood, five, six and seven inches.

18. Manuring in general? and 19. Manuring with lime? } Mr Loudon manures once every course with the turnip or fallow crop: the summer fallows limed at the rate of from 30 to 60 quarters an acre. Mr Wood manures 200 acres in 1000 annually, 150 with common manure, and 50 with lime. The expence of liming will be L. 4, 10s. an acre to him, and L. 5, 5s. to Mr Loudon.

20. Nature of the leases?—The leases are for 21 years. In Mr Loudon's, the landlord may have any number of acres not exceeding 300, to be valued by neutral men, for pleasure grounds or plantations; is to erect a farm-house, with offices and farm-yard, threshing machine to go by water, garden, rick-yard and pond, agreeable to a plan drawn by Mr Loudon: to put all the old farm-houses and buildings, ditches, water-courses and fences, into complete repair, except such as are to be pulled down or grubbed up; and to plant other fences where they may be wanted; to make sufficient roads through the farm, and to drain the whole of it; to pay for the expence of digging and burning whatever lime may be wanted, the tenant paying *5 per cent.* interest on the money so laid out; the tenant to farm the whole in a husband-like manner, with any course of crops he thinks proper, except the last three years, when he is to consume the hay and straw on the premises; or if he sells any, he must buy two load of manure for every load of hay or straw sold; and must not sow two corn crops in succession; and may subset any part of it to under-tenants, first offering it to the landlord, but being himself

bound with the under-tenant for the payment of the rent, and the fulfilment of the lease; to keep and leave all the buildings, threshing machine, and fences, in complete repair; to warn off trespassers, and to lend his name to actions brought by the landlord against them.—Mr Wood's is the same, except that the landlord is not to pay more than L. 2000 for the improvements to be made on his farm, which is to be laid out according to Mr Wood's judgment: and there is no clause in Mr Wood's for the landlord to pay for digging and burning lime.

21. What is the expence of the new buildings, specifying the particulars?
22. Expence of threshing mills?
23. Expence of altering the fields and fences, and what effect it has on the appearance of the country?

} I cannot at present answer the above so fully as I could wish.

The whole of the improvements on Mr Loudon's farm will come to L. 11,600, of which the threshing machine and barn is L. 700; conveying the water to it, and excavating the ground, to let it off after falling from the wheel, L. 800. The threshing machine is turned by water, acting on a wheel 16 feet high. It certainly is larger than was required, having once threshed and winnowed for experiment, 19 quarters and 2 bushels of oats (9 gallon measure) in one hour, and it would have done more, had not the straw been exceedingly long, which made it take more time in passing through the machine than it would otherwise have done. It will, however, with great ease, thresh nine quarters an hour, and clean it completely, doing the work as well as possible. Part of the improvements on Mr Wood's farm will consist of two threshing machines, turned by water, but of smaller power than Mr Loudon's; they will cost about L. 300 each. The fences are not yet all altered, from the circumstance of some of the farms being still in possession of the old tenants. In Mr Wood's farm they will require little or no alteration, as the fields are most of them of good sizes and shapes: and from the greatest part of it having been arable land under the old tenants, it will receive no other alteration in appearance than what will arise from its superior cultivation. Mr Loudon's farm having

consisted originally of small inclosures, and the greatest part of them pasture, is very much altered in appearance. All the trees that were in the hedge-rows are left standing, and have a more picturesque effect than they had, which is increased by that of the new roads, which serpentine round the farm on the sides of the hills, (that the level may be kept), and appear like rides through an arable *ferme ornée*. The reservoir for the threshing machine has also a very good effect on the prospect, as water was before much wanted to enliven the scene; and the new farm-house, which stands on the brow of a hill, commanding a beautiful valley, and a view of a great part of the farm, is also a very ornamental object. Its roof, and that of all the farm buildings, is paper, dipped in tar, &c. which, from the enormous price of pitch and tar, did not cost much less than slate or tiles, but is much more picturesque than either.

24. Expence of roads?—There will be seven miles of new roads in Mr Loudon's farm, six of which are finished. They are stoned, 16 feet wide, and ten inches deep; and cost 1s. 10d. a-yard making, and 2s. 3d. a-yard covering (carriage included), with white stone-brash, brought from the other side of the estate. Thus the seven miles on Mr Loudon's farm will coast L. 2515 : 6 : 8. I do not exactly know what extent of new road will be required on Mr Wood's farm; but as it is already intersected diagonally by a public parish road, and as it abounds with excellent materials in all parts, much less new road will be required, and it will not be nearly so expensive in proportion.

25. Expence of liming?—From L. 3, 3s. to L. 5, 5s. *per* acre, exclusive of carriage.

26. Payments to old tenants?—This I have already answered in my preliminary observations.

27. What rates or taxes are paid by you, or by the tenants, and their amount?—They pay all, except the landlord's income tax.

28. Do not the trees left standing injure the crops of grain?—After all the pollards are grubbed up, there will be few trees left but oak and elm, of any size, which, though certainly in


PLAN of the ESTATE of
GEO. FRED. STRATTON. ESQ.
in the County of Oxford
As it was March 1809
Drawn by G.E.S. Esq.
Scale of Chains
5 10 20 30 60
Swerford Parish.
Great Tew.
Sandford.
South Newton
A Arable.
P Pasture.
M Meadow
SOUTH NEWTON PARISH
SANDFORD PARISH
SWERFORD PARISH
LITTLE TEW PARISH
STOKE PARISH
PARK
Village
Mill
Tilmanor Farm
Grove Ash
Gt Eynsham Farm
Eynsham Farm
Bearonfield Farm
Starches Farm
Tinnes Farm
Tracey Farm
To Sandford
To Woodstock and Oxford
From S. Newton
From Chipp. Norton
From Little Tew
Turnpike Road from Banbury to Chipp. Norton
Turnpike Road to Enstone


SKETCH of the ESTATE,
Shewing the Effect the whole will have when the
Present Alterations to
the Fences & the additional Roads & Buildings are completed;
Aug. 30th 1810.
To Lenthall and Sandford
To Sandford
Road to Dishley
Grove Ash
Tew Lodge Farm
From South Newton
To Banbury
TEW PARK
Mansion & Church
Pinnacle
Parsonage
Beaconfield
Starches Farm
Bracey Farm
Thomas Farm
To Ch. Newton
To Ch. Tew
To Enstone and Charlbury
All the divisions between the Fields are hedges
often abounding with trees which with several
small Plantations & other things could not well
be shewn on so small a Scale At some future
period when every thing is completed a Plan on
a large Scale will be produced.
The shows in the Fields are intended to represent the different crops
For example Tew Lodge Farm is in 4 Shows Equal quantities of 8
Shews Beans as there will constantly be Fallow or Turnips 2 Barley
or Oats 8 5 Wheat or Oats the 8 & 4 being 18 2 more Oil seeds
or fewer here.
S. Neele Sculp.

some degree injurious to the crops, and impediments to aration, are yet so ornamental, that, in my opinion, they ought not to be removed. So partial indeed am I to them, that I have constantly bought timber for the necessary repairs, rather than have them cut down. It is but fair also to allow them the merit of sheltering cattle from the heats of summer, and the storms of winter.

I have now, I believe, answered all the questions delivered to me by your orders, as far as can be done in the present early state of the alterations which have been commenced. I have added two maps, which I have drawn on such a scale as enables a sheet of letter paper to contain the whole of the estate in its original state, and the other a plan of it, as it will be when all the improvements are completed. I have to lament, that numerous avocations, and engagements of various descriptions, have prevented me from an earlier compliance with your desires on the subject. Any farther information you may require, that it is in my power to supply, I shall be most happy to send. I can only add, that the whole system which I am now pursuing, is entirely owing to the suggestions of Mr Loudon, who has the entire merit of planning it, and to whom I must give the credit of finally opening my eyes to the real value of my estate. The only praise I can claim, is for resolution and perseverance in adopting and going through with them, in opposition to the general opinion of the country, and to the advice of almost all my acquaintance. I am happy to say, however, that the reign of prejudice is rapidly declining in power, and that many of my neighbours are rapidly adopting that grand support of Scotch husbandry, the two-horse plough. I begin to feel sanguine hopes that the county of Oxford will, in course of time, be as pre-eminent in agriculture as its university is in learning, and that the rest of the country, following its bright example, will adopt a system of husbandry, which will provide ample resources for its increasing population, without being under the necessity of applying to foreign

nations, for their permission to import the first necessaries of life.

I have the honour to be, Sir, your very obedient,
and very humble Servant,
GEO. FRED. STRATTON.

To Sir John Sinclair, Bart.
&c. &c. &c.

N. B.—I have since been informed, that Mr Wood has sublet all the land he had in hand, (1100 acres), at an advance of L. 450 *per annum.*

RESULT OF THE ADOPTION OF THE SCOTCH SYSTEM OF HUSBANDRY ON AN ESTATE IN OXFORDSHIRE.

1. An estate of 3700 acres, in the short period of about two years, has been increased in rent, from L. 4070, to L. 10,730, making an additional income of L. 6660 *per annum.*

2. This increased rent would have been obtained at an expence of only L. 6500, or about one year's additional rent, had it not been for an unexpected rise in the price of labour and materials.

3. From the sum actually laid out, namely, L. 13,600, there ought to be deducted L. 3504, being payments to the old tenants for renouncing their leases, or bounties to tenants at will, for some improvements executed by them, leaving a balance of L. 10,000 as the amount of actual expenditure: but that sum having been laid out *in permanent and substantial improvements*, as in the making of roads, and in draining, inclosing, building, erecting threshing-machines, &c. the income to be derived from the estate, as well as its real value, must be very considerably augmented when the present leases terminate.

4. By these improvements the total value of this property has been already increased from L. 120,000 to L. 230,000. The difference, amounting to about L. 100,000, being clear profit, after deducting all the real expences of the improvement.

5. Instead of 1990 acres under arable crops, and 1472 in permanent pasture, the whole 3462 acres are rendered arable under the convertible System of Husbandry. A great addition is thus made to the produce of the country, and the food of its inhabitants.

6. Though there are thus 1472 additional acres under the plough, 17 fewer horses and 10 fewer oxen, are employed by the farmers; in consequence of which, and by the use of threshing machines, the expence of cultivation is greatly reduced.

7. Instead of 201 fields, there are now only about 100, by which the healthiness of the country is greatly improved.

Permit me then to ask,

What would not be the income of the landed proprietors of England, the additional produce of their estates applicable as food for the people, and the addition to the public revenue, if the Scotch System of Husbandry were universally adopted? How can it be said, that the resources of the nation are exhausted, when we have such means of additional wealth in our power? Had the Board of Agriculture been enabled, to have completed its inquiries some years ago, (which, by adequate grants, might easily have been accomplished), the most economical, and the most judicious systems of cultivation, would have been long ago ascertained, and this country would have already made considerable progress in a new era of prosperity and improvement.

JOHN SINCLAIR.

5. Terrace, Palace Yard, Westminster,
12th April 1810.

No. IV.

ON THE NECESSITY OF AN ACT OF PARLIAMENT TO ENCOURAGE DRAINING.

BY THE REV. WILLIAM DALING, MINISTER OF CLEISH, BY KINROSS.

An act of Parliament to encourage draining in Scotland is much wanted. As the Parliament have rewarded the inventor of a new method of draining, upon condition of its being made public for the advantage of the country, it is to be hoped that they will remove the greatest obstruction which at present exists to the draining of wet land in Scotland. This obstruction consists in a deficiency in those acts which have contributed so much to raise the agriculture of Scotland to its present state of excellence. We have laws for dividing runrig lands and commons, for straighting marches, and making march-fences: but we cannot oblige our neighbours to join in a common drain, as we can do in a common fence. Yet the former is of much more importance than the latter; for ground may be highly improved, and excellently cultivated without fences, as the Carse of Gowrie is: but wetness is a bar to all improvement. A great deal of wet land would immediately be brought into cultivation, if an act were passed, proceeding upon the following principles:

1. Every person should be entitled to have his ground made and kept dry.

2. The expence should be defrayed by the persons who receive advantage from the drain, and in proportion to the ad-

vantage received, as ascertained by arbitrators, or commissioners nominated for that purpose.

3. Full compensation should be made to those whose property may be injured in draining the grounds of others.

4. The method of carrying the law into execution should be so cheap and easy, that the advantage of it might be within the reach of every one who has the smallest quantity of ground to drain.

For that purpose, the method of proceeding might be the same which is already established in the cases of marches, &c. If the persons concerned could not agree among themselves to settle the business by arbitration, they might apply to the Sheriff: if it was found necessary to go to the Court of Session, that court might settle it, as they do the division of commons, by sending commissioners to the place. A litigious spirit should be checked, by the judges giving expences, or damages, if necessary.

Our ancestors, in framing the laws concerning the division of commons, and the inclosing of land, have evidently proceeded upon this principle, that every man should have the complete enjoyment of his property, so that he may be able to manage it any way that he thinks best. And if the advantage, and proper method of draining, had been as well understood, when these laws were passed, as they are now, a draining act would also have been made, and the improvement of the country would have been much greater than it now is. But as it has hitherto been overlooked, the present seems to be a very proper time for bringing forward such a measure, for the following among other reasons:

All men are now sensible of the advantage of draining. Wet ground is generally rich, and will, when drained, produce excellent crops for several years, without manure.

Many tracts of wet land have also the advantage of climate, as they lie low, and upon the banks of rivers; so that they would form a valuable addition to the corn lands of Scotland: And such an addition would be extremely desirable, as a great proportion of the surface of the country is not arable, and can never be made so.

At present, in particular, an additional quantity of corn land would be of the utmost importance, when the country does not raise corn sufficient for its own consumption, and when our supplies from other countries are in a great measure stopped.

The cultivation of the wet grounds would increase the quantity of manure for those which were before in tillage: if they are ploughed, by the straw and corn; if kept in watered meadow, by the superior quantity and quality of the produce; for dung, except in a few situations, cannot be purchased.

The attention of the public has of late been drawn to the cultivation and uses of moss, a subject of great national importance; here also the advantage and necessity of draining are evident.

The improvement of the climate is an obvious effect of draining. The great evaporation that takes place from the surface of bogs, must render the air much damper, and much colder than it would otherwise be. Consumptions, the rheumatism, and probably other diseases, would thus become less frequent.

The beauty of the country would be improved in a very high degree. A taste for neatness and ornament is now much more generally diffused than it was at any former period: it is the sign of the increasing wealth and improvement of the country.

There are now many persons completely qualified to direct the formation of drains, and plenty of labourers to be got for executing them. At present, especially, when such numbers are out of employment by the stagnation of trade, a draining act would have the effect of setting many of them at work, and in a way most beneficial to the public. Those who could not use the pickaxe and spade, might be equally useful with the wheelbarrow: women could be employed in this manner, as they always are in peat mosses.

In some cases the same cut which serves for a drain, might form part of a canal.

Neighbours often quarrel about the draining of their grounds: but if it were always in the power of any one of the parties, to

settle the dispute by arbitration, quarrels would soon be settled, and soon forgot, when the good effects of the draining were experienced. Probably no man ever repented the draining of wet ground: of other things which were supposed to be improvements, as much cannot be said.

If such a law were made for Scotland, it would save time and trouble to parliament, and much unnecessary expence to individuals *. Perhaps England and Ireland also, if their laws are in that respect deficient, would follow our example.

It is to be hoped that some public-spirited institution will step forward, and be the means of procuring such an advantage to their country.

No. V.

PROOFS OF THE UNFAVOURABLE IDEA ENTERTAINED BY BRITISH STATESMEN, OF THE ABILITY OF THIS COUNTRY TO RAISE A SUFFICIENCY OF GRAIN FOR ITS OWN CONSUMPTION, AND OF THE LITTLE IDEA THEY ENTERTAINED OF THE IMPORTANCE OF AGRICULTURE, PRIOR TO THE ESTABLISHMENT OF A NATIONAL INSTITUTION FOR PROMOTING ITS IMPROVEMENT.

In the year 1790, the Committee of Privy Council appointed to inquire into all matters relating to trade, took into its consideration the laws regarding the exportation and importation of grain, and presented a report to his Majesty upon the subject, which is drawn up with much ability, although with such little idea of the *agricultural resources of the country*, that we are told, we must depend for a part of our consumption, not on an increased cultivation at home, not even on the produce of Europe, but on the harvests of America. Yet in the year 1808, as appears from the customhouse accounts,

* The same idea of a law to facilitate draining, occurred to the intelligent reporter of Berwickshire, An. 1809. See report, p. 490, p. ii.

we exported corn to the value of L. 470,431, and imported only to the amount of L. 336,460, consequently Great Britain became again an exporting country, and for that year at least, with the assistance of Ireland, was independent of foreign nations for food.

In the year 1791-2, Mr Pitt explained, in a speech on the state of the nation, what appeared to him the causes of the general increase of the national prosperity which had taken place at that time. That speech is very ably commented upon by Mr Arthur Young, in his Annals of Agriculture *. Mr Young was shocked to find, in that speech, the greatest, dearest, and most important interests of the kingdom, totally and contemptuously overlooked, as of no sort of consequence in the great scale of national prosperity. A financier, he observes, in giving a general view of the national resources, and dwelling with pride on the public revenue, does not think that agriculture, which, even then paid twelve millions Sterling *per annum*, in public burdens, worthy even of being named amongst the sources of prosperity!

Mr Young also remarks, " that the agricultural interests of this kingdom, perhaps never found themselves placed in so contemptible a position, as in this speech of the minister, who, wishing to make the utmost parade of every circumstance that would count in a catalogue of national advantages, totally overlooks every thing connected with land." Mr Young little expected, in the course of a few months, to be secretary to a Board of Agriculture, established with the concurrence of that very minister, by whom that speech had been delivered.

As late as the year 1796, another British statesman, distinguished for political information, (Lord Auckland), delivered a speech in the House of Lords, which was afterwards published, and of which the following is an extract:

" To what, under the protection and favour of Divine Providence, shall such prosperity be ascribed?—to our naval superiority and successes; to our conquests in the East and West Indies; to the acquisition of new markets; to the enterprising

* Vol. xvii, p. 369.

spirit of our merchants; to the improvements of our manufacturers; to the energy of our countrymen in arts and in arms; to the union of liberty with law; to the national character, cherished by, and cherishing the principles of our inestimable constitution; that constitution, which it has been the object of our enemies to destroy, by means and effects utterly destructive to themselves; that constitution, which it is the great purpose of our struggles in this just and necessary war, to preserve and to maintain *."

Not one word of agriculture in this whole paragraph, intended to enumerate the causes to which our prosperity was to be ascribed. We have hitherto indeed been too much considered as a mere commercial nation; whereas every country possessed of an extensive and fertile territory, ought to account the cultivation of its soil, as the surest foundation of its prosperity, and the best entitled, of all the sources of that prosperity, to the peculiar attention of an enlightened government. Such a government will be ready, at all times, to remove every obstacle to improvement; if not to promote, by public encouragement, those unceasing exertions, by which alone the whole territory of a great country, can be rendered, what it ought to be—one uninterrupted scene of industry and cultivation.

No. VI.

ACCOUNT OF JAMES SMALL, AND OF HIS IMPROVEMENTS IN THE CONSTRUCTION OF AGRICULTURAL IMPLEMENTS.

BY SIR JOHN SINCLAIR.

NEXT to the pleasure of promoting the improvement of a country, by personal exertions, is the satisfaction of doing jus-

* See the Substance of Lord Auckland's Speech in the House of Lords, the 2d day of May 1796. London, printed for J. Walter, Charing-cross.

tice to the merit of those, who have distinguished themselves, by their successful efforts in the accomplishment of that object. I am thence induced, to give some account of a native of this country, JAMES SMALL, to whom Scotland, and the agricultural world in general, are peculiarly indebted. That is the more necessary, as the services of this useful mechanic have not hitherto been sufficiently known or appretiated.

James Small was born at Upsetlington, in the parish of Ladykirk, and county of Berwick, about the year 1740. His father's only profession was that of a farmer. Under his superintendence, his son, the late James Small, was instructed in all the various branches of agricultural labour; a knowledge, of which he afterwards experienced the advantages.

Young Small was first bound as an apprentice to a country carpenter and ploughmaker, at Hutton, in Berwickshire. He remained in Scotland for some time after his apprenticeship was over; but about the year 1758, he went to England, where he worked with a Mr Robertson at Doncaster, in the making of waggons and other wheel carriages.

It was in the year 1763, that he settled at Blackadder Mount in Berwickshire, under the patronage of John Renton, Esq. of Blackadder. He there set up a manufactory of ploughs and other agricultural implements; and as he at the same time occupied a farm of considerable extent, he had an opportunity of trying many experiments, which he might not otherwise have been enabled to attempt. He there contrived a device for ascertaining the best shape of the mould board, by making it of *soft wood*; by means of which, it soon appeared, where the pressure was the most severe, and where there was the greatest friction.

When he first settled at Blackadder Mount, the old Scotch plough was almost solely in use throughout Berwickshire. It was drawn by a pair of horses, with the addition of four, and sometimes of six oxen; the smallest number was a pair of horses, and a pair of oxen, attended by a driver.

He began with trying experiments on his own farm, with ploughs of smaller sizes, and of different forms, proving, by a

steel-yard with a stronger spring than usual, which of them performed the best work with the least force of draught.

Some persons are impressed with an idea, that he had no other merit, but that of introducing into Scotland, the Rotherham plough, or reviving a plough that had been made by an itinerant ploughmaker, called Lomax, or Lummas, many years before, but which had fallen into disuse, neither of which however is the fact. That he was well acquainted with the Rotherham plough, appears from his own treatise on ploughs and wheel carriages, (p. 172.) ; and he probably would adopt any particulars in the construction of that plough, which might appear advantageous * : but it is well known, that he improved his own plough *gradually, and by means of repeated experiments ;* and there is positive evidence, that instead of the Rotherham, the old Scotch plough was the foundation on which he proceeded. Besides the testimony of Lord Kames, to be afterwards quoted, his book-keeper, Hector Heatlie, in a letter to one of the late James Small's sons, states, " That when his father began business at Blackadder Mount in 1763, there was nothing used in Berwickshire but the old Scotch plough, a comparatively very awkward instrument, which went with two oxen and two horses, and indeed often with four oxen and two horses. *Your father, observing the faults about her*, made and introduced a plough with the broad sock ; she was a short little plough, with a wood mould board, and round in the breast. You know what I mean. The mould board was round on the top, and not straight, which consequently made her worse to draw. This plough was much esteemed, and she was far easier drawn, and made tolerable neat work, especially on ley ground ; but your father did not stop there, but continued to make some additional improvements on her."

Indeed, any mechanic who will take the trouble of examining the beam, the sheath, the handles, the coulter, and the

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* There were a few Rotherham ploughs in Scotland at that time, and I am informed that moulds were got by a gentleman in Forfarshire, from a wright at Grindon in Northumberland, who had travelled with Lummas.

muzzle or bridle of Small's improved plough, with the old Scotch one, will find the parts similar; and Mr Gray, who is so thoroughly acquainted with the construction of ploughs, is of opinion, that the superiority of Small's plough, in a great measure consists in this, that its different parts are made neater and lighter, than in the old Scotch plough, and that these parts are so much better combined together, that the line of traction, and the centre of gravity of the plough, perfectly coincide, the line of draught, (as will appear from the annexed engraving), passing through the centre of resistance.

Like other ingenious men, James Small was distinguished by simplicity of behaviour, and modesty in his pretensions; he did not, therefore, bring himself forward, nor do himself that justice to which he was entitled. In the introduction, however, to his treatise on ploughs and wheel-carriages, he states, "The chief merit I claim in the following sheets is this, that I have given directions by which any sensible workman may be enabled to make a plough *on my principles;*" thus claiming to himself the merit of an improved construction. In that assertion no person ventured to contradict him, whilst he was alive to defend his own pretensions to the credit of his improvements.

In regard to the merits of Mr Small's plough, they arise from this, that the sock and the mould board are formed according to strict mechanical principles; and that those parts which enter the earth, and cut up the furrow, have that equal tapering, or sharpened wedge-like form, which occasions the least resistance in raising the furrow slice. The mould board, in particular, has that regular curve or twist, which not only lessens friction, in elevating and turning over the furrow slice, but it also places and leaves that slice in the most proper position for the beneficial effects of the atmosphere, and the operations of the harrow *. Small has also the sole merit of invent-

* Mr Kerr considers the peculiar advantages of Small's plough to arise from this, that at its anterior part it is an exceedingly thin wedge, and therefore cuts the plit from the fast land, with the smallest possible resistance, aided by the broad thin feather of the sock, which cuts off the plit below

ing and modelling the mould-board, and other parts of the plough, in cast metal, which contributed so much to the speedy extension of that valuable instrument.

It is a striking proof of the excellence of his plough, that many ploughmen in Berwickshire, for their own ease and satisfaction, offered to be at the sole expence of the wood work, if their masters would supply them with Small's plough, and would defray the other charges of the implement.

The celebrated Henry Home, Lord Kames, who was a friend to merit, and an ardent promoter of agricultural improvements, warmly patronized Small's exertions. In his Gentleman Farmer, 4th edition, chap. I. p. 5, he says, "I boldly recommend a plough introduced into Scotland about twelve years ago, by James Small in Blackadder Mount, Berwickshire, which is now in great request, and with great reason, *as it avoids all the defects of the Scotch plough*,"—evidently declaring, that the object of Small was, not to bring into use a new plough, but to remedy the defects of the old-established implement of the country; and his sons positively affirm, that during all the period whilst their father was attempting to improve his plough, they never recollect to have heard him mention the Rotherham plough; and they are certain that there never was one of them, either in his manufactory, or on his farm.

In consequence of the great improvements made by James Small on this implement, instead of two or more horses, together with two or more oxen, formerly used, and a driver; Lord Kames had the satisfaction of seeing himself, scarcely a plough with more than two horses and the ploughman, in the lower part of Berwickshire, and he then prophesied, what has since

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from the subsoil. The mould board gradually increasing, the obtusity of the wedge-form, gradually turns over the plit in a proper manner, instead of having all its work to do at once, against the whole resistance. It was experimentally proved, before the Dalkeith Farming Society, that Small's plough, in tearing up old ley, was drawn by a force of from 9 to 10 cwt. while the old Scotch, in the same field, required a force of 16 cwt. to perform the same work, in the same field.

taken place, that the practice would become general. It may be now considered as universally established over all the improved districts of Scotland. The saving thereby made in the expence of cultivation can hardly be calculated.

It was by Lord Kames's encouragement, and at his particular request, that James Small was prevailed upon to draw up a treatise on ploughs and wheel carriages, which was printed after his Lordship's death in 1784. This is certainly one of the best and most useful, as well as one of the earliest publications, on this interesting subject. In that treatise he gives a distinct and scientific account of the principles on which ploughs and wheel carriages ought to be constructed.

When a *Farming Society* was established in Ireland, consisting of the most respectable characters in that spirited and improving country, they ordered this treatise to be reprinted; in consequence of the circulation of which, numbers of Small's improved ploughs were sent to Ireland. The demand became so great, that the society resolved to send over a person to Scotland, (Mr Robert L'Estrange), to learn the art of making Small's ploughs, and other agricultural implements. With the utmost liberality and public spirit, though attended with much detriment to their own personal interests, every information was most readily given by Alexander Small and Company, who continue their father's profession, that they could possibly furnish; and the society have since erected a manufactory for these implements, under Mr L'Estrange's superintendence, which has spread these ploughs over the greatest part of Ireland.

It was about the end of the year 1779, or the beginning of the year 1780, that James Small made a pattern in wood for the mould-board, and also for the land-side plates of his plough, and he took them with him to Carron, where he got them cast. They were so well shaped, and answered the purpose so well, that they gave the highest satisfaction both to gentlemen and farmers. Some years afterwards, he made another important improvement, that of getting the sheath and head, which were formerly of wood, made of cast-iron, by which they were rendered much less liable to injury; and indeed, when the head formerly gave way, the plough was often rendered useless.

The plan of making these parts of the plough of cast metal, was one of the most important improvements ever effected in agricultural machinery; and, without which, Small's plough could never have spread so rapidly as it did over all Scotland. But when ploughmakers were thus furnished with the most difficult parts of the plough, according to the most approved models, ready for putting together, the rest of the implement, more especially after Small had explained in his treatise the principles on which it was to be formed, was much more easily constructed.

The difficulties James Small had to contend with, to introduce his plough, even in his own neighbourhood, were very great, of which the following instance is recorded: The late Mr Lumsdaine of Blanerne, was one of the first who ordered the new improved plough, but his servants did all they could to prejudice their master against it, pretending it did not go well, &c. Small was then obliged to appear in the field himself, and taking the plough into his own hand, he proved to Mr Lumsdaine and all his ploughmen, how well it could work. Had he not been a good ploughman, as well as an able mechanic, he could not have thus triumphed over those who opposed the introduction of his improvements.

Having established his plough in Berwickshire, Small wished to introduce it into Mid-Lothian, where it had met with much opposition; but being confident of the superiority of his invention, he offered to make a comparative trial. In consequence of that challenge, a competition of ploughs took place in a field near Dalkeith, in presence of many gentlemen and farmers from Berwickshire, Mid Lothian, East Lothian, &c. A number of ploughs were brought forward, as the old Scotch plough; several English ploughs; a plough by Mr Hutchison with an iron-wheel, &c.; but Small's was successful, the judges having decided, that it did the best work, and was considerably lighter in the draught, than any of the others. In consequence of the success of his plough at this public trial, it spread rapidly over all the different counties in Scotland, and has since been adopted in many parts of England, Wales and Ireland, and in many foreign countries.

Small's plough has likewise been successful in many other competitions, in England, and in Ireland, as well as in Scotland, which it is unnecessary here to detail.

It is proper, also, to remark, that he made several improvements in other agricultural implements besides the plough, as in harrows, rollers, winnowing machines, and wheel carriages.

It was a rule with James Small, that whatever piece of work he undertook, whether the making of a cart or plough, or any other implement, it should be made complete; and so anxious was he, that his implements should give perfect satisfaction, that rather than suffer any insufficient work to be sent from his manufactory, he would break it to pieces, whatever loss he might thereby sustain.

There was nothing, however, by which he was more distinguished, than by his zeal to promote useful improvements in the department of agriculture.

One who knew him well, (Hector Heatlie, formerly his book-keeper, and now resident in Dunse), affirms, " that to serve his country in the line of his profession was his incessant object, and to which he had so great a propensity, that to it he sacrificed his ease, his health, his strength, and his substance." Had it not been for this turn of mind, James Small might have left behind him a competence for his family; but instead of thinking of his pecuniary concerns, he was constantly trying experiments, and making improvements in machinery. When his ploughs were sent to any distance, he was often under the necessity of attending to see them tried, and to refute any objections that might be made to them. This occasioned, not only much loss of time, but expence. He also lost considerably by publishing his Treatise on Ploughs and Wheel Carriages, which enabled others to rival him in that branch of business. In fact, he had such a propensity to be useful, that he laid personal interest too much aside. He had the satisfaction, however, of performing services to his country, to which I have endeavoured to do justice, from information the authenticity of which may be relied on, and to leave a character behind him, which will long be remembered with respect. By him an implement was constructed, which has ma-

Fig. 1.

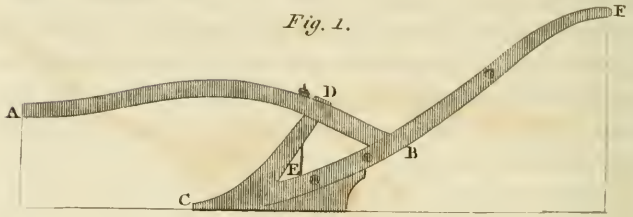


Fig. 2.

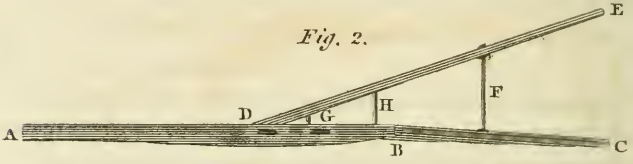
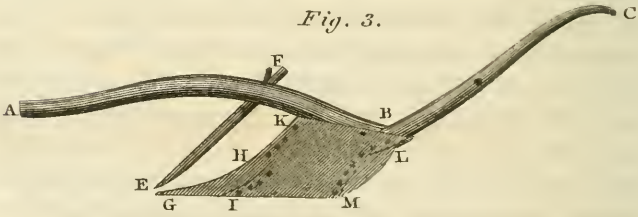


Fig. 3.



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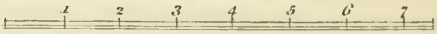


Nicholson & Strand.

Smalls or the Scotch
Improved Plough.
Cultivator Grass

Fig. 4.

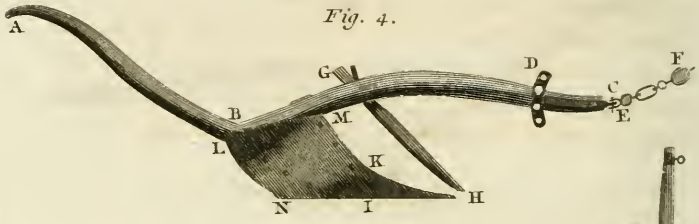


Fig. 5.

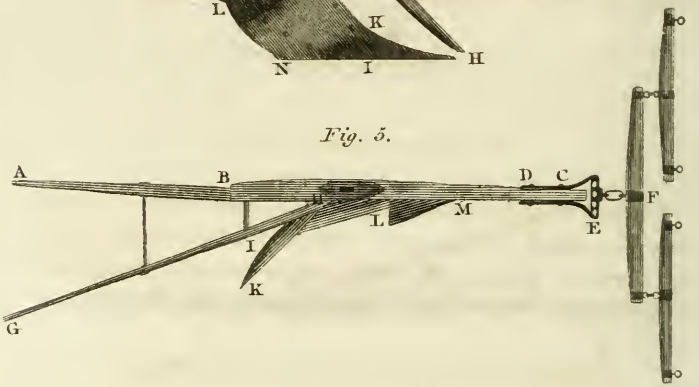
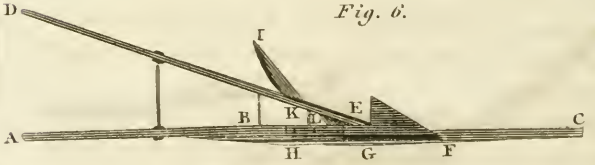


Fig. 6.



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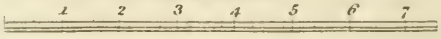

Neele sc. Strand.

Smalls or the Scotch
Improved Plough
Andrew Cran

terially diminished the expence of cultivation, which will answer in every soil, which will turn out the cleanest and deepest furrow with the least force of draught, and which, on the whole, is better adapted, *for general purposes*, than any plough that has hitherto been seen or heard of*."

James Small died in the year 1793, about the 53d year of his age. Of him it may be safely affirmed, that a man possessed of more public zeal, and of a greater turn for mechanical inventions, has rarely appeared in any age or country.

Description of Small's Plough.

In order that the reader, who may not have seen this plough, may be enabled to form a just conception of its construction, an engraving is annexed, which will be perfectly intelligible, with the aid of the following references:

References to the Engraving of Small's Plough.

FIG. 1. *The left hand or land side of its wooden frame.*

A, B, represent the beam; C, D, the sheath fixed into the beam at D; and its lower end C, serves for the sock or share to be fixed upon.

E, F, the left hand or larger handle, placed upon the beam at B, and the lower end is fastened to the sheath at E, by which the sheath is supported against the resistance that the sock is exposed to in passing through the ground. There is also an iron-bolt goes up through the frame at E, and is secured by a screw nut on the upper side of the beam;

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* That intelligent practical farmer, Robert Brown, Esq. of Markle, in his recent treatise on Rural Affairs, vol. i, p. 236, remarks, that under a parity of circumstances, the swing plough brought into practice, and afterwards improved by Mr Small, is fitted for executing work to better purpose, than any other of the numerous varieties of that implement, employed in the several districts of Great Britain.

by this means, the beam, the larger handle, and the sheath, are kept firm together.

FIG. 2. *Plan, or bird's eye view of this machine.*

A, B, the beam; B, C, the larger handle; D, E, the right hand or lesser handle, attached to the larger one by the iron rod F, and the wooden roundels G, H.

FIG. 3. *The land, or left-hand side of the plough when completed.*

A, B, the beam; B, C, the larger handle; E, F, the coulter fixed into the beam at F.

G, H, I, the sock or share, placed upon the lower end of the sheath.

H, K, L, M, are plates of cast-iron, nailed upon the land side of the plough, to prevent the wood from wearing, by rubbing on the firm land.

L, M, the hindermost end of the mould-board.

FIG. 4. *The right-hand, or furrow side of the plough.*

A, B, the lesser handle; B, C the beam; D, E the bridle or muzzle, placed upon two iron-bolts which pass through holes in its arms, and the fore part of the beam; E, F the chain, and swing or cross-trees to which the horses are yoked.

G, H, the coulter; K, H, I the share; L, M, N, I the mould-board; its fore part M, I, is fastened to the sheath, and its back part fixed on the lesser handle.

FIG. 5. *The upper side of the plough ready for working.*

A, B, represent the larger handle; B, C the beam; D, E the bridle, having a few holes in its fore part by which the draught chain can be shifted a little to either side, and cause the plough take a broad or narrow furrow slice, as may be found necessary. In the cross D, are also several holes, by which the depth of the furrow can be regulated, by shifting the bolt that passes through the cross D, and the beam.

E, F, the chain, and swing-trees, to which the horses are attached when ploughing.

G, H, the lesser handle; I, H, K, L, the mould-board; L, M, the fine or feather of the share.

FIG. 6. *The under side of the plough.*

A, B, the larger handle; B, C the beam; D, E the lesser handle; E, F, G the share; G, H the sole, and I, E, K, L the mould-board.

In regard to the weight of Small's plough, it varies from 134 to 141 lbs. English; but when the chain is added, it amounts even to 162 lbs. A set of drawing bars or *horse trees*, as they are sometimes called, weighs from 20 to 21 lbs. more. The price of the plough is L. 3, 12 s. and of the drawing bars 12 s. or L. 4, 4 s. in all, so that it unites the advantages of strength and cheapness, and is at the same time much lighter than many other ploughs.

Alexander Small and Company, the sons of this ingenious mechanic, have lately reduced the weight of the plough considerably, for light land, (from 141 to 105 lb.), so that it will suit a single horse, of a strong make, or a pair of small horses. The price is also diminished from L. 4, 4 s. to L. 3, 10 s. Their manufacture is carried on at Leith Walk, near Edinburgh, where those who may wish to encourage ingenuity, may be furnished with ploughs and other instruments of husbandry, of the best construction.

As unfortunately they are deficient in capital, at least for any extensive undertaking, it is proposed, that a sum of money shall be raised by subscription, under the patronage of the Highland Society of Scotland, the Farming Society of Ireland, and other public spirited institutions, to enable them to carry on their business, to the extent, to which their father's services to the country, and their own ingenuity and merit, would procure them a demand.

Charlotte Square,
Edinr. 19th December 1811.

No. VII.

DESCRIPTION OF A MACHINE FOR DRESSING, (HUMBLING) BARLEY OR BEAR, INVENTED BY MR GEORGE MITCHELL, MILLWRIGHT AT BISHOP-MILL, NEAR ELGIN.

References to the Plan.

FIG. I. A B C D E F represent the framing that carry the wheels and scutching apparatus. G G G G, a hollow cylinder of wood or cast-metal, into which the bear or barley is conveyed from the hopper K.

H H represent a wheel fixed upon an iron axle or spindle, placed perpendicular in the centre of the cylinder G, and upon this spindle is also fastened the scutchers I I I I; so that when the wheel H is turned by the wheel N N, which is fixed upon one end of the horizontal axle M, and on the other end of this axle is also placed the wheel O O, this wheel being attached to a threshing-machine or any other engine by which means motion may be conveyed to the scutching arms I, which revolve in cylinder G, and clear the grain of the beards or awns as it passes down through among the scutchers placed on the spindle, (see E F, G H and I K, in Fig. III).

P P the cross-rail, in which the upper pivot S of the perpendicular axle turns. L a spout or opening that allows the grain to issue out of the machine, when completely humbled, or the beards wholly cut off.

FIG. II. Elevation of this machine, wherein

A B C D represent the frame that supports the different parts of the machinery.

Fig. 2.

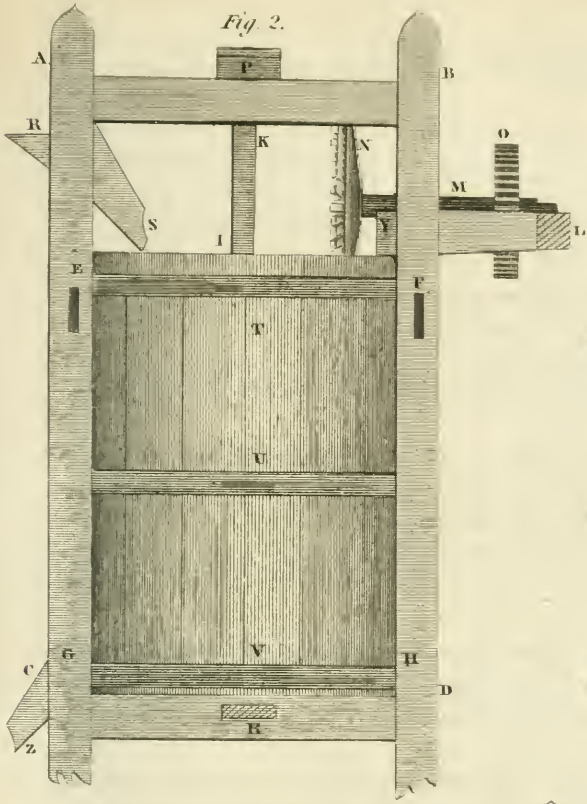


Fig. 3

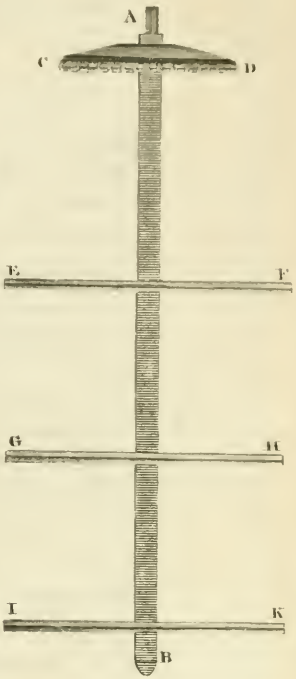


Fig. 1.

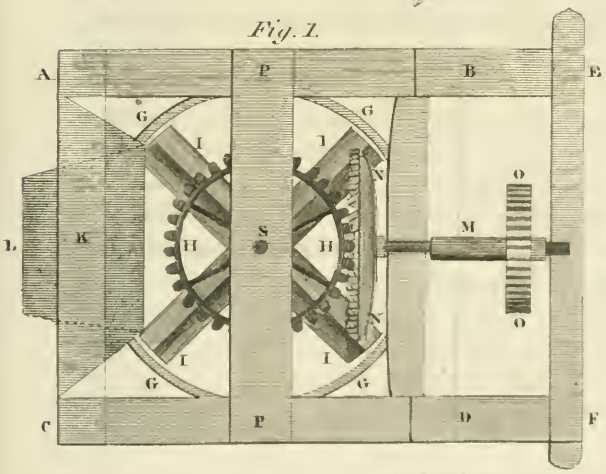


Fig. 4

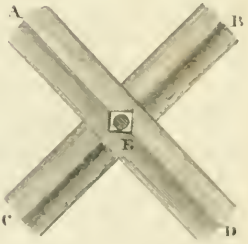
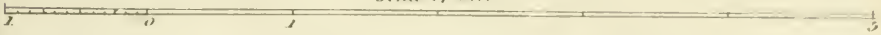


Fig. 5.

Scale of Feet



E F G H the tube or receptacle into which the bear or barley passes through the spout R S, from a hopper above the machine.

T U V are hoops of iron to hold the tube firmly together.

I K the perpendicular spindle on which the scutchers and horizontal wheel are fixed, (see C D in Fig. III.). M represents an iron axle, upon which are fixed the wheels N and O, that convey motion from the threshing-machine to the scutchers. L Y are beaters, in which the pivots of the horizontal spindle M turns. R a rail, that the foot of the spindle or axle I K turns. Z a spout or opening, through which the grain runs from the scutchers or beaters.

Fig. III. A B represent the spindle, on which are fixed the wheel C D, and also the scutchers E F, G H and I K; these scutchers, revolving in the tube at about two thousand feet in the minute, detach the beard or awns from the bear completely.

Fig. IV. A B C D represent one of the beaters, and E the axle on which it is fixed; a greater number of scutchers may be placed upon this axle if found necessary.

Fig. V. An end view of one scutcher; its edges F G should be a little rounded, to prevent them from cutting the bear or barley in the operation of humbling.

This useful machine has been attached to many threshing-mills, and it has been found to answer the intended purpose so well, that it is recommended by those gentlemen who have applied it, as a very great improvement. There must be some additional stress on the power by which it is turned, but by experience it is found to be so trifling, that this machine may be added to any threshing-mill, whether driven by water, by wind, or by horses.

No. VIII.

ON THE MANUFACTURE OF POT, OR PEARL BARLEY.

Pot or pearl barley should never be manufactured from grain weighing less than sixteen stones *per* boll, (nearly six Winchester bushels), and particular care is requisite in selecting the grain, so that it be plump, well filled, and of equal size.

Grain of sixteen stones weight is generally reduced, when common barley is the object, to from eleven to twelve stones, and proportionably lower for fine. The expence of making pot barley, in general, is at the rate of 2 s. 6 d. *per* boll, and the dust or refuse, which is always retained, is commonly valued at that sum. It is excellent food for horses, for cows, (more especially if boiled), and for hogs.

The process of making pot barley is as follows: After kiln-drying the barley, it is put into the mill, and rough hulled, which may be done in about fifteen minutes; if the mill is in good order, and wrought by a proper hand, twenty bolls, (120 Winchester bushels), may be put through it in eleven or twelve hours. This quantity is laid in the trough or floor, as it comes from the cases, and made a little damp; it is kept in this state about forty-eight hours; and if not made very fine, the same quantity may be again completely finished in eleven or twelve hours.

Next to wheat, barley is the grain, the best adapted for making bread, but it is attended with two great inconveniences; 1. It has a coarse outer husk, of which wheat is naturally divested; and, 2. It has a dark inner husk, of so delicate a texture, that, when ground with the flour, it can never afterwards be extracted, by bolting or any other contrivance. It is principally this dark inner husk, which makes the barley bread so dark coloured and unpalatable.

To be placed Opposite the Appendix page 50.

Fig. 1.

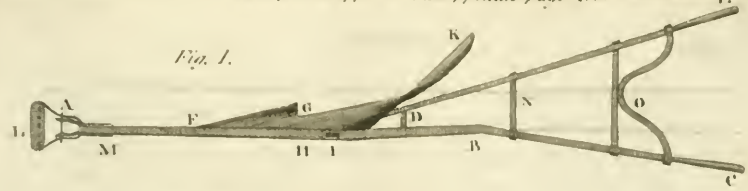


Fig. 2.

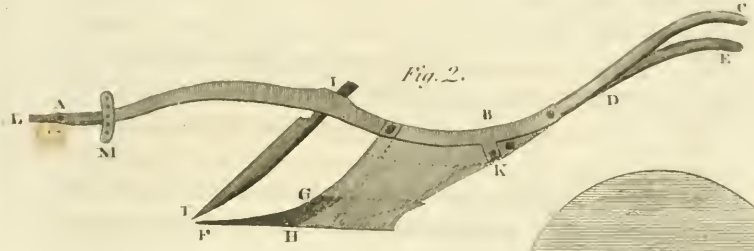


Fig. 1.

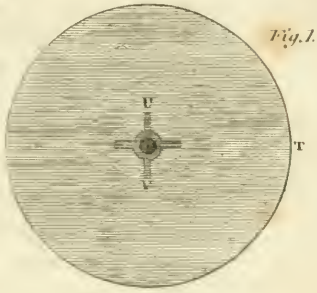


Fig. 2.

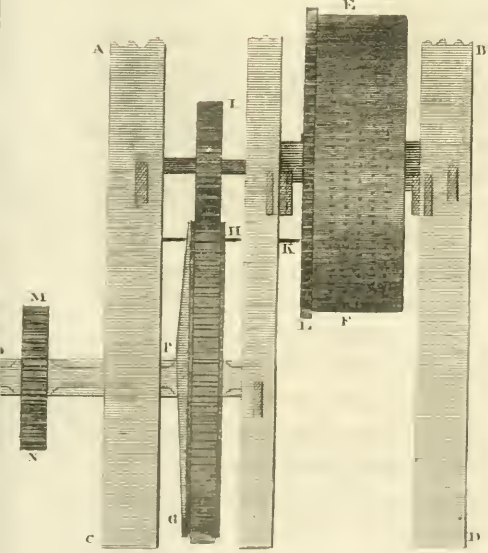
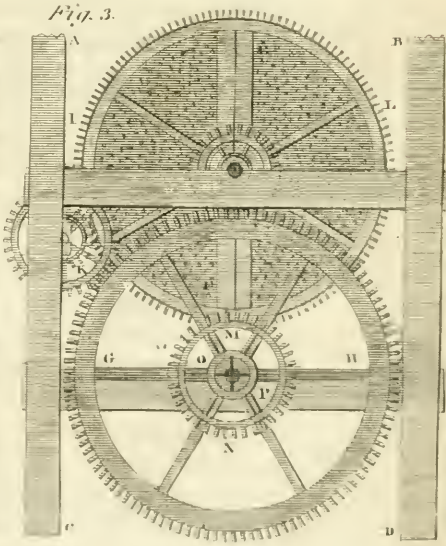
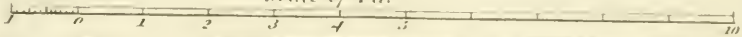


Fig. 3.



Scale of Feet



When pot or pearl barley is made, both these husks are taken off; and when flour or meal is manufactured from pot or pearl barley, it resembles much wheat flour. It may be made by itself into excellent cakes, which some from its lightness prefer to any other sort of bread. Mixed with wheat flour, in various proportions, as one-fourth, or even one-third, it makes as good loaf bread as any one could desire.

The following statement will explain the saving which would thence arise, *per* quartern loaf, and *per* sack.

20 English stones of 14 lbs. avoirdupois, each, or 16 Dutch stones of 17½ lbs. avoirdupois, each, } make a load.

A load is equal to an English sack, each weighing 2 cwt. 2 qrs. or - } 280 English pounds avoirdupois.

A sack of flour will produce, on an average, twenty peck loaves, each weighing 17 lbs. 6 oz. avoirdupois,

	Lbs.	Oz.
Total product of a sack, - -	346	6
Deduct the weight of a sack of flour, -	280	0
Increased by the addition of water and yeast, &c.	66	6

15 Dutch stones of flour (from wheat) at 5s. *per* stone, - - - - £. 4 0 0

Hence, the peck loaf 4 s.
——— the quartern loaf 1 s.

10⅔ Dutch stones of wheat flour at 5s. -	£.	2	13 4
5⅓ Do. do. of barley flour at 3 s. the price at which it can be furnished, - -		0	16 0
-	£.	3	9 4

Hence, the peck loaf 3 s. 5¾ d.
——— the quartern loaf 10½ d.

Saving by the use of one-third barley flour, *per* quartern loaf, 1½ d.

Saved by mixing the barley flour with wheat, on each sack, - - - £. 0 10 8

If the price of wheat flour rises, the saving will increase, as the price of barley will not probably rise in the same proportion.

N. B.—There is an allowance to the baker of 1 s. 6d. *per* bushel, which would make about one penny addition to the price of the quartern loaf.

Description of a Machine for making Pot or Pearl Barley.

Fig. 1. represents the mill-stone, and U V an iron cross or rind, by which it is fixed upon the spindle or axle, (See R in fig. 4).

Fig. 2. A B C D represent the frames and bearers which support the machinery.

E F, the case or curb that incloses the mill-stone, and being covered with sheet iron, in which are small holes, to allow the refuse or dust to escape, while the barley is retained within the case E F, in which the mill-stone moves with considerable velocity.

M N represent a wheel fixed on the scale, O P; this wheel may be driven by any machine having power to turn the barley mill-stone with its case. G H represent a wheel, also fixed upon the axle O P, by which wheel the pinion H I, is driven; this pinion being fixed upon the iron-axle spindle R. Upon this spindle is also fastened the mill-stone, and by this means driven within the case or curb with considerable velocity. K represents the small wheels that are driven by the wheel G H, to turn the case or curb E F, by acting on the wheel L L, which wheel is fastened upon the case. This case is made so as to be easily taken separate in the middle, in order that it may easily be put on, or taken off from the mill-stone, at any time when necessary.

No. IX.

ACCOUNT OF SEA-WEED BEING EXHIBITED TO COWS BY WAY OF CONDIMENT.

COMMUNICATED BY MR JOHN SHIRREFF, ABBEYHILL.

Mr Maccallum, south side of the Grassmarket, opposite to the Corn-stand, keeps about twenty milch cows, which he feeds on grass in summer, and always on grains, (in Edinburgh called draff), in winter. He also gives them distillers' dreg or lees for drink, in that season, when he can get it, which is at all times when distillation goes on. His cows likewise get some turnip once a day in winter and spring, and sometimes twice; not so much for food, as for a condiment, or, as he says, *a medicine*. And when turnip are very scarce, and high priced, he gives sea-weed in lieu of them, particularly in the months of February, March and April. This he gets on the Black Rocks, near Leith, at spring tides only, so that he keeps some of it for two weeks. There are two species used, the *fucus digitatus*, and the *fucus serratus*. He does not use the *F. resiculosus*, lest it fill the cows too full of *wind*, meaning air. Mr Maccallum begins by parboiling the sea-weed, and giving the cows a little of the water it has been boiled in: When they drink the water, they are then offered some of the parboiled weed itself, and when they eat it parboiled, it is gradually exhibited to them raw. He gives each cow, once or twice a-day, as much as a person can neatly carry, at once, between his two hands. These marine plants operate as a gentle laxative, and Mr M. thinks the use of them promotes the health of his cows, and consequently adds to the quantity of milk they yield.

N. B.—The cow-keepers about Edinburgh frequently sell their milk to retailers, at a certain sum weekly; in some cases as high as a guinea *per* week. Whenever the cow begins to fall off in milking, she is disposed off, and another purchased; and she is usually in such good condition, that the price she sells for buys her substitute.

No. X.

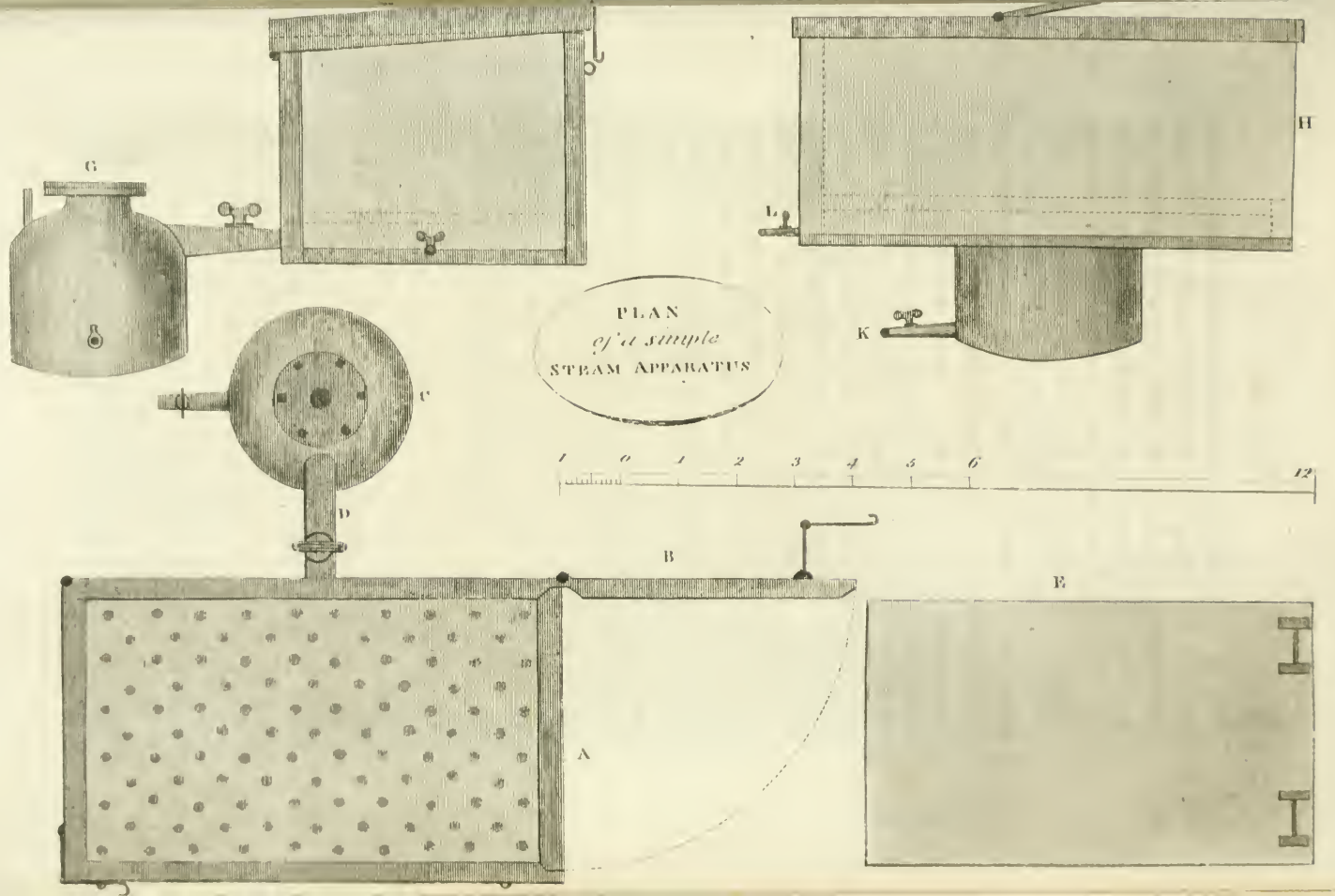
ACCOUNT OF A SIMPLE STEAMING APPARATUS FOR COOKING ROOTS OR OTHER FODDER FOR LIVE STOCK, WITH A DRAWING, EXPLAINING THE NATURE OF THE PROPOSED APPARATUS.

BY MR JOHN SHIRREFF, ABBEY-HILL.

The chief advantage attending the use of the apparatus about to be described, consists in saving labour and time in lifting off and on, the tubs or casks for holding the materials to be steamed, also the expence of cost and repairs of leaden pipes, cocks, &c. Its superiority over those commonly used, particularly in a large operation, will be at once perceived by those who have paid attention to the subject.

The boiler may be of any approved form, and of a size proportioned to that of the box, with a furnace of that construction which affords the greatest quantity of heat to the boiler, with the smallest waste of fuel. The box may be made of stout pine plank, well jointed together. One of eight feet in length, five feet wide and three feet deep, will serve for cooking potatoes, in the space of one hour, sufficient to feed fifty large milch cows for twenty-four hours.

The box should stand within a few feet of the boiler, with its side parallel to it, either on a piece of solid building, or on six or more posts. It must have a porous bottom, with a close one about a foot below it. From the upper part of the boiler, a pipe of wood, or any other suitable substance proceeds, and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enters into the box about the middle of it, between the false and solid bottoms, conducting the steam into the space between them, which penetrating through the holes or grating of the false bottom, rises upwards, and mixes with the contents of the box, while the condensed steam and any liquid matter that may ooze out of the materials, drips through the apertures, and lodges on the solid bottom below, from whence it can be let off by a cock fitted to it for that purpose. There is an opening in the upper part of the box two feet square, shut by a lid that moves on hinges. This lid is kept down by its own weight only, and acts as a safety valve to the box and boiler also, from the connection between them, though the boiler may be accommodated with a separate safety valve if thought necessary. When the force of the steam is very great, the lid is lifted up, and a quantity escapes into the atmosphere, and the lid then falls down again of its own accord. This aperture is made so large, that it may be used to fill the box with whatever material is intended to be steamed. One end of the box must be accommodated with a door, which must fit close, and be secured firm, while the operation of steaming goes on, but must admit of being opened to one side when the business of cooking is finished, to allow the cooked contents of the box to be drawn out by a solid iron rake, into a large trough placed immediately below to receive them. From the ignorance and carelessness of servants, in managing fire in the furnace, the bottoms of cast-iron boilers are sometimes fused, especially if the water in the boiler be allowed to get too low; and, again, if the boiler be too suddenly supplied with water, when red hot, it will crack. To prevent these accidents, the bottom of the boiler has been cut out, and its place supplied with broad plates of malleable iron lapped over each other, and clinched to the cast-iron sides of the boiler. But all risk of either fusing or cracking would be prevented, by supplying the boiler gradually with water from a cistern, in the manner it is furnished to the boilers of steam engines. The boiler may also be equipped with two cocks, attached to pipes of different lengths, to determine at any time whether the boiler has too much or too little water in it, though there will hardly be any occasion

for these; because, if the valve or lid hanging on the aperture at the bottom of the cistern, and the stone suspended on the surface of the water in the boiler, be in due equilibrium, the quantity of water in the boiler must always be the same, while there is a sufficient quantity in the cistern to supply the waste from evaporation in the boiler.

It might be an improvement, to have the top of the box made to lift off and on, for the purpose of filling it more conveniently with the materials to be steamed: Also to have divisions to slide out and in, to contract the space in the box, to suit a smaller quantity of materials that might at any time be required to be steamed. These sliding divisions would, each in their turn, become the top of the box, and would each require to have the lid moveable on hinges accordingly. It would greatly expedite the business, if a crane were used for lifting the potatoes from the washing machine, and depositing them on a barred platform to drip. This platform might be placed near to the box, above it somewhat, and projecting over it a little withal, so that when enough of potatoes shall have been washed, the whole might be tumbled into the box at once by raising the opposite side of the platform.

No. XI.

LIST OF THE INTELLIGENT FARMERS, FROM WHOSE COMMUNICATIONS THE PRECEDING ACCOUNT OF THE HUSBANDRY OF SCOTLAND, HAS BEEN DRAWN UP.

1. Berwickshire.

1. William Robertson, Esq. of Ladykirk.
2. George Logan, Esq. of Fishwick.
3. A. Low, Esq. Woodend.
4. David Low, Esq. ditto.
5. Mr Robert Kerr, Ayton.
6. Mr William Dudgeon, Primrose-hill.
7. Mr John Wilson, Idington Mains.
8. Mr James Wilson, Simprin.

2. Roxburghshire.

9. Thomas Nisbett, Esq. of Mersington.
10. Robert Walker, Esq. of Wooden.
11. Adam Walker, Esq. of Mellendean.
12. Thomas Hood, Esq. Hardacres.
13. Mr Thomson, Bewlie.
14. Mr Andrew Blaikie, Holydean.

3. East Lothian.

15. The Honourable Baron Hepburn.
16. George Rennie, Esq. of Phantassie.
17. Robert Brown, Esq. Markle.
18. David Wight, Esq. Ormiston.
19. William Hunter, Esq. of Tynefield.
20. William Hume, Esq. East-Barns.
21. Mr Rennie, Oxwell Mains.

22. Mr Dudgeon, Prora.
23. Mr Buist, overseer at Tynninghame.
24. Mr Somerville, Athelstonford Mains.
25. Mr Skirving, Garleton.
26. Mr Richard Somner, Gilchriston.
27. Mr James Cuthbertson, Seton Mains.
28. Mr Murray, Kirkland-hill.
29. Mr Archibald Park, Windy Mains.
30. Patrick Brodie, Esq. Garvald.
31. Mr Robert Hope, Fenton.
32. Andrew Pringle, Esq. Ballencrief.
33. Mr John Carnegie, Drylaw-hill.
34. Mr Adam Murray jun.,

4. Mid-Lothian.

35. Mr Thomas Scott, Craiglockhart.
36. John Newton, Esq. of Currie-hill.
37. Mr Thomas Allan, Craigcrook.
38. Mr William Gray, Gorgiemoor.
39. Mr John Shirreff, Abbeyhill.
40. Mr Alexander Guthrie, of Edinburgh.
41. Mr Richard Shirreff, Dalry, near Edinburgh.
42. Gilbert Grierson, Esq. merchant, Leith.
43. Mr Robert Laing, Campend.
44. Mr George Frame, Braidwood.
45. Mr John Milne, Smeaton.
46. William Aitchison, Esq. of Clements Wells.

5. West Lothian.

47. Mr Thomas Trotter, Newton.
48. S. Wood, Esq. Millrig.

6. Dumfriesshire.

49. William Stewart, Esq. of Hillside.
50. Mr John Church, Hitchill.

7. Galloway, Ayrshire, and Clydesdale.

51. Sir Alexander Gordon, of Greenlaw.

52. Mr David Shank, Curghie.
53. John Tennant, Esq. Girvan Mains.
54. Mr William Aiton, Strathaven.
55. Mr George Douglas Aiton.
56. John Mackenzie, Esq. of Glasgow.

8. PEBBLESSHIRE.

57. Mr Charles Alexander, Easter Haprew.

9. STIRLINGSHIRE.

58. John Campbell, Esq. of Carbrook.
59. Mr Andrew Robertson, Almon.
60. Mr Andrew Chalmers, Dunmore.
61. James Boyd, Esq. Powis.

10. CLACKMANNANSHIRE.

62. J. F. Erskine, Esq. of Mar.
63. Robert Stein, Esq. Kilbagie.
64. John Phipps, Esq. Dolls.
65. Mr John Laing, Tullybody.
66. Mr Peter Mitchell, Balquharn.
67. Mr Alexander Kerr, Lorns-hill.
68. Rev. Dr Moodie, Clackmannan.
69. Mr James Thomson, Park.

11. FIFE.

70. The Earl of Kelly.
71. John Newton, Esq. of Cartland-hill.
72. Mr Neil Ballingal, Sweet Bank.
73. Thomas Bruce, Esq. of Grangemuir.
74. Robert Spears, Esq. of Dysart.
75. William Young, Esq. of Burntisland.

12. PERTHSHIRE.

76. Sir Patrick Murray, Bart. of Ochtertyre.
77. E. Marshall Gardiner, Esq. of Hilcairnie.
78. William Blair, Esq. of Montague.
79. Mr James Kilgour, Perth.

80. Mr James Andrew, Tillylumb.
81. Mr William Cunningham, Goodlyburn.
82. Mr Henry Thomson, Muirtown of Balhousie.
83. Mr Robert Clerk.

13. Carse of Gowrie.

84. George Paterson, Esq. of Castle-Huntly.
85. Mr Thomas Drummond, Westbank.
86. Mr Patrick Jack, Moncur.

14. Northern Districts.

87. George Robertson, Esq. Muirton, near Bervie.
88. Mr Brown, Cononsyth, by Arbroath.
89. Mr Rennie, Kinblethmont, near Arbroath.
90. Mr Barclay, Knock-Leith.
91. Mr John Milne, Mill of Alvah, near Banff.
92. Mr John Lawson, in the county of Banff.
93. Mr A. Wilson, near Cullen.
94. Mr Young, Morayshire.
95. Mr Sheriff, Kinmylies, near Inverness.
96. Capt. John Henderson, of Aimster, in Caithness.

15. Correspondents, regarding the introduction of the Scotch System of Husbandry into England.

97. Sir Joseph Banks.
98. Arthur Young, Esq.
99. G. F. Stratton, Esq. of Great Tew Park, Oxfordshire.
100. James Brougham, Esq. Howis, near Penrith.
101. William Wolstenholme, Esq. near Weymouth.
102. George Culley, Esq. of Eastfield, by Belford.
103. Mr Money Hill, of Waterden, in Norfolk.
104. Admiral Bentinck.

There were also a number of other intelligent proprietors and farmers, who transmitted to me very important communications, but under the express injunction, that their names should not be mentioned; a circumstance much to be lamented, as their authority would have added much weight to any publication.

If the intelligent farmers whose names are contained in the preceding list, and others who are well acquainted with the Husbandry of Scotland, were to favour the author of this work with their remarks upon it, he would be enabled to render it much more complete, than it possibly can be without such assistance.

There are no means by which any subject, of so extensive, and so complicated a nature, as that of Agriculture, can be brought to any great degree of perfection, but first by collecting the result of the experience and observation of great numbers *of practical men*, and next, after that information has been methodised and detailed, to have it remarked upon, by other intelligent men, *and discussed as thoroughly as possible.*

EXPLANATION OF THE PLATES.

1. *The Berwickshire Hammels.*

The division walls which are not under cover, are only so high as to have the effect of keeping the horses or cattle perfectly separate. That part of the wall which is covered ought to be as high as the roof of the building, in order to stand the great draught of air from one end of the building to the other, thus rendering the whole much warmer.

At the side of the gates are troughs for holding turnips, water, &c.

The building NO. 8. is not separated into two divisions, but is similar to the others, with this difference, that there is a wide gateway for a cart, or any farm carriage, with a close made gate on the north end for shelter: this alteration was thought necessary to have more ready access to different parts of the farm-offices, when that hammel happens not to be occupied.

Each hammel will hold *three* moderate sized animals, that is to say, oxen or steers below 65 stone in weight, 14 lb. to the stone. No doubt *two is better*, but that takes up room, and increases the expence of building.

These hammels completely answer the object in view.

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2. Explanation of the Engraving of the Steaming Apparatus.

See Appendix, NO. X.

A False bottom of the steaming box.

B Door of the box,—To open with iron hasp, to secure it when shut.

C The boiler.

D The pipe for conducting the steam between the false and real bottoms of the box.

E Sliding division of the box, with handles for pushing it in, and drawing it out.

F End view of the steaming box, with iron hasps securing the door.

G Boiler and pipe.

H Side view of the steaming box.

I Lid moveable on hinges, and acting as a safety valve.

K Cock for discharging water from the boiler.

L Cock for discharging condensed steam and other liquids from the bottom of the steaming box.

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3. DESCRIPTION OF AN IRON PLOUGH, CONSTRUCTED BY MR JOHN WILKIE, AT UDDINGSTON, NEAR GLASGOW.

[*See Plate*, APPENDIX, p. 50].

FIG. I. and II. Plan and profile of an iron plough, wherein the same letters represent the same parts.

A B Represent the beam; B C the left-hand stilt, or large handle.

D E The right-hand stilt, or lesser handle.

F G H The sock or share, placed on the fore-end of the head.

I I The coulter, fixed into a hole or mortise in the beam.

G K The mould-board, fastened upon the furrow, or right-hand side of the sheath, and lesser handle.

D N O The rods of iron that connect the two handles, and also hold them at a proper distance from each other.

L M The muzzle or bridle, placed upon an iron bolt, which passes through a hole in its arms; and the fore-part of the beam at A, upon the back-end of the bridle at M, is a cross, in which are several holes to receive a bolt that passes through one of these holes, and one in the beam, so that by shifting this bolt in the different holes of the cross M, the bridle having liberty to turn on the bolt at A as a centre, the fore-end L of the bridle can easily be either raised or depressed, in order to give the plough a greater or lesser hold of the ground, as may be found the most convenient.

INDEX.

The Numerals refer to the Part ; the Figures to the Page.

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THE END.

EDINBURGH:
Printed by Abernethy & Walker.

This Day was Published, in 8vo, Price 15s. boards,

THE

PLANTER'S KALENDAR;

OR THE

NURSERYMAN AND FORESTER'S GUIDE;

BY THE LATE

WALTER NICOL, &c.

EDITED AND COMPLETED BY

EDWARD SANG, NURSERYMAN.

Edinburgh: Printed for ARCHIBALD CONSTABLE & Co. Edinburgh; LONGMAN, HURST, REES, ORME, & BROWN, and J. MURRAY, London.

☞ This work contains an extended view of the methods of raising Trees from infancy to maturity; their management in the Nursery, in the Forest, and the Grove;—as Hedge-Row, and detached Ornamental Trees in the Park, and in the Lawn. It shows the methods for raising and managing simple and mixed Copses;—with the qualities of Soils best adapted to the various kinds of Forest Trees, and in which they have attained to the greatest perfection in many places, both of Scotland and England.

The whole is intended to enable the landed proprietor, engaged, or to be engaged, in the cultivation of Timber upon his estate, to adopt the speediest, cheapest, and most effectual methods of arriving at the proposed end.

THE FARMER'S MAGAZINE.

This Day is Published,

By ARCHIBALD CONSTABLE & Co. EDINBURGH,

AND

LONGMAN, HURST, REES, ORME, & BROWN, LONDON;

Handsomely printed in Twelve Volumes, price, in 48 Numbers, L. 5, 17s.; in Eleven Volumes, boards, extra, L. 6, 3s.; or handsomely half bound, Russia backs and corners, Twelve Volumes, L. 7 : 18 : 6,—

THE FARMER'S MAGAZINE, a periodical work, published quarterly, exclusively devoted to Agriculture and Rural Affairs, for the Years 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, and 1811, 48 Numbers, (and Supplement to 1808.)

*** The establishment of a Board for promoting Agriculture and internal improvement, brought Husbandry into fashion, and directed public attention to an art which, before that period, had been undervalued and neglected. From this change of public sentiment, the Proprietors of the FARMER'S MAGAZINE were encouraged to bring forward a periodical work, which both contained interesting discussions upon agricultural subjects, and furnished select and important information respecting the state of markets, produce of crops, rate of rents, and value of labour in almost every district of the island. The design, at least the latter part of it, was new, therefore was not carried into execution till the assistance of numerous respectable Agriculturists, both in Scotland and in England, was sought for and obtained; and to the active and steady exertions of these friends, may be attributed the uncommon and unprecedented success of the work since its commencement—a success far beyond that of any agricultural publication hitherto attempted in this or any other country.

In the volumes of the FARMER'S MAGAZINE already published, may be found regular Essays or Dissertations upon every agricultural subject which can be mentioned, together with an immense number of hints or observations, all calculated for the improvement of agriculture, and the benefit of those connected with it. What is of great importance to husbandmen, information is given in a plain and practical manner, neither clouded by theory, nor enveloped in technical terms. That eminent writer on husbandry, the Rev. Mr Harte, in his Treatise on Agriculture, says, "The plain practical author pays his little contingent to the republic of knowledge with a bit of unstamped real bullion, whilst the vain-glorious man of science throws down an heap of glittering counters, which are gold to the eye, but lead to the touchstone."

DUE DATE

JAN 30 1974	
FEB 20