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GENERAL REPORT
OF THE
AGRICULTURAL STATE, AND POLITICAL
CIRCUMSTANCES
OF
SCOTLAND.







GENERAL REPORT

OF THE

AGRICULTURAL STATE, AND POLITICAL
CIRCUMSTANCES,

OF

SCOTLAND.

DRAWN UP FOR THE CONSIDERATION OF THE BOARD OF
AGRICULTURE AND INTERNAL IMPROVEMENT,

UNDER THE DIRECTIONS OF

THE RIGHT HON. SIR JOHN SINCLAIR, BART.
THE PRESIDENT.

VOL. I.

“ Knowledge is Power.” BACON.

EDINBURGH:

Printed by Abernethy & Walker,

AND SOLD BY ARCH. CONSTABLE & CO. EDINBURGH; AND
LONGMAN, HURST, REES, ORME & BROWN,
LONDON.

1814.



ADVERTISEMENT.

To determine on the best mode of drawing up this Report, was attended with peculiar difficulties.

In the first place, no model existed of a work of the same description. No attempt has ever before been made, under the sanction of public authority, to give a comprehensive view of the agricultural state, and political circumstances of this or any other country; and if it had been made, it must have been defective, from the want of such information as has been obtained for the present work, both from the County Reports, and the Parochial or Statistical Surveys.

In the second place, it was difficult to prepare a work, that should neither be, on the one hand, too general, nor on the other too much detailed. If the various subjects discussed in this Report, had been minutely entered into, being founded on the basis of such an extensive mass of information, it must have required ten or twelve volumes to have completed the work. On the other hand, if it had been attempted to have compressed the work into one or two volumes, a variety of important information must have been omitted. It was therefore thought

most expedient to adopt an intermediate plan, the nature of which will appear from the following observations.

1. Being a *General Report*, minute details were to be avoided, and the work was thus restricted to a size that might be generally read, and easily purchased. For the accomplishment of these objects, the Report itself, independent of the Appendixes, has been condensed into three volumes octavo, of a size similar to the larger County Reports, or the Statistical volumes.

2. But as a report of so limited a size, cannot possibly contain all that mass of useful matter which has been accumulated regarding the agricultural state, and political circumstances of Scotland, the details respecting each subject, are given in Appendixes, which may be consulted by those, who are desirous of obtaining more particular information. For instance, in the Report itself, a *general view* is given, of the nine great agricultural divisions of Scotland, in seventeen pages; and in the Appendix, there is a *particular description of each county in these several districts*, requiring, in all, about one hundred pages more. These descriptions are interesting to Scotchmen, and must be particularly gratifying to the inhabitants of the several counties therein described. But if all that matter had been included in the Report itself, a native of England, or Ireland, who would have perused with equal pleasure and instruction, a general and concise account of districts on

a large scale, would probably have laid aside the work, as containing a number of details, regarding smaller districts, in which he could feel but little interest.

In like manner, a stranger might desire to know the size of the greater rivers, and most considerable lakes in Scotland, the extent of its sea-coast, including its numerous bays, or arms of the sea; and to form some idea of its minerals, and of the commerce and manufactures of the country; but to enter into the minutiae of these heads of inquiry, would have rendered the Report itself too prolix and bulky.

In short, it was proposed to draw up a work, resembling as much as possible the plan generally followed, when Reports are made to the Sovereign, by any Board of Commissioners, or to either House of Parliament, by a Committee appointed for the investigation of any particular point. In such cases, the subject under discussion, and its results, are clearly, yet concisely stated in the body of the report; while the minute details of particular circumstances, and the evidence on which the whole is founded, are contained in an appendix, or series of appendixes.

An erroneous idea has been entertained by some, that this Report ought to have been entirely confined to agricultural topics. But it must not be forgotten, that the institution, under the direction of which the Report has been drawn up, is not only a Board of Agriculture, but also "of Internal Improvement;" and that the Report itself, not only

embraces the agricultural state, but the *political circumstances of Scotland*. Both ought, therefore, to be discussed in a Report, the result of which may ultimately be submitted to the consideration of Parliament.

These are the principles on which the General Report of Scotland has been drawn up, as furnishing the most likely means of rendering it generally useful, and calculated to answer the important purposes for which it was undertaken.

JOHN SINCLAIR.

EDINBURGH, }
December 1813. }

CONTENTS

OF

VOLUME FIRST.

	PAGE.
Preliminary observations,	1
1. Origin and progress of the undertaking,	ib.
2. Plan of the work,	6

CHAP. I.

ON THE GEOGRAPHICAL STATE, AND GENERAL CIRCUMSTANCES OF SCOTLAND,	10
SECT. 1. Situation and extent of Scotland,	ib.
General table of the extent of the several counties of Scotland,	13
— 2. General divisions,	14
1. Political divisions,	ib.
1. Representation of the Peerage,	ib.
Table of the Scottish Peerage,	15
2. Parliamentary representation of the counties or landed property,	16
Table of landed representation,	17
3. Representation of the boroughs,	18
2. Ecclesiastical divisions,	19
Ecclesiastical table,	20
Table of religious persuasions,	21
3. Agricultural divisions,	22
District 1. The south-east Lowlands, or arable district,	ib.
— 2. The southern, or pastoral division,	24
— 3. South-west Lowlands, or manufacturing district,	26
— 4. The central division,	28
— 5. North-east Lowlands,	30
— 6. The West Highlands,	32
— 7. The North Highlands,	33
— 8. The Hebrides, or Western Islands,	34
— 9. The Northern Islands,	35
General view of the nine agricultural districts,	57

	PAGE.
SECT. 3. Climate of Scotland,	38
1. General observations respecting the climate,	ib.
1. Latitude,	39
2. Situation with respect to the adjacent seas and continents,	40
3. Peculiar soil and natural productions,	42
2. Abridged results of meteorological tables,	44
1. The barometer,	ib.
2. The thermometer,	45
3. Rain,	ib.
4. Winds,	46
5. Electrical and other phenomena,	ib.
— 4. On the surface, soils, and subsoils of Scotland,	47
1. On the general appearance of the surface,	48
2. On the particular constitution and qualities of the more fertile soils, and the extent of each,	49
1. Sand,	53
2. Gravel,	ib.
3. Peat,	54
4. Obdurate clay or till,	55
5. Rich or improved clay,	ib.
6. Loam,	ib.
7. Alluvial soils,	56
Table of the productive soils in English acres,	58
3. On the subsoils,	59
4. On the advantages of a more minute investigation regarding the soils and subsoils,	62
— 5. On the minerals and fossils of Scotland,	64
1. Coal,	ib.
2. Lime,	67
3. Iron,	68
4. Lead,	69
5. Copper,	71
6. Common building stones, basalt, &c.	72
7. Blue slate,	73
8. Grey slate, or thin sandstone,	ib.
9. Marble,	74
10. Precious metals,	ib.
11. Precious stones and pearls,	75
12. Marl,	76
13. Scarcer mineral and fossil substances,	77
— 6. On the waters of Scotland,	ib.
1. Rivers and streams,	78

	PAGE.
2. Fresh-water lakes, - - - - -	80
Table of the principal Scottish lakes, - - - - -	81
3. Of firths, and inlets of the sea, - - - - -	82
4. Mineral waters, - - - - -	ib.
Of the geographical, or the natural advantages and disadvantages of Scotland, - - - - -	83
 CHAP. II. 	
OF THE STATE OF LANDED PROPERTY IN SCOTLAND, - - - - -	87
SECT. 1. Of the value and extent of estates in Scotland, - - - - -	ib.
Tabular view of the landed estates in Scotland, estimated according to their valued rent, - - - - -	89
— 2. Of the tenures by which landed property is held, - - - - -	90
1. General tenures, - - - - -	ib.
2. Local tenures, - - - - -	92
— 3. Of the management of estates, - - - - -	93
— 4. Of the qualifications in land required in those who vote at county elections, - - - - -	97
— 5. Of property held in common, - - - - -	99
— 6. Of property held under entail, - - - - -	101
— 7. Of property held by corporate bodies, - - - - -	106
— 8. Of the manner of registering deeds in Scotland, affecting landed property, - - - - -	107
— 9. Of servitudes affecting landed property, - - - - -	109
— 10. Of burdens affecting landed property, - - - - -	111
§ 1. Law charges, - - - - -	112
§ 2. Parochial burdens, - - - - -	ib.
§ 3. Provincial burdens, - - - - -	115
§ 4. National burdens, - - - - -	ib.
§ 5. Miscellaneous burdens, - - - - -	114
On the advantages of possessing landed property in Scotland, - - - - -	115
Table of the state of landed property in Scotland, - - - - -	122
Table of the gross amount of rent, or annual value of lands, houses, &c. in the several counties of Scotland, as assessed under the Property Act, for the year ending 5th April 1811, - - - - -	123
 CHAP. III. 	
OF BUILDINGS, AS CONNECTED WITH AGRICULTURE, - - - - -	125
Preliminary observations, - - - - -	ib.
SECT. 1. Of cottages, - - - - -	126
— 2. Of farm-houses and offices, - - - - -	131

	PAGE.
Principles to be attended to in the construction of farm-houses and offices, - - - - -	134
Of the accommodation required on arable farms, -	157
1. Farm-houses, - - - - -	ib.
2. Barns, - - - - -	138
3. Granaries, - - - - -	141
4. Stables, - - - - -	142
5. Feeding-houses, - - - - -	144
6. Cow-houses or byres, - - - - -	148
7. Calf-houses or pens, - - - - -	ib.
8. Dairies, - - - - -	149
9. Poultry-house, - - - - -	151
10. Pig-houses, - - - - -	ib.
11. Boiling or steaming houses, - - - - -	152
12. Cart-shed and repository for implements, -	153
13. Root-house, - - - - -	ib.
14. Stack or rick yards, - - - - -	154
15. Straw yards, (or courtines), dung-pits, &c. -	155
General remarks on the size and arrangement of farm-offices,	156
— 3. Of houses for proprietors of moderate fortune, who reside on, and cultivate their own estates, - - - - -	158
General observations regarding buildings of an agricultural description, - - - - -	163

CHAP. IV.

ON THE OCCUPATION OF LAND IN SCOTLAND, - - -	165
Preliminary observations, - - - - -	ib.
PART I. On lands occupied in common, - - - - -	166
— 2. On lands occupied by the proprietor, - - - - -	170
1. On the occupation of land by proprietors of small estates, -	ib.
2. On the occupation of land by proprietors of considerable estates, - - - - -	171
— 3. On land occupied by farmers, - - - - -	176
SECT. 1. Size of farms, - - - - -	177
— 2. Character of the farmers, - - - - -	184
— 3. Leases, - - - - -	188
— 4. Rent, - - - - -	194
— 5. Burdens to which the occupier is liable, -	203
— 6. Expence and profit of farming, - - - - -	205
Conclusion, - - - - -	208

	PAGE.
CHAP. V.	
IMPLEMENTS OF HUSBANDRY,	213
Preliminary observations,	ib.
SECT. 1. Implements of tillage,	214
1. Ploughs,	ib.
The improved Scotch plough,	216
2. Harrows,	217
3. Horse-hoes,	220
4. The scuffler, grubber, cultivator, &c.	221
— 2. Implements for reaping corn,	222
— 3. Implements for harvesting corn,	224
— 4. Implements for threshing and cleaning corn,	226
Fanners or winnowing machine,	232
— 5. Implements of conveyance,	233
Carts, or wheel carriages in general,	235
— 6. Implements for draining land,	243
— 7. Rollers,	244
— 8. Drill-machines,	246
— 9. Miscellaneous articles,	247
Conclusion. —1. Of the materials of which the implements of husbandry are generally made,	250
2. Of the means of preserving the implements of hus- bandry,	252
3. Of the means of improving the construction of imple- ments of husbandry,	253
List of useful agricultural implements, with a note of the price,	254

CHAP. VI.

ON INCLOSING LAND, AND THE NATURE AND ADVANTAGES OF FENCING,	257
Introduction,	ib.
PART 1. On the laws of Scotland respecting the division of property held in common, and the inclosure of land,	259
SECT. 1. General views on this subject,	ib.
— 2. Of the statute law of Scotland, as applicable to the division and inclosure of land,	261
— 3. Of the division of commons,	262
— 4. Of the division of run-rig lands,	265
— 5. Of straighting and fencing boundaries,	266
— 6. Of the protection of inclosures,	ib.

	PAGE.
PART I. SECT. 7. Of the common law of Scotland in these cases,	268
— 8. Of arbitration, for attaining some of the purposes already mentioned,	ib.
— 9. Of settlements by private agreement,	269
— 10. General observations on the subject,	270
— 2. Of the advantages derivable from inclosures, and the principles on which they ought to be conducted,	271
Preliminary observations,	ib.
SECT. 1. General view of the advantages of inclosures,	273
— 2. Advantages of inclosures to proprietors,	274
— 3. Advantages of inclosures to farmers,	275
— 4. Advantages to the labourers,	278
— 5. Advantages of inclosures to the public,	ib.
— 6. Practical illustrations of the advantages of inclosures,	280
— 7. Of the proper means to be employed in the inclosure of land,	282
— 8. Of the expence of inclosure,	283
— 9. Miscellaneous circumstances to be considered in forming a well digested plan of inclosure,	284
— 3. Of the various modes and sizes of inclosures,	287
General views,	ib.
SECT. 1. Of inclosures on low and rich soils,	ib.
— 2. Of inclosures in the vicinity of towns and villages,	289
— 3. Of inclosures on low arable farms,	290
— 4. Of inclosures on upland arable farms,	291
— 5. Of inclosures on sheep farms,	292
— 6. Of inclosures in pleasure grounds,	296
— 7. Of inclosures on new farms,	297
— 8. Miscellaneous considerations connected with inclosures,	298
— 4. Of fences, gates, and styles,	301
SECT. 1. Of the nature of fences in general,	ib.
— 2. Of the dry stone-wall, and Galloway dike,	304
— 3. The sod-wall, or feal-dike,	307
— 4. Hedge and ditch,	309
— 5. Of wooden fences,	326
— 6. Of the expence of different kinds of fences,	327
— 7. Of field gates,	328
— 8. Of styles and wickets,	334
Conclusion,	335

CHAP. VII.

ON THE MANAGEMENT OF ARABLE LAND IN SCOTLAND,	341
Preliminary observations,	ib.
PART I. Of tillage in general, and the operations connected with that fundamental branch of agriculture,	343
SECT. 1. Of ploughing,	ib.
— 2. Of harrowing,	360
— 3. Of rolling,	362
— 4. Of scarifying,	363
— 5. Of sowing broadcast,	365
— 6. Of drilling,	366
— 7. Of putting in crops without ploughing,	371
— 8. Of changing seed,	372
— 9. Of horse-hoeing,	375
— 10. Of hand-hoeing,	376
— 11. Of weeding,	377
— 12. Of reaping and harvesting,	381
— 13. Of stacking,	390
— 14. Of threshing,	400
— 15. Of dressing grain,	407
— 16. Of gleaning,	411
— 17. Of stubbles,	ib.
— 2. Of fallowing,	413
SECT. 1. Advantages of fallow,	ib.
— 2. Disadvantages of fallow,	416
— 3. Result of the discussion,	417
— 3. Course of crops,	424
Introductory remarks,	ib.
SECT. 1. Rotations on clay soils,	428
— 2. Rotation on loams,	431
— 3. Rotations on light land,	432
— 4. Rotation on sandy soils,	435
— 5. Rotation on peat,	437
— 6. Rotations according to elevation and climate,	ib.
1. Of elevated pastures,	438
2. Of the edges of the moors,	439
3. Of water sides,	441
— 7. Of rotations according to the state of culture,	442
— 8. Miscellaneous circumstances,	444

	PAGE.
PART 4. Of the articles principally cultivated for their seed, -	446
SECT. 1. Of wheat, - - - -	447
— 2. Of rye, - - - -	482
— 3. Of barley, - - - -	486
— 4. Of oats, - - - -	500
— 5. Of beans, - - - -	515
— 6. Of peas, - - - -	526
— 5. Of articles principally cultivated for their leaves and stems, 533	
SECT. 1. Of rye-grass and clovers, including the practice of soiling, - - - -	ib.
— 2. Of tares, - - - -	548
— 6. Of articles principally cultivated for their roots, - 552	
SECT. 1. Of turnips, - - - -	ib.
— 2. Of ruta-baga, or Swedish turnip, - - - -	567
— 3. Of potatoes, - - - -	571
— 4. Of carrots, - - - -	579
— 7. Of miscellaneous articles cultivated on arable land, - 582	
SECT. 1. Of flax, - - - -	ib.
— 2. Of hemp, - - - -	590
— 3. Of articles not commonly cultivated, or which might be introduced with advantage into this country, 596	
Conclusion.—General remarks on the Scotch system of hus- bandry, - - - -	602

GENERAL REPORT,
OF THE
AGRICULTURAL STATE, AND POLITICAL
CIRCUMSTANCES,
OF
SCOTLAND.

PRELIMINARY OBSERVATIONS.

BY SIR JOHN SINCLAIR.

It is proposed, in this introduction, to give a concise account of the origin and progress of the undertaking, and a plan of the work.

I.—ORIGIN AND PROGRESS OF THE UNDERTAKING.

THE BOARD of AGRICULTURE and INTERNAL IMPROVEMENT, was constituted in August 1793, by a charter from the Crown, in consequence of an Address from Parliament recommending such an establishment.

Among the various objects to which the attention of the new institution was directed, the most essential undoubtedly were, first, to ascertain the agricultural and general state of the country; and next, to point out the means of its improvement.

In order to carry on these important investigations, the Board commenced its proceedings, by employing a number

of individuals, to draw up Agricultural Reports of the several districts of England and Scotland. These reports, intended as a basis for future inquiries, were very extensively circulated, for the purpose of receiving the additions and corrections of those who were conversant in the various topics to which they related. Even these original sketches, taken in a collective point of view, are of great value. It was observed of them, by an author, distinguished for his skill in husbandry, "that in the course of little more than one year, the Board of Agriculture had printed a body of authentic facts, respecting the agricultural, and internal economy of this country, greater than was ever obtained, in any other nation, since the beginning of time*."

After every district in the island had thus been described, the Board resolved to survey the kingdom a second time; and to have the Reports of the several Counties again drawn up, *according to one uniform, or general plan*. The practices adopted in one county, might thus, with more ease, be compared with those of another; and the state of any particular branch of agricultural inquiry, might be traced throughout the whole Island, and compared, by any individual, with the result of his own experience and observation. These Reports, including both England and Scotland, amounting to about seventy volumes octavo, are now on the eve of being completed. In them will be found, (as has been emphatically expressed by another eminent writer), "more useful and distinct information, on various branches of Agriculture, and on rural concerns in general, than was in print, before these were drawn up †."

In addition to the County Reports, the Board of Agriculture has carried on an extensive correspondence, with such individuals, both at home and abroad, as were most

* Essays relative to agricultural and rural affairs, by Dr James Anderson, vol. iii, p. 4.

† Dr Coventry's Discourses on Agriculture and Rural Economy, vol. i, 8vo, p. 187. (Printed in 1808).

likely to furnish it with useful information. The result of that correspondence, comprehended in seven quarto volumes, is printed under the title of "*Communications to the Board of Agriculture,*" and contains a number of papers of considerable merit.

Besides these publications, the Board has likewise printed several distinct works on specific subjects, regarding the manufacture of bread, the culture of potatoes, &c. ; and, in particular, a valuable paper, explaining the best mode of Draining Land, on the principles of the celebrated Elkington.

So great a collection of important facts, arranged in general, under distinct heads, and accompanied by useful explanations, has never perhaps been amassed, regarding any other branch of human knowledge. There is reason indeed to believe, that no subject has engaged so much public attention, or been so thoroughly examined, as that of Agriculture, by means of the inquiries recently carried on. The publications of the Board, however, are so numerous, that many individuals cannot afford to purchase them, and others cannot find sufficient leisure for their perusal : and as the Board was established with a view, not only of collecting information, *but of digesting it when collected*, it became its duty to compress, within moderate limits, the result of all these various publications, so as to render, at least the substance of the whole, accessible to every proprietor and farmer in the kingdom. Hitherto the Board has been employed, in collecting the materials necessary for a great erection ; but the edifice must now be raised, by the formation of which, the future improvement and prosperity of the country will be most essentially promoted. There is every reason to believe, that the advantages which are thence to be derived, will most amply compensate, both the labour which individuals have bestowed upon it, and the expence, (moderate for an undertaking of such extent and importance), which it may have cost the nation.

In drawing up a general view of the agricultural and political state of the kingdom, and explaining, at the same time,

the circumstances of the country, regarding the various important particulars connected with these subjects, it appeared highly expedient, to follow the comprehensive system adopted, in preparing the enlarged County Reports for publication; and according to which, they will probably be again executed, as soon as the improvements that take place in the country, may render a new Survey necessary or desirable.

It was also judged proper, that a General Report of the Agricultural State of England, should be distinct from that of Scotland. These countries, though now happily united in a political point of view, differ essentially in other respects, as in soil, climate, markets, capital, systems of husbandry, &c. Any attempt, therefore, to conjoin them in the same General Report, would necessarily create confusion. It will likewise be much easier, for a native either of England or of Scotland, to prepare an account of any branch of husbandry, or any department of political economy, regarding his own country alone, than if he were at the same time under the necessity, of attending to the systems or practices of another kingdom, with the customs of which he is imperfectly acquainted. Besides, when the accounts of the two kingdoms are kept separate, a species of laudable emulation must be excited, among those by whom they are respectively undertaken, which cannot but conduce to render each Report more complete; and although that plan may, in some degree, increase the expence, yet, ultimately, it must prove of the greatest advantage to both countries.

It was likewise thought most advisable, to begin with the Report of Scotland. In addition to the County Reports of that part of the united kingdom, great assistance was to be derived, from a work completed there, in twenty-one volumes octavo, entitled, "The Statistical Account of Scotland," which contains a detailed account, drawn up by the resident Clergyman, of every parish in that part of the Island.—Nothing can be more satisfactory, than a relation of facts resting on such authority; and no other country in Europe possesses such a document. Regarding that work, an able

political author has recently declared, "that the very valuable accounts collected in it, will ever remain an extraordinary monument of the learning, good sense, and general information of the clergy of Scotland." He adds, "that it exhibits a better picture of the internal state of a country, than has yet been presented to the world *." With such a basis, the experiment of the proposed plan of "*A General Report*," may be tried, in regard to Scotland, with peculiar advantage. Parliament will thence be enabled to judge, whether it should be extended farther, and in what respects the system may be improved.

In order to draw up this General Report of Scotland with accuracy, a number of well-informed individuals have been selected, to each of whom, one, or at the utmost two, or three, important heads or chapters, and sometimes only a particular section of peculiar importance, have been intrusted. So various are the points, either directly or indirectly, connected with the political economy, or the agricultural interests and improvement of a country, *that no single individual, nor even two or three individuals, can be competent to the task, of completing so great a work, in the manner in which it ought to be executed.* A good corn farmer, for instance, may be unacquainted with the best mode of managing grass lands; and a person perfectly conversant in the management of live stock, may be unable to give a proper description of the implements of husbandry, or of the buildings necessary for a farmer. Different persons, therefore, were selected, conversant with each department; and they were severally furnished, with the information contained in the County Reports, connected with each particular head, and with such other publications, as might enable them, with the aid of their own personal observation and experience, to prepare the portions of the work they had respectively undertaken. In order to render the whole as complete as possible, the portions thus pre-

* Malthus on Population, 1st edit. 1803, p. 13 and 14, note.

pared, were submitted, in a printed state, to the consideration of several respectable individuals, who voluntarily undertook to revise and correct them.

With all these precautions,

A GENERAL REPORT,

OF THE AGRICULTURAL STATE, AND POLITICAL CIRCUMSTANCES OF SCOTLAND,

has been drawn up, and is now submitted to the consideration of the public.

It may next be proper to explain, the details of this undertaking.

II.—PLAN OF THE WORK.

A beneficent Sovereign, a patriotic Minister, or a wise Legislature, would naturally be desirous to ascertain a variety of particulars, relative to the state of a country, before they adopted any decisive measures for its improvement. Indeed, without such a previous inquiry, the ablest rulers might commit innumerable errors, and their well-meant endeavours, might not only be completely frustrated, but might prove the source of much mischief. Whereas, if the circumstances connected with the agricultural and political state of the country, be previously investigated, the beneficial measures which may be carried into effect, are both numerous and important.

The following appear to be the principal objects concerning the internal state of a country, which it would be desira-

ble, for an enlightened and patriotic government to ascertain :

1. The geographical state and general circumstances of the country ;—its situation and extent ;—political, ecclesiastical, agricultural, and other divisions ;—climate ;—surface, soils and subsoils ;—minerals ;—waters, more especially the rivers, streams, lakes, and arms of the sea ;— and its geographical or natural advantages and disadvantages.

2. The different tenures by which the territory of the country is held ;—the number of proprietors, in as far as that can be ascertained, and the system according to which their estates are generally managed.

3. The nature of the buildings inhabited by the class of husbandmen, and their dependents, with the accommodations they require.

4. The mode in which the land is occupied ;—whether possessed in severalty, or in common ; the rent paid to the proprietors ; the nature of the leases granted to the farmers, the covenants they contain ; and any other particulars connected with the occupation of the soil.

5. The various sorts of implements employed in husbandry ; their construction, uses, properties, price, mode of preservation, &c.

6. Whether the land be inclosed or open ; and where the fields are inclosed, the nature of the fences, the expence of making them, and the advantages attending them.

7. How the land, in actual cultivation for farming purposes, is managed, and the various crops raised on it, whether as food for man, for domestic animals, or for other purposes ; also, the most useful practices in the management of arable land, and those which ought to be avoided.

8. How the land in grass is occupied, whether converted into meadows for hay, or employed in pasture ; also, the various sorts of grasses that ought to be preferred, either for meadows or pasture land ; and the preferable systems for laying land down in grass, or breaking it up again.

9. The state of the gardens and orchards in the different districts, and the best mode of managing them, more especially the extent and management of those possessed by the farmer and the cottager.

10. The extensive subject of woods and plantations, which are not only of such peculiar importance, with a view to the conveniences and luxuries of social life, but so essential to the prosperity of a maritime power.

11. The state of any part of the territory, whether mountains, moors, bogs, or marshes, lying in common, or waste and unproductive, and the means of rendering such tracts fertile.

12. The best means of rendering the cultivated land of a country more productive, and of preserving it in that state, more especially the improvements effected by draining,—paring and burning,—manuring,—flooding, and irrigation.

13. The means of increasing the productive territory of the country by embankments against the sea, and against lakes or rivers.

14. The various particulars respecting the live stock of the country, as cattle, sheep, horses, &c.; the different breeds of each kind, their food, management, distempers, value, &c.

15. The topics connected with what may be called rural economy, as labour, provisions, fuel, &c.

16. The particulars connected with political economy, as the nature and the extent of the agricultural, or of other branches of national industry, and the means of improving them; the facilities of intercourse, by the establishment of fairs and markets, the formation of roads, &c. the population of the country, and its distribution; and the state of its poor.

17. The obstacles to improvement to whatever circumstances they may be attributed, as want of capital, deficiency of markets, defective police, &c.

18. Such articles of a miscellaneous nature, as could not be comprehended under any of the preceding heads: for in-

stance, the nature and advantages of Agricultural Societies, &c.

19. The whole Inquiry to conclude, with a general view of the Means of Improvement, and the measures calculated for that purpose.

Such is the nature of the plan, according to which Reports have been made to the Board of Agriculture, regarding every county in Great Britain, amounting to seventy-five in all, and the substance of which, in so far as relates to Scotland, it is proposed shall be contained in this General Report, arranged in a similar manner.

To prevent the work from swelling to a size that might be objected to, compression has been studied, as far as was thought consistent with perspicuity; and all matters of minute detail, that could not properly be placed in the body of the work, are inserted in Appendixes.

On the whole, every endeavour has been made, to render the work as perfect as could be expected, in a new attempt of a nature so peculiarly extensive and laborious; and with such a basis as the information here given, it is to be hoped, that useful knowledge will be rapidly diffused, and that by the union of public encouragement, and private exertion, this part of the united kingdom, will be raised to an unexampled degree of happiness and prosperity.

 CHAP. I.

 OF THE GEOGRAPHICAL STATE, AND GENERAL CIRCUM-
 STANCES OF SCOTLAND.

THE subjects proposed to be discussed in this Chapter are ;

1. The Situation and Extent of Scotland, including its numerous Islands.
2. Its Divisions, Political, Ecclesiastical, and Agricultural.
3. Climate.
4. Surface, Soils, and Subsoils.
5. Minerals.
- And, 6. Waters ; to which will be added, some observations on the geographical, or the natural advantages, and disadvantages of the country.

 SECT. I.

SITUATION AND EXTENT OF SCOTLAND.

BY MR GEORGE ROBERTSON.

SCOTLAND, exclusive of its islands, is situated between $54^{\circ} 37'$ and $58^{\circ} 42'$ north latitude, and between $1^{\circ} 47'$ and $6^{\circ} 7'$ longitude west from London. It is bounded on the south-east, for about 75 miles, by England, from which it is divided, for a few miles by the Solway Firth, the rivers Esk and Sark, Liddell and Tweed, and other streams, or well-known limits ; and every where else by the sea.

The most southerly point is the Mull of Galloway, in longitude $4^{\circ} 45'$ west; and the most northerly of what may be called the continent of Scotland, is the Dunnet-head, in Caithness, in longitude $3^{\circ} 27'$. The distance between these extreme parallels is $284\frac{1}{2}$ miles; but Scotland no where extends so far in a line due north and south. Its greatest length, in that direction, is, from the Mull of Galloway in the south, to Farout-head in Strathnaver in the north, in the same longitude, in which the distance is 275 miles.

The breadth is very unequal. The greatest, in a line east and west, is from Buchanness in Aberdeenshire, to the point of Rownamoan in the territory of Applecross in Ross-shire, where it is 147 miles. From Montrose Point in Angus, to the Point of Ardnamurchan in Argyll, it is 137; and from St Abb's head in Berwickshire, to the Point of Knap in Argyll, 134. In the northern part of the kingdom, it is only 71 miles at its greatest breadth, viz. between the Noss-head in Caithness, to the Point of Assint in Strathnaver. But the narrowest point is from the mouth of the Firth of Dornoch in the east, to Loch Broom in the west; where it is contracted to a breadth of only 36 miles from shore to shore, without ascending these respective arms of the sea. These distances are all taken in parallel lines from Arrowsmith's large map, which has been constructed on good authorities, and in general seems to be correct.

The whole surface of the mainland of Scotland, as calculated with great care from that map, amounts to about 25,520 square miles of land, and 494 square miles of fresh-water lakes.

Besides these lakes in the interior, the salt water firths, bays, and lochs, are very numerous and extensive. Were the whole space to be measured between the outlines as above described, it would contain 46,846 square miles. Hence, the surface of these firths and bays would amount to 20,807 square miles; but calculating the space contained in a firth or bay, only from the head-lands or promontories on each

side, the total may be estimated at 5000 square miles. As these firths or bays cut deep into the land on all sides, they afford great facility to navigation in general, and to the fisheries in particular,—sources of great emolument to the Scottish nation; but they are not included in the total extent of Scotland.

What has been stated, relates merely to the continent or mainland of Scotland. There are, besides, a great number of islands belonging to it, and many of them of considerable extent. Some of these are situated as far north as latitude $61^{\circ} 13'$, and the whole lie between the meridian of London on the east, and $8^{\circ} 18'$ of west longitude. They are usually classed under two distinct divisions,—the Hebrides on the west coast, and the Orkney and Zetland islands towards the north. They comprehend in all an area of 4224 square miles. Thus Scotland, with its lakes and islands, but not including its bays, altogether extends over a surface of 30,238 square miles.

The following table details the size of the several counties; and the extent, both of the land, and of the fresh-water lakes which they respectively contain.

General Table of the Extent of the several Counties of Scotland.

NAME.	Square miles of Land.	Ditto of Lakes.	Whole Extent.
Aberdeen,	1960	10	1970
Argyll, besides islands,	2200	60	2260
Ayr,	1059	6	1045
Banff,	645	2	647
Berwick,	442	—	442
Caithness,	687	10	697
Clackmannan,	48	—	48
Cromarty,	256	10	266
Dumbarton,	228	31	259
Dumfries,	1253	10	1263
Edinburgh,	354	—	354
Elgin,	473	7	480
Fife,	467	3	470
Forfar,	888	4	892
Haddington,	279	—	272
Inverness, besides isles,	9904	132	5056
Kincardine,	380	2	382
Kinross,	72	7	79
Kirkcudbright,	821 $\frac{1}{2}$	12 $\frac{1}{2}$	834
Lanark,	942	3	945
Linlithgow,	120	—	120
Nairn,	195	3	198
Peebles,	319	—	319
Perth,	2588	50	2638
Renfrew,	225	2	227
Ross, besides isles,	2069	60	2129
Roxburgh,	715	$\frac{1}{2}$	715 $\frac{1}{2}$
Selkirk,	265	1 $\frac{1}{2}$	264 $\frac{1}{2}$
Stirling,	489	13	502
Sutherland,	1754	47	1801
Wigton,	451 $\frac{1}{2}$	7 $\frac{1}{2}$	459
Total Mainland of Scotland,	25,520	494	26,014
The Hebrides or Western Isles, ..	2,800	104	2,904
The Orkney Islands,	425	15	440
The Isles of Zetland,	855	25	880
Whole of Scotland and its Isles, ...	29,600	638	50,238
N. B.—The Hebrides are attached to five different counties, viz.			
1. Bute and its Isles,	161	4	165
2. Argyllshire Islands,	929	21	950
3. Inverness-shire Islands,	1150	59	1209
4. Ross-shire, viz. Lewis,	532	20	572
5. Cromartyshire,	8	—	8
Hebrides in all, as above,	2800	104	2904

 SECT. II.

GENERAL DIVISIONS.

BY THE REV. DR SKENE KEITH, AND MR GEORGE ROBERTSON.

THE general divisions of Scotland may be considered under three distinct heads: 1. Political; 2. Ecclesiastical; and 3. Agricultural.

I.—POLITICAL DIVISIONS.

THE most important point, connected with the political state of Scotland, is, unquestionably, its system of Parliamentary Representation,—whether 1. of its Peerage; 2. of the counties, or landed property; and 3. of the boroughs, or commercial interest. It is not here proposed, to enter into any disquisition regarding the origin of these rights, nor how they are at present constituted, but merely to state how they are respectively enjoyed at this time.

1. *Representation of the Peerage.*

The number of Peers in Scotland, at the Union in 1707, amounted to 154; and as such an addition to the Peerage of England*, which then amounted to 190, (the Archbishops and

* *English Peers at the Union.*

Dukes and Duchesses,	24
Marquises,	3
Earls and Countesses,	68
Viscounts,	9
Barons and Baronesses,	60
	<hr/>
	164
Archbishops 2, Bishops 24,	26
	<hr/>
Total,	190

Bishops included), was neither in proportion to the extent of the two countries, nor to their population, or revenue, or any other fair criterion, it was found necessary to restrict the Scotch Peers, entitled to sit in the British Parliament, and sixteen was fixed upon; a number which, it is contended, is not equal to the just claims of the northern part of the kingdom. It appeared, indeed, that the Commissioners on the part of Scotland, insisted on the tenth part of the representation of England*, which would have amounted to 50 Commoners, and 19 Peers; nor is there any bar in the way of that increase, the number being restricted to 45 Commoners and 16 Peers, "by virtue of that *treaty only*," leaving an opening for an adequate increase, whenever the circumstances of the case shall justify it †.

In conformity with the system adopted regarding the representation of the Scotch Peerage, the 16 Peers are elected for every new Parliament, by the whole body of the Peerage, duly qualified to vote at the period when the election takes place, and are not, when once elected, continued for life, as is the case in regard to Irish Peers, by the recent union with Ireland.

The following table will give an idea of the diminution that has taken place in the numbers of the Scotch Peerage, since the Union, and their amount at present.

Table of the Scottish Peerage.

1. Number of Scotch Peers at the Union,	154
2. The Duke of Rothsay, when entitled to vote,	1
3. Added by subsequent orders of the House of Lords,	4

159

Of whom

1. Extinct or dormant, including the title of Solway,	41
2. Merged in, or united to other titles,	10
3. Forfeited,	26

77

Remain, 82

* De Foe's History of the Union, 4th edition, p. 165.

† See the papers given in by the Commissioners on the part of Scotland, on the 13th of June 1706, and the words of the 22d article of the Treaty of Union.

Of these 23, (including the Duke of Rothsay), are British Peers, but who still retain the privilege of voting at elections, and even continue eligible, though it can hardly be supposed, that these hereditary Peers would persuade their brethren, not enjoying the same privilege, to elect them.

At the last election on the 13th November 1812, there were 3 minors, 3 peeresses, and 2 Roman Catholics, consequently eight disqualified from voting. The Peers who actually voted were 52, and 22 were out of the kingdom or did not vote.

2. *Parliamentary Representation of the Counties or Landed Property.*

Scotland is divided into 33 counties, which are represented in Parliament by 30 commissioners, or knights of the shire. The following table contains the amount of the valued rent, in Scotch money, as it stood in 1674, and the number of freeholders or voters in each county. The number of freeholders must alter from year to year, according to the state of property, and various other incidental circumstances, as deaths, minorities, &c. The list here given, is the one drawn up for the year 1811, since which there has been but little variation.

Table of Landed Representation.

Counties represented.	Valued Rent in Scotch Money.	Number of Freeholders.
1. Aberdeen,	£. 235,665 8 11	147
2. Argyll,	149,595 10 0	50
3. Ayr,	191,605 0 7	146
4. Banff,	79,200 0 0	35
5. Berwick,	178,568 8 6 $\frac{7}{4}$	120
6. Bute, and } <i>per vices</i> ,	15,042 13 10	17
7. Caithness, } <i>per vices</i> ,	37,256 2 10	21
8. Clackmannan, and } <i>per vices</i> ,	26,482 10 10	19
9. Kinross, } <i>per vices</i> ,	20,250 4 3 $\frac{2}{3}$	15
10. Greenarty and } <i>per vices</i> ,	12,897 2 7 $\frac{6}{12}$	14
11. Nairn, } <i>per vices</i> ,	15,162 10 11 $\frac{1}{2}$	22
12. Dumfries,	158,502 10 0	74
13. Dumbarton,	35,527 19 0	41
14. Edinburgh,	191,054 3 9	125
15. Elgin,	65,603 0 5	35
16. Fife,	363,129 3 7 $\frac{3}{12}$	207
17. Forfar,	171,239 16 8	117
18. Haddington,	168,875 10 8	70
19. Inverness,	73,188 9 0	49
20. Kincardine,	74,921 1 4	73
21. Kirkcudbright,	114,597 2 5	135
22. Lanark,	162,131 14 6 $\frac{10}{12}$	98
23. Linlithgow,	75,018 10 6 $\frac{8}{12}$	62
24. Orkney and Zetland,	57,786 0 4 4 $\frac{7}{108}$	27
25. Peebles,	51,937 13 10	39
26. Perth,	339,892 0 9	178
27. Renfrew,	69,172 1 0	77
28. Ross,	75,043 10 5	69
29. Roxburgh,	314,663 6 4	133
30. Selkirk,	80,307 15 6	37
31. Stirling,	108,509 5 3 $\frac{1}{12}$	98
32. Sutherland,	26,093 9 9	28
33. Wigton,	67,641 17 0	51
Total,	£. 3,804,221 0 0	2429

It is to be remarked, that 6 of these counties are represented in Parliament by only three members, two of them, united for that purpose, electing a representative alternately, (a circumstance of a most peculiar nature, which is much complained of); and that the Zetland Isles, owing to some defect regarding their valuation, though entitled to share in the representation of Orkney, have as yet no freeholders on the roll.

Lands holding of the crown, to the extent of £. 400 Scotch of valued rent, or, in particular cases, what is called a *forty shilling land of old extent*, entitle the proprietor to a vote; and those freeholders only are included in the above table. There are, in every county, more persons who possess freehold property below, than such as have land either equal to, or above that valuation; and besides, the nobility are never put on the rolls of freeholders, whatever extent of property they may possess. This in some measure accounts for the number of freeholders being so low as 2429*. Were there to be a voter for every £. 400 of valuation, the total number would be 9511. Lands holding of a subject superior give no vote, whatever may be the amount of their valued rent.

3. Representation of the Boroughs.

The representatives of royal boroughs are limited to 15 in number, and are sent from the following towns:

1 from Edinburgh, including North and South Leith, and the West Kirk, or St Cuthbert's parish, the population of the whole, in 1811, was	102,987
1 from Jedburgh, Lauder, Haddington, Dunbar, and North Berwick, about	10,500
1 from Selkirk, Peebles, Lanark, and Linlithgow	9,600
1 from Stranraer, Wigton, Whithorn, and New Gal- loway	5,400
1 from Sanquhar, Kirkcudbright, Dumfries, Lochma- ben, and Annan	16,200
1 from Ayr, Irvine, Rothesay, Campbelton, and Inve- rary	24,500
1 from Glasgow, Rutherglen, Renfrew, and Dumbarton	109,500
8	Carry over, 278,687

* Another circumstance which contributes to this, is, that proprietors of entailed estates, can only sell their superiorities to their immediate vassals, and that it is unpleasant for a great landholder, to possess lands, the superiority of which is vested in another.

7	Brought over,	278,687
1	from Stirling, Culross, Dunfermline, Inverkeithing, and Queensferry	22,000
1	from Burntisland, Kinghorn, Kirkaldy, and Dysart.....	9,600
1	from Anstruther—East and West,—Pittenweem, Kilrenny, and Crail	5,330
1	from St Andrews, Cupar-Fife, Dundee, Perth and Forfar	65,000
1	from Brechin, Arbroath, Montrose, Bervie, and Aberdeen	58,200
1	from Kintore, Inverury, Banff, Cullen, and Elgin	8,600
1	from Forres, Nairn, Inverness, and Fortrose	17,000
1	from Dingwall, Tain, Dornoch, Wick, and Kirkwall	7,000
15 members from 66 towns.—Total population,		471,417

The above is calculated to be the population that *properly belongs* to the boroughs, exclusive of the country districts attached to some of the town parishes. With that addition, the total population would now, (*anno* 1812), amount to above 500,000 souls. But the number of persons who actually vote at the elections, is very inconsiderable, consisting in general of the magistrates, and town-council of the different boroughs.

Other particulars regarding the political divisions of Scotland, will be found in the Appendix, NO. I.

II. ECCLESIASTICAL DIVISIONS.

ACCORDING to the present establishment of the church, the country is divided into 893 Parishes, comprehended in 78 Presbyteries, which are again classed into 15 Synods,—all of which are represented in the General Assembly of the Church of Scotland, which meets annually at Edinburgh. In its deliberative and judicial capacity, this ecclesiastical court is justly accounted among the most enlightened and respectable in the Christian world.

In the division of the country into Synods and Presbyteries, conveniency has been principally attended to, the limits of counties being, in general, no further observed, than they are consistent with contiguity to the respective synodical and presbyterial seats. But, in the arrangement of the whole into parishes, contiguity to the churches has not been so much observed as it ought to have been; and, in many instances, remote parts are conjoined into one parish, to the great inconvenience of the parishioners, as well as of the officiating clergy. With respect to extent and population also, there is a great disparity;—the first was settled in remote times, the second has been determined, in a great degree, by the effects of manufactures and commerce.

The following table explains the Ecclesiastical Establishment of Scotland, as it stood in 1811.

Ecclesiastical Table.

Synods.	Presbyteries.	Parishes.	Clergymen.	Population in 1811.	Square miles.
Lothian & Tweeddale, ..	7	104	115	228,092	1190
Merse & Tiviotdale, . . .	6	66	66	72,226	1557
Dumfries,	5	53	54	77,481	1504
Galloway,	5	37	37	50,285	1275
Glasgow and Ayr,	7	124	152	421,595	2320
Perth and Stirling,	5	77	81	162,594	2506
Fife,	4	66	71	108,993	550
Angus and Mearns,	6	75	81	140,362	1282
Aberdeen,	8	97	101	156,006	2254
Moray,	7	51	54	86,543	2146
Ross,	3	23	23	40,803	1960
Sutherland & Caithness,	3	23	23	47,048	2498
Argyll,	5	39	41	95,732	3470
Glenelg,	5	29	29	71,975	4606
Orkney }	5	17	18	} 46,153	1320
Zetland * }	1	12	12		
15 Synods.	78	893	958	1,805,688	30,238

* Zetland stands in a peculiar predicament, not belonging to the Synod of Orkney, but having a presbytery, entitled to synodical powers.

The following table gives a general view of the manner in which the inhabitants of Scotland may be arranged, according to their religious tenets.

Table of Religious Persuasions.

1. The established Presbyterian Church.....	1,408,388
2. Seceders from the Established Church of various descriptions, but all holding presbyterian principles *,	256,000
	<hr/>
Total Presbyterians,.....	1,664,388
3. Separatists of various persuasions, as	
Baptists, Bereans, Glassites, &c.....	50,000
4. Roman Catholics.....	50,000
5. Scotch Episcopalians †.....	28,000
6. Methodists.....	9,000
7. Church of England †.....	4,000
8. Quakers, &c.....	300
	<hr/>
	141,300
	<hr/>
	1,805,688

It appears from this table, that so much does the genius of the Scottish nation incline to the Presbyterian form of religion, that nearly 19 parts in 20 of the people, are either adherents to the National Church, or have adopted tenets still more rigidly Presbyterian, than even that church itself.

Some other particulars concerning the ecclesiastical state of Scotland, and the various sects of dissenters from the Established Church, will be found in the Appendix, NO. II.

* For the names, and the numbers of these several sects, see Appendix, NO. II.

† These are the members of the Protestant Episcopal Church, which was dispossessed of its civil establishment at the Revolution in 1688, when Presbytery was established in its stead. They do not acknowledge the authority of the Bishops now officiating in Scotland, as the English Episcopalians do.

III. AGRICULTURAL DIVISIONS.

THESE might be considered under three general heads: 1. The Lowlands; 2. The Highlands; and, 3. The Isles: But, as several counties are situated partly in the Highlands, and partly in the Lowlands, and as the state of agriculture is pretty similar in several adjoining counties, it has, on the whole, been thought most expedient, to divide Scotland, in so far as regards its agricultural state, into nine districts; a short description of each of which is subjoined. It is not pretended that this division is perfectly accurate, or that any division can be so: But when large districts are thus examined separately, a more distinct idea of each province can be formed, and a more comprehensive view of the kingdom at large can be obtained, than by considering each county by itself.

District I.—*The South-east Lowlands, or the Arable District.*

This district includes the counties of Roxburgh, Berwick, and the three Lothians, and by way of pre-eminence it may be called *the arable district*, for agriculture is carried there, to as great perfection, as in any country of Europe. The proportion of land in cultivation is considerable; and its farmers, in general, are distinguished by intelligence, industry, and capital. Not only the extensive valleys, but even a great proportion of the hills, and elevated muirs, must attract the attention of every traveller, who can derive pleasure from beholding an improved system of agriculture; and the seats of the proprietors, adorned with numerous plantations of various sorts of trees, with the different cities, towns, and villages which are interspersed throughout, both enrich and vary the scenery. In this district is situated the metropolis of Scotland, which unites the advantages of natural situation, to the art and magnificence displayed in its fine buildings of beautiful freestone; and, from its containing the various

courts of law, the public offices, and a celebrated university, the population is much greater than either the agriculture or the commerce of the district would require. Hence, notwithstanding the number of hills, and the elevated and extensive muirs of this district, nearly three-fifths of the whole surface, are either in a high state of cultivation, or covered with plantations: And this division, with a moderate share of manufactures and commerce, contains, in one-sixteenth part of the extent, above one-seventh part of the population of Scotland. Among its mineral productions, freestone equally beautiful and durable, limestone of such importance both to the farmer and to the builder, and excellent coal, (more especially in the three Lothian counties, and near the metropolis), deserve to be particularly mentioned, even in this general account.

The several counties in this district may be thus discriminated:—Roxburghshire, the most southerly, has a great extent of hills, especially along the English border; some of which are of considerable elevation, and are adapted only to the pasturing of sheep. But the rich valley of Tiviot is a fine corn country; and, notwithstanding its distance from both lime and coal, has of late been much improved by its spirited farmers.—Berwickshire, though a large share of its surface, in the interior, is included in the *Lammermuir*, and best adapted for pasture, contains, in the *Merse*, soil that is equally fertile by nature, and well cultivated by its farmers, who are distinguished for intelligence, capital, and perseverance.—East Lothian is, in general, a highly cultivated plain, diversified by a few gentle eminences, and skirted on two sides by the German Ocean, and the Firth of Forth; but there is attached to it, a considerable share of the *Lammermuir*, naturally a barren district, though even on it the plough is annually making encroachments. No where in Europe is agriculture better understood, or better practised, than by the opulent and enterprising farmers of East Lothian, who, in general, occupy large farms, which are let at very high rents,

and bear the weightiest crops of wheat and beans on the heavy or dense, and of turnips and barley on the lighter or more friable soils. — Mid Lothian, or the county of Edinburgh, with a considerable variety of surface, and enriched by the manure of the metropolis, and the constant demand for its produce, (but with farms of smaller dimensions, and a soil inferior to East Lothian), unites ornament to industry; and derives wealth, not only from corn and green crops, but also from horticulture, in the neighbourhood of the metropolis. There, also, a spirit for agricultural improvement, induces many who follow the profession of the law, to vie with the farmer in the cultivation of the soil.—And West Lothian, or the county of Linlithgow, besides the correctness of its agriculture, by which it is distinguished in the more cultivated parts of the district, is ornamented by extensive plantations, which are laid out with taste, and cover a large proportion of surface that is not under the dominion of the plough; while the situation, on the banks of the Firth of Forth, adds to the beauty of the scenery, and to the advantages which the county naturally possesses.

District II.—*The Southern, or Pastoral Division.*

The Second District includes the counties of Peebles or Tweeddale, Selkirk, Dumfries, Kirkcudbright, and Wigton. In this district are the highest mountains south of the Forth; and from the great proportion of hills, which abound in excellent pasture, and the small extent of arable land, more of the surface is adapted for live stock, than for corn. Yet the vales, particularly in Dumfries-shire, are of considerable extent and fertility. In this division, the celebrated breed of polled cattle, the Galloway, is to be met with in great numbers; and there are also numerous and excellent flocks of hardy sheep. Yet, even the hills, and also the narrow valleys, now exhibit that great change, both of aspect and fertility, which is produced by improved systems of agriculture.

Considerable tracts of land, from forty to fifty years ago, and even later, were manured with shell marl; now, lime is preferred, as a more portable manure; and in the county of Dumfries, limestone is burnt, both for manure and buildings, to a very considerable extent. On the coasts of the counties of Kirkcudbright and Wigton, sea shells, and sea weed, and sleet, are much used. Partly owing to the distance of manure, and of fuel for burning lime, and partly to the great extent of hill territory, only four-fifteenth parts of the whole surface are in cultivation; and with nearly one-tenth part of the whole area of Scotland, this district contains only one-thirteenth part of the population. The lead-mines of Wanlockhead in Dumfries-shire, and the coal-pits in that county, and in a part of Peebles-shire, afford employment to a number of the inhabitants. A mine of antimony was, for several years, worked to advantage, in the county of Dumfries, and excellent quarries of sandstone abound in many different parts of it. Very valuable quarries of granite, of that species of rock called Siennite, also abound in Galloway. The vales and maritime parts of this district are very fertile, contain many beautiful seats, and are increasing rapidly in culture and population.

In this pastoral district, there is a considerable diversity of appearance. The windings of the Tweed add to the beauty of the scenery along the green hills of Tweeddale; and its valleys, here contracted to much narrower limits than in Berwickshire, are fertile in corn. Only a small proportion of the territory, however, is arable, and late harvests occasionally blast the prospects of the farmer, though in a smaller degree, since the introduction of early oats. In the county of Selkirk, formerly known under the name of "*The Forest*," a still smaller proportion of the land is under cultivation; but new plantations begin to rise, and will in time supply the place of those natural woods, with which, several centuries ago, this county abounded. The vales are enriched by shell marl. The green hills, both in this county, and in that of Peebles, are covered by numerous flocks of hardy

sheep. The three extensive *dales* of Dumfries-shire have each its distinguishing river; while their hills are pastured by sheep, partly by the Tweeddale, but chiefly by the Cheviot race. Great numbers of cattle are also found in these districts, and considerable tracts of land are now in cultivation. In both the divisions of Galloway, their excellent breed of cattle, and hardy breed of sheep, are supported much better than they were formerly, in consequence of the late improvements in agriculture; and not only oats and barley, but wheat of good quality, is raised to advantage, both on the sea-coast of Wigton, and in every other part of the arable district. The valley of the Southern Dee, in the stewartry of Kirkcudbright, has also been much improved; and though, on the banks of that river, there are neither coal-pits, nor lime-quarries, yet imported coal forms the chief article of fuel, and imported lime, the principal means of improving the land.

District III.—*South-West Lowlands Division, (where manufactures and commerce greatly prevail).*

The Third Division is washed by the Atlantic Ocean; and by means of a navigable canal, also communicates with the German Sea. It includes the counties of Ayr, Renfrew, Lanark and Dumbarton. Notwithstanding the humidity of the climate, from its exposure to the Atlantic, and the extent and elevation of its hills, agriculture is not neglected, and, in many parts, is carried on at a great expence, and with considerable success. Commerce and manufactures stimulate the exertions of the farmer. Lead-mines are found on its boundary with Dumfries-shire, and coal through nearly its whole extent. Iron, in great abundance, is wrought very successfully, also limestone and freestone, for both of which there is, in many places, a great demand. All these give employment to labourers, and furnish a market for more corn and butcher meat, than the farmers can produce. Hence, great quantities of grain, and of fat cattle and sheep, are imported: and there is every inducement to break up the extensive tracts of

barren land, which still deform these districts. The houses of proprietors, and numerous plantations, now adorn a country, which was formerly bleak; and the opulent merchant and manufacturer, employing part of their capital in the purchase of land, and the improvement of the soil, become most spirited cultivators. Still, however, the soil and climate are more adapted to the rearing or fattening of live stock, than to the raising of corn; and the best breeds of horses and of dairy cows are to be found in this district, which are sold in great numbers, to the other divisions of Scotland. From the concurring causes of commerce, manufactures and minerals, agriculture has flourished in an ungenial climate; and nearly one-half, or more accurately, seven-fifteenth parts of the whole surface, are under cultivation. With only one-thirteenth part of the extent, nearly one-fourth part of the population of Scotland is included in this division.

Though humidity of climate is common to all the counties of this district, Ayrshire is most exposed to the influence of the Atlantic. Its numerous small towns contain one-half of the population; and the inhabitants are employed, partly in agriculture, and partly in manufactures. In Renfrewshire, nearly three-fourths of the inhabitants live in towns. The commerce and manufactures of the city of Glasgow, and other towns in Lanarkshire, which give employment to above three-fourths of the whole population, have had happy effects on the agriculture of that county. Improved agriculture, by raising artificial grasses and other green crops, has been beneficial to the dairy, and contributed much to increase both the size and strength, of a breed of work-horses equal to any in the island. In Dumbartonshire also, agriculture has been encouraged, by the demand occasioned by the manufacturer for the produce of the soil. Only one-third part of the population of that county resides in towns, though with the advantage of the Firth of Clyde, and of two arms of the sea, or salt-water lochs, (circumstances favourable to town population), a greater proportion might have been expected.

District IV.—*The Central Division.*

This district includes the counties of Fife, Kinross, Clackmannan, Stirling, Perth, and Forfar or Angus. Coal abounds in the southern parts of Fife, and in some other parts of the district. It contains immense quantities of the purest shell marl, in several of its fresh-water lakes in the interior; whilst it is enriched, in other parts, with excellent limestone. It exhibits every variety of soil and surface, from the level and rich carse of Stirling, Falkirk, and Gowrie, and the great valleys of Strathmore, Athol, and Strathern, to the lofty Grampians, which shelter a considerable proportion of this division, from the northern blasts. This extensive district affords a wide range to human industry,—digging in the coal-pit, quarrying for lime and ironstone, raising every species of corn, rearing the different kinds of live stock, and prosecuting successful fisheries, both in its rivers and in the ocean. In the rich carse, the various fertile valleys, and along the firths and sea-coast, it produces the best wheat, beans, barley, and broad clover. In some of the inland districts, are raised excellent crops of turnips, bear or bigg, and oats; but towards the mountains, there are only a few patches of corn, on the banks of its numerous streams and rivers. Its live-stock, in general, is of an excellent description. The towns of Dundee, Perth, Alloa, both the Cupars, with Dunfermline, Stirling, St Andrew's, Clackmannan, Kinross, Forfar, Montrose, Brechin, and a number of inferior villages, contain two-fifths of its whole population. The country exhibits many examples of correct husbandry; and notwithstanding the great extent of mountains, seven-fifteenth parts of its whole surface, (the same proportion as in the third or preceding district), are under cultivation. This division contains nearly a fourth part of the population of Scotland, in less than a sixth, (nearly two-thirteenth parts), of its total extent.

In this extensive district, Fifeshire is distinguished by the great variety of its productions, and by its fisheries, its flax and linen manufactures,—its coal mines, lime works, and ironstone, — by its improved agriculture, and its breeds of cattle and horses. The numerous small towns, contain three-fifths of its inhabitants, who are employed, partly in agriculture, and partly in manufactures.—The small county of Kinross, ornamented by its lake, and abounding in coal and limestone, is considerably elevated above the level of the sea. Formerly it was not attractive to a stranger; but its aspect is now much improved, since agriculture has been more attended to.—Clackmannan, of still more limited extent, but of greater fertility, is distinguished by a correct cultivation of the soil, and by abundance of lime and coal. The half of its population reside in three towns of very moderate extent.—The county of Stirling includes every variety of soil, from the rich carse on the south bank of the Forth, to the barren rocks of the towering Ben-Lomond. There is a great iron-foundery at Carron, and the vale in its neighbourhood is rich and well cultivated. In the valleys of Enrick and Strathblane, there are rich fields, cultivated by intelligent and enterprising farmers; and the scenery is much diversified in all parts of the county. One half of its population resides in a number of small towns.—The very extensive county of Perth, with no coal-pits, except in a detached corner, is equally distinguished by the most fertile and the most barren soils, and exhibits the two extremes of correct, and defective agriculture. In the carse of Gowrie and valley of Strathern, there are many opulent and intelligent farmers, who cultivate successfully the most fertile soil in the kingdom. In several of the smaller vales, an improved cultivation is pretty general. But in the more remote highland straths or glens, even where the land is naturally fertile, a correct system of agriculture is little known, and less practised. Manufactures give employment to one-third part of the population, who inhabit above twenty towns or large villages.—In Forfarshire,

along the sea-coast, and in the rich valley of Strathmore, the farmers have been long distinguished for their exertions; and in the inland parts of the county, shell-marl, obtained in abundance from the fresh-water lakes, which have been drained, has contributed very much to the improvement of the soil, both in the *Great Valley**, and in the Braes of Angus. Various manufactures also, especially that of linen, have been long established in this county, and give employment to above one half of its population.

District V.—*North-East Lowlands.*

This district includes the counties of Kincardine, Aberdeen, Banff, Moray and Nairn; and contains a greater extent of sea-coast than any of the preceding divisions. Yet on the south-west, where it extends to the middle of the island, it is extremely mountainous, the Grampians stretching from its boundary with Perthshire, nearly to the sea at Aberdeen. By far the greatest part of the arable land, is either in the maritime or midland parts, there being very little near the mountains. The climate is, in general, dry and salubrious. It is remarkable, that the maritime parts of Moray enjoy, perhaps, the best climate in Scotland; and that, for many centuries, wheat has been cultivated there to great advantage. Wheat is also raised successfully, in the maritime parts of Kincardine and Banff shires; and its cultivation is spreading rapidly in Aberdeenshire. The turnip husbandry, and artificial grasses, are to be met with, over the principal part of this division, in very great perfection. But the most striking feature in the cultivation of this district, is the great expence at which barren land is improved, by trenching with the spade and mattock, in the neighbourhood of Aberdeen, which has been known to exceed L.100 for a single acre. A considerable share of this expence, (a fourth, a third part, and sometimes nearly one half of the

* *Strathmore*, a Gaelic word, means *The Great Vale*.

amount), has been repaid by the stones which have been carried off the soil, and sent to pave the streets of London. The district in general, raises food for the support of its inhabitants, and in good seasons exports a considerable quantity of grain; but it is chiefly distinguished for the rearing of excellent cattle, of which it sends yearly great numbers to England. Owing to the great proportion of hills or mountains, particularly the Grampians, and those in the district of Mar, only four-eleventh parts are as yet under cultivation. But in no part of the island have plantations of wood, and the improvements of the soil, been carried on at a greater expence, or on the whole, more successfully, than in this division. It is much adorned by plantations near the houses of its proprietors; and its natural woods in Braemar are extensive and valuable. It contains nearly an eighth part, both of the surface and population of Scotland; about a third part of its inhabitants reside in towns; and though it has no coal, and imports nearly one-half of its lime, yet from the sale of black cattle, of fish, and of pork, and occasionally of grain; from the encouragement granted by the landholders, and from the demand for the produce of the soil, for the populous city of Aberdeen, and the prosperous manufactures in its neighbourhood, it is enabled to carry on its expensive agricultural improvements.

Kincardineshire, except what part of it lies in Mar, is sheltered on the north by the Grampian mountains. That small county was early induced to attend to the cultivation of its soil, by the example of the late Robert Barclay, Esq. of Ury, and a few others of its landed proprietors.—Aberdeenshire, which fifty years ago brought most of its work-oxen from Fife and the Lothians, has now taken the lead in the rearing of black cattle, and cultivates for that purpose sown grass and turnips, (for which its soil is peculiarly adapted), in great perfection. Wheat and beans also are raised successfully in the heavy loams of Formartin, and on the still heavier clays of Buchan.—Banffshire owed much to a distinguished charac-

ter, the Earl of Findlater and Seafield, who introduced an improved system of cultivation in that county, and encouraged his farmers to imitate his example. Not only near the sea-coast of the Boyne and the Enzie, where that improved system began, but in the more inland parts, a spirit of improvement has now become general, and has greatly altered the face of the county.—Though nature has done much for Moray, (which includes the shires both of Elgin and Nairn), yet the culture of turnips and of sown grasses, was not, till within the last thirty years, so general, as in less favoured counties. But of late, both these and corn crops, with the rearing of live stock, have been attended to with ardour and perseverance.

District VI.—*The West Highlands.*

The Sixth District contains the two extensive counties of Argyll and Inverness, and comprehends nearly one-fifth part of the whole surface of Scotland, with only one-eleventh part of its population. About two-nineteenth parts of this district are cultivated or productive. Near Inverness, at Campbelton in Argyllshire, and in some other parts, wheat and turnips are successfully cultivated. The country in general is unfit for tillage, except on a small scale; but its grazings are extensive, and well adapted for the rearing of live-stock. Its fisheries also are of great importance, both to the inhabitants and to the nation. It likewise contains a great extent of plantations, and the remnant of the *Coillemore*, or Great Forest of Scotland. Manufactures have been introduced into the towns, and sheep-farming on a large scale over the country. Only one-tenth part of its inhabitants live in towns or villages; the rest have their dwellings in the valleys, along the banks of the several streams and rivers. The black cattle of this district, are in high estimation, as excellent feeders; the hardy breed of Tweeddale sheep, and in some instances the Cheviot, occupy the hills. This division extends across the island; and the Caledonian Canal is now carrying on directly through it, from the German

Sea to the Atlantic Ocean. The advantages of this Canal, cannot at present be estimated; but it is to be hoped, that it will carry industry and wealth into this remote district, and furnish the means of facilitating and enlarging the commerce of the other parts of the kingdom.

That part of Inverness-shire which lies near the county town, is distinguished by a milder climate, than is found in several of the more southern counties. Agricultural improvements, and extensive manufactures, are carried on around Inverness, the capital of the Highlands. In the interior of this district, and on all the west coast, both of Argyll and Inverness shires, the soil and the climate are more favourable to the rearing of live stock, than to the cultivation of corn. The attention of the inhabitants is likewise directed to the fisheries, both as a supply of food, and a source of wealth.

District VII.—*The North Highlands.*

The Seventh Division comprehends the counties of Cromarty, Ross, Sutherland, and Caithness. This district is in some respects superior to the former, though more northerly. East Ross, with a part of Cromarty, contains a considerable proportion of excellent soil; and both the wheat and turnip husbandry are carried on successfully. The eastern coast of Sutherland, and the plains of Caithness, are also good corn countries. West Ross, and by far the greatest part of Sutherland, of Cromarty, and of that portion of Caithness which bounds with Sutherland, are rugged and unproductive. Not a tenth part of this district, which contains nearly one-sixth of the extent, and one-eleventh of the population of Scotland, is capable of being cultivated, and only a twelfth part of the people reside in towns or villages; yet, by the introduction of sheep-farming, by encouraging manufactures, and, above all, by the extensive fisheries of herring and cod, now successfully established along the coast of Caithness, this remote district must soon be greatly increased in value, and the inhabitants rendered richer and happier. The breeds of cattle have

been greatly improved of late years; the Linton, or Tweeddale breed of sheep, is now spreading over the western parts of this district, and there are already about 40,000 of the Cheviot breed in various parts of it, more especially in Sutherland and Caithness. The Merino breed, and crosses with them, have likewise been successfully introduced into Ross, and other parts of this district. East Ross and Cromarty are ornamented with the seats of the proprietors, and extensive plantations. Wood also thrives in Sutherland, and in the more hilly part of Caithness; but in the plains of Caithness, and near the sea coast, it cannot be raised to advantage, from the nature of the subsoil, in general a gritty close gravel, of little depth, incumbent on a horizontal flaggy rock, which keeps the water near the surface.

The discovery of coal in Sutherland, merits the great attention that has been bestowed upon it. There are likewise indications of other valuable minerals in this district. As the climate is rather adverse to cultivation, grazing ought to be more attended to; and the operations of the miner would be productive of the most beneficial consequences.

District VIII.—*The Hebrides, or Western Islands* *.

These islands, which form the Eighth District, were formerly denominated the Ebudæ, but are now better known by the name of the Hebrides, or the Western Islands. They contain about one-tenth part of the total extent of Scotland, with about only one-eighteenth part of its population. Of the whole surface, nearly one-seventh part is under culture. Wheat has been raised in some of the islands; and the turnip husbandry, and sown grasses, (which have been likewise introdu-

* The ancient Roman name is supposed to be Hæbudes, or Æbudæ, corrupted, in transcription, to Hebrides. The Highlanders of the adjacent continent, denominate them by the appellation of the "*Innis-Gall*," that is, the Islands of the Strangers; *Gall*, in Gaelic, being the term used, in contra-distinction to *Goel*, the Caledonians.

ced), by providing spring food for the cattle, will be the means of increasing the value of these islands in a very high degree. In Bute more especially, in Islay, and in Coll, wheat and turnips have been cultivated successfully. In Skye and some of the smaller islands, turnips have likewise been raised. In all these isles, the breed of black cattle is excellent, though in general small. The fisheries and kelp manufacture are very valuable; and by proper attention to them, these islands may furnish a great addition, both to the wealth and the strength of the empire. The only island that gives name to a county is Bute, to which Arran and a few islets are annexed.

In regard to the general state of these islands, it may be observed, 1. That where an improved system of agriculture has been attempted, it has uniformly succeeded; 2. That an increase of the size and value of the live-stock has been produced by better feeding, as is evinced by the management of Mr Campbell of Shawfield, and of Mr Macneil of Colonsay; 3. That the fishery should be the chief object of those islanders, where the soil is peculiarly barren, and the manufacture of kelp where the shore abounds with sea-weed; and, 4. That if more attention were directed to draining, inclosing, and planting, and effectual precautions adopted against the blowing sands; if more ground were improved by trenching in cases where it could not otherwise be cultivated; and if leases were granted on a proper plan; this remote district would soon be rendered, infinitely more valuable, to the proprietors, the inhabitants, and the public.

District IX.—*The Northern Islands.*

The *Ninth or last District* consists of the northern islands of Orkney, and Zetland or Shetland. The former contain about 440, and the latter nearly 880 square miles, and form one county, the extent of which is about one twenty-third, and the population, nearly one thirty-ninth part of Scotland. Only about one-seventeenth part of the whole surface of these islands is in cultivation. Wheat and turnips have both been

SECT. III.**CLIMATE OF SCOTLAND.**

BY THE REV. DR PATRICK GRAHAM OF ABERFOYLE.

IN treating of the subject of this section, it is proposed, 1. To make some general observations respecting the climate of Scotland; and, 2. To state, concisely, the general results of meteorological tables, from the most authentic information that could be procured.

In the Appendix, NO. V, a more enlarged view of the results of these meteorological tables will be found, arranged under the five following heads:—1. The barometer; 2. The thermometer; 3. Rain; 4. The winds; and, 5. Electrical and other phenomena; together with some other particulars connected with this branch of the inquiry.

**1. GENERAL OBSERVATIONS RESPECTING THE CLIMATE
OF SCOTLAND.**

IN forming a judgment of the climate of a country, there are three circumstances which claim our especial consideration; namely, 1. Its latitude; 2. Its situation with respect to the adjacent seas and continents; and, 3. Its peculiar soil, and natural productions. To these may be added, the consideration of the elevation of a country or district, above the level of the sea.

1. *Latitude of Scotland.*

Scotland, stretching from the Mull of Galloway on the south, to Dunnet-head on the north, between the parallels of $54^{\circ} 34'$, and $58^{\circ} 42'$ of north latitude, may naturally be expected to be a cold and bleak country. Being situated so far north, and a great proportion of it mountainous, its climate is very variable, and, excepting on the east coast, is generally moist.

With regard to the weight of the atmosphere, which is considered as furnishing one of the principal indications of the state of the weather, it is well known, that the range of the barometer increases as we advance from the equator towards the poles. It is also greater in the mountainous districts, than in the low country of Scotland. From Dr Macfarlane's tables of the weather, inserted at length in the Stirlingshire Report *, and of which an extract will be found in the Appendix, it appears that the greatest height of the barometer, observed in latitude $56^{\circ} 7'$, during a period of eleven years, was $30\frac{20}{100}$ inches, and the lowest $28\frac{13}{100}$; leaving a range of $2\frac{7}{100}$ inches. The observations were made at an elevation of about 70 feet above the level of the sea.

At Longforgan, in Perthshire, on the banks of the Tay, and probably at the elevation of only a few feet, the greatest height observed was $30\frac{20}{100}$ inches, and the least $28\frac{10}{100}$, leaving, in like manner, a range of the barometer of $2\frac{8}{100}$ inches. The period of observation was 11 years †.

The mean annual temperature of any place is also known to depend, in a great measure, upon its latitude. Mr Kirwan has constructed tables ‡, to shew the mean annual temperature of different latitudes, in reference to a standard mean, which he derives from the general temperature of the Atlan-

* Chap. i, Sect. 3. † Statistical Account, vol. xix, p. 461.

‡ Dr Thomson's Chemistry, vol. iii, p. 304, 1st edit.

the prevalence of south-westerly winds, accompanied by frequent showers, and often long tracts of rainy weather.

6. That the influence of the German Ocean, upon the east coast of Scotland, is also very considerable. Being five degrees warmer in summer, than the Atlantic, a copious evaporation takes place, throughout its extent, which produces the eastern *haars* (as they are called) or thick mists, which are seen, at a certain period of the day, to arise from the sea, and advancing upon the land, occasion colds and other disorders.

3. *Peculiar Soil and Natural Productions.*

Countries, in a state of nature, are found to be colder than countries in the same latitude, which have been long under cultivation; which accounts, in a great measure, for the difference of climate under the same parallels, in Europe and America.

The soil of Scotland, in several districts, especially on the eastern coast, is dry, and a great proportion of it cultivated. Hence, the climate is warmer, than in some other countries, in the same latitude.

It seems unquestionable, that the prevalence of carse or clay soil, or peat, more especially when undrained, and probably too, of woods, at least in flat countries, has some effect upon the climate of the adjacent districts.

An instance of the influence of a carse soil, is given in the Stirlingshire Report*. In the carses of that district, intermittent fevers had formerly prevailed; but by an improved mode of ploughing, and more effectual draining, joined to other circumstances, as more substantial houses, better food, clothing, &c. these fevers have disappeared. From the same causes, agues have likewise disappeared in other parts of Scotland.

With regard to the influence of moss soil upon climate,

* Page 246.

it is observed, in very striking terms, by the author of the Clydesdale Report, that the climate of that district is greatly deteriorated, by the " huge masses of peat earth with which it abounds."—" May we not suppose," he adds, " that the cold moisture arising from them, in exhalations, before they acquire the temperature of the common air, may cool the earth, and benumb the vegetables over which it passeth? It is certain, that the high lands where these bodies of peat earth abound, are less fertile than they have been in early times *."

The Author of this section has frequently remarked a meteorological phenomenon, depending on moss soil, and which is well known to affect the climate of the adjacent district. In the great moss which extends, with little interruption, from Gartmore, on the west, to the vicinity of Stirling, on the east, through a space of about sixteen miles in length, by three to four in breadth, the heat of the sun, in summer, occasions a very copious evaporation during the day: this, at night, is condensed by the cold, and forms a thick body of vapour of 20 or 30 feet in depth, exhibiting the appearance of a vast lake, with islands and promontories, formed by the eminencies which occur in the moss, or on its outskirts. It furnishes a picturesque appearance to the eye; but its effects are injurious to vegetation, blighting every thing within its reach, particularly the fruit trees in gardens and orchards, when it happens to settle on them, and is followed by a clear sun. The same phenomenon is observable at certain seasons, in districts similarly circumstanced, and produces the same effects.

A country covered with wood is moister, and has a greater range of the thermometer between the extremes of heat and cold, than a country cleared of woods in the same latitude. Hence its summers, for a part of the day at least, are

* Page 6. All sorts of peat-moss occasion cold, by the process of evaporation, and rain, when this vapour is sufficiently condensed.

warmer; but its winters are colder *. Thick woods, in a level country, exclude the rays of the sun, and prevent the drying of the ground, by evaporation. Scotland, however, does not appear to be at present so much covered with wood, as it ought to be. The heights of this country, if planted with judgment, would very materially improve in temperature, and the benefits would be felt also in the vales.

To the above circumstances, which contribute principally to give a character to the climate of Scotland, it may be added, that particular districts are besides affected, in this respect, by their respective elevations above the level of the sea.

Scotland is a mountainous country. The northern division especially, situated beyond the isthmus formed by the Forth and Clyde, abounds with lofty mountains, interspersed with fertile *straths* or valleys, to which they give shelter. It may be observed, in general, with regard to the mountainous districts, that the valleys are warm, and the climate genial; but by the evaporation from the adjacent seas, and from the numerous lakes, clouds are formed, which are attracted by the mountains, and fall in frequent and heavy showers.

In order to assist us in forming an estimate of the climate, so far as it is affected by this circumstance, it seems proper to offer a table of some of the more important elevations above the level of the sea, that occur in different districts of Scotland, which will be found in the Appendix.

III. ABRIDGED RESULTS OF METEOROLOGICAL TABLES, RELATING TO SCOTLAND.

1. *The Barometer.*

ACCORDING to the more enlarged results which will be subjoined in the Appendix, it appears, that the greatest height

* The Euxine Sea was not only frozen, but carriages drove upon it in the days of Ovid. It has not been frozen at all for many centuries; and its climate is now very mild, being no longer surrounded with woods of great extent.

of the barometer in Scotland is $30\frac{2}{100}$ inches, and the least, $28\frac{1}{100}$ inches, leaving a range of $2\frac{1}{100}$ inches. In the Orkneys, the range of the barometer is three inches*.

2. The Thermometer.

The lowest average temperature of a whole year that occurs in the tables printed in the Appendix, is 41.11 degrees of Fahrenheit: the greatest is $50^{\circ} 326$. It should seem, therefore, that we may safely take the annual average temperature of Scotland to be from 45 to 47 degrees.

The greatest height of the thermometer that has been observed, appears to have been 92° of Fahrenheit, and the lowest, (at Edinburgh, 31st December 1783), 3° below zero.

3. Rain.

The general average of the quantity of rain that falls in Scotland, appears to be from 30.88 inches to 31 . The quantity of rain on the east coast, is generally one-fifth less than on the west. In considering the important subject of the *distribution* of this quantity of rain throughout the whole year, the general results appear to be as follow:

Towards the west coast, it rains, or snows, about	205
The weather is fair for	160
	<hr/>
	365
Towards the east coast, on an average of twelve	
years, it rains for	$110\frac{6}{5}$
It snows for	$24\frac{1}{5}$
The weather is fair for	$230\frac{1}{5}$
	<hr/>
	365

* At Galashiels in Selkirkshire, on 10th January 1806, and on the 19th October 1812, the barometer was rather below 29 .

4. *Winds.*

It will appear from the tables in the Appendix, that the wind blows, upon the west coast, on an average, as follows :

1. From some point between E. and W. measuring by the northern semicircle of the horizon, for	197
2. Measuring by the southern semicircle, the wind blows from some point between W. and S. for	139
3. From some point between S. and E. for	29
	<hr/>
	365

Upon the east coast, the winds are, from the westerly points,	232
From the easterly, - - - - -	120
From due north, - - - - -	10
From due south, - - - - -	3
	<hr/>
	365

5. *Electrical and other Phenomena.*

1. Violent thunder storms are almost unknown in Scotland. Yet accidents sometimes happen in the country from lightning, when accompanied by thunder. *Silent lightning* is very frequent, but seldom hurtful. It is remarked, that in Orkney, thunder and lightning occur most frequently in winter.—2. The *aurora borealis*, which is supposed to be occasioned by electrical matter in a rarefied atmosphere, is frequently seen in the northern regions, and sometimes also in the southern countries.—3. Whirlwinds very seldom occur, but when they do, are attended with damage to corn-stacks, and the inferior sorts of buildings.—4. Water-spouts have occasionally occurred, both in the northern and southern counties, but not very frequently.

SECT. IV.**ON THE SURFACE, SOILS, AND SUBSOILS OF SCOTLAND.**

BY THE REV. DR. SINGER.

'**L**AND, considered as the basis of vegetation,' is called '*soil*.' The quantity and value of the fruits to be drawn from it depend, partly on the substances of which the soil consists; partly on the manner in which it is treated; and partly on the nature of what is called the '*subsoil*,' or the stratum on which it is incumbent.

To cultivate land with judgment and profit, is a matter of great interest, both to the farmer, and to the proprietor of the soil: But in regard to the nation at large, which depends on the fruits of the soil, not only for comfort, but for subsistence, the art of correct agriculture is of incalculable importance.

That art depends on a variety of circumstances, as climate, labour, manures, tenure, stock, markets, and other particulars. But it is of radical and primary importance, to understand the nature, and proper treatment, of both *the soil*, and *subsoil*.

Indeed, without that knowledge, a landholder cannot know the real value of his lands, nor can a tenant or farmer profitably occupy them; and it is not to be expected that the soil can be cultivated to the public advantage.

A full and correct discussion of the subjects of *soil* and *sub-soil*, would make, by itself, a most important and extensive branch of inquiry; for it ought to embrace whatever is correctly known, either by the farmer, or by the man of science, with respect to the component parts, the properties, the faults, and the means of improvement, both of the soils and subsoils. But, for the purpose of the present inquiry, restricted as it is to the section of a General Report, the discussion must be compressed and abridged. It may be proper, however, to give,

1. An idea of the general appearance of the surface of Scotland;
2. To describe the various *Soils* in the more cultivated parts, the extent and the amount of each.
3. To make some observations on that important and hitherto neglected subject, the *Subsoils* of the kingdom. And,
4. To explain the advantages that would result from a more minute and extensive investigation into these interesting particulars.

I.—ON THE GENERAL APPEARANCE OF THE SURFACE OF

SCOTLAND.

THE barren hills and mountains of Scotland, immense in size and number, present the most prominent feature of this part of the kingdom. A portion of them is clothed with green herbage, more especially where sheep-farming prevails; but in general they are covered with heath, vegetating above peat, rock, or gravel; and they frequently terminate in mountain caps of solid rock, or in vast heaps or cairns, of bare and weather-beaten stones. Whether the eye ascends to the mountains, or is turned on the vales, the scenery, though often grand and picturesque, is very seldom naturally rich. On the former, the signs of sterility are apparent; and, in regard to the latter, as the soil is formed in part of the substances

contained in the mountains, no high degree of natural fertility can be expected. Yet by a judicious mode of stocking those hills and mountains with sheep and cattle, by regularly manuring and cultivating the vales, and by sheltering the country with plantations and hedges, the people of Scotland have shewn, how much they are capable of effecting, for the improvement of their northern and alpine country.

Besides those *mountains* and intervening *vales*, there are districts containing *gentle slopes* or *plain surfaces* of every variety of shape, consisting of arable soils, in considerable extent, and respectable in point of fertility. Sandy tracts, and *carses*, appear likewise along some of the rivers and their estuaries; the latter containing flat lands of superior quality.

Scotland thus displays every variety of surface. There is unquestionably a great extent of uncultivated mountain-lands, and a very large portion of surface occupied with peat-mosses, with muirs, with lakes and rivers, and with rocky and unimproved wastes. But still Scotland exhibits exertions in agriculture, more than proportioned to the numbers and wealth of the people, when compared with most other nations; and a careful observer will discover an unexpected extent of cultivated lands, considerably more than a traveller, hastily passing through the country, could imagine.

II.—OF THE PARTICULAR CONSTITUTION AND QUALITIES OF THE MORE FERTILE SOILS IN SCOTLAND, AND THE EXTENT OF EACH.

SOIL has been found, on examination, to consist of different proportions of the simple earths, of decomposed minerals, or of the substance of decomposed vegetables. The natural fertility of every soil depends, partly upon the situation in which it lies, and partly upon the nature and proportions of the ingredients of which it is composed.

Very important alterations have fortunately taken place in the soils of Scotland. Where the surface was moist, or water had stagnated, the quality of the soil was necessarily greatly injured; and where the redundant moisture has been carried off, its fertility has been much improved. From the first cause, large tracts of land, once under forest trees, are now covered with peat mosses; and lands neglected, which became wet, and consequently produced coarse plants, unfit for use, acquired a covering of the same kind. On the other hand, by industry and skill, considerable tracts of muir are now converted into fertile lands: wastes are improved, and are becoming productive in trees, or grass, or grain; and even *peat-mosses*, by draining, manuring, and culture, become *peat earth*; which is not only comparatively fertile as a soil, but may be instrumental in rendering other soils more productive.

The western districts of Scotland, are, *in general*, less rich in soil, than those on the east*. An intelligent writer † ascribes this, and similar facts observed in other countries, to the irresistible force of diluvian tides pouring from the Pacific Ocean, and moving to the north-east. It is alleged that by these waters, the south-western parts of lands and continents were washed bare of soil, and the sediment carried and deposited towards the north-eastern parts. Many observed facts appear to coincide with such a theory; but other facts do not accord with it. Whatever the cause may have been, in this island, the effect is fortunate. The climate of the western parts, in the vicinity of the Atlantic, is more suitable for grass and pasturage; whilst that on the east is more favourable to corn: and the *soils* on either side in general correspond with the *climate* in regard to these particulars.

* There are several exceptions to this observation, as in various parts of the Hébrides, and western coasts of Ross-shire and Inverness-shire; also in Argyll, Ayrshire, Galloway, &c.

† Dr Graham, quoting Kirwan.

The soil, in most cases, appears to be composed in a material degree of substances originally resembling the subsoil. We find stone in a decayed state, and in great variety; with clay, sand, gravel, and many different mineral substances, in a state of decomposition. In some cases, however, we find the subsoil considerably different from the soil; and the fertility of the latter, much improved by a mixture with the former.

The *quality* of the soil depends, in a considerable degree, on those mineral ingredients which contribute to form it. *Limestone* and *schistus* rocks, in general, add both to the quality and the depth. *Freestone*, if it has a mixture of calcareous matter, is beneficial; but if otherwise, it does not improve a *free* soil, though it is of service in *clay* or *peat-moss*; and too great a proportion of the metallic oxides in soils, is injurious to plants.

What is called *vegetable mould*, is an important mixture in all fertile soils. It is the decomposed substance of such vegetables, as have grown and fallen on the surface of lands not in cultivation; or it is the remaining parts of such vegetable manures, in cultivated lands, as have been only in part dissolved by putrefaction, and have added to the bulk and quality of the soil. Where this substance abounds, the soil is very productive.

Nature accumulates, on old and dry pastures, this vegetable mould; and the farmer, by industry, resolves the mass into its original elements, and thus furnishes new supplies to living plants.

When the pasture happens to be rich in itself, in a good climate, and under proper management, the mass of surface vegetables which die, is converted slowly, by the dung and urine of cattle, by the shade of the grass, and by the aid of climate and of top-dressings, (chiefly of lime), into mould; and in this manner it feeds the growing vegetables, and furnishes a succession of rich crops of grass.

Besides the smaller proportions of decomposed minerals, and of the vegetable earths, which are found in greater or less quantities in different soils, there are certain ingredients, which are found in such abundance, as to give names to the soils in which they predominate: Hence, in treating of the soils of Scotland, it is not proposed to attempt chemical accuracy, or to infer, that any particular soil has no other quality but that of the substance under whose name it is classed. It is only intended, that the quality which predominates, shall give name to the class under which it is arranged.

On the whole, the soils in the more cultivated parts of Scotland may be classed under seven heads:

1. *Sand*; 2. *Gravel*; 3. *Peat*; 4. *Obdurate Clay or Till*; 5. *Rich Clay*; 6. *Loam*; and, 7. *Alluvial Soils*.

All these may be materially affected in their value, and in respect to the proper mode of treating them, by adventitious mixtures of many different substances; particularly water, lime, schistus, carbon, iron, &c.

They will also be very materially affected, by the nature of the subsoil, and by its dip or inclination; or, if rock, by its being either close or open. It is, indeed, well observed, by an eminent agriculturist, whose opinion on this point is entitled to much respect*, that the subsoil of a farm is often of more importance than the soil itself. "It is wonderful, (he observes), what even a thin soil will do, when full of manure, if the climate is favourable, and if it rest on a sound and dry subsoil. Seldom indeed is land unproductive, when the subsoil is dry and good."

* William Robertson, Esq. of Ladykirk, in Berwickshire.

1. *Sand.*

Small and loose grains of real sand, consisting mostly of what is called *silex*, very hard, and neither cohering, nor softened by water, nor soluble in acids, constitute a poor, loose, and barren soil.

But sandy soils along the margin of the sea, often contain shells and mud; and, having thus a mixture of calcareous earth and of clay, they are thereby greatly enriched.

In the lower districts also, where fields of sand appear in various parts of Scotland, enriched with vegetable earth or other substances, the soil, though open and porous, is kindly, and moderately productive.

When a sandy soil is very loose, and so clean as not in any material degree to soil the fingers in handling it, the farmer considers it by far too poor, in that state, to be cultivated with advantage.

The blowing sands, which have been destructive in Scotland, not only on the eastern coast, but also in the Hebrides, ought never to be cultivated, except in as far as may be necessary, in order to sow them with the sea-bent, and other suitable plants, for preventing their being driven by the wind.

Fields of excellent sandy soil occur in Moray, Dumfriesshire and other counties. Being generally dry, open or porous, and early, they answer well for turnips, potatoes, barley, common oats, and pasture; but, above all, carrots might be cultivated on such soils to advantage.

2. *Gravel.*

This kind of soil often consists, chiefly, of the same substance with that of sand, namely *silex*, only differing in point of size; but it also frequently contains granite, and other kinds of rock, partially, but not very minutely, decomposed. Gravel, being more porous even than sand, is generally a poor and hungry soil, especially when the parts of it are hard in sub-

stance and rounded in form. A gravelly soil, into which limestone, or stone-marl, or schistus, enter liberally in composition, is, on the contrary, a rich and valuable soil *; and it improves by culture and exposure. Even barren, hungry gravel, becomes fit for culture, when there is access to clay, in order to improve its texture; or to water, in order to enrich it by irrigation and sediment.

3. Peat †.

It is agreed on by most authors, and it is the opinion of the generality of farmers, that peat-moss is formed by the accumulation and natural decay of coarse vegetables, which have been in some measure decomposed, without being completely reduced.

It is equally well understood, that peat moss is barren as a soil; but that, by the putrefactive fermentation, it is changed into *peat earth*, which is comparatively fertile.

Still, after this important alteration, peat earth is defective in point of *solidity*. In heavy and long continued rains, it is too soft, and wet; and in severe drought, it suffers even more, from the opposite extreme, being too light and dry.

To convert peat moss into really good soil, two changes appear necessary; the one to reduce the tough moss into earth; and the other, to give that earth a proper degree of density.

The means by which these objects can be accomplished, will be explained in a subsequent part of this Report ‡.

* Gravel is, perhaps more frequently than sand, found on the shore, with a mixture of calcareous substances, and is then very fertile.

† Some object to the idea of considering peat as a distinct soil; but the authority of the intelligent Dr Walker, Professor of Natural History in the University of Edinburgh, (*Transactions of the Highland Society*, vol. ii, p. 57), is, regarding this point, important. Peat is certainly a substance which, when drained, manured and cultivated, will produce useful plants, and may therefore be properly called a *soil*.

‡ See Chap. XI. on the Improvement of Waste Lands.

4. *Obdurate Clay or Till.*

In their original state, clayey soils are, in general, of a hard and obdurate nature, mixed with ferruginous matters, and, in that state, are known in Scotland, under the name of *Till*. By exposure, manures, and culture, this stubborn earth is reduced and rendered fertile. There are, however, considerable tracts of this species of soil, only partially cultivated in Scotland, and not yet thoroughly improved. It is necessary, therefore, to consider this as a species of soil, distinct from the finer clays.

5. *Rich or Improved Clay.*

The value of clay, as a soil, depends materially on the sub-soil; for, if this be open, it renders the clay more tractable and productive. A clay soil often contains too large a proportion of *argil*, which is the fine, soft, unctuous part of it, in which case it is over-tenacious, and close in the texture; in time of rain too wet, and in dry weather too hard. A suitable mixture of sand improves it much, and of gravel still more. A proper texture, however, is not the sole object of the farmer: he also enriches with putrid and calcareous manures, in due succession; and he is careful to adapt his crops and tillage to this productive soil, which, under good management, is attended with profit; but, in bad cultivation, requires great labour, and makes no adequate return.

6. *Loam.*

This esteemed and most valuable soil, is a fertile mixture of earthy and other substances. When it has a considerable mixture of clay, it is called a strong or heavy loam. The richest loams are those which abound most in vegetable earth, and have a just proportion of clay or sand. In general, loam is a soil neither liable to the fault of mere sand, which is too loose, nor to that of indurated clay, which is too stiff; and not only the texture of it is proper, but, by containing vege-

table mould, in a great proportion, it is also rich and fertile. Of this species of soil, garden mould is the best artificial kind.

The application of manures, chiefly dung and lime, with suitable culture, has the happy effects of rendering stiff soils open, and of giving some tenacity to such as are loose,—converting both into varieties of loam.

A peat moss, duly improved by manures, and liberally earthed, clayed, or sanded,—and also a tough clay, well cultivated, and opened with gravel,—may, in process of time, and by cultivation, approach to the nature of loam.

7. *Alluvial Soils.*

These must be distinguished into two sorts, *haughs* or *holm lands*, and what are called *carse lands*, or sea sleet. The haugh soil is deposited by rivers, and the substances contained in it are not the same with those of carse lands, which are deposited by the combined waters of rivers and of the sea, in their mouths or estuaries. Carse lands and sleet, are composed of nearly the same original materials, only the former have been changed by consolidation and culture. Both haugh and carse lands may be considered as varieties of loam; but in order to preserve a due line of distinction, it is better to retain these names, indicating at once their origin and composition.

Carses are, in general, the richest soils that exist. In Scotland, those of Gowrie on the Tay, and of Falkirk on the Forth, both on the eastern side of the kingdom; and that of Baldoon adjacent to Wigton Bay on the west; together with such soils as the sea has deposited in the mouths of other streams and rivers, constitute valuable examples of carse lands. The subsoil under them varies much; it is not unfrequently peat moss, and sometimes marl is found below the moss.

These carse lands, being even, and nearly level in the surface, mostly deep, and always rich, are adapted for the culture of the most valuable crops. On first breaking these carse

lands, or by digging in them, one sees the appearance rather of a clay soil; but after exposure with manures and cultivation, the texture and colour approach nearer to those of hazel loam.

It will now be proper to give a general view, without pretending to minute accuracy, of the probable extent of each of these different sorts of soil, in the several districts of Scotland.

General Table of the Productive Soils, in the several Districts of Scotland, Partially or Fully Cultivated, in English Acres.

SOILS.	I. District.	II. District.	III. District.	IV. District.	V. District.	VI. District.	VII. District.	VIII. District.	IX. District.	X. Total.
1. Sandy soils, not yet fully cultivated,	16710	28348	57758	30300	70500	—	30000	20343	19630	263771
2. Gravel, ditto,	115035	69572	60000	280100	37500	40000	28185	50560	2910	681862
3. Peat moss, ditto,	24000	10000	72224	161860	46844	15000	19780	51560	9828	411096
4. Clay or till, ditto,	64705	15000	113000	170500	102300	12000	15000	14500	3000	510265
5. Improved clays,	174250	58000	237000	215500	235000	25000	38760	11560	1000	987070
6. Loams,	262280	500068	167018	385986	322124	165410	145275	115032	10000	1869195
7. Alluvial, haugh or cause land,	30000	55548	26156	111688	119000	55185	29256	500	—	320192
Totals,	684980	556556	732116	1354934	826868	312655	296256	262257	46368	5043450
The whole land, already fully or partially cultivated, amounts to	5,045,450 English, or									
The barren or uncultivated to	15,900,550 English, or									
Total,	20,945,000 English, or									
	15,019,281 Scotch acres.									

The whole land, already fully or partially cultivated, amounts to 5,045,450 English, or 3,998,572 Scotch acres.
The barren or uncultivated to 15,900,550 English, or 11,020,709 Scotch acres.

Total, 20,945,000 English, or 15,019,281 Scotch acres.

III. ON THE SUBSOILS OF SCOTLAND.

It is not proposed, in this place, to enumerate all the substances which in Scotland constitute subsoil. Nothing more is requisite here, than to mention such as have most influence in forming the character of the soil, either by their *texture*, when entire,—or by adding to the soil, when *decomposed*,—or by the particular *qualities* of the subsoils, as doing good or harm, and contributing to the formation of a soil, either fertile or barren.

I. By the *texture* of the subsoil, great effects are produced; either when it is *close* and retentive of water, or when it is *porous* and dry.

1. A *retentive subsoil*, is commonly stratified, in a position approaching to horizontal, and consisting frequently of clay, or of rock. A subsoil of marl, is very seldom to be found in Scotland, though common in England, under cultivated lands. Clay, which is almost in every case retentive, is frequently covered with peat moss, encouraged and bred by the moisture which the clay retains. Freestone, if near the surface, and horizontally stratified, is commonly overlaid with a mossy surface. Subsoils of a close texture, lying near the surface, in a similar position, occasion barrenness, almost in proportion to their degree of closeness,—other circumstances being the same. The coal metals, when placed near the surface, are known to have this effect. A cold and tilly subsoil intermixed with stones, placed as in a rude pavement, is generally covered with an extremely barren soil.

The improvement of soils, thus unfavourably placed, is not practicable, till by a judicious course of drainage, the superabundant water is directed into proper courses, so as to be easily taken away. Water, in too great quantities, not only obstructs the putrefactive process, and of course prevents manures from operating, but also soaks the soil, so as to destroy or expel the seeds committed to it, — and

in case of their growing, chills the crop with moisture and cold.

2. An *open subsoil*, if not in extreme, is always advantageous, yet sometimes such a hungry gravel, below a thin sand, will be found, as is much too open. Few such cases, however, occur in the vales, to any considerable extent; though on the tops of small eminences in cultivation, there are such instances. On the mountains, where vertical rocks, (very open with seams and fissures), are common, below a sand or gravel, forming a thin barren soil,—these instances are very numerous, and to a great extent.

An open subsoil, below peat moss, is not common; though in places where water has been locked in over such a subsoil, there are instances of it*. Below clay, an open soil is particularly desirable; it is most common, however, below dry loams, and it is also frequent in dry muirs. The advantages of such an open subsoil, must be estimated, in connexion with the closeness and density of the superjacent soil.

In ordinary cases, a subsoil, open in a moderate degree, and in proportion to the closeness of the soil, is favourable to all the operations of agriculture,—tends to promote the good effects of manures in resolving and fertilizing soils,—and contributes to the preservation and growth of the seeds, and to the prosperity of the plants. Yet there is a proper selection of plants, in proportion to the degree of openness or density, to which every judicious farmer attends; and a similar degree of care is requisite, in the selection of manures, and the adoption of courses of culture.

II. A *decomposed subsoil*, necessarily affects the value of the soil. Even coarse granite or sandstone, when decomposed, adds to the bulk and depth of it; and though the particles of granite, (consisting mostly of felspar and quartz), are hard to

* Mr Aiton states, that peat or moss is often found above sand and gravel, where water is not locked up. This circumstance, he adds, is not easily accounted for, but the fact is indisputable.

reduce, they tend, when separated from each other, as common gravel or sand, to open a close, and to give density to a light mossy soil: and, in decomposed rocks, if the cement happens to be clay or lime, it improves, in a small degree, the soil with which it mingles. Hard rocks, apparently incapable of becoming soil, such as *wacken*, which is liable to spontaneous decomposition, and rocks which contain a good deal of alumine (argil), are capable, after decomposing, of improving a soil in point of depth, or of quality; and in this view, even basalt, unpromising as it seems, has that effect.

But it is chiefly by decomposed schistus, containing *clay*, and by reduced subsoils, of a calcareous description, that a soil is improved in a remarkable manner. Stone-marl has this effect, by adding both clay and lime to the soil. In a remote situation, a striking proof of the benefit of a limestone subsoil, appears in the island of Lismore, which lies entirely on that rock, and contains a soil of remarkable quality and fertility.

III. By the *particular qualities* of the subsoil, either good or harm will be done to the soil. It has been stated, that clay and lime have good effects. A thin mossy surface above clay, has been greatly improved by mixture with it; and when the plough can reach the clay, in a regular manner, and this substance is capable of being taken up by it, a cheap and durable improvement is effected; a denser substance being mixed with one that is too light.

Farmers, in ploughing old ley, (that has never been deeply cultivated), with the Scotch plough, and without a cutting feather on the share, often go too deep, as they think, raising *till*, or hard ferruginous clay and gravel, which they call *under temper*. There is often, in the subsoils of Scotland, a great extent of this *till*, containing the oxide of iron, in many cases mixed with sand. Iron, in moderate quantities, is found in all fertile soils, and it forms an ingredient in the composition of plants; but when abundant, it is injurious to vegetation, from its acid combinations. It may, however, be rendered harmless by exposure to the action of the atmos-

phere; and soils, with even an excess of this metal, may be fertilised by cultivation and manure. The farmer, therefore, who cultivates land on a ferruginous till, and wishes to plough deep, ought to do so when the ground is under fallow, that by exposing, breaking, and manuring the subsoil, he may be enabled to correct its defects.

Various mineral substances are found in the subsoil, part of which are corrosive to the roots of plants, and therefore injurious to the soil; others are hurtful, only by their mechanical solidity and coldness; and some, which are injurious in their natural state as minerals, are not so, when exposed and oxidized, or changed by decomposition, and by new affinities. Coal and sulphur are the most abundant substances; the latter in various combinations. Fossil coal, in its natural state, and alum rock or sulphureous schistus, if not positively hurtful to soils, have not been understood as improving them, when underlaid, in the form of subsoil; excepting soils full of calcareous matter, in which a portion of alum rock, decomposed, may operate as manure. Both fossil coal, and charcoal, in process of time, and by suitable means, become soluble, and then may furnish the carbonaceous principle to plants, in some degree like peat earth, or like putrid vegetables.

Water, as an adventitious mixture passing into soils, frequently percolates through strata containing salts of iron, and, passing over a subsoil of strong ferruginous till, as very often happens in Scotland, it runs from the strata where it has received this impregnation, into soils lower situated; and as it always injures their fertility, it ought to be drained away as effectually as possible.

IV. ON THE ADVANTAGES OF A MORE MINUTE INVESTIGATION, REGARDING THE SOILS AND SUBSOILS OF THE KINGDOM.

THE connexion betwixt the soil and subsoil being thus intimate, and the fertility of the former, depending so materially

on the quality of the latter, there can hardly be in the whole art of agriculture, an object of more importance, than to ascertain the qualities of the soil and subsoil; and, if possible, to apply the proper correctives to such as are faulty.

To accomplish this, would require the united efforts of landholders and farmers, and, indeed, the assistance of the public. A more ample discussion of the proper modes, and the best means of effecting these objects, would be of primary importance; and then would naturally follow, a course of local surveys, with suitable maps and sections. The celebrated Elkington's, and other boring instruments, would thus come into more liberal use; and while such investigations were going on, (for the purpose, in the first place, of improving the quality of the soils of North Britain), in penetrating through the strata, other objects, of a secondary and incidental, yet most important nature, might be accomplished. The sections likewise would answer many valuable purposes connected with improvement, in all the material interests by which the value of property is augmented.

To do justice to this important object, which lies near the foundation of the agricultural improvement, and prosperity of the kingdom, an incomparably more extensive and more perfect survey, especially of the *subsoils*, would be requisite; and then it would be proper, not only to present *maps* of the soils, but also to prepare *sections* of the several ridges and vales, exhibiting at once, both the soil and subsoil, together with the external form and elevation. Such a work, would also most naturally connect mineralogy with agriculture; and it would pave the way, for improving every sort of communication, by roads, canals, and railways; and for arriving at precise ideas respecting climate, in so far as it operates conjointly with soil or subsoil, in reference to green or white crops, to plantations or woods, to gardens or orchards, to meadows, and to pasture grasses.

As the basis of such a work, intelligent men consider the grand survey, begun by the late General Roy, for the Board

of Ordnance, and continued by Colonel Mudge, extremely valuable. An outline will thus be drawn, in the most extensive and authentic manner. It will then remain for the public, to see that most interesting outline of the geometrician, filled up by the skilful mineralogist, and the well-informed agriculturist, or judicious farmer.

The complete execution of such a work, would form a basis of improvement, incomparably superior to any that has hitherto been heard of, either in this or any other nation. It is the more essential, as a great proportion of subsoil, in most of the districts of Scotland, is extremely injurious to cultivation and produce.

SECT. V.

ON THE MINERALS AND FOSSILS OF SCOTLAND.

BY MR GEORGE ROBERTSON.

THE object of this section is, to give a general view of the minerals and fossils of Scotland, in the order in which they appear, on the whole, to be of the greatest profit to the nation.

1, *Coal.*

This most important mineral production, is found in several districts of Scotland, as in Dumfriesshire, and Roxburghshire, in the more southern counties, and in Sutherland towards the north; but the great field of Scotch coal stretches from S. W. to N. E., and is to be found, in greater or smaller quantities, in the shires of Haddington, Edinburgh, and Lin-

lithgow, (commonly called the Lothians), Stirling, Clackmannan, Kinross, Fife, a part of Peebles and Perth, Ayr, Renfrew, Lanark, Dumbarton, and a part of Argyll. Its average breadth is 33 miles, and its length, on the mainland of Scotland, is 98 miles; consequently its total area is 3234 square miles. From this, deducting 360 miles for the space covered by the Firth of Forth, there will be left 2874 square miles of territory, in some parts of which coal is found at different depths, and of various qualities; and in 600,000 acres of which, it is computed, it may be worked to advantage. The districts through which this great field of coal extends, are by far the most populous in the kingdom, containing above two-fifths of the people, in less than one-tenth part of the space; and the soil in general is well cultivated. This improved cultivation is in no small degree to be attributed, to the advantages arising from the extensive distribution, easy conveyance, and moderate price of coal; for wherever fuel is most abundant, there the population is greatest, and manufactures, commerce, and agriculture, mutually aid, and stimulate each other.

The depth of coal varies, but in general it seems to be rather nearer the surface in the western, than in the eastern division of the country. There is also a great variety in the number of its seams or strata, and their thickness. The most extraordinary thickness in the island, is at Quarrelton, near Paisley, where five contiguous seams are upwards of 50 feet thick*. Seams less than 18 inches, are not deemed equivalent to the expence of working.

Its quality differs from the small fusing coal of Newcastle. It rises in large masses, does not adhere, or cake together in the fire; but each piece continues separate, takes fire readily, and burns with a clear light, and considerable flame. There are, however, several instances of the caking or blacksmith's coal to be found, and these generally in the same pit with the

* Statistical Account of Scotland, vol. vii, p. 80.

great coal, but in separate seams; the whole, however, will not exceed one part in twenty of the general mass.

The following statement, will give some idea of the quantity consumed, and of the purposes to which it is applied:

1, Consumed by the inhabitants in their houses, for ordinary purposes	TONS. 2,000,000
2, By the different blast furnaces, by other iron-works, and by common blacksmiths	250,000
3, By lime works	150,000
4, By glass-works, soap-works, distilleries, &c. &c.	100,000
<hr/>	
Total,	2,500,000

The price varies at the pit mouth, either according to the quality, or according to the demand, from 4s. to 10s. the ton. Perhaps 6s. 8d. is nearly the average: hence the total value would be L. 833,333 : 6 : 8. Of the average value, 5s. 6d. may be set down as wages to the pitmen, and other attendant labourers; the remainder may be stated as rent to the proprietors, and for the expence of erecting and upholding the works.

Some are of opinion, that notwithstanding the seeming abundance of coal at present, yet, at no very distant period, this indispensable article of fuel, may not only become scarce, but be entirely exhausted. There is reason however to believe, that the great field of Scotch coal alone, contains about 600,000 acres, and that the consumption does not exceed 172 acres *per annum*. Deducting therefore the quantity already consumed, there would still remain, from this great field alone, a quantity adequate to the consumption of about 3000 years, independent of the other two fields in the southern and northern extremities of Scotland*.

* The grounds of this opinion, will be given in the Appendix, NO. VI.

2, *Lime.*

Next to coal, limestone is the most valuable mineral belonging to Scotland, and from its importance to agriculture, one of the greatest sources of its national wealth. It is very generally met with, but is not equally plentiful in every district.

It is commonly found in strata like coal, differing in respect to depth and thickness, but generally nearer the surface. There is a great variety, both in its external appearance, and inherent quality. The greater part, before it is calcined, is mottled or runs into veins, and is of a very close texture. It is thought of tolerable quality, if it has 60 *per cent.* calcareous, and even less will, in most cases, pay the expence of working it, with profit. It is also reckoned very good stone, that produces two and a half bushels or bolls of slaked lime, from one of the burnt shell. Some few quarries give three times the bulk in slaked lime, that the shells originally occupied; and one extensive lime quarry in Aberdeenshire, yields lime of such excellent quality, that a boll of burnt shells will yield nearly $3\frac{1}{2}$ bolls of slaked lime.

It is impossible to ascertain accurately, the whole quantity annually manufactured in Scotland, but it cannot be less than three millions of bolls, each containing rather more than 4 Winchester bushels*. Indeed, such is the demand for lime as a manure, in Scotland, that considerable quantities are annually brought from Sunderland, and from Ireland, by sea; and from Northumberland and Cumberland, by inland carriage. The price at present, although it varies at the different works, is probably not less, on an average, than 2s. 6d. *per* boll, though many would estimate it higher. Even at this rate, the value of three millions of bolls, would amount to L. 375,000; one-third of which may be stated as profit to

* It is computed, that 14,000 acres are annually dressed with lime in the county of Dumfries alone; and that above 100,000 acres must be manured with lime, every year, in Scotland.

the proprietors, and those who undertake the manufacture, for interest on the capital employed, and for erecting and keeping up the works; the other two-thirds are required for labour, and for coals. The quantity of coals required, varies at different lime-works. At Causland, 20 cwt. of coals burn $20\frac{1}{2}$ bolls of shells; at Hedderwick, near Montrose, 20 cwt. of coals burn $15\frac{1}{2}$ bolls of shells; and at Lord Elgin's works, 20 cwt. burn 21 bolls of shells: But three millions of bolls of lime, on an average, will probably require, in all, about 150,000 tons of coal.

It is much to be regretted, that greater efforts are not made for burning lime with peat, which might be effected with great advantage in many of the mountainous districts of Scotland, where coal cannot be obtained, and by means of which, extensive tracts of barren land might be improved.

3, Iron.

This metal is very generally found in Scotland, but more especially in the coal districts, where, in the searching for coal, the iron, which otherwise would not have appeared, is also discovered.

The art of converting iron ore, balls, and ironstones, into metal, has been long known in Scotland, though perhaps not so perfectly as at present: it is but of late that this branch of manufacture has been carried to any considerable extent; it is now increasing, the manufactured iron being greater in quantity, and better in quality than formerly. Indeed, from every appearance, there is reason to believe, that the raw material is inexhaustible, and that the country will be soon able to supply itself with this most useful metal, without being under the necessity of procuring any from abroad.

The greatest manufactory of iron, is near Falkirk, known by the name of the Carron-works. These were first erected in 1760, and are maintained on the greatest scale, employing about 2000 people, requiring a capital of L. 150,000, and

smelting 6500 tons of iron yearly. They use 800 tons of coal, 400 tons of ironstone, and 100 tons of lime, (as a flux), weekly *. There are altogether 21 blast furnaces in Scotland, each producing on the average 30 tons of iron weekly, or 32,760 annually, which, at L. 7 *per* ton, amount in value to L. 229,320 Sterling, and they employ 7650 people in the different operations of the manufacture. Part of the produce is converted into malleable iron, a process now fully understood, and well performed.

4, Lead.

There are a number of places in Scotland, where this valuable mineral is found. The richest mines, however, are those of Leadhills, and of Wanlock-head, on the confines of the shires of Lanark and Dumfries, situated in the highest inhabited country, at least where any village is erected, and probably the least attractive in the island †. The first belong to the Earl of Hopetoun, and the other to the Queensberry family: they have both been wrought for ages. The produce of Lord Hopetoun's, is, on an average, 35,000 bars, and of the Queensberry mines, 25,000 annually, each bar weighing 1 cwt. 1 qr. 2 lb. avoirdupois. The quantity varies, however, very much in different years, according as the miners chance to fall upon richer or upon poorer veins. The price also varies at different periods. Till within these last fifteen years, it was commonly about L. 1 the bar. Of late it was as high as L. 2, 2 s., but it has since fallen. At the largest price it produced annually about L. 126,000, obtained from a territory, not exceeding two square miles in extent. The number of people in Leadhills' village, is about 1000; in that of Wanlock-head, and in the vicinity, about 870. They were formerly subject to diseases, peculiar to

* Statistical Account, vol. xix, p. 93, 95.

† Ibid, vol. iv, p. 512. & vol. xxi, p. 97.

such places, which in some degree was occasioned by the deleterious nature of the waters, and which not unfrequently terminated in madness or idiotism. By a careful attention to their diet, (more especially by abstaining from the use of spirituous liquors), and by a better mode of spending their time, these people now enjoy as good health as those of other districts, and they are no longer subject to any intellectual derangement as formerly. A circumstance, in some degree singular with regard to these mining villagers, is worthy of being recorded. As they continue at work only six hours in the twenty four, and from experience find, that they dare not indulge in the bottle, they have substituted a circulating library in each village, which affords a more rational mode of recreation. Their collection of books is said to be pretty numerous, and well selected; affording them an ample store of both amusement and instruction.

There are lead mines also in the isle of Isla, that have been wrought for many years, and give employment at present to 48 miners. In the isle of Coll, a lead mine has been opened, and bids fair to succeed. At Strontian in Sunart, 46 miners are employed, whose labours are stated annually to have produced lead to the extent of L. 4000 in value. It was at these mines that the peculiar sort of earth, known under the name of Strontian, was first discovered. At Tyndrum, on the confines between Breadalbane and Argyll, some lead mines were opened, and after having been abandoned, are now again wrought. On the lands of Afton, in the parish of New-Cumnock, there is a lead mine. In the parish of Minnigaff in Galloway, there was a mine that formerly produced annually from 30, to even 400 tons of ore, but which is now given up. It seems probable, that all these lesser mines may, in conjunction, produce L. 10,000 yearly, making the total produce of this branch of minerals about L. 136,000. The proprietor's share, is the sixth part, or every sixth bar. The rest goes to the contractors, who in-

cur great expence in paying the miners, and upholding the works.

Besides these mines at present working, there are appearances of lead at the following places: In the parishes of Hoy, Stromness, and Stronsay in the Orkneys; on the lands of Skinnet near Thurso; among the Ochil hills; in the parish of Anworth in Galloway, where a trial is making with much appearance of success; at Ballater in Aberdeenshire; Benledie in Monteith; the Lomond hills in Fife; in the parish of Crawford-John in Clydesdale, and in that of Auchinleck, and several other places in the shire of Ayr. Appearances of this mineral, in other parts of Scotland, are taken notice of in the Statistical Accounts; from all which it seems highly probable, that much unwrought lead is yet remaining, to reward the exertions of future adventurers in this branch of mining.

5, *Copper.*

There are many indications of this metal, both in the Highlands and Lowlands, and in the Western and Northern Islands. From a valuable paper written by the Rev. John Fleming, annexed to the Report of Orkney and Shetland, it appears, that in the space of two years from June 1802, about 472 tons of copper ore were raised in Fair Isle, one of the Zetland Islands, and sent to Swansea to be smelted. From some mismanagement the mine has been abandoned; but Mr Fleming is of opinion, that copper might still be wrought to advantage in that island. Copper has likewise been found in considerable quantities, in the Ochil hills, near Stirling*. Tin has not been observed in Scotland.

* See Stirlingshire Report, p. 55.

6, *Common Building Stones, Basalt, &c.*

Scotland abounds in all kinds of stone, from the hardest whin, to the softest sandstone; hence, building stones, being so generally accessible, seldom yield much profit to the owner of the quarry. Yet, in the vicinity of populous towns, such as Edinburgh, Dundee, and Glasgow, especially if it is a stone easily wrought, a quarry becomes a valuable concern. The freestone quarries in the neighbourhood of Edinburgh, rent at about L. 10,000 yearly*. From the excellence of the stone, they have been one chief cause of the beauty and solidity of the fine buildings in that city. It seems probable, that in all the rest of Scotland, the rent of the quarries does not exceed that sum. In the vicinity of Aberdeen, L. 8400 is stated as the value of stones sold annually, but only a few hundred pounds go to the proprietors of the quarries†. This, after all, is not a low rent, as a very few acres comprehend the whole. The rent of these quarries necessarily varies, according to their distance from Aberdeen, which occasions the expence of carriage to be widely different. The rock near Aberdeen is a hard granite, which requires much labour to raise. But the stone is often found in large masses lying on the surface. It is so very hard, that none, but those accustomed to it, can work it to any advantage.

Among the stones of Scotland, basalt, which is found in great abundance in many parts of the kingdom, merits particular notice. Some of the Western Islands are almost entirely composed of it. Among these is Staffa, which has long been celebrated on account of the magnificence and beauty of its columnar arrangement of basaltic rocks. At Fingal's cave in that island, some of the pillars of basalt are about 60 feet in height, and their construction is such, that it is not difficult for the imagination to conceive, that they are a work

* Survey of Mid Lothian, p. 25.

† Statistical Account, vol. xix, p. 155.

of art, raised by the hero of Ossianic poetry. Basalt is an admirable stone for the purposes of building: it is durable and little liable to decompose; the soils upon basalt are usually very fertile*.

7, *Blue Slate.*

This excellent material for covering houses, is to be met with in great abundance, in many places of the country. The best, or at least the most extensively wrought quarries, are those of Easdale, and some other neighbouring islands, on the coast of Lorn in Argyll, of Balachulish in Appin, also at Camstradden in Dumbartonshire, and Aberfoyle in Perthshire. Slate also abounds near Dunkeld, at Genocher in Crawfordmuir, and on the estate of Kames in Bute. The total quantity raised in Scotland is supposed to exceed fifteen millions of slates *per annum*.

The price at the quarry varies from 30s. to 40s. *per* 1000: Hence, in all, the value is about L. 25,000. The expence of working, is, in general, stated to be, about one-half of the quarry price †.

8, *Grey Slate, or thin Sandstone.*

This article abounds, in many places, especially in Angus, in the vicinity of Forfar and Glamis, in Perthshire, by the water of Almond, and in the parish of Rafford in Moray. There is a species of red sandstone, employed for the same purpose in Dumfries-shire. All these make a strong and durable roof; but being much thicker than blue slate, they are of course more weighty, and require stronger timbers, which causes them to be less used, where blue slate can be

* Remarks by Sir Humphry Davy.

† In the south western counties, the price is computed by the ton, and the cover is from 18 to 24 square yards *per* ton, according to the thickness of the slate. The slate of Lancashire and Westmoreland, surpasses any that has hitherto been worked for sale in Scotland, in point of size, but they are not found to be so durable as those of Easdale, &c.

had. There is no mention, in any of the Statistical Accounts, of the quantity or price. Probably it may be equal to one-fourth part of the number, and to double the price *per* thousand of the blue slate; for being greatly larger, 1000 of the one will cover nearly as much as 2500 of the other. It is much used for farm-houses and offices, and is doubtless a superior covering to either tiles or thatch; but is very apt to draw water through the pores of the stone, unless it is either pitched or painted.

9, *Marble.*

Enough of marble, to serve all Europe, may be had in the Hebrides*, on the west coast of Argyllshire, and in Sutherland. The colours are very various, and many of them elegantly blended. The British marbles, however, want the imaginary qualification that results from being brought from a distance, to make them celebrated at home. They are too easily obtained, and are not therefore sufficiently estimated. They are often also blended with other minerals, which injure their beauty, and render them difficult to work. In most of the lime quarries of Dumfries-shire, veins of marble occur.

10, *Precious Metals.*

Gold.—This precious metal is rarely sought after at present, but it is sometimes found by accident in very small particles. It is said, however, that in the reign of James V, above three hundred people were employed by that monarch, for several summers, near the Leadhills, in picking up small pieces of gold along the sides of the rivulets, by washing the gravel; and that gold was in this way obtained, to the extent

* Some very promising quarries of marble have been lately opened on Lord Macdonald's estate in the Isle of Skye.

of L. 100,000 Sterling in value*. There are still to be seen, many heaps of small gravel, by the banks of the streams in that district; and the tradition of the country is, that these are the heaps that had been collected and washed for gold, at the period above stated.

Silver.—There are a few places in Scotland, where silver is said to have been found formerly, and where it is still to be met with in small quantities. The richest Scottish silver mine on record, was one in the parish of Alva in Stirlingshire, on the north side of the Forth, among the Ochil hills. This, about the year 1710 or 1711, was worked by Sir John Erskine of Alva. It was so rich, that twelve ounces of pure silver, are said to have been obtained from fourteen ounces of ore; and it was found in such quantities, that silver, to the amount of L. 4000 Sterling, was once produced in a week. It was thought that Sir John made from L. 40,000 to L. 50,000 Sterling of it, before it was exhausted†. There are several other places in that neighbourhood, among these hills, and likewise among the Sidla hills, and the Grampians, in which small veins of silver are still to be met with. The hills between Linlithgow, and Bathgate in West Lothian have likewise produced small quantities of silver. But at present, the only silver that is obtained in Scotland, is not from silver ore itself, but from lead. That metal produces, from six ounces, to seventeen ounces of silver, for every ton of lead, and the produce, at an average, is worth about L. 10,000 *per annum*. The lead, till within these twenty years, was sent to Holland, for the purpose of extracting the silver, but that process is now carried on at home.

11, *Precious Stones and Pearls.*

These principally consist of the agate, the amethyst, the beryl, the garnet, the topaz, and the cairngorum crystal, of

* Statistical Account, vol. iv, p. 515, and vol. vi, p. 276.

† Ibid. vol. xviii, p. 141.

which last there are several large and valuable specimens. Pearls also formerly abounded: But the great celebrity which the Scottish pearls had acquired in the London market, and the high price which was the consequence of it, have occasioned the best stations of the fishery to be nearly exhausted, by the avarice of the undertakers. This has been more especially the case with the pearl fishery on the river Tay, which was so productive, as to yield about L. 10,000, between the years 1761 and 1764, but soon after, it dwindled down to a trifle, and has been in an unprosperous state ever since. Pearls from the Tay sold then, at from 10s. to L. 1, 10 s. *per* ounce, and one was found that weighed 33 grains. Next to the Tay, the Ythan, an Aberdeenshire river, has been the most celebrated for pearls. Some of the pearls in the Scottish crown, are said to have been obtained from this river; and there are still a few to be had in it, which are much esteemed. The Upper Forth was also celebrated for this production, till exhausted by the same company that plundered and ruined the fishery in the Tay about the year 1764. These pearls are produced by the *mya margaritifera* of Linnæus, which, he remarks, is to be found in all the cataracts of the northern hemisphere.

12, *Marl.*

This valuable fossil is to be met with in various parts of Scotland. Shell marl is chiefly found in lakes, the remains in general of the fresh-water wilk, or periwinkle. From 20 to 30 tons of it, when dried, are sufficient to manure an acre. Clay marl is found in several districts; but is not now much used, as it requires from 120 to 180 tons *per* acre. Stone marl is attended with considerable labour and expence in breaking and carriage, and it requires long exposure before it be sufficiently reduced. Marl is not a commodity like lime, that may be exported to any distance; it is a bulky article, and can be used only in a limited vicinity.

13, *Scarcer mineral and fossil substances.*

Of articles to be classed under this general head, there is a great variety; as antimony, alum, black-lead, cobalt, &c. the particulars of which will be found in the Appendix, NO. VI.

From the preceding short statement, it will appear, that if Scotland produced nothing else of importance, but the various articles above enumerated, it would still be highly valuable on that account alone.

SECT. VI.

ON THE WATERS OF SCOTLAND.

BY MR GEORGE ROBERTSON.

THERE are few countries more amply provided with water, for every beneficial purpose, than Scotland; and the importance of this circumstance, in a national point of view, can hardly be sufficiently estimated.

This subject may be considered under the following heads:

- I. Rivers and Streams.
- II. Fresh-Water Lakes.
- III. Firths, and other inlets of the Sea, provincially called
Lochs, and
- IV. Mineral Waters.

Artificial Navigations or Canals form a separate object of investigation, under another head of this Report, where the means of conveyance are discussed.

1, *Rivers and Streams.*

These are so very abundant, that a description of the whole, even in the most concise terms, would swell this part of the work, beyond all moderate bounds. It is proposed, therefore, merely to give a list of the principal rivers, as they rank in regard to the extent of territory from which they derive their waters, or through which the drainage of the district passes; and in the Appendix, NO. VII, to furnish a more particular detail, of the principal rivers and streams which fall directly into the ocean, commencing with the Tweed on the south-east, and going round the coast by the east, north and west sides, and terminating with the Esk in Dumfries-shire on the south.

The following may be stated as the order, in which the greater rivers rank, in regard to the extent of territory from which they derive their waters, in as far as that circumstance can be ascertained.

	Square miles.
1, The Tay	2396
2, Tweed,	1870
3, Spey.....	1300
4, Clyde.....	1200
5, North Dee.....	900
6, Ness.....	850
7, Forth.....	840
8, Lochy.....	530
9, Nith.....	504
10, Findhorn.....	500
11, Don.....	496
12, Esk, Dumfries-shire.....	484
13, Deveron.....	430
14, Leven, Dumbartonshire.....	400
15, South Dee.....	396

	Square miles.
16, Annan.....	384
17, Beaully.....	324
18, Conan.....	320
19, Oikel.....	300
20, South Esk in Angus.....	295
21, Awe, in Argyll.....	250
22, North Esk, in Angus.....	224

With respect to navigation, the Forth, the Clyde, and the Tay, are the most important, arising more from their connexion with the sea, through their respective firths, than from the magnitude of their own streams. The Nith, the South Dee, and the Leven, through its whole course of five miles till it joins the Clyde, also enjoy, in some degree, this advantage. In all the others, there is no navigation practicable beyond a few hundred yards from their mouths.

The secondary rivers are likewise of essential service, as they are well adapted for giving motion to machinery, a purpose to which they are often applied in Scotland. Even the smaller rills are, in this respect, peculiarly useful, from their capability of being applied to the turning of mills, and to other economical purposes. It is of no small importance, that there should in all places be an ample supply of water for live stock; and Scotland is not deficient in that essential provision. There is seldom a square mile of territory, that is not in the vicinity of some stream or rill.

The quality of the water is almost universally excellent. The only instance of a scarcity, or of a defect in the water of any district, is perhaps in the Carse of Gowrie, which, in other respects, possesses the greatest natural advantages, but, in this particular, is rather deficient.

2. FRESH-WATER LAKES.

The natural beauties of the fresh-water lakes of Scotland, have long been celebrated, as equal to those of any other country. A short description of the most considerable, will be found in the Appendix, NO. VII. The reader will be enabled to form some general idea of them, from the sub-joined list, and the account there given, of the most material circumstances connected with each.

Table of the Principal Scottish Lakes.

NAMES.	Length in miles.	Greatest breadth in miles.	Square miles of surface.	Counties in which they are situated.	CIRCUMSTANCES.
1 Loch Lomond, ..	24	7	45	Dumbaron & Stirling, ..	Full of wood-clothed islands, partly surrounded with mountains, & abounding in fish.
2 Loch Awe,	25	2	30	Argyll,	Ditto, ditto, amid beautiful mountain scenery.
3 Loch Ness,	22	2	30	Inverness,	Surrounded with mountains, full of fish, and in the tract of the Caledonian Canal.
4 Loch Shin,	20	1½	25	Sutherland,	Surrounded with wild mountain scenery, and abounds in fish.
5 Loch Mari,	12	3	24	Ross, west coast,	Abounds in fish, full of islands, many of them wooded.
6 Loch Tay,	15	2	20	Perth,	Full of fish, and in the heart of a beautiful Highland country.
7 Loch Arkieg, ...	12	2	18	Inverness,	Abounds in fish, and in the heart of a fine rural Highland country.
8 Loch Shiel,	16	1	16	Inverness, west coast, ..	Abounds in fish, and in the heart of a mountainous country.
9 Loch Lochy,	16	1	15	Inverness,	In the tract of the Caledonian Canal, fine salmon, and clear hard water.
10 Loch Laggan, ...	8	1½	12	Inverness,	Abounds in fish, and in the heart of a wild Highland country.
11 Loch Morrer, ...	9	2	12	Inverness,	Abounds in fish, and in the heart of a rural Highland country.
12 Loch Fannich, ...	7	1½	10	Ross, in the middle,	In a remote part of the country, surrounded by lofty mountains.
13 Loch Erricht, ...	14	2	10	Perth and Inverness, ...	In a wild mountainous country, fringed with wood, remote from habitation.
14 Loch Earn,	8	1½	9	Perth,	In a pleasant Highland country, with much natural wood.
15 Loch Naver,	6	2	9	Sutherland,	In a remote and mountainous country.
16 Loch Stennis, ...	8	2	8	Orkney, Mainland,	Full of fish, much haunted by sea-fowl, and in the midst of a low and barren country.
17 Loch Rannoch, ...	9	1	8	Perth,	Full of fish, and in the heart of a woodland Highland country.
18 Loch Leven,	4	2	7	Kinross,	Full of fish, has some islands, and in the heart of a cultivated country.
19 Loch Fuir,	4	2	6	Ross,	In a wild mountainous country.
20 Loch Lydoch,	6	1	6	Perth and Argyll,	In a wild country, remote from habitation.
21 Loch Dee & Ken, ..	10	0½	6	Galloway,	Abounds in fish, and in the heart of a cultivated country.
22 Loch Loyal,	6	1	6	Sutherland,	In a mountainous country, near the north coast.
23 Loch Glass,	3	1	5	Ross, east,	Abounds in trout, in the midst of a hilly country.
24 Loch Katterin, ...	8	0½	5	Perth, Monteth,	Abounds in uncommon picturesque scenery, wild and gloomy.
25 Loch Doon,	9	1	4½	Ayrshire,	Encircled with a rocky shore, and abounds in trout.
26 Loch Hutchart, ..	3	1	3	Ross,	In a mountainous country, the precipitous shores covered with wood.

III. OF FIRTHS, AND INLETS OF THE SEA.

SCOTLAND is remarkably indented by arms of the sea, which enter deep into the land. The extent of sea-coast, on the mainland, is nearly 2500 miles. Were the boundaries of the country to be taken by regular straight lines, it would not exceed 620*. This indentation of firths is highly beneficial. It facilitates commerce, as each of these firths, according to its extent, serves the purpose of a canal;—it furnishes considerable quantities of manure, and materials for the manufacture of kelp;—it is favourable to the fisheries, as it brings them more within reach;—it increases, by lengthening the line of coast, the number of people, who are trained from their infancy to a seafaring life;—and it renders the climate more temperate, from the influence of the sea air.

For a short description, or rather an enumeration of these different Firths and Sea Lochs, reference may be had to the Appendix, NO. VII. To enter minutely into the relative circumstances, or into a statement of the importance of each, would fill a volume.

IV. OF MINERAL WATERS.

THESE are abundant, and to be met with in almost every district. Those which have acquired the greatest celebrity are,

1. *Moffat* in Annandale; 2. *Pitcaithly* in Strathearn; 3. *Pannanich* in Mar; and 4. *Peterhead* in Buchan.

Particular descriptions of these waters will be found in the Appendix, NO. VII.

There are many other mineral wells, that have likewise had their day of celebrity, and that continue still to be famed. The most distinguished are, *Merkland* and *Lochinbrack* in Galloway; *Dunse Spaw* in Berwickshire; *Innerleithan* in

* Each coast, in a straight line, would be 280 miles, besides the distance from *Duncansbay-head* to *Cape Wrath*, about 60 more, or 620 miles in all.

Tweeddale; Kirkconnel in Nithsdale; Ecclesmachan, and Torphichen in West-Lothian; Salton in East-Lothian; Grange in the parish of Maybole, Ayrshire; St Bernard's in the vicinity of Edinburgh; Airth, and Boquhan in Stirlingshire, the latter of which, in particular, is rapidly increasing in repute; Monimail, and Kingsbarns in Fife; Arbroath, and Rossie in Angus; the well of Boyndie in Banffshire; Strathpeffer in Ross, and Kildingue in the Isle of Stronsay in the Orkneys.

ON THE GEOGRAPHICAL, OR THE NATURAL ADVANTAGES, AND
DISADVANTAGES OF SCOTLAND.

It may be proper to conclude this Chapter, by enumerating the advantages, and disadvantages, by which Scotland, in general, is peculiarly distinguished.

The Advantages of Scotland, notwithstanding its northern latitude, are considerable.

1. Its maritime situation is of the utmost importance. It embraces a great extent of sea-coast, and abounds in creeks and harbours. Even the mainland is so much indented by bays, firths, and arms of the sea, as to possess upwards of 2500 miles of coast; and the islands belonging to Scotland, that most valuable nursery to the British Navy, have, in all, a still greater extent of coast belonging to them. The advantages thence arising, in regard both to internal and foreign commerce, from the facility of communication, and also in regard to agriculture, from procuring manure, and transporting lime and coals from one district to another, are too apparent to require illustration. Owing to its maritime and insular situation also, it is neither chilled by severe cold, nor oppressed by excessive heat.

2. The numerous streams and lakes are likewise of great value, not only from the supply of fish which they afford, but also from their utility in driving machinery, facilitating irrigation, and in some cases internal commerce.

3. The fisheries, not only along the coast, but in the numerous bays, firths, or arms of the sea, and in the greater lakes and rivers, are very productive. The herring fishery, alone, under a proper system, might be rendered to Scotland, as it was to Holland, a mine of wealth; and the fisheries of cod, ling and salmon, are both abundant, and very valuable.

4. The minerals and metals of various kinds, give employment to industry, afford raw materials for manufactures, and are productive of the most beneficial consequences to the nation. Coal, so valuable, in various respects, is to be had in abundance, in the most populous districts, and can easily be conveyed to most other places in the kingdom. Limestone, so essential, both for building, and for improvements in agriculture, is to be found in most districts, or can be obtained by water carriage. Ironstone is very general, of excellent quality, and adapted for various useful purposes. Lead ore, of the richest quality, is found in the mountains, and wrought to a considerable extent. Slate, marble, freestone, granite, porphyry, and building stones of various sorts, are abundant, and in many districts inexhaustible. Even the most barren and rugged mountains contain the topaz, the beryl, and other precious stones; while valuable pearls are to be found, in the beds of several of the rivers.

The disadvantages of Scotland, on the other hand, are :

1. Its northern situation. There is more cloudy weather, and less sun-shine, than in many other countries of Europe, such as France, Spain, or Italy, or even in England. The winter is longer—the spring and harvest generally about a month later, than even in Yorkshire, or the centre of England; hence many articles cannot be cultivated at all, or at

least cannot be raised to advantage, which thrive in warmer climates, and are even produced in the neighbouring kingdom of England.

2. Its variable climate. This renders the labours of the husbandman more precarious, especially when quick changes, from genial warmth, to hard frost, tear asunder the tender vesicles of plants in spring; or when the equinoctial storms in autumn, injure the ripening corn, before the ear is filled, or prevent it from being harvested for a considerable time after it is cut down. Hence, all the skill of the husbandmen, in laying their land dry, in sowing, reaping, and harvesting early, is necessary; nay sometimes is employed unsuccessfully, in struggling against the obstacles which nature has opposed to their exertions. Yet these exertions frequently obviate, or at least often palliate those evils, which human intelligence or strength cannot altogether prevent.

3. The irregularity of its surface, which renders cultivation more expensive, and communication more difficult. The industry of the farmers, in draining, levelling, and inclosing their lands, has, in some measure, overcome the first difficulty; the skill which has of late been displayed, in planning roads and canals, and the liberality of government, joined to the public spirit of individuals, have surmounted the latter. They have rendered communication, through a mountainous country, much easier, than half a century ago would have been considered practicable.

4. The great proportion of wastes, or of lands which are hardly susceptible of culture. About two-thirds of the whole surface of Scotland are supposed to be of this description; and by the plough alone, a large proportion of it can never be brought into cultivation: yet it must be remembered, that the extent of waste land has been daily diminishing, and that extensive tracts of such territory have been already added to the productive lands of the kingdom. In the most barren districts, the spade, and the mattock, have preceded the plough, and assisted in establishing its dominion. When

this could not be attempted, plantations have been made in places, where the irregularity of the surface, though hostile to arable culture, forms no obstacle to the growth of trees. By the general introduction of sheep also, into those hilly districts where corn cannot be raised, the pasture is improved, and the wealth of the nation has been augmented.

Nay, the very adverse circumstances above enumerated, have been turned to advantage, for they have tended to rouse the powers, to stimulate the industry, and to animate the zeal of our husbandmen, who thence have been led, to make the greatest exertions to overcome these difficulties, and to contrive the most effectual means, of counteracting the injurious effects of a northern latitude, of a moist and variable climate, and of a surface, the greater proportion of which is barren and irregular.

CHAP. II.**ON THE STATE OF LANDED PROPERTY IN SCOTLAND.**

BY MR WALTER THOM, AND OTHERS.

THE object of this chapter is, to give a general view of the state of landed property in Scotland, in regard to the following particulars: 1. The value and extent of estates; 2. The tenures by which they are held; 3. The management of landed property; 4. The qualification in land required in those who vote at county elections; 5. The state of property when possessed in common; 6. Of property held under the fetters of an entail; 7. Of property possessed by corporate bodies; 8. The registration of deeds connected with landed property; 9. The servitudes affecting it; 10. The burdens to which it is liable; and, lastly, Some remarks will be offered, on the peculiar advantages attending the possession of landed property in Scotland.

SECT. I.**ON THE VALUE AND EXTENT OF ESTATES IN SCOTLAND.**

IN a rude state of society, when the art of agriculture was but little understood, it is not to be supposed, that the value of land could be correctly appreciated, and its valuation, when

stitious, and the other lands held by it given to the Crown. Lands now destined for charitable purposes, are vested in trustees, and held feu or blanch.

2. Local Tenures.

1. *Udal*, is a species of tenure found in Orkney and Zetland, where the proprietors pay certain duties to Lord Dundas, as lessee of the crown rents, and grantee of the bishop's rents, (besides their proportion of land-tax, in common with the rest of the kingdom), but require no other title than mere possession, certified in Lord Dundas's rental-book, to constitute the right of property; yet from the advantages which arise from written documents and registrations, many of the proprietors now prefer taking out regular charters and sasines; and udal property is every day diminishing in extent, being converted into blanch-holding of the Crown.

2. *Lochmaben* Tenure. This is a species of tenure which has totally disappeared, excepting in the case of the *four towns* of Lochmaben, given by the ancient kings of Scotland to their household servants, or the garrison of the castle, who then were, and still are called, not proprietors, but *kindly tenants*. Their properties are in general small, and require no other mode of conveyance, than the insertion of the owner's name, in the books of Lord Mansfield, as the representative of the ancient keepers of the castle. It resembles the English copy-hold.

Leases are considered in England as a species of holding, but in Scotland are merely accounted a right of occupancy, and not of property, and will be treated of in the fourth Chapter of this Report.

These observations will give the reader some general idea of the nature of Scotch tenures; a more particular account of which, will be found in the Appendix to this Chapter, NO. I, together with some important suggestions, tending to ameliorate this great branch of the legal policy of Scotland.

SECT. III**OF THE MANAGEMENT OF ESTATES.**

CONSIDERING the very opposite consequences resulting from the proper, or improper management of landed property, both to the public and to the individual proprietors, no duty can be more important, than that which devolves upon them, regarding the management of their estates. Many land-owners in Scotland, fully aware of the magnitude of the trust, and convinced that their duty, in this respect, coincides with their interest, have made the proper management of their estates, an object of peculiar attention; and the beneficial consequences resulting from this conduct are apparent, in the great increase of their rents, in the improved circumstances of their tenantry, and in the general wealth and prosperity of the country.

Estates in Scotland are usually managed in one or other of the three following modes: 1. By far the greater number is managed by the proprietors themselves. 2. The estates of those proprietors who have considerable tracts of land, are commonly managed by stewards or factors, under the inspection of the land-owner: And, 3. Those of the higher class of proprietors, are frequently managed by commissioners, having under them stewards or agents, the proprietors being prevented by political or other avocations, from attending to the conduct of their estates.

1. The first mode of management, very generally prevails in Scotland among small proprietors, and those who have estates of moderate extent. Nay, even in some instances, large estates are managed by the proprietors themselves, es-

pecially when they are men of an active turn of mind, and fond of agricultural pursuits.— This is certainly the most advantageous method, both for the landlord and tenant; as the tie which naturally subsists between them, is preserved unbroken; and as their relative situations are founded upon a reciprocity of interests, the closer they are drawn together, the more will their mutual benefit be promoted. By thus attending to the management of his own estate, the proprietor has the best opportunity of knowing the real value of his land; and, from frequent inspection, may appreciate the exertions of his tenants, in the improvements of their farms, or may detect and prevent any deteriorating plans, proceeding either from ignorance or design.

In the more improved districts, the relations which form the bond of connexion between the landlord and tenant, are simple, and easily conducted, as the farms are of considerable extent. In such cases, resident proprietors collect their own rents, and they generally manage the whole concerns of their estates, with the occasional aid of a neighbouring country writer or attorney, to draw out leases, after the conditions have been agreed upon.

2. The second method of management is, where stewards or agents are employed, under the occasional superintendance of the proprietor; and this mode frequently occurs in Scotland. In this case, the steward attends to the more minute business of the estate, occasionally reporting to his employer the nature and extent of the transactions carrying on with the tenants, with whom he settles all the particular obligations contained in their leases, collects the rents*, and

* It is a proper rule, to deliver to the factor or steward the rent-roll of an estate, when he is appointed, as a charge against him, for the amount of which he is responsible; and to cause him make up a similar one, at the commencement of every new year, pointing out any alterations, which may have occurred, since the former one had been made out.

otherwise manages the property as directed by the landlord. This mode of management is calculated to relieve the proprietor from the burden of minute details, and leaves him at liberty to go occasionally from home, or to devote a part of his attention to other pursuits. In this case, it is evident, that much must depend upon the character of the steward. He ought to be a man of good temper, prudence, and considerable address, that he may patiently listen to the complaints of the tenants, redress their grievances, if well founded, and preserve their esteem, respect, and good will, without sacrificing or neglecting the interest of his employer. It is necessary, that he should have a competent knowledge of those laws by which landed property is regulated, and of the legal forms on which transactions between landlord and tenant are principally founded, by which he may be able to settle disputes, and to prevent unnecessary law-suits. He ought also to be well acquainted with the nature of soils, the value of different kinds of land, the best methods of agricultural management, and indeed with every branch of rural economy. It may almost seem superfluous to add, that he ought to possess strict integrity and independence of mind, more especially as he is placed in a situation, that exposes him to much temptation. Having to act between two individuals, whose interests frequently appear different, though in general they are the same; it requires unceasing exertion, both to avoid partiality, and to resist the influence of prejudice, by which the rights of either party might be affected.

Thus qualified, and thus situated, he is able, on the one hand, to form a correct judgment of the interests of his employer, and to guard him against any unfair advantages that might be attempted; and, on the other hand, to discern clearly what ought, and what ought not to be granted to tenants, both in the original agreement, and during the progress of its fulfilment. A steward of this character inspires the tenants with activity and confidence, strengthens their attachment to their landlord, secures a cheerful and punctual pay-

ment of the rents, and promotes the best interests of both parties*.

3. The third mode of management is generally confined to estates of great extent, and considerable value, where the proprietor is either unacquainted with agricultural operations, or unwilling to bestow that attention which is requisite, to render them efficient; or, as often happens, when he is frequently absent from home, either from choice, from ill health, or in the service of his country. In such cases, the management of large estates is entrusted to commissioners, on whom the granting of leases, and the more important concerns of the estate devolve, and to factors, or land-stewards, under such commissioners, who collect the rents, superintend improvements, and conduct all the rural affairs of their employers.

Where a regular system, for the management of a large and princely fortune is adopted, the commissioners to be chosen ought to be men of comprehensive minds, as well as of prudence, and peculiarly distinguished by their knowledge in agriculture, and rural concerns. These commissioners ought to make themselves thoroughly acquainted with all the affairs of the estate, by means of proper documents; such as reports on the boundaries, state of the farms, nature of the leases, and covenants in them, number of servants, cottagers, live stock, the state of culture, &c. with such views of improvements, as alterations in the size of the farms, and the boundaries of each, may render both practicable and advantageous. They ought likewise to have correct reports, regarding the titles to the estate; the political, and other privileges which belong to it; also detailed information, in proper documents, of the state of the woods, fishings, mines, drainages, roads, bridges, &c. These reports, properly arranged, and inserted in books, accompanied with sufficient references, would give a view of a great estate, that would bring every important par-

* Fifeshire Report, p. 56.

ticular under the eye of the proprietor, or of his commissioners, at a single glance; whilst, at the same time, a curious and interesting account, of a great portion of a country, might thus be preserved for future information. In conducting the business of such a property, every legal question, and every demand of a tenant, or of a neighbour, every question about roads, bridges, stipends, churches, manses, &c. would thus be brought under the consideration of intelligent men, capable of deciding, and judging impartially, on the points that came before them. Under the superintendence of such persons, the affairs of a great property would be as well conducted, as on the best-managed small estates, while the duties of the proprietor would be, only those exercises of benevolence, which consist in softening those stricter decisions, which such a commission might conceive itself bound to give; or in granting those marks of approbation and reward, which can only be properly bestowed by the proprietor himself.

SECT. IV.

OF THE QUALIFICATIONS IN LAND REQUIRED IN THOSE WHO VOTE AT COUNTY ELECTIONS.

In former times, all those who held lands immediately of the Crown, were called *Barons*, and, however small their freeholds might be, enjoyed a right to sit in Parliament; but when attendance in Parliament became burdensome to the Lesser Barons, by an act, (1427, c. 102), it was dispensed with, upon their choosing two or more of their own number, in each county, to represent them. Of old, crown vassals, who held lands, estimated at forty shillings of old extent, by a valuation supposed to have taken place in the time of Alex-

under the Third of Sootland, and preserved in documents, called "Retours of the Services of Crown Vassals," were entitled to vote in the election of a commissioner or representative in Parliament. But as, after the Reformation, church lands, of which a large proportion of the kingdom consisted, had not previously afforded a qualification to a freeholder, and the new proprietors could not produce the evidence of a retour, excepting where there remained a retour, *previous* to the gift of the lands to the church; it was thought proper, to give a right of voting to the proprietors of church lands, whose yearly rent was ten chalders of grain, or L. 1000 Scotch in money. Afterwards, when a new valuation of the whole kingdom came to be made, in cases where the lands could not be ascertained by retours to be forty shilling lands of old extent, the right of voting was given, by an act (1681, c. 21) to those, who were infeft in, and possessed of lands, whether in property, or superiority, holding of the Crown or Prince, to the amount of L.400 Scotch of valued rent. This right is enjoyed by the vassal, whether he holds of the crown either feu, or blanch.

It is singular, that the qualification of 40s. in land, should be the same in Scotland as in England; but the Scotch legislature thought it advisable, to fix the value, at the time when their right was established; and it does not admit of any variation, in consequence of the decrease in the value of money.

The single exception to these enactments is found in the county of Sutherland. As by far the greater proportion of land in that county holds of the Earldom of Sutherland, it has been found necessary, to give to the vassals of that earldom, as well as to the vassals of the crown, the privilege of voting; and, in consequence of the inconsiderable number of small proprietors in that district, the qualification of the freeholder is reduced to L. 200 Scotch of valued rent.

SECT. V.**OF PROPERTY HELD IN COMMON.**

ARABLE land held in common, like the *common fields* of England, is, or rather was, known in Scotland, under the names of *Run-rig* and *Run-dale*; being a number of small allotments, either in narrow or broad irregular strips, interspersed among each other, with divisions between them, consisting of slips, or patches of uncultivated land. The narrow strips were termed *run-rig*, and the broad ones *run-dale*.

The origin of this distribution, is alleged by some writers to have been, for the purpose of inducing the whole community, interested in this mixed property, to assist in repelling the sudden incursions of any foreign invader. But according to others, it arose from poverty in the peasantry. In these intermixed allotments, indeed, sometimes two, four, or more tenants, joined in the establishment and support of a single plough, and cultivated the lands conjointly: At other times, where each tenant had a plough, the lands were thus intermixed, that all might be on the same footing; for the better attainment of which object, these lots or ridges were interchanged yearly, to give equal advantage to all. While the land continued in that situation, the feuar or tenant often had his various allotments of arable land, in separate and remote parts of the estate or township. There were also certain regulated rights in common pastures; which sometimes embraced neighbouring estates, and entitled the feuars and tenants, after the crop was carried home, and until the period of seed time in spring, to graze their cattle in common on the arable lands.

The obvious disadvantages of this practice, and the obstructions arising from it to agricultural improvement, in-

duced the parliament of Scotland to enact, "That land belonging to several heritors, or proprietors, lying *run-rig*, may be divided at the instance of *any of the parties*, on citation of all having interest, by the sheriff and justices of the peace, who are to have special regard to mansion-houses, that the divisions may be made commodious for them; and excepting from this act *burrow aikers* *." Wil. parl. 1. sess. 5, c. 23.

In consequence of this statute, *run-rig* and *run-dale* land, with their common rights, have been almost universally abolished.

Besides the arable fields, extensive tracts of waste or uncultivated land were formerly possessed as common pasture, instead of being in severalty. But by statute 1695, c. 38, proprietors having right in common over waste or pasture lands, are entitled to sue for a division in the Court of Session; with the exception of commons belonging to the King in property, or to royal boroughs.

These two statutes, forming conjunctly a general inclosure bill, have greatly tended to the improvement of Scotland. Yet their benefits were not very generally resorted to, till nearly half a century after their enactment.

Some important observations regarding the origin of commons, and common fields, and the mischievous consequences attending that mode of occupying land, will be found in the Appendix, No. II.

* That is, lands or acres belonging to the boroughs, and rented or feued by the inhabitants.

SECT. VI.

OF PROPERTY HELD UNDER ENTAIL.

THE genius of the feudal law is peculiarly adapted to the maintenance of an aristocratic body in the state ; and accordingly, the nobles and great proprietors in Scotland have devised expedients, in correspondence with our legal institutions, by which they are enabled to preserve their lands perpetually in their respective families.

The means by which this object is accomplished, are termed deeds of *entail* or *tailzie* ; and their effect is, to establish an arbitrary line of succession, according to the intention of the entailer, under such regulations and restrictions, as he shall think proper to prescribe.

An entail includes every species of settlement, from a simple destination, which merely *cuts off* the heir at law, to a deed which secures the succession to a long series of heirs, and contains the strictest prohibitions from selling, alienating, contracting debts, &c. and guarded by irritant and resolute clauses. In common language, however, we distinguish by the term *entail*, those deeds only, which are regulated by statute James VII, 1685, c. 22. By this act, it is declared lawful for subjects to tailzie their lands, and to substitute heirs, with such provisions as they shall think proper ; and to enforce these tailzies, by irritant and resolute clauses, prohibiting heirs from selling, alienating, or disposing the lands, or to contract debt, or to do any thing to the prejudice of the substitutes in the tailzie, provided certain forms of publication are observed, by which the public may be protected against any scheme of imposition which might be attempted, by a person possessing an entailed property, assuming the character of absolute proprietor, while in fact he is only a liferenter.

The entail is principally intended, to preserve the name of the granter, and to continue the succession and inheritance of an estate, to a certain series of heirs, under specific conditions. For this purpose, all who shall possess under the entail are prohibited, 1, From selling; 2, From contracting debt that may affect the estate, excepting in favour of wives and children to a certain extent, and under certain regulations; and, 3, From altering or defeating the order of succession. Such are the ordinary conditions of the entail, and they are enforced by the irritant and resolute clauses, which, by the statute, are indispensably requisite to give efficacy to the deed, as by the former, the acts of contravention are rendered null; and by the latter, the right of the contravener is *resolved*, or destroyed.

To give both efficiency and publicity to the entail, the statute expressly orders, that it shall be recorded in a particular register established for that purpose*: and the irritant and resolute clauses, to give them effect against singular successors, must be inserted in all after conveyances, as well as in the procuratories, precepts and sasines, by which the tailzies are first constituted. As this mode of perpetuating property, in a certain line of succession, imposes a severe restraint on the heir in possession, and in some respects, indeed, infringes upon the general law of the country, the conditions, in so far as they affect the obvious interest of the heir, are not liberally interpreted. If the granter intends that they shall be strictly adhered to, they must be particularly expressed; for entails are *strictissimi juris*, and nothing is to be understood by implication; so that the prohibition to sell, to contract debt, to alter the succession, &c. must each be expressed; none of them will be inferred from the other; and they must be guarded by irritant and resolute clauses, in terms of the act of Parliament.

“To encourage the improvement of land in Scotland held “under settlements of strict entail,” it was enacted by statute (10. Geo. III, c. 51, A. D. 1770), that every proprie-

* Erskine, Book iii, tit. 8.

tor of an entailed estate, who shall lay out money in inclosing, planting, draining, or 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 expended 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 heir of entail. By this statute, it is lawful for the proprietor, to let leases for thirty-one years, or for fourteen years, and one existing life, or for two existing lives, under certain conditions as to inclosing, if let for longer than nineteen years; and proprietors may let building leases, if not more than five acres' extent, under conditions, for any period not exceeding ninety-nine years.

There are some very injurious restrictions, however, which have not been noticed in this act. When a property, as is often the case in the Highlands, lies disjointed and scattered in small portions, in various and distant districts, there is no authority given by the law, to exchange beyond a hundred acres, or to sell, for the purpose of buying land more contiguous to the mansion-house, or main body of the estate. An act of Parliament is wanted, which would authorise the Sheriff of the county, and a jury, to exchange entailed lands, which are discontinuous or incommodious, for land more conveniently situated*.

* The standing orders of the House of Lords, expressly prohibit any use being made of the interest of the money, obtained by a sale, not even such a part of it as may be equal to the rent, until a new purchase be made. No harm could arise, from vesting the price of the estate in the public funds, until a property of equal value was purchased; and to allow the heir of entail, in the interim, the interest of the money thus invested.

A want of power to feu land for building, is another hardship severely felt in many cases; and there are many entails, which do not admit of any provision for widows or children, or at least one adequate, in the present state of society, to the expence of education and living.

Under certain circumstances, the powers of the entail cease to operate, as in the case when the last heir called in the tailzie comes to succeed, as then there is no person in whose favour the irritancies can be exerted, and the fee, therefore, becomes unlimited in the person of that heir. By act, 20. Geo. II, c. 50, the king is entitled to purchase lands within Scotland, notwithstanding the strictest entail; and by the statute, same year, c. 51, "heirs of entail may sell to their vassals, the superiorities belonging to the entailed estate." But these, and a few other cases*, form only exceptions to the general principle, which have but rarely occurred; and as the law at present stands, a deed of entail, properly constituted, is a barrier to every species of alienation.

In favour of entails, it has been urged, that the right which every individual enjoys, in this free country, of disposing of his property as he shall think proper, authorises entails; and that the constitution of our government, which admits an aristocratical, as well as democratical interest, fully acknowledges the principle on which they depend. On the other hand, it is asserted, that entails, to the unlimited extent authorised by the laws of Scotland, do not exist in England; yet the English constitution does not differ materially from that of Scotland, nor is the aristocracy of England less wealthy, less powerful, less independent, or less respectable, than the aristocracy of Scotland. As to the right that every individual has, to dispose of his property as he shall think fit, it is contended, that this proposition is directly hostile to the argument which it is intended to support; for that the law, by permitting entails, suffers the caprice of a single in-

* By the act establishing a society for extending the British Fisheries, heirs of entail may feu lands to enable that society to make their settlements.

dividual, to deprive the whole series of his successors, of the very right, which every individual, in a free country, ought to enjoy, "the right of disposing of his property, as he shall think proper." Nay, it is maintained, that this right ought to have some limits; for every well-regulated state will provide, as far as it is possible, by its laws, that the interest of the community at large shall not be injured, by the arbitrary and capricious acts of individuals.

Many of our ablest writers are likewise of opinion, that entails, carried to the extent of those in Scotland, are *absurd*, *unjust*, and *impolitic*. They consider it to be *absurd*, that any private individual should have the power of placing landed property *extra commercium*, and of regulating its descent, its disposal, and its use, to the end of time. They deem it *unjust*, that any proprietor should be deprived, by the act of a remote ancestor, of the power of making rational provisions for his wife and children: And on strong grounds, they hold it to be *impolitic*, that any impediments should be thrown in the way of agricultural improvement. The irritant and restrictive clauses, which tie up the proprietor of an entailed estate, from the full management of his property, are so hostile to improvement, that they must be considered as objects of essential national concern; and in that respect entails ought to be, either still farther modified, or entirely abolished; for it is of paramount importance, that the land should yield the greatest possible quantity of produce, for the maintenance of an increasing population, which, in a free country, is constantly pressing hard upon the stock of subsistence.

On this important subject, some observations will be found in the Appendix, NO. I. and II, which may be entitled to the reader's attention.

From the best information that can be procured, as to a point regarding which accuracy cannot be expected, for the extent must be constantly varying, it would appear, that the lands under the fetters of strict entail may amount to L. 1,190,403 of valued rent, which is about one-third part of the kingdom. (See Table A).

SECT. VII.

OF PROPERTY HELD BY CORPORATE BODIES.

THE extent of land, possessed by public bodies, or corporations, in Scotland, (See the annexed Table A), is estimated at L. 44,388, scarcely $\frac{1}{11}$ th part of the kingdom. This is by many supposed to be rather a fortunate circumstance, as the estates belonging to public bodies are rarely managed to advantage, the interest of the individual too often predominating over that of the community to which he belongs.

On the other hand, it may be observed, that *mortifications*, as they are termed in Scotland, which are devoted to pious purposes, or for the encouragement of literature, though they may be attended with some disadvantages, yet are a desirable means of furnishing a *permanent* provision for objects of benevolence, and for the promotion of learning. The perpetual settlement of land, for such purposes, is the only means of fulfilling the intention of the donors; and, if the law had not cast a safeguard around these settlements, they would have been exposed to the grossest abuse. Even during the turbulent period of the Reformation, lands mortified to charitable uses, and to universities, were held sacred.

The glebes, and grass lands of the clergy, consisting of from six to eight acres each, and, upon the whole, amounting perhaps to from 6000 to 8000 acres of land, though given by law to the residing clergymen of the Established Church, yet are by some considered as belonging to a species of corporation. Being generally of a fertile soil, long under cultivation, and from the smallness of their extent, having a greater quantity of manure applied to them, than the neighbouring far-

mers could in general lay on an equal extent, they produced weighty crops under the old husbandry. As the clergymen who have glebes almost uniformly reside in the country, they find it necessary, (for the accommodation of a riding horse, carriage of fuel, &c.), to retain their glebes in their own occupation, and they are stimulated by example, regard for their own character, and personal interest, to cultivate them to the best advantage. Within the last fifty years, the clergy were considered, from their superior intelligence, to be models of farming, although the interest they possessed was merely that of life-rent. Their farming, however, does not now make such a distinguished figure, owing to the progress of agriculture, which has rendered improvements in that art, much more general, and consequently far less striking.

SECT. VIII.

OF THE MANNER OF REGISTERING DEEDS IN SCOTLAND, AFFECTING LANDED PROPERTY.

It is well known that records are established in Scotland, by which every transmission of heritable property, as well as every burden with which it can be affected, is distinctly pointed out: there are also records of royal grants, and of the decisions of courts of justice. The system of registration likewise, in regard to private deeds, merits attention in this report, as leases and other deeds regarding landed property may be thus preserved, and enforced.

The Court of Session, the Sheriffs, and other inferior courts, have records, in which every deed may be recorded for preservation, or, in technical language, that letters of horning, on six days' charge, and all other diligence may proceed upon it. This is attained by what is termed a clause of registration; which is, in other words, the nomination of

a procurator or mandatary, who may appear before the judge, and authorise a decree to go out in terms of the deed; the consequence of which is, that whatever obligation is contained in the deed, may be enforced by the whole diligence of the law; that is, all execution against the person or estate of the party may proceed under the sentence which the judge is thus authorised to pronounce, for enforcing the obligation. Where there is no obligation to be enforced, the deed may likewise be recorded, for preservation simply.

In place of the decree which formerly was pronounced, the matter has now become extremely simple; but not the less effectual. The deed, with the clause of registration, is given in to the clerk of court, who engrosses it in a book, and at the same time he makes a copy of it, to be returned to the party, which contains a warrant, in name of the judge, authorising the same procedure to take place, for enforcing the obligations of the deed, that would follow, if a decree were pronounced by the same judge, in a cause brought before him for carrying the deed into effect. The principal deed is, at the same time, carefully preserved in the records of the court. The extract given out, and signed by the clerk of court, answers every purpose, excepting where the principal deed is brought under reduction on the ground of forgery; in which case, it is procured from the record office, and produced in the court of session, where such trials proceed. The expence of this act of registration, and of the extract given out, is very trifling; and thus, by the simple expedient of registration, all the effect of the decree of a court is given. It is what in England is termed a *confession of judgment*; and the conditions of a deed, so recorded, for instance the stipulations of a lease, may be enforced without the necessity of an action. This cheap and rapid means of enforcing an obligation, the legislature has extended to bills and promissory-notes.

These devices seem to have been originally introduced in the church courts, and have fortunately been adopted in the civil

courts of Scotland: Nothing can be more simple, more efficacious, or less expensive.

The advantages arising from the preservation of principal deeds, induced the legislature to enact, (1698, c. 4), that deeds, though not containing a clause of registration, may be recorded in the books of council and session, as probative writs; and in this case, a copy is taken and preserved in the record, and the principal deed, marked as having been recorded as a probative writ, is returned to the party.

Such is the system of registration in regard to private deeds by which they may be preserved, or their obligations enforced, and by which the greater part of the private business of the country is conducted.

SECT. IX.

OF SERVITUDES AFFECTING LANDED PROPERTY.

EVEN where an individual has a complete right to property in land, it may yet be subjected to burdens, by which the proprietor is either restrained from the full enjoyment of his property, or liable to certain privileges claimed in behalf of another person*.

Servitudes are divided, by writers on the law of Scotland, into three classes, *natural*, *legal*, and *conventional*.

1. *Natural servitudes* are, where two or more adjoining properties, from their local situation, must allow certain privileges, or suffer certain burdens. For instance, the running of a stream of water in its accustomed channel cannot be interrupted; and an inferior or lower situated tenement, must

* Erskine, B. ii, tit. 9, sect. 1.

§ 1. *Law Charges.*

Every proprietor of lands in Scotland has necessarily to incur certain expences of a legal nature, before he can obtain possession of his property. In the case of a purchaser, or of a donee, he must receive the consent of his superior, through a charter of confirmation, or a charter of resignation and infestment. The heir again, resorts to his immediate superior, whether he be the king or prince, or a subject superior, and the law so far supports the original right inherent in the superior, that it enables him to give an entry to the heir of the deceased vassal, by an order or precept of infestment, directed to his bailie. These forms are attended with considerable expence; but the burden is amply repaid, in large properties, by the security arising from this mode of investiture, though these expences are severely felt in small, or even moderate sized estates. Besides these expences, owing to the peculiarity of the Scotch tenures, various questions are frequently occurring respecting them; also, questions in regard to roads, leases, votes at elections, churches, manses, glebes, augmentation of clerical livings, &c. all which are brought before the Supreme Courts at Edinburgh. Hence it becomes necessary, for almost every great landed proprietor in Scotland, to employ a law agent, attorney or writer at Edinburgh, to conduct these complicated concerns. These legal expences must necessarily vary, according to the business to be transacted by these agents; and as they depend upon a variety of circumstances, no general estimate can be formed of their amount.

§ 2. *Parochial Burdens.*

These are various, and the amount may thus be computed.

1. The stipends of the clergy, though much higher in small than in large parishes, may be estimated, at from one-twentieth to one-thirtieth part of the gross rental, or from one shilling to eightpence in the pound.
2. The schoolmasters'

salary, together with the expence of repairing churches, man-
ses, the minister's offices, school-houses, and other charges
connected with these, may be calculated at from four to five
pence in the pound. 3. Voluntary contributions, and assess-
ments for the poor, more especially in times of scarcity, must
vary as the exigency requires. 4. Payments to the crown,
or to lay titulars and patrons, on account of unallocated teinds
or tithes, affect comparatively but few estates where the pro-
prietors have no right to their tithes or teinds, and cannot
therefore be made the subject of a general estimate.

§ 3. *Provincial Burdens.*

These are, *rogue-money*, for supporting the police of the
county; commutation-tax for highways; allowance for the
wives and children of militiamen; and other incidental ex-
pences of a similar nature; which altogether may amount to
about threepence in the pound.

§ 4. *National Burdens.*

1. The property-tax on the landlord, as on other classes,
is at the rate of 10 *per cent.* or 2s. in the pound, from which
there are some small deductions, as allowances for improve-
ments, &c. and the tax, at present, payable by the tenants,
whose income is assumed at the half of their rent, will, in all
probability, fall ultimately on the landlord.

2. House, window, and other assessed taxes, the amount
of which varies.

3. The old cess or land tax, where not redeemed, may a-
mount to about twopence in the pound.

4. The tax on horses employed in husbandry, is a species
of land-tax. The inequality of the operation of this tax, has
been strongly objected to, for grass lands or pasturage pay no
part of it, and the burden consequently falls upon arable farms
or lands under tillage. It has been suggested as an improve-
ment, in the mode of levying this tax, that when the plough-
men are married, the horses should be exempted, which would

operate as a premium for the encouragement of rural population.

§ 5. *Miscellaneous Burdens.*

The expence of management, of collecting the rents, &c. when the estate is not managed by the proprietor himself; also the expence of attendance at the county, district, road, and parish meetings, are considerable, and increasing burdens.

There are likewise a number of other miscellaneous expences incident to landed property, which cannot be correctly estimated; such as the expence of farm-buildings, of draining, inclosing, and other improvements continually going on, together with road assessments, which are often very high.

From these statements, it appears, that the burdens affecting landed property in Scotland are very considerable, and that any material addition to their present amount would be severely felt by the landholders in that part of the united kingdom.

ON THE ADVANTAGES OF POSSESSING LANDED
PROPERTY IN SCOTLAND.

THE security of property, is the great cause of the prosperity of any country. Where property is insecure, the inducements to exertion are diminished: For it is only by that unceasing industry, which security excites and cherishes, that any society can become opulent or powerful. It is to the spirit of the British constitution, and to those laws, which are the safeguards of individual right in property, that we owe the great, and still increasing prosperity of these kingdoms.

In no country in Europe, are the rights of proprietors so well defined, and so carefully protected, as in Scotland. The process of investiture, by charter and sasine, ascertains the manner in which the proprietor becomes possessed of his lands, whether as the heir of his ancestor, or as a purchaser; and in general fixes their limits or boundaries, with the utmost accuracy. The Scotch system of records affords advantages both in the security and conveyance of property, that are unknown in any other part of Europe. All burdens on land must be recorded, to render them effectual; and by referring to the particular register, their nature and extent can be easily discovered. A purchaser is thus guarded against the effects of all deeds which might operate to his prejudice; as by a knowledge of the nature and extent of the burdens affecting the estate, he may regulate his conduct accordingly.

The rights of the Scottish proprietor being thus fully secured by a series of recorded deeds, at once ample and explicit, he can pursue the improvement of his lands, with the certainty of reaping every advantage that may result from it.

There is nothing more advantageous to landed property in Scotland, than its being exempted from the payment of tithes in kind, and that poor-rates are regulated in such a way that they are hardly felt, even where assessments are imposed. Tithes exacted in kind, are a heavy burden on the profits of the improver, and, in fact, a tax upon industry, which saps the foundation of exertion. In Scotland, fortunately, the ministers of the church are provided for, without trenching on the profits of the farmer. The beneficial consequences of this regulation, place the proprietor of land in Scotland in a more advantageous situation, than the landholder of many other countries, because he receives the fullest return, that can possibly arise, from the expenditure of his capital on the improvement of his land: he is thus stimulated to exertion, by the assurance that he shall enjoy undiminished the fruits of his industry.

The practice of granting leases for a specified duration, is attended by the happiest consequences both to the proprietor and to the country, as it affords full security to those who are the actual cultivators of the soil, and identifies their interests with those of the landlord. Thus, the exertions of both parties are directed to the accomplishment of the same object, and the improvement of the land is inseparably connected, with the interests of the proprietor, and of the tenant. The advantages which result from granting leases, for a certain period of endurance, have been fully established, by the experience of those proprietors who have adopted this beneficial plan, which is daily extending over every part of Scotland, and will soon become the universal practice of the country.

The wide diffusion of agricultural knowledge, among all classes of farmers, has spread a spirit of enterprise, that has called forth all the latent energies of the country. The knowledge and experience of scientific and practical men, have been combined and reduced to a system of management, that is fast approaching to perfection. The operations of the agriculturist are founded upon known principles; and his improve-

ments are not matter of doubtful issue, but in general afford, except in very unfavourable seasons, an adequate return for the capital employed. The nature of the soil, the best mode of treating it, and the expence required to improve it, are becoming daily better known; and, at the same time, the value of the produce can be calculated, with a reasonable degree of precision. This general diffusion of agricultural knowledge, in the opinion of the most intelligent Scotch farmers, has been materially promoted by the establishment of a public institution, for the encouragement of agricultural pursuits; under whose auspices, the landholders, and the farmers of Scotland, have had the merit of conceiving and executing plans of improvement, which are not to be surpassed by those of any other country.

The advantages attending the possession of landed property in Scotland, of a public nature, may therefore be resolved into the following:

1. The absolute security of the proprietor's right, by means of a series of records the most ingenious and complete in the world.
2. The easy transmission of property from one man to another, by a set of forms, entitled '*Investiture*,' which are simple and comprehensive.
3. The exemption from the payment of tithes in kind, which, if once valued, do not afterwards increase with the progress of improvement; and,
4. The exemption from poor-rates, except under great modifications.

Besides these advantages of a public nature, which are founded on the law of the country, and which place the proprietors of Scotland in a more favourable situation than the landholders of almost any other country; the following advantages, originating from the good sense and spirit of the proprietors and cultivators themselves, merit peculiar attention:

1. The general practice of granting leases, which secures the rights of the cultivators for a determinate period, identifies their interest with that of the proprietors, and enables them to carry on plans of improvement, with the prospect of an ample, though not perhaps an immediate return.

2. The diffusion of agricultural knowledge, and the prevailing taste for reading works, containing information relative to the cultivation and improvement of land, by which the discoveries of one individual are quickly communicated to another: And,

Lastly, the enterprising spirit of both the landlords and tenants, which has enabled them to surmount difficulties of every description, to realize new theories, by an improved system of practice, and has inspired them with a taste for experiments, by which the progress of the art is greatly promoted.

There are likewise some local advantages attending the possession of landed property in Scotland, which it may be proper briefly to touch upon.

1. In various parts of Scotland, there are considerable natural woods; and where these do not exist, yet, from the immense size of the estates in Scotland, *plantations*, the cheapest and most profitable of all means of improvement, may be carried on to a very great extent. As the price of timber is continually increasing, it is of infinite advantage, to have large tracts capable of this improvement; more especially where plantations can be made at no great distance from water carriage, which is frequently the case in North Britain.

2. In various parts of Scotland, particularly in the hilly districts, minerals abound, which, on being properly wrought, would doubtless turn out to considerable advantage. Besides immense quantities of coal and lime, mines of lead are worked with much profit; and there are, it is supposed, other

mineral substances, to be found in several districts in the kingdom, of great value.

3. There is no species of property in Scotland, that has, in various instances, so much increased in value, as the salmon fisheries, owing to the more effectual means employed for catching the fish, the improved modes of conveying them to market, and the increased consumption and luxury of the metropolis, where this species of fish is in great request. In some cases, however, the value of that description of property has rather diminished, in consequence of the laws for the protection of the fish not having been properly attended to, and enforced by the proprietors.

4. Within these few years, a *Fishery Board* has been established, to promote that important branch of industry, the Sea Fisheries, which can hardly fail to be productive of the most beneficial consequences. By this institution not only the general wealth, and naval strength of the kingdom will be increased, but great additions will be made, to the value of those districts, which are situated in the neighbourhood of the cod and herring fisheries: these great sources of wealth are likely, therefore, to be carried on, with redoubled energy and spirit.

5. The burning of sea weed into kelp, for the purpose of being used in the soap and glass manufactures, has become a source of immense profit to those estates, on the coasts of which that article is produced in great quantities; and its value is likely to increase, while Spain continues in a disturbed state, and while barilla, the only article that can rival kelp, cannot be obtained in such abundance as formerly. That value has been already nearly trebled, having, at one time, risen, from £.7 to £.20 per ton, but the price has since fallen.

6. When the Highlands of Scotland were exclusively appropriated to the rearing of cattle, the income of an estate, in that part of the country, entirely depended on the price they fetched; but of late, sheep have been introduced there, and

hence the value of highland property has been materially augmented; for the same extent of ground will produce, in the Highland districts, twice as much mutton as beef, besides the value of the fleece. In regard to wool, its value must be greatly increased indeed, if the Merino or Spanish breed of sheep, or even a cross with them, would answer in that part of the kingdom, which, from the trials already made, there is every reason to expect: sheep farms will then be worth at least double what they are at present.

7. To those who are attached to the pleasures of the sportsman, the immense quantities of game frequently found upon Scotch estates, more especially in the Highland districts, are objects of some consideration. On the same property, there are often to be seen, red-deer, roe, the mountain hare, partridges, grouse, ptarmigans, black game, &c. within a short distance of each other. Many keen sportsmen from England, and Ireland, annually visit, on that account, the moors in Scotland; and, besides the pleasures of the chase, derive much benefit to their health, from the pure air they breathe, and from the invigorating exercise they take, in the pursuit of their favourite amusement.

8. Parliament has fortunately adopted the system, of paying attention to the improvement of the more northern parts of the kingdom, or, in other words, has resolved to *colonize at home*. Expectations are entertained, that considerable advantage will in time be derived, from the completion of the Caledonian Canal. The new roads which are forming in those districts, must also rapidly increase their value; and even the most remote parts of the kingdom will soon become perfectly accessible. Above all, the harbours now constructing along the eastern coast, must be of very great advantage to that part of the kingdom, by augmenting its commerce, and extending the fisheries to a height hitherto unknown.

The only objection to holding property in Scotland is, the distance from the metropolis. But many Scotch proprietors

find, that what appears to be a disadvantage, is in fact a benefit; their health being so much improved, by change of air, new scenes, &c. that they consider any inducement to the making an annual, or occasional visit to North Britain, as an advantage rather than otherwise. It may not be advisable, indeed, for a native of England, or a person residing there, to lay out the whole of his property in the northern part of the kingdom, but it might be prudent for individuals of great wealth, to invest, at least, a certain proportion of it, in a country, where it is so likely to increase in value—where it is not liable to such severe and increasing burdens, as tithes, or poor rates—where the titles being duly recorded, are always secure—where property in land is attended with the local advantages above enumerated—and where its safety is not likely to be affected by any internal commotion.

On the whole, the advantages above enumerated, joined to the exertions of the manufacturing and commercial interest, have raised Scotland to a state of prosperity, which, half a century ago, the most sanguine *economist* could scarcely have imagined; and the same causes continuing to operate, the people in that part of the united kingdom, are progressively advancing, in national wealth, and individual happiness.

TABLE (A.)

STATE OF LANDED PROPERTY IN SCOTLAND.

Counties.	Valuation as returned by the Collectors of the Land-tax.			No. of Estates exceeding L. 2000 Scots of valuation.	No. of Estates from L. 2000 to L. 500 Scots of valuation.	No. of Estates under L. 500 Scots of valuation.	Total number of Estates	Total valued rent belonging to Corporations.			No. of Estates belonging to Corporations, &c.	Estimated am of Valued of Entailed perty, Scots ney.	
	£.	s.	d.					£.	s.	d.			£.
Aberdeen,	235,665	8	11	28	88	114	230	9100	7	2	1	90,000	0
Air,	191,605	0	7	20	51	200	271	Trifling.				79,095	0
Argyle,	149,595	10	0	17	43	131	191	5	14	6	1	49,898	0
Banff,	79,200	0	0	9	17	14	40	None.				42,762	14
Berwick,	178,366	8	6 ⁷ / ₄	22	59	152	233	905	17	0	2	59,788	2
Bute,	15,042	13	10	2	2	6	10	Not valued.			1	5,010	0
Caithness,	37,256	2	10	5	11	14	30	None.				13,631	0
Clackmannan, ..	26,482	10	10	4	6	22	32	952	16	9		9,844	11
Cromarty,	12,897	2	7 ¹ / ₄	3	2	5	10	None.				7,196	8
Dumfries,	158,502	10	0	10	30	405	445	322	0	0	3	86,709	3
Dunbarton,	33,327	19	0	1	19	136	156	80	0	0	1	11,109	6
Edinburgh,	191,054	2	9	10	92	569	661	6752	18	0	19	33,685	0
Elgin,	65,603	0	5	7	18	29	58	None.				24,580	0
Fife,	363,192	5	7 ¹ / ₄	45	102	491	638	500	0	0	29	122,064	0
Forfar,	171,239	16	8	16	59	191	266	4251	6	0	19	57,079	5
Haddington,	168,873	10	8	23	29	133	185	1303	14	3		56,257	3
Inverness,	73,188	9	0	12	18	37	77	Trifling.			1	24,364	5
Kincardine,	74,921	1	4	11	29	46	86	410	3	10	3	18,730	0
Kinross,	20,250	4	3 ² / ₄	7	7	161	168	25	0	0	1	6,750	1
Kirkcudbright, ..	114,597	2	3 ¹ / ₂	7	40	554	401	576	6	8	5	3,326	16
Lanark,	162,131	14	6	9	50	1096	1155	8878	1	6	13	36,141	11
Lintlithgow,	75,018	10	6 ¹ / ₂	8	29	122	150	365	13	0	11	34,043	4
Nairn,	15,162	10	11	3	3	9	15	None.				2,506	3
Orkney,	57,786	0	4 ⁴ / ₁₀	4	11	195	210	Not valued			1	2,736	6
Peebles,	51,937	13	10	6	21	54	81	198	9	0	1	35,114	0
Perth,	339,892	6	9	59	95	621	755	2009	18	8	11	28,019	11
Renfrew,	69,172	1	0	6	22	300	328	1237	6	8	2	29,841	0
Ross,	75,043	10	5	10	25	50	85	417	19	6		22,466	2
Roxburgh,	314,663	6	4	33	55	264	349	3094	0	0	5	104,887	4
Selkirk,	80,307	15	6	9	20	15	44	1033	3	4	1	32,661	0
Stirling,	108,509	3	3 ¹ / ₄	9	29	109	147	1333	4	2		25,007	0
Sutherland,	26,093	9	9	2	3	8	13	None.				14,427	17
Wigton,	67,641	17	0	6	16	85	105	92	0	0	2	44,000	0
	3,804,221	0	0	396	1094	5147	7595	44,388	0	0	145	1,213,159	17

TABLE (B.)

ACCOUNT of the *Gross* Amount of Rent, or Annual Value of *Lands*, (including Mines, Quarries, Collieries, Fishings, &c.); and of *Houses*, in the several Counties in Scotland; as assessed under the Property Act, for the year ending 5th April 1811.

Counties, including, their respective Towns and Burghs.	Gross Amount of Rent of Lands.	Gross Amount of Rent of Houses.
Aberdeen,	£. 233,826 19 10	£. 65,557 9 9
Argyle,	192,073 14 2	5,208 18 10
Ayr,	336,471 10 0	22,823 0 0
Banff,	79,396 3 4	5,514 2 0
Berwick,	231,973 2 7	8,152 17 6
Bute,	18,591 9 2	2,310 1 7
Caithness,	30,926 1 9	1,698 7 6
Clackmannan, ..	32,047 12 0	2,827 5 0
Cromarty,	10,860 2 8	480 0 0
Dumfries,	246,001 12 6	16,787 0 0
Dunbarton,	56,972 15 0	5,791 15 0
Edinburgh,	277,827 19 1	400,004 5 6
Elgin,	62,312 9 6	2,753 14 6
Fife,	335,290 14 6	38,756 1 6
Forfar,	260,196 15 0	64,108 0 0
Haddington, ...	180,654 5 9	6,870 15 2
Inverness,	195,843 15 0	9,235 2 0
Kincardine, ...	159,895 19 2	9,235 2 0
Kinross,	83,487 11 8	3,549 16 7
Kirkcudbright, .	22,752 10 0	1,623 5 0
Lanark,	298,019 3 1	286,071 13 5
Linlithgow,	82,947 2 0	5,793 8 0
Nairn,	11,725 14 0	216 0 0
Orkney,	9,495 3 6	2,138 14 6
Peebles,	57,382 0 0	2,568 0 0
Perth,	460,738 13 11	36,697 19 7
Renfrew,	127,063 15 9	106,238 7 2
Ross,	91,089 13 8	2,798 1 4
Roxburgh,	230,663 9 9	11,508 6 3
Selkirk,	39,775 10 0	834 0 0
Shetland,	6,741 6 0	1,408 0 0
Stirling,	177,498 14 0	25,370 7 8
Sutherland,	28,457 9 0	247 0 0
Wigton,	123,836 10 10	3,595 10 0
Lands, &c.	4,792,842 13 2	£. 1,158,777 7 4
Houses,	1,158,777 7 4	
Total, ...	£. 5,951,620 0 6	

124 ADVANTAGES OF POSSESSING LANDED PROPERTY, &c.

It is evident that these tables must be subject to perpetual variation, but they are sufficient to give a general idea of the particulars to which they refer.

CHAP. III.**OF BUILDINGS, AS CONNECTED WITH AGRICULTURE.**

BY MR RICHARD CRICHTON, ARCHITECT IN EDINBURGH,
AND OTHERS.

PRELIMINARY OBSERVATIONS.

IN every country, but more especially in one, which, like Scotland, lies in a high northern latitude, and is subject to an unfavourable climate, every improvement in the construction of buildings must be of the highest importance. This is particularly the case in regard to the agricultural classes of the community, whose health and happiness must greatly depend on having a comfortable habitation to retire to, when their labours are finished. Indeed, the industrious farmer is not only well entitled, to a suitable house to reside in, but ought also to have a set of substantial and well-arranged offices, constructed on a scale adequate to the size of the farm he occupies, the rent he pays, and the system of farming he has adopted, otherwise his operations in husbandry must be carried on with much additional trouble and expence. Besides, with proper accommodations, his cattle thrive better, and are

more likely to go through their daily labours without injury, than when confined to wretched hovels, or exposed to all the vicissitudes of the seasons.

Under the head of buildings, as connected with the agricultural state of the country, it is proposed to treat, 1, Of Cottages; 2, Of Farm-houses, with their offices; and, 3, Of Houses for gentlemen of moderate fortune, who cultivate and reside on their own estates. The splendid mansions of the great landed proprietors do not come within the scope of the present investigation.

In this part of the work, it is intended to restrict the inquiry to general views of the subjects treated of. Details, with regard to erecting the walls, covering the roofs, and constructing the floors of such buildings, will be found in the Appendix*.

SECT. I.

OF COTTAGES.

THE habitations of the labourer constitute a class of buildings peculiarly interesting. They consist, either of cottages attached to farms, or of the houses of day labourers and mechanics, who reside in villages.

In regard to the houses of the farm cottager, who is usually a married servant, they are built, in the more improved districts of Scotland, like the other houses on the estate, by the proprietor, unless undertaken by the farmer in consequence of a special agreement. These cottages are situated

* See Appendix to this Chapter, NO. I, II, and III.

at a convenient distance from the farm offices; and there is a small garden attached to each of them. Sometimes, also, landlords build cottages of a superior description for their own labourers.

As to the village cottages, they are generally built by the villagers themselves, on a long lease or feu of the site of the house, with the addition of a small garden, which is usually situated at the back of the cottage.

The miserable cottages, built of turf or sod, which are in some districts rapidly, and in others slowly disappearing, do not require any particular description. They are seldom well situated*, and their construction is despicable. Indeed nothing but ignorance of any thing better, or necessity, which must submit to every inconvenience, could have induced any human being to be satisfied with such wretched accommodation. Besides the low and uncomfortable walls of turf, the rounded form of the roof with the fire place in the middle, characterises a considerable number of the habitations of the lower classes in the Highlands and Islands. This is occasioned by the great scarcity, and consequent high price of wood in some of these districts. A rounded roof requires not only the least quantity of wood, but, excepting a few principal supporters, even that may be of weak rafters of brushwood, or of other timber of inferior quality.

The dry-stone cottage, where earth is put in place of clay or lime, among the interstices between the stones, and which has generally one foot of turf-wall built above five feet of stones, was, till within the last fifty years, in many parts of Scotland, the habitations of married servants, who were attached to farms. Both in this, and in the turf-walled cottages, the *couples* or supporters of the roof were built in the wall, the feet of the couple resting on flat stones placed in it for that particular purpose. This sort of cottage, however imperfect,

* On the proper situation of Cottages, and some hints regarding their construction, see Appendix, NO IV.

was greatly superior to the Highland shealing, or round-roofed cottage, which was built wholly of turf.

In some parts of Scotland, particularly in Dumfries, Perth, Forfar and Kincardine shires, cottages are still constructed of clay; and when properly made, they are warm, and even durable, and not very expensive; and they are considered much superior to the dry-stone cottage.

Stone, however, is the most common material, and cottages, in the best cultivated districts, are usually built of stone and clay, or stone and lime, according to circumstances. In farming villages, where feus, or even long leases have been granted of the site of the house and garden, to blacksmiths, house-carpenters, and other mechanics, it has been customary to build with stone and lime, where the house consists even of but one story, and is only a cottage.

In the southern counties of Scotland, and particularly in Berwickshire, and the Lothians, the cottages attached to farms are now generally constructed from 18 to 20 feet in length, and 16 in breadth, divided into two apartments, the first of which may be called the living room, and the other the store or lumber room, where meal, potatoes, coals, &c. are kept. The height of the side-wall is usually from seven to eight feet, and they have rarely more than one floor; being considered, when of that construction, to be warmer, and less liable to have the roofs damaged by the violent winds so frequent in Scotland.

For the sake of economy, when only two cottages are required, they are usually erected together, as one gable answers for both, and are therefore cheaper when thus built in pairs.

When the size of a farm requires a number of cottages, they are commonly attached to one another; and as married servants are usually allowed to keep cows and pigs, houses for these are sometimes placed on the back-wall, or at the end of the range of cottages; or their cows are kept along with those of their masters, in the byre or cow-house at the farm-offices, and their pigs in small hovels near the cottages.

More ample details, regarding the construction of the Lothian and Berwickshire cottages, will be found in the Appendix, NO. V.

In the central district, and the north-east Lowlands, the accommodations given to the married farm-servants are of a different description. Their cottages are generally 12 feet wide, and from 24 to 36 feet long. They usually have two divisions, or what they term "a *But* and a *Ben*." In the one of these divisions most commonly used, (besides a bedstead for some of their children, and the kitchen furniture), there is a fire-place. In the other, there is a bedstead for the cottager and his wife, or sometimes two bedsteads, if the children are young and numerous, and also a fire place. These cottages have only an earthen floor below, and in general no more than two windows, one in each end. A few of them have three or four windows, and are ceiled above in one end, with a plain coat of lime plaster, or covered with thin deals. In some places they are thatched commonly once in two years, which costs from 5 s. to 10 s., besides the cottager's trouble in putting on the thatch. More frequently they are *stob-thatched* or sewed, that is, covered with a coat of straw from 5 to 10 inches thick, which costs from £. 5 to £. 6, and lasts from 15 to 20 years. The inferior kind of these cottages, till within these last seven years, cost only from £. 8 to £. 10; and the better sort, or tradesmen's houses, from £. 15 to £. 20; but from the great rise in the price of wood and labour, an artificer's house built with stone and clay, and pointed with lime on the outside of the walls, having a ceiled roof, with a wooden floor in the best end or bed-room, and stob-thatched with straw, costs from £. 30 to £. 40. A few of the richer artisans, and some of the small farmers in the north-east Lowlands, have houses 8 feet high in the side-walls, and as wide as the cottages in Berwickshire. But in that case, they have a loft, with a foot of side-wall above the floor, and two windows in the gable. This gives them a convenient garret the whole length of the house; in one end of which they usually have a fire place. Wherever

a house has 8 feet of side-wall, and is from 16 to 18 feet wide, it can always have a garret at an expence of £. 10 or £. 12, sufficient for a lumber place, and also for a spare bed-room.

Here it may be proper to take notice of a mode of constructing cottages *on a new plan*, which seems to be well calculated for those parts of the kingdom, where there are quarries of flat stones, and where timber for the roof is expensive.

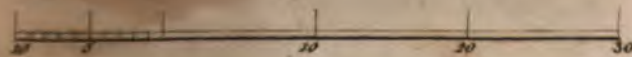
The first construction of that sort was by the President of the Board of Agriculture, near Thurso, in Caithness. He built a cottage on a circular plan, with flat stones, and constructed the roof, by a dome arch from the side walls, covering the outside with a smooth coat of well prepared plaster; and thus formed both walls and roof of the same materials. As the circular shape, however, upon a small scale, is not well adapted for subdivision, or for containing furniture, the plan of building cottages of a square or oblong form has been preferred. The arch for the roof is raised on the side walls, in the Gothic or pointed shape, the outside of which is made in a straight slope line, and covered with broad flat stones or slates. Buildings of this shape, where thin flat stones, or grey slates, can easily be obtained, would not be expensive; and if a number of them were built together, the same centering that is required for the arch of one would serve for the whole. The comparative expence of these, with cottages roofed in the usual way with wood, &c. must entirely depend on the expence of the materials of which they are constructed. When bricks are high priced, where there are quarries of thin flat stones, it will, no doubt, particularly where timber is costly, be more convenient, and even cheaper, to build in this manner. Such cottages have the peculiar advantage of being dry, warm, and comfortable, and, when once erected, they will last for ages. If the plan should be found to answer the expectations which are entertained of its success, it may become a most important discovery, in this particular branch of rural architecture, to districts producing the necessary materials.

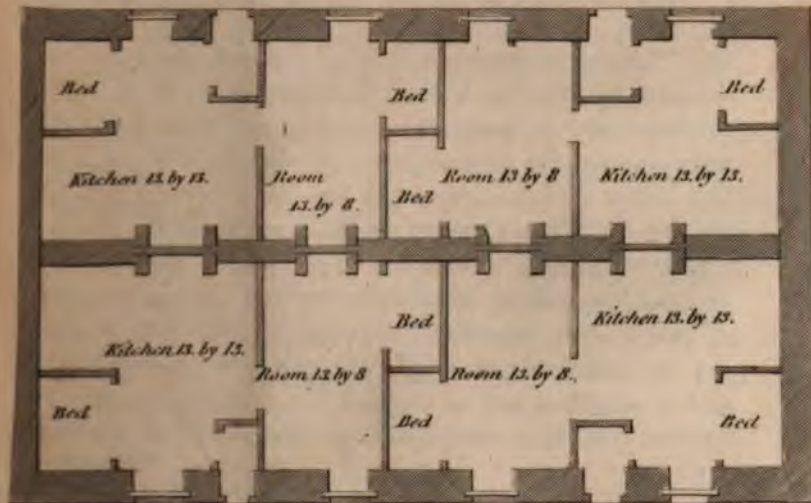


N^o 1 Two Cottages



N^o 2 Two Cottages





As it is impossible to foresee to what length this plan (which has already been successfully adopted in regard to cottages, and has even been extended to farm offices), may in time be carried, all the information which has yet been collected on the subject, with plans and estimates of the buildings, will be found in the Appendix, NO. VI.

As many persons may be inclined to prefer cottages with tiles or slates, instead of arched roofs, and others to have them of two stories, and with paper roofs; the plans (Plates III. and IV.) and estimates of such buildings, will be found in the Appendix, NO. VII, explaining the particulars regarding these modes of construction.

SECT. II.

OF FARM-HOUSES AND OFFICES.

It has been observed by a most competent judge, "that there is no criterion by which the agricultural prosperity of a country can be better determined, or the condition of those who exercise it, more correctly ascertained, than by the general state and appearance of farm-houses and offices. If these are substantially constructed, and properly arranged, it will always be found, that agriculture is in a prosperous state. If, on the other hand, the farm-buildings are meanly executed, or improperly arranged, then it may be laid down as a rule, that the districts in which these circumstances prevail have not reached to that perfection in husbandry, to which their more fortunate neighbours have attained *."

* Robert Brown, Esq. of Markle.

It is little more than a century, since much attention was paid to the proper construction and distribution of the farm-buildings in Scotland; and indeed not above half that time since good farm-houses of two stories, with a regular court of offices, were to be seen in the most improved counties. Even in East Lothian, the modern farm-houses mark the progress of agricultural improvement, and the amelioration in the condition of the farmers, more than almost any other single circumstance. Formerly, the greater part of the farm-houses were mean, and, except in having more apartments, differed very little, in point of comfort, from the cottages of their servants. Of late, however, a better taste has prevailed, and the houses built within these last forty years, are generally in a very good style, and contain much of that accommodation, which is inseparably connected with the comforts of a farmer's family*. This has likewise taken place in many other counties.

At present, in all the improved districts of Scotland, when leases are entered upon, either a new farm-house and offices are built at the proprietor's expence, or an allowance of one, two, and even, in some cases, of three years' rent is given, for building a farm-house, and a suitable court of offices.

It is not proposed, in this part of the work, to give any description of the miserable hovels in which the farmers of Scotland formerly resided, even in the more southern and fertile districts; and which, unfortunately, still prevail in the more remote parts of the kingdom †. They were, in general, improperly placed and arranged, and rarely kept in sufficient repair ‡. Additions were occasionally made to sup-

* East Lothian Report.

† In Appendix No. VIII, there is a particular detail of the humbler sort of farm-steadings in the several districts in Scotland.

‡ The following extract will give some idea of the general nature of those farm-buildings, previous to the improved plans which have been recently introduced. Some were set down at the extreme corner of a farm,—some at a distance from water,—some were on too small a scale,—some badly constructed or

ply the defects of the original construction; but this seldom contributed much to their improvement, (not being parts of a complete and uniform plan); and the little expence attending such alterations, induced the occupier, or landlord, to go on, making occasional additions, from time to time, with a view of procuring better accommodation, until, at last, more money was actually expended in this way, than would have built a convenient steading from the foundation. There was but one apology for such a mode of proceeding, namely, that the expence was gradually incurred, whereas, if a new erection had been made, it would have been all demanded at once*.

Before the details connected with the construction of farm-houses and offices are explained, it may be proper to state the general principles which deserve attention when such buildings are under consideration. These are, 1. Their situation; 2. Command of water; 3. Access; 4. Expence of construction; and 5. Judicious arrangement †.

arranged,—some had no granaries or lofts for holding threshed grain,—some had either no sheds, or sheds not sufficiently large for holding the farming implements, which, in consequence of continued exposure to the sun and rain, rapidly decay.—some had no straw yards,—some no feeding houses for their cattle; and where they had, the stables and cow-houses were, in many cases, too short,—some had no proper site for the dung, and the dunghill was sometimes socking in water, or its rich moisture permitted to run to waste;—some wanted a proper milk-house and other conveniences for a dairy,—some had no better threshing floors than damp clay. In short, several accommodations were wanting, which are essential to the prosperity of a farmer. (*Fifeshire Report*, p. 76.)

* See the Agricultural Survey of Kinross-shire, by the Rev. Dr Graham, p. 93.

† “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

Principles to be attended to in the construction of Farm-Houses and Offices.

1. The first object of a judicious farmer who has a new set of farm-houses to build, is, to fix on a proper situation, which ought to be as nearly as possible in the centre of an arable farm.* In many cases this makes a difference, in point of rent, of from 1s. to even 5s. *per acre*, according to the size of the farm, and various other local circumstances. By some intelligent farmers, it is calculated at the expence of a plough, or L. 100; and on very extensive farms, at nearly L. 200 *per annum*. Indeed, if the houses and offices are placed at the corner of a large farm, a part of the land will often be neglected; less manure will be sent to it; the expence of cultivation will be materially increased; the strength of the horses uselessly wasted in going backwards and forwards, and the remote parts of the farm left, in what is termed in Scotland an *outfield* or *afterwall* state, that is to say, in miserable pasturage, and when occasionally broken up, the crop will scarcely defray the expence of seed and labour.

There can be but one reason for not having the farm-house and offices in a central situation, and that is, when at another point of the farm a better command of water can be procured for family use, and for the farm-stock; or for driving a threshing-mill, by means of which a great saving in the labour of horses is 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 *."

farmer would be willing to purchase if he can procure them at home. Indeed so sensible are farmers, in the more improved districts, of the truth of these matters, that almost every one of them has a kitchen garden upon a large scale; any excess of produce being given to swine and cattle."—*Sir J. Sinclair's Account of Scotch Husbandry*, p. 20.

* *Sir John Sinclair's Husbandry of Scotland*, p. 9. and 10.

Where the circumstances of the case admit, the farmhouse ought always to front the south, by which means it is sheltered from the cold north winds, and the fold-yard, at the same time, enjoys the benefit of the sun in winter. The farmstead is usually placed on a well-aired and dry spot of ground, and, where that can be had, *an elevated situation* is preferable. It is not only healthier for the farmer, his family, and his servants, but in this way another advantage of considerable importance is obtained, namely, it puts it in the power of the farmer to see what is going forward around him*.

2. A command of water is essential, more especially if a quantity sufficient to drive a threshing-mill can be procured. It is desirable, on that account, that the house should be situated near some river or stream; but if that cannot be obtained, ponds, wells, troughs, &c. for conveying water to the dairy, and to the feeding-houses, should be constructed. Nothing can be more injurious to stock, than to compel them to drink at ponds, where the water is not perfectly salubrious. A bore, made according to Elkington's plan, will in many cases raise water to supply any part of the offices †.

3. A judicious farmer also endeavours to have easy access, not only to and from all the fields belonging to the farm, but also to any good roads in the neighbourhood leading to market towns, to harbours where the grain is shipped, to lime, coal, &c. To attain so important an object, he lays it down as a rule, to keep his farm roads always in good repair.

4. The farmer's house and offices are generally on a scale proportionate to the size and produce of the farm. It is certainly an object of primary importance, to provide the farmer with comfortable and convenient buildings, for the accommodation of himself and family, and with cottages for his servants, together with offices for the reception of his live stock and the

* Sir John Sinclair's Husbandry of Scotland, p. 11.

† For a mode of improving water, as a beverage for the farmer, cottager, &c. See Appendix, NO. IX.

threshing of his crop of grain ; but it can only be considered as wasteful prodigality, to erect these on a scale larger than circumstances require ; or to increase the expence by making ornamental erections, which are rather a loss than an advantage to the farmer. It ought to be considered, that the repair of buildings upon a farm, is a heavy burden upon the occupier during the lease, and especially at its conclusion, when, according to the general practice of Scotland, he is obliged to put the whole in good condition. A farmer, without doubt, is entitled to comfortable and convenient buildings, if they are not upon the premises at his entry ; but in their erection, a prudent economy ought never to be neglected*.

5. In erecting agricultural buildings, the necessary conveniences of a farm are more attended to, by a plain judicious farmer, than symmetry and outward appearance. His great object always is, to have his offices so arranged, as to save both time and labour, and to enable him to carry on his business, with as few servants as possible, consequently with more satisfaction, and at less expence. Such is the importance of these particulars, that it is found to make a difference, to the extent of the labour of one, and in large farms even of two servants, that is, from L. 50 to L. 100 *per annum*, where a judicious arrangement, in the construction of farm-houses and offices, has been properly attended to.

On the whole, it appears, that the central position of the farm-house and offices, the proper arrangement of these offices, and the other particulars above detailed, are of such importance, as to make a difference in the expence of working the farm, of L. 100 to even L. 200 *per annum*, in very extensive farms † as previously stated.

* Remarks by Robert Brown, Esq. of Markle.

† Mr Walker of Mellendean in Roxburghshire states, that by altering the situation, and improving the construction of the buildings on his farm of Ruthersford, he saves nearly L. 200 *per annum*.





11/26/01

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Of the Accommodation required on Arable Farms.

On farms chiefly adapted to grazing, a small set of offices will suffice; but arable farms require a great number of conveniences, more especially when they are on a large scale; and it is a misfortune attending small arable farms, that they require nearly the same number of offices as large ones, the difference being only in regard to size or extent. On small-sized farms, however, the farmer must often submit to many inconveniences, which cannot be remedied without more expence than a small occupation can afford. For the court yard of such farms, the parallelogram figure is usually preferred, having the long sides from east to west, with a plain wall, fronting the south, which renders it easy to enlarge the area at pleasure.

In the engraving, Plate V, will be found the plan and elevation of a house and offices, for a small farm of from 50 to 100 acres, in which the buildings are made as simple and economical as possible; but on arable farms of a greater extent, say of 300 acres and upwards, the following accommodations are necessary.

- | | |
|----------------------------------|---|
| 1. A comfortable dwelling-house. | 9. A poultry-house. |
| 2. Barns. | 10. Pig-houses. |
| 3. A granary. | 11. A boiling or steaming-house. |
| 4. Stables. | 12. A cart shed and place for implements. |
| 5. Feeding-houses. | 13. A root-house. |
| 6. Cow-houses or byres. | 14. Stack or rick yard; and |
| 7. A calf-house. | 15. Straw yards, with dung-pit |
| 8. A Dairy. | and reservoir for urine. |

The most approved construction and arrangement of these buildings shall be concisely stated.

1. *Farm-houses.*

It is considered as a good rule, to have the farmer's house not too far removed from the offices, and so placed that he may

command a view of the open side of the court, from the windows of the most frequented apartments.

The size of a farm-house is regulated by that of the farm. On farms from 200 to 400 acres, a parlour, kitchen, scullery, pantry and dairy, on the ground floor, with four bed-rooms above, are found to be sufficient. On larger farms, a house with two parlours, business room, kitchen, back kitchen, pantry and dairy, on the ground floor, with four or more rooms above, is commonly allowed.

When the house is placed on a slope, and the ground falls considerably to one side, the principal entrance is frequently made from the high ground, the parlour floor being raised as much as necessary to admit an under story, entering from the low ground behind, which contains the kitchen, scullery, dairy, &c. thus forming two stories, and a half sunk one. This makes a convenient house of a large size, and, owing to the small extent of roof, is executed at less expence, than one of two stories, containing the same accommodation.

For the more minute details, see Plates V, VI, VII, IX, and XIII, and Appendix No. 11.

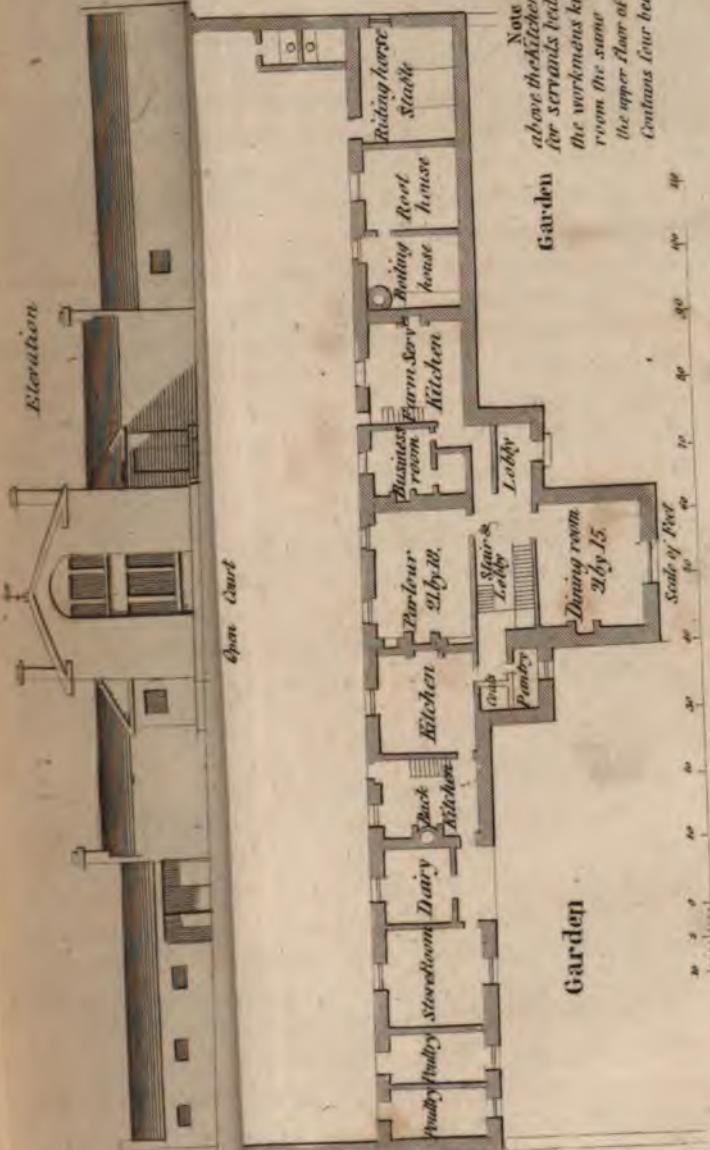
2. *Barns.*

Where the grain is threshed by the hand, a circumstance rarely occurring in the more improved districts, the floor of the barn is made all on the same level, with the space for threshing near the middle, and large doors on the opposite sides of the walls. In all barns, it is held to be of essential consequence, that the floors be perfectly dry, and particularly so in threshing barns, where the use of the flail is continued. But the great advantages of the threshing-mill being now so well established, and that machine being so generally adopted, it becomes unnecessary to describe any other barns, than those generally erected where such machines are employed.

Barns are built in three different forms, according as they best suit the situation and arrangement of the other offices.

Elevation

Shan Court



Note
 above the Kitchens are Garrards
 for servants beds &c. and above
 the workmens kitchens Business
 room the same
 the upper floor of the Main house
 contains four bed rooms





Index to the Offices

- AA *Open Sheds each 39 by 14 Feet*
- B *Hen house 18 by 10 Feet*
- C *House for Wood Potatoes 35 by 16 Feet*
- D *for Mare & Foal 20 by 16 Feet*
- E *for Calves 16 by 16 Feet*
- F *Byre 22 by 16 Feet*
- G *Cattle Shade 36 by 16 Feet*
- H *Straw Barn*
- I *Horse Course 30 Feet within walls*
- K *Mill Barn 30 by 16 Feet*
- L *Stable 60 Feet by 16 Feet The Stable would have been placed in the west range entirely but for the Cart shade in that case opening into the Barn Yard*
- M *Corn Chest placed at the end of the Stables for the purpose of being filled with a Spout from the Granary*
- N *Cart Shade and Granary with a hatch in the floor*
- O *Hay house 16 feet Square*
- P *Riding Stable for four Horses*
- Q *Intended for water but is not included in the Estimate*
- RR *Open Courts each 86 by 49 Feet*
- SS *Gates 10 feet wide to open outwards*
- TT *Small Doors to keep the Cattle from the Barn Door*
- W *Barn Yard*



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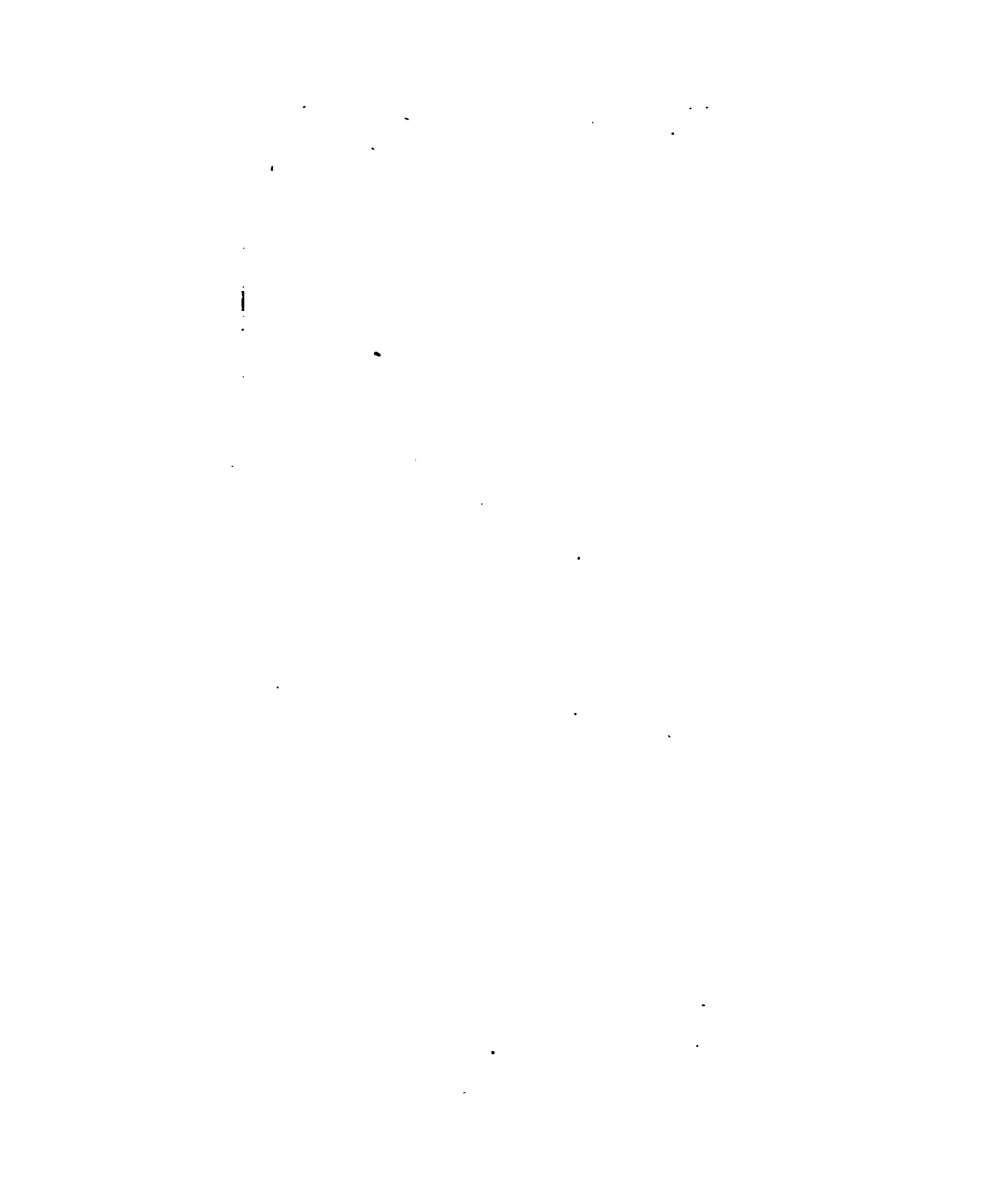
- A Sheep Cot
- B Straw Yard with She
- C D^o D^o
- D Barn
- E Mill Room
- F Straw House
- G Horse Course

Walls of the Barn 14 Feet
 of the Horse and Cattle Yard
 of the Sheep Cot 14 Feet
 Front of D^o 4 Feet
 Mill Room Loft 8 Feet
 The Whole to be That

NB. A Reservoir for the
 of the Yards to be placed
 to the lay of the Ground

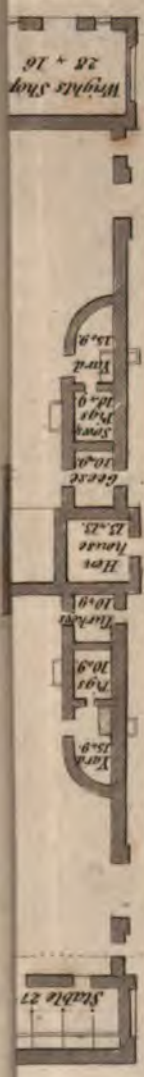
Elevation of the East Side with D^o





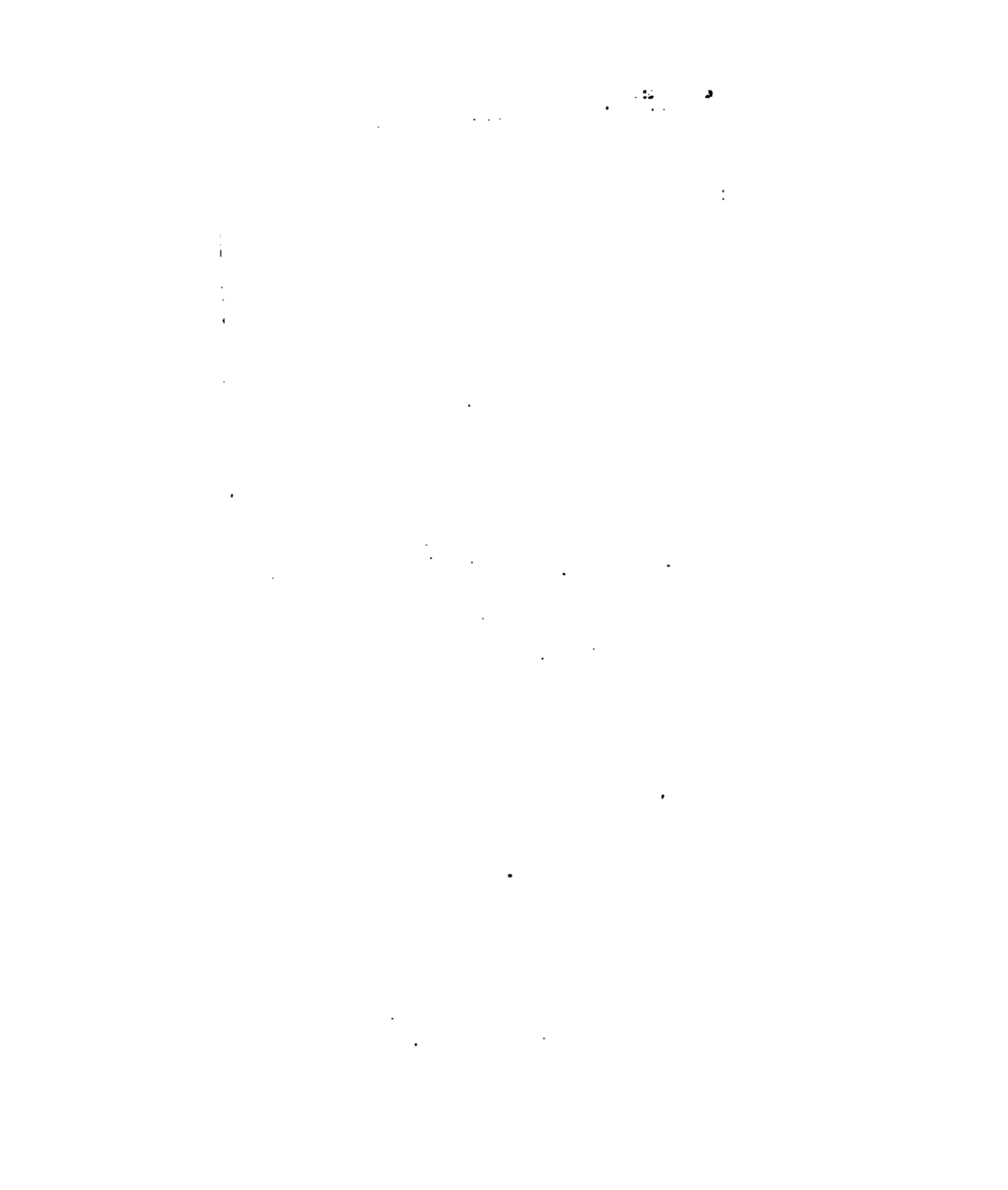


Section on the Line I K



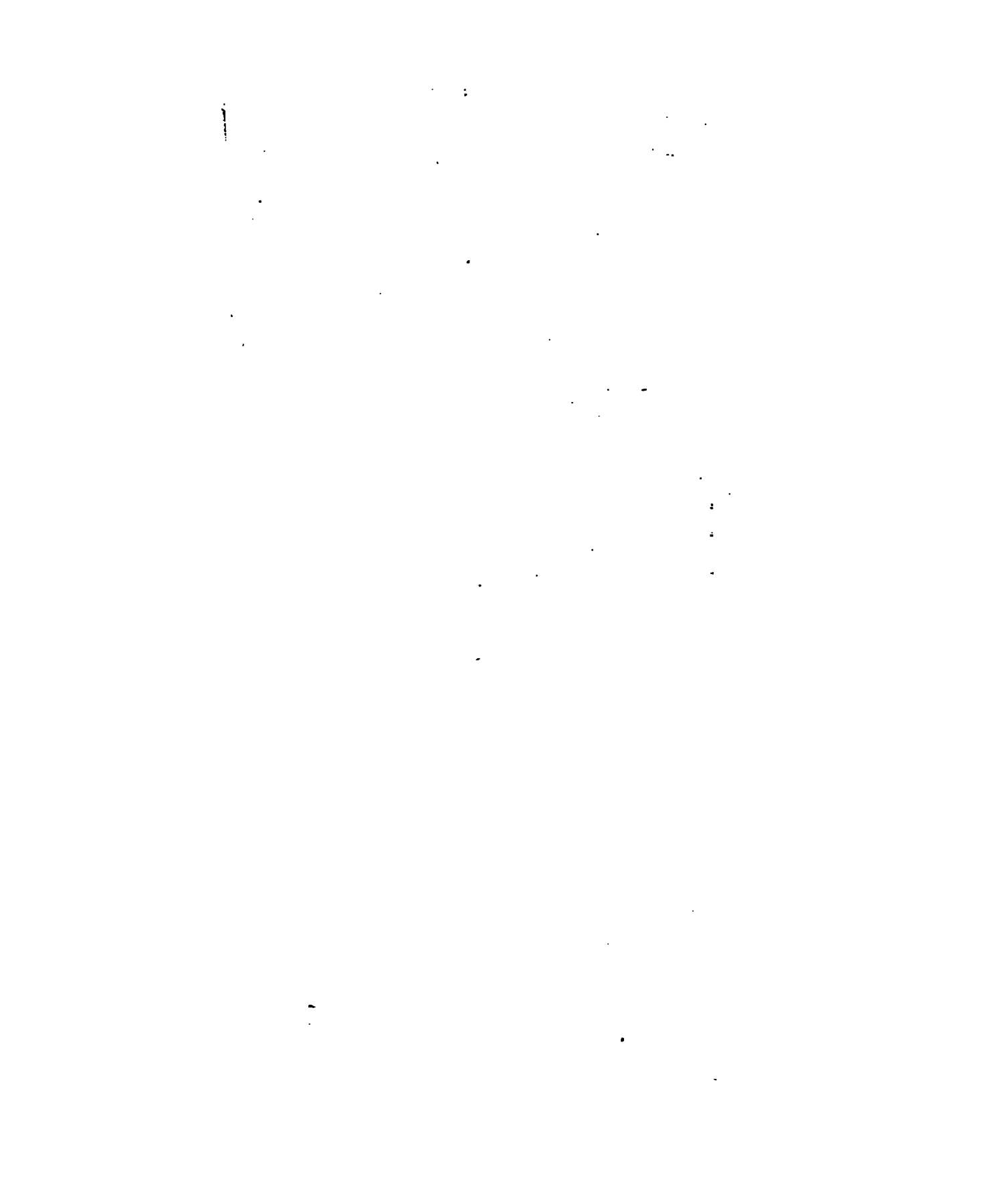
20 4 Feet over Walls

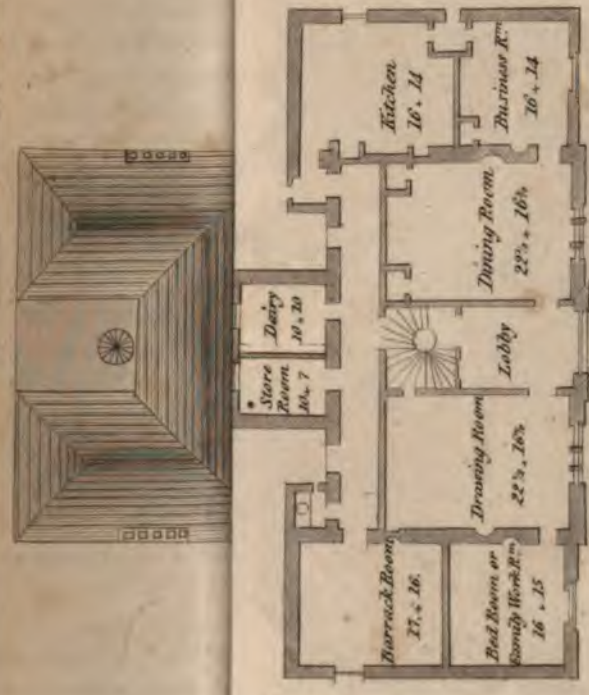






Elevation on the line E. F.





1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to support informed decision-making.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and reporting, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that data is used responsibly and ethically.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that data management practices remain effective and aligned with the organization's goals.

1. In a straight line forming one side of the court, having the threshing-mill near the middle, with the horse course, wind tower, or water wheel, on the outside; the corn barn on the one end, and the straw barn on the other, as in Plate VI.

2. At one corner of the court, with the corn barn along one side, and the straw barn along the other, the threshing-mill at the corner, as in Plate VII.

3. At the centre of the north side of the court, in the form of the letter T, having the straw barn in a line with the court, and the corn barn projecting out from its centre into the stack-yard, with the mill at the end next the straw barn, and the horse course, &c. in one of the angles, as in Plate VIII. This plan is generally preferred as the best*.

The length of the barn is in proportion to the size of the farm; the breadth also varies from the same cause; and where foreign wood and a slate roof are used, the barn is much wider than where Scotch fir, and roofs of heath and thatch are found. Some barns, even in the more improved districts, are only eighteen feet within walls; but many intelligent farmers consider twenty feet preferable. A barn of thirty-five feet in length, and twenty feet in breadth, exclusive of what part is occupied by the machinery, can easily con-

* In various cases barns have been built, 1, Three stories high; 2, Two stories, having the under story fourteen feet high, with a platform for fanners in the middle; and, 3, Two stories of the common height. The two first were raised with an intention of winnowing the corn completely, by additional fanners driven by the machine. They are more complete, though more expensive.

Mr Erskine of Mar is of opinion, that a floor, after the fashion of the hay chambers of Norfolk, would perfectly answer for the upper floor of a threshing barn, and would be a considerable saving of expence. In this description of barns, the only communication to the granary should be from this floor, which is easily done by a gangway over the void of the lower floor of the barn. The corn barn, with a threshing-mill, has two floors; the upper, for receiving corn from the stack; the under, for the corn room, where the threshed grain is received from the mill, with a space taken off for chaff. In this room also, there may be a corn-mill, straw-cutter, &c. The straw barn should be placed imme-

tain two moderate stacks of from twenty-five to thirty bolls each. Where corn farms are of great extent, however, the barn should be sixty feet long, and from twenty to twenty-four feet broad, not only to hold a considerable quantity of unthreshed corn, but the fanners also, which universally stand across the threshing barn, at its junction with the straw barn; for it is found, that fanners, with a good chaff-house, cannot be contained in less than from twenty-two to twenty-four feet. The door in the upper floor is usually of such height and breadth, as to admit sheaves easily when thrown in from the stack-yard.

Although the walls and roofs of barns too often remain in the rough state in which they were left by the mason and slater, of course subject to become the residence of insects and vermin of all descriptions, yet as the expence of covering the walls of a barn 100 feet long, with a coat of plaster, would not, in most places, exceed ten pounds, and the lathing and plastering of the ceiling not above twenty or thirty pounds more;—the superior advantages of barns so finished is certainly well worth consideration.

As a preservation from vermin, the spaces between the scantlings, if the floor be laid with deal, and not built solid with stone and lime, often are filled with washed gravel, well beat down. Where gravel cannot be had, or where it has been omitted, openings are made to admit of cats under the floor. In clay floors, to prevent vermin from burrowing under the walls, a considerable quantity of broken glass is sometimes mixed with the materials of the floor, for the space of three feet all round within walls.

The walls of buildings properly constructed, after the roof is put on, are built at the top, by some careful farmers, close up to the covering, and well plastered between the scantlings.

diately beyond the machine, and of a size sufficient to hold the straw of two stacks at once; one for fodder, and another for litter. See Berwickshire Report, p. 691, and particularly the East Lothian Report, p. 368.

3. *Granaries.*

To all arable farms of any extent, a granary is an essential article of accommodation. The chief requisites for such are, to be conveniently situated, dry, well aired, and free from vermin.

The most convenient situation for a granary is either over the threshing floor, or adjoining to the end of it. The most common situation, however, is above the cart-sheds, which are usually at some distance from the barn. In this case, the corn must be carried from the barn in bags, and raised to the granary by means of a small crane, or by a stair erected for the purpose. When the granary is contiguous to the barn, the labour is somewhat abridged, though a crane or a stair be still necessary. But when it is placed above the threshing floor, the corn is at once raised either by the threshing machine itself, or by means of a crane or windlass from the ground floor, through a hatchway, and deposited in the granary without exposure to the weather, and with the greatest expedition and the smallest labour. The barn door is so wide as to allow a cart to enter it backwards upon a piece of pavement; so that when the corn is to be sent to market, it is dropped into the cart through the hatchway, instead of being carried on men's backs, which is still too often the practice even when a crane could be used with advantage.

It is often necessary to carry corn to the granary when but very imperfectly dried; and when it is kept for some time, it contracts a disagreeable smell, however dry it may be at first. It is therefore of great advantage to place the granary in an exposed situation, to give free access to air by means of sash windows, or boards overlapping each other that may be raised or shut at pleasure. The granary, when placed above the threshing floor, is so high as to give free access to the air from all quarters without the interruption of the other buildings, or even of the stack yard.

pit. Allowing six inches for this, there will remain a width of $8\frac{1}{2}$ feet to the back wall, if the stable be 18 feet wide, a part of which, close to the wall, is occupied with corn chests and places for harness.

In some of the best stables, the racks occupy one of the angles formed by the wall and trevices, and form the quadrant of a circle. The spars are perpendicular, and wider placed than in the hanging racks. The hay seed falls into a box below, instead of being dropt on the ground, or incommoding the eyes and ears of the horses.

With a view to save both the hay and the seed, it is an advantage to have the hay stack so near the stable, as to admit of the hay being thrown at once upon the loft. In some stables there is no loft, and the hay is stored in a separate apartment. Ventilators are not common in farm stables, though there are windows on the back wall, which may answer nearly the same purpose. The floor is for the most part paved with undressed stones, but, in some instances, the space from the gutter to the back wall is laid with flags of freestone. (See Plates VI and VII).

5. Feeding-houses.

These are required on farms where either the turnip husbandry or soiling is practised. They are generally well aired, and constructed so as to occasion the least labour in feeding, and in clearing away the dung, and that the cattle may be kept as clean and dry as possible. The dung, in the more improved districts, is never put out at the windows, which is a most slovenly practice, but taken away in wheelbarrows.

A small stream of water, if it can be got, is occasionally introduced, for washing the stalls, and affording drink to the cattle; but the generality of *courtins* or straw-yards are provided with ponds, or pump wells, from which any supply of water may be obtained.

There are a variety of methods of constructing feeding-houses. The most common are the following:—

1. Single close sheds, having stakes along the wall, (where a trough is made for containing their food), at the distance of 20 inches or 2 feet, to which the cattle are fastened. The trough is filled from the outside by openings opposite to every two stakes, covered with flap boards or shutters, which open and shut on hinges, or let up and down in grooves. The cattle enter from the opposite side, and there is a passage behind them. (See Plate VIII.)

2. The same mode of construction observed, and the houses made double, with the heads of the cattle along each of the outside walls, and the passage in the middle, entering from the gables.

Houses constructed as above are found the cheapest, as holding more cattle, in less room, than any other; but are objected to, as exposing them to cold, from the want of tightness in the coverings or shutters where the food is admitted, and in some cases, from the difficulty of access to them, owing to situation, wet weather, or snow.

3. To remedy those defects, it has been suggested, that the cattle should be ranged in the same way as in the single close sheds, with the difference only of having a passage for a wheel-barrow left between their heads and the wall, for the purpose of giving them their food within the building. This is certainly the preferable mode wherever cattle are fed in stalls; and has in numerous instances been adopted.

4. Feeding-houses may have as many double rows of stalls, running from the one side wall to the other, as are sufficient to contain the number of cattle wanted, as in Plate VII; but the cattle in the different rows are not to look at each other. In this manner the access to the troughs and stalls may either be quite through from both sides, or from one only, with openings for light, air, and, if wanted, for food, from the other side. It must be observed, that where feeding passages are made between two rows of cattle, they should be so covered as to prevent those on the one side

from seeing those on the other, which would disturb their feeding.

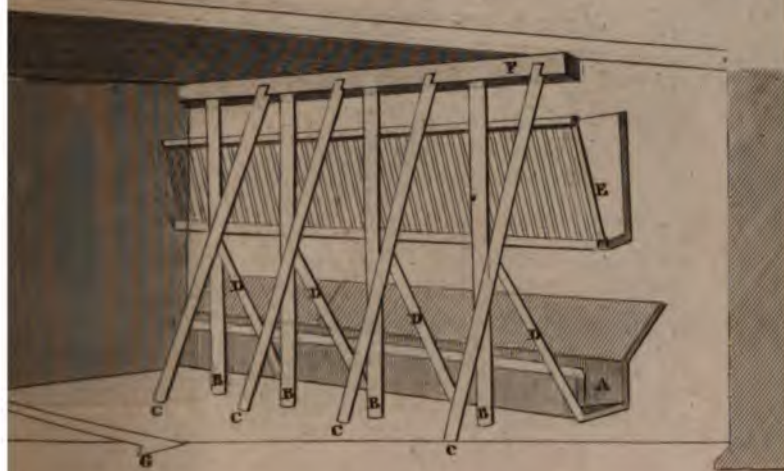
5. As it is understood that cattle thrive better, and are more fit for travelling to distant markets, when instead of being tied up to a stake, they are allowed to move about, with a choice of eating their food, either under or without covering, feeding-houses are therefore made as open sheds, with a narrow inclosed yard along their outside. Both the covered shed, and the adjoining yard, are divided into spaces for two, or at most three cattle each, by cross divisions or racks, having a row of troughs along the covered shed, with a passage for filling them, either under the roof, or on the outside. (See Plate VII.) These are called *hammels* in Berwickshire, and have been found to answer uncommonly well*.

The stakes for tying up cattle are placed at the distance of from three to four feet apart, according to the size of those proposed to be kept. The cattle are fastened to these stakes, by a chain and swivel, fixed to a ring round the stake, which allows it to move up and down; and to prevent them from throwing their heads too high, and thus incurring the risk of choking on small turnip, the ring is stopt from going further up than is thought proper, by a pin driven through the stake.

In most feeding-houses and byres, there are no divisions between the cattle; but as the stalls could not be kept clean if the cattle were allowed to turn about in them, it becomes necessary to tie them close to the stake, to prevent them from turning round, and injuring one another with their horns. When divisions are put up, inclosing each pair separately by a trevice, and a small division at their heads, in the middle of this double stall, the cattle may be allowed more freedom, which must certainly be a great relief to them, and this is often practised in many parts of Scotland, both with

* Horses also, when kept in this manner, are found to be much less liable to grease, than in close warm stables. See Report of Berwickshire, p. 95; and Sir John Sinclair's Husbandry of Scotland, p. 23.

VIEW OF THE STALLS



PLAN of the Cattle Stalls

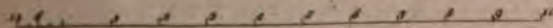
Slope Side

Feeding Trough



Gutter

Scale of Feet



Reference

- A. Feeding Troughs
- B. Stakes for fastning Cattle with rings
- C. Posts forming the division between the Cattle and preventing their overtopping one another when lying
- D. Struts supporting D^o
- E. Rack
- F. Beam at top of Stakes posts. under the joint of the Ceiling
- G. Gutter



cows, and fattening cattle. In Plate X is given a plan and view of cattle stalls, taken from a model designed by Mr Erskine of Mar, which will probably be found among the best hitherto used.

A manger of wood or stone, for holding their food, is placed along the wall, under the heads of the cattle, with a small declivity towards one end, to admit of being occasionally washed. It has wooden divisions which can be drawn up when required for washing. On the outer edge of the manger, and next the passage for feeding, are placed wooden spars or grating, which may be raised up either by pulleys, or hinged for opening when the food is put into the manger.

Instead of one manger running along all the stalls, some prefer to have a separate trough for each ox or cow to eat from, with a trough for water to each couple, supplied by a pipe, or otherwise.

In large farms, where turnip fields are at a considerable distance from the farm-steading, it is very expensive to carry the turnips first to the cattle, and then to cart their dung to the field. To remedy this inconvenience, Mr Walker of Wester Fintray has lately built, at half a milè's distance from his farm-steading, a cow-house sixty feet long by seventeen broad, with two wings, or small *byres*, as they are called, thirty-two by seventeen feet each, for feeding part of his cattle on the turnips, raised on the adjacent parts of the farm. A large avenue leads from the steading to these feeding houses; and eight fields lie so contiguous to them, that the turnips can be carted at a very small expence, and in all seasons. This will soon repay what has been expended on building the houses*. It is probable that an open shed, with a well enclosed fold-yard, might answer the same purpose, particularly in situations but little exposed.

Feeding-houses are paved, as already described when stables were treated of; only, as the dung produced in the for-

* Aberdeenshire Report, p. 137.

mer is more liquid; in some instances a tight drain is made along and under the centre of the passage, behind the heels of the cattle, having branches at short distances to the gutter, where gratings are placed to let off the urine, and convey it to the reservoir at the dunghill. The remainder, or what does not pass through at the gratings, is usually carried off in wheel-barrows, unless where the site of the dunghill is under, or considerably lower than the floor of the feeding and cow houses, in which case the whole will go off, in consequence of the declivity of the drains.

6. *Cow-houses or Byres.*

Milch-cows require warmth; and their byres usually have a passage in the middle across the width, to which their heels stand, while their heads are fixed to stakes about twenty inches from the walls.

Where a great number of cows are kept, however, it is found much more commodious, to arrange them as described in the fourth class of feeding-houses, that is, with their heads and heels opposite to each other, having passages between their heads for feeding, and access to the stalls from behind. Dividing cow-houses into stalls is found to be of great advantage; and the paving, draining, lighting, and ventilating of these houses will not be neglected by the skilful farmer. The best constructed byres or cow-houses in Scotland are supposed to be those of Mr Harley in Glasgow, where a hundred cows, arranged as above, are kept under one roof, together with boilers for preparing their food. The whole floor is laid with dressed stone pavement, and kept as clean as that of a dwelling-house.

7. *Calf-houses or Pens.*

These buildings are usually placed at some distance from the cow-houses, in order to prevent the calves from being heard by the cows.

The principal object to be attended to in calf-houses is, to keep them warm and dry. For this purpose, the floor is

raised about two feet above the level of the ground, and great care is taken to litter the calves frequently, and to keep them clean. It is also found profitable, where a number of calves are kept at once, to have the penn separated, by thin boards or spars, into several divisions.

8. *Dairies.*

Although it is only on farms of a particular description that dairies of any extent are required, yet it may be useful to explain some of the most important particulars regarding their construction and management.

The essential properties of dairies are, that they should preserve the heat at a temperature of from 40 to 50 degrees, both in summer and winter; that they should be thoroughly ventilated, and so constructed as to admit of the utmost cleanliness.

The accommodations of a complete dairy for twenty cows, are, a milk-room about fifteen feet square, a scalding and churning room of equal dimensions, and a store-room. The churning room is sometimes a separate apartment, and it is found an excellent plan to have the scalding house and churning chamber separated from the dairy room by a small court, where the dairy utensils may be aired. The milk-room is commonly placed on the north side of the dairy, and if possible shaded by trees or higher buildings, with windows or ventilators on three sides. The door enters not from the scalding room, but from an open porch communicating with it. The windows do not admit much light, and canvas or wire cloth should be closely fitted opposite the opening part, to exclude flies, &c. when the window is opened. The sun is entirely excluded by the situation, the projecting of the eaves of the roof, or by weather boards outside of the windows. A complete ventilation may be preserved by a number of narrow openings in the outside walls near the floor, covered with canvas or wire cloth, to which sliding shutters are fitted on the inside. If there is no

apartment above, a ventilator should be made on the roof, covered with weather boarding, and communicating with the ceiling of the milk-room by an inclosed box or case formed betwixt the scantlings, with openings both on the under side next the ceiling, and on the upper side to the ventilator in the roof. Where there is an apartment above, the case in the ceiling should have openings at the ends through the walls, with wire-cloth coverings. Two of these cases should be made in the ceiling, with two openings to each from it, about one foot square, perforated with holes or covered with wire cloth. The ceiling should be eight feet high at least, and close lathed and plastered free of the roof scantlings.

The shelves are erected all round the milk-room, and are usually twenty-four to thirty inches broad; the first shelf is about six inches above the floor, and the space between it and the pavement is closed along the front by means of a board; the second is about the height of a table. The under shelf or stand should be of stone or paving bricks, the same as the floor: the upper may be either of stone or wood: if of stone, it will require a thin covering of wood in winter to keep off the cold from the stone. Between the shelves, and for two feet above each, the walls should be lined all round with polished flags, to admit of frequent washing: but where the expence of white glazed tiles is allowed for this purpose, they are much handsomer, and have a more cleanly appearance.

As the utmost degree of cleanliness is essential for a dairy, a plentiful supply of water will at all times be necessary; and, it will be found highly convenient, to have a cistern placed above, or near the ceiling of the scalding room, into which the water may be raised either by a pump, or by a pipe from a higher reservoir. From this cistern a pipe may be conducted to the boiler, with branches to wherever water is wanted*.

* Details regarding the management of the Dairy, will be found in the Appendix.

9. *Poultry-house.*

On most farms there is but small accommodation for poultry; as rearing a greater number than can subsist by picking up waste grain, is not esteemed a profitable concern. Any thing, therefore, beyond one apartment, with hatching nests below, and a roosting place above, is seldom found necessary. The smallest poultry houses might be kept clean, however, by making the roosting stage separate from the nests. If the roosting stage be placed on the wall opposite to the nests, the eggs may be removed without treading on the dung of the fowls.

Attached to farms belonging to gentlemen of fortune, poultry houses, however, are found of considerable extent. In such cases, there is a keeper's house, and a range of small apartments for the different kinds of fowls, having a projecting roof in front towards the south, supported by small pillars of iron or wood, at from three to four feet from the wall, to afford shelter to the fowls in wet weather. All these usually open into a court covered with sand and gravel, in or near which is a pond or rivulet of water. The inclosure of this is generally about seven feet high, and sharp pointed, to prevent the fowls from flying over it, the larger the court the better; it being understood that all sorts of poultry thrive best when allowed to range over a variety of ground. The apartments are sometimes warmed in winter by a steam-pipe from the keeper's house, carried through the roofs. Flues behind the nests are apt to be more injurious than useful, as any want of attention may overheat and hurt the poultry in them.

Where poultry are fed on steamed potatoes, a boiler for that purpose may be so placed, as to serve at same time for heating the houses with steam.

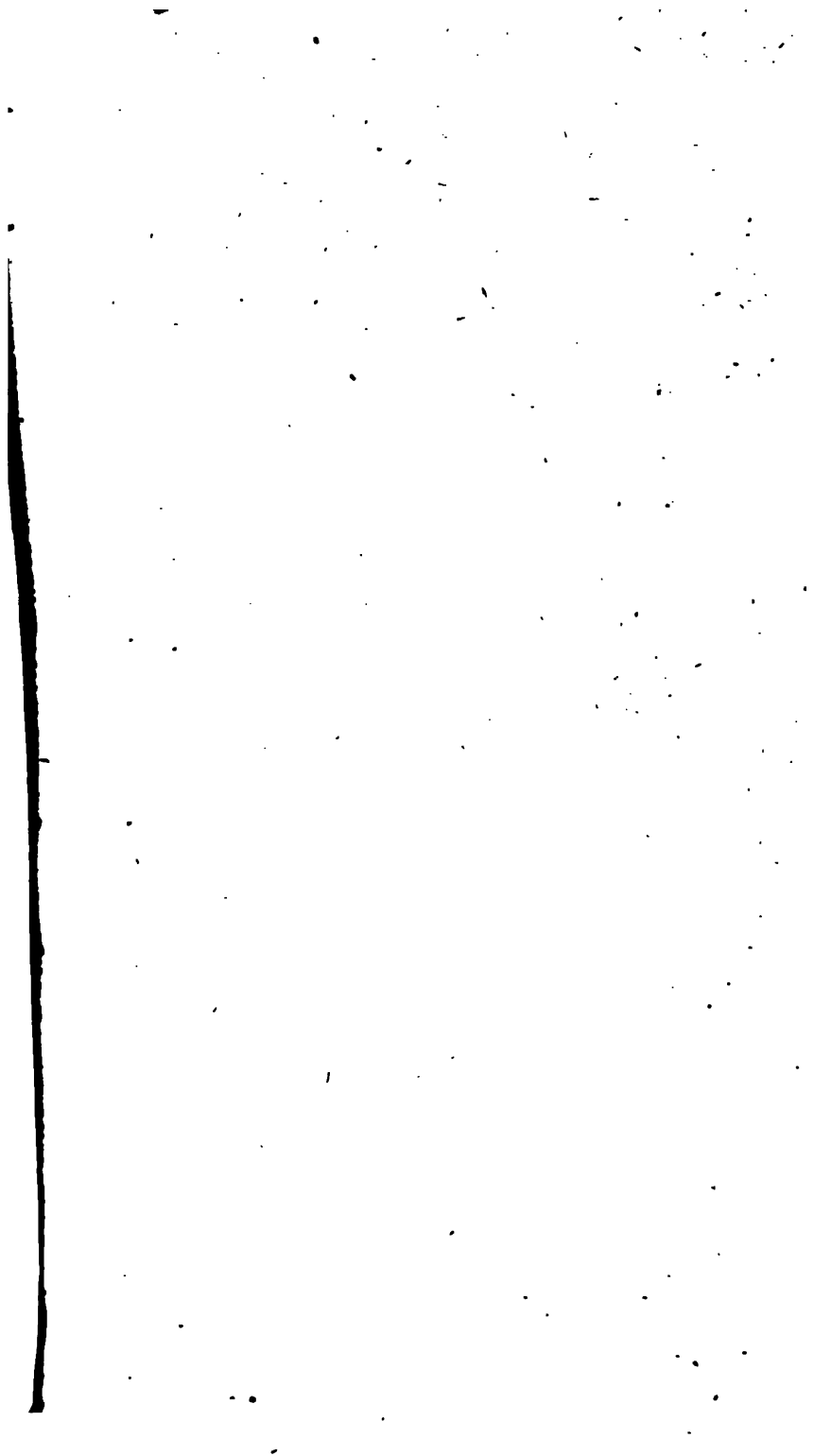
10. *Pig-houses.*

When considerable numbers of pigs are kept, their houses are placed in the straw-yard, or in a separate court; but if

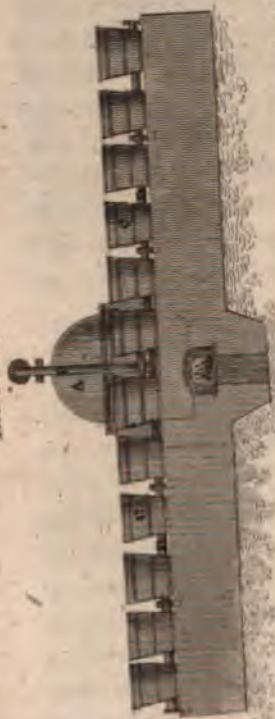
kept in smaller numbers, their houses are placed near the kitchen, for the conveniency of receiving the offals. The styes for the swine have usually a warm exposure, and are divided into different apartments, of about six feet by eight, for keeping the several sorts apart, for swine thrive best when there are not many together, and when those of the same size are kept by themselves. The styes open into an inclosed yard, and their floors being elevated above it nine inches, and made to slope outwards, they are thus kept clean and dry. In the yards are placed troughs for their food, each divided into as many places as there are swine, by boards reaching about half the depth of the troughs, which are so placed as to be easily filled without going into the yards. Water is introduced into these yards; and the bottoms of them are paved with rubble stones, having a declivity to a drain or outlet, that they may be washed and cleaned out occasionally.

11. *Boiling or Steaming houses.*

These are by no means generally introduced, but the great advantages arising from feeding horses, poultry, pigs, &c. with boiled or steamed potatoes, as well as other boiled food, as cut straw or chaff, render a place for that purpose necessary in all farm-offices. A proper boiler, fitted with a cask for containing the food and receiving the steam, may either be put up at one end of the tool-house, or in a house expressly appropriated to that purpose. This boiler may be about two feet diameter, and twenty inches deep. It must have a cover with a circular opening of about eighteen inches diameter in the centre. On this a cask is placed, perforated with holes to admit the steam to the potatoes, &c. having a safety valve at the top to prevent accidents. The complete steaming apparatus, constructed by Mr Baird of Shotts' Iron-works, and now getting into general use, consists of a steam-boiler, with a screwed cover, and as many cast-iron pitchers as may be deemed requisite, into each of which the steam is conducted by a pipe. By this means a variety of vegeta-

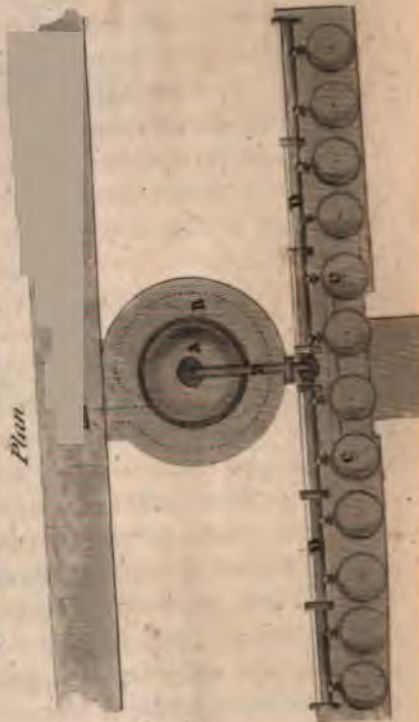


Elevation



Apparatus for Steamrotaries for Horses, with wooden buckets

Plan



- A Boiler with fixed Tip
- B Flue round it
- C Buckets
- D Steam pipes with cocks
opposite each bucket



*Elevation of Steaming Apparatus
with Cast Iron Buckets.*



- A Boiler with fixed Top
- B Pipe round it
- C Buckets
- D Steam pipes with a cock
opposite each Bucket

bles may be steam-boiled at once, as every pitcher may contain a separate kind, and, from their commodious size, they can be easily moved where wanted*. See Plates XI and XII.

All steam boilers, with screwed covers, should be so constructed as to supply themselves with water. This may be done by means of a cock balanced to a float within the boiler, which falls and rises with the surface, and of course opens or shuts the cock through which water is admitted into the boiler, in the same manner as in steam engines. They should have a safety valve, to prevent accidents.

12. *Cart-shed and Repository for Implements.*

The cart-shed is commonly so placed that the access to it may be easy and open from the road, and in most cases it will be found to suit best when placed under the granary, where the same roof covers both. The open space for the carts and ploughs admits a free circulation of air under the granary floor, and thus keeps it free from damp; and the carts can be loaded from the granary, when wanted, with the greatest ease, by means of a hatch. Such sheds need not be above six feet high, and the distance between the pillars not more than seven or eight.

13. *Root-house.*

On all farms where cattle are kept, a store-room is appropriated near the feeding-houses for containing turnips, potatoes, &c. The method of covering up potatoes in the field having been found to answer, no more space will be wanted for them, than what is sufficient to contain one of the field piles at a time. It is found convenient to have the root-house of dimensions sufficient to admit of a cart being turned up, and emptied within it.

* A description of a simple steaming apparatus for cooking roots or other fodder for live-stock, with an engraving, explaining the nature of the proposed apparatus, by Mr John Shirreff, Abbey-hill, is given in the Appendix of Sir John Sinclair's Account of the Husbandry of Scotland, p. 34.

14. *Stack or Rick yards.*

These are placed on a dry bottom near the barns, and in a free airy spot, well inclosed, with declivity sufficient to carry off all surface water as soon as it falls. The proper inclosure for a stack-yard is a sunk fence, with open railing on the top, which will freely admit the air to the bottom of the stacks*. The stacks, or ricks, are, in some cases, supported on a frame of wood, placed on stones, about eighteen inches high, having flat projecting stones at top, to prevent vermin from getting up. But by far the best mode of placing stacks is upon cast-iron pillars, more especially where stone cannot be had. These pillars are two and a half feet long, having a round cape or bound at the top, and another at the bottom, one foot in diameter. After levelling the ground intended for the stack, so that all the pillars may stand perpendicular, they are placed on the surface, and require neither building nor flag. Being placed in this way, they can be removed with very little trouble or expence. Vermin have no way of getting up cast-iron pillars of the above description; and neither rats nor mice have been found in any stack standing properly upon them. Seven pillars are required for each stack, which cost about 50s., or 7s. 1d. each; and the frame, which is made of the very coarsest timber, may be valued, including workmanship and nails, at 8s.; so that the whole costs 58s. At some foundries, pillars may be had at 5s. 6d. or 6s. 6d. each; but these being slighter, a greater number in that case perhaps may be necessary. When *bosses*, or triangular frames of wood, also are used for the centre of the rick, the corn may be stacked in half the usual time, if not less, and the expence will be repaid in one year.

* Berwickshire Report, p. 96, and East Lothian Report, p. 41.

15. *Straw-yards (or Courtines), Dung-pits, &c.*

The area formed by the surrounding buildings containing the farm-offices, is commonly allotted for the straw-yard, after a paved cart road is taken off to afford access to the different offices. The yard is often divided into two or more parts, for cattle of different ages and feeding, with open sheds to each, well sheltered, having troughs for water, and racks for fodder and turnip. These yards may be inclosed with a rough stake paling; but the best inclosure is a stone and lime wall, with a gate to each, large enough to admit of carts to supply fodder, and remove the dung.

A space for receiving the dung from the stables, byres, &c. is sometimes taken off from the straw-yards, where it may be kept till convenient to remove it to the fields. Near the dunghill, two reservoirs for urine should be formed*, at a depth sufficient to admit of a declivity for draining it from the byres and feeding-houses. The insides of these reservoirs, after being coated with a thick layer of clay well puddled and beat down, and after having their bottoms treated in the same way, should be lined with stones, and the whole made perfectly tight.

Where the inequality of the ground will admit of it, a most useful and convenient receptacle for dung and urine may be made under the byres, feeding-houses, or stables, where it may remain till ripe for the field. This receptacle may be arched to support the floor of the offices above, and access may be had for carts from the lower side, the entry to the byres, &c. being as usual from the court-yard †.

* Sir John Sinclair's State of the Husbandry of Scotland, p. 19.

† See Report of Perthshire, p. 52.

General Remarks on the Size and Arrangement of Farm-Offices.

An intelligent gentleman farmer in East Lothian, (Mr Hepburn of Sydserff), strongly recommends *a large area* for farm-offices, according to the improved system of Berwickshire and the Lothians. Nothing, he remarks, is more injudicious, than to have farm-buildings huddled together, round so small an area as from 60 to 70 feet. Where a farm contains from 300 to 600 acres, the area should not be less than from 150 to 200 feet square. If it should be found expensive to surround the square with buildings, a simple wall will afford shelter, till it be found convenient to improve the farm-yard. From 1000 to 2000 yards of dung, with roads round the offices, will require an area of these dimensions. In fact, none but a practical farmer, who has had a large crop, and a number of cattle maintained during winter on his farm, and who has seen the farm-servants carelessly driving cattle and carts in confined court-yards, can fully appreciate the advantages of a large area. When dung is removed, it should be carried to the field, instead of being thrown to another part of the yard, which is unnecessary labour.

The proper arrangement of farm offices, next to the construction, is of most essential consequence, for any blunder committed in this respect can seldom be remedied without considerable trouble, inconvenience, and expence. Peculiarities in the situation, such as a run of water for turning a mill, declivity of ground, &c. will occasion a variety in the arrangement; but that set of offices only can be said to be laid out to the best advantage, where all are so placed as to require the least possible labour in conducting the business of the farm. Thus, the easy access from the stack-yard to the barn, from the barn to the granary, and the accommodation of loading carts on the one side; the propinquity of the straw-house to the feeding-houses, byres, straw-yards, &c.

on the other ; the ready access from the road to the cart-shed and farm-stable, and so of all the other offices, together with the proper shelter and exposure, constitute the chief requisites in the arrangement.

All the surface water from the roofs and courts must be carefully drained off, and not allowed to get into the dung pit, or form stagnant pools ; at the same time, the gutters and drains for such purposes, must be so conducted, that the rain may not wash away any of the dung or soil.

Of the four designs here given for a farm-house and offices,

Plate V shews the plan and elevation of a house and offices, for a small farm of from 50 to 100 acres, in which the accommodation is made in the most simple and economical manner possible.

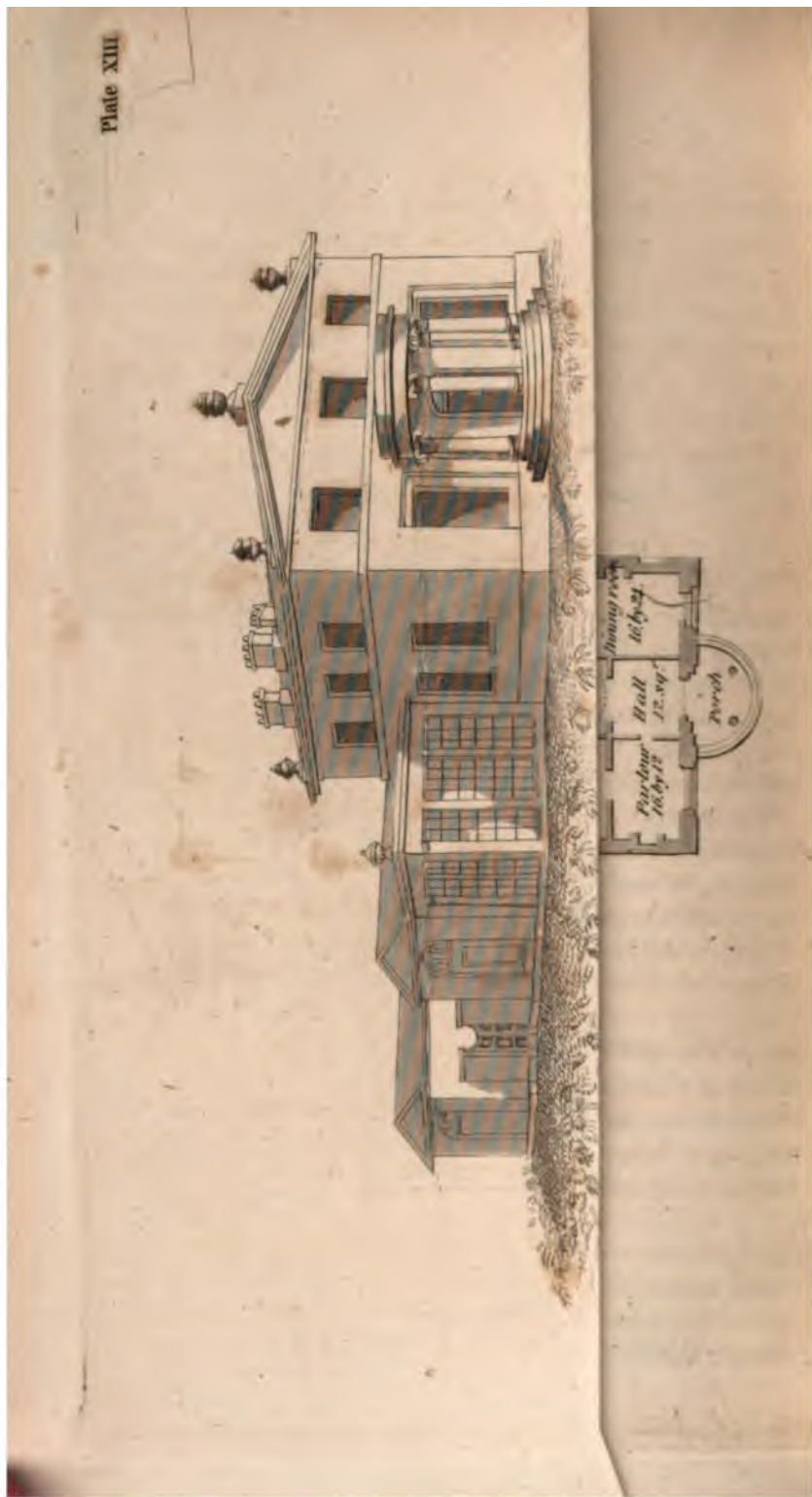
Plate VI, Is the plan and elevation for a farm-house and offices on an extensive corn farm : the arrangement of the whole will be understood from the plate. According to this plan, it is proposed that the dung should be placed either under the byre, if the fall of the ground admit of it, or on the outside of the byres and stables, or at the ends of the straw-yard.

Plate VII, Is a plan and elevation of a farm-house and offices for a similar extent of farm as the last, with a different arrangement of the offices, which will be easily understood by the description of the plans.

Plate VIII, Contains a plan and elevations of farm-offices ; the arrangement and extent of which will also be understood from the plate.

In the Appendix, NO. X, will be found specifications of the expence of building a farm-house and offices, according to plans which are much approved of in the arable districts of Scotland ; and in Appendix NO. XI, some additional hints regarding the details of their construction.





ing winds by plantations, and of such an agreeable form, as may embellish the landscape of which it makes a part.

Simplicity and elegance are to be peculiarly studied, both in the exterior, and interior arrangements. The access to all the apartments should be open and free, but so as to occupy as little space as possible, with stairs and passages. The whole of the apartments and offices ought to be so conveniently placed, that the business of the family may be performed, in the readiest manner, and with the fewest possible servants.— The rooms to be so placed, as to command the best views, and to be well lighted, with the fewest windows.

In some situations, the house may be placed with advantage on the edge of a knoll or plot of ground, so that the body of the building may stand upon the declivity, and thus admit of an under story, for the kitchen and servants' apartments; but in all cases, where the ground is nearly level, there should be no sunk story.

The principal floor should be raised two or three feet above the surface; the kitchen and inferior offices disposed in wings, either at both ends of the house, wholly behind, or projected from one end only, and made, either on the same level, or within one foot of the surface. The stable offices for houses of this kind, are often made part of the farm buildings, but are sometimes built near the mansion-house, in which case, they should join the kitchen offices. The bed rooms will occupy the upper story, and unless the construction of the roof permits of one or two garrets, houses of this description never exceed two stories in height, except in the positions already mentioned, where a sunk story may be formed.

Plate XIII is the design of a house, calculated for a proprietor of moderate fortune; namely, from L.1000 to L.3000 *per annum*. The engraving contains the plans of the two floors, with a view of the front and end. This design is suited to a situation fronting nearly south, having the best views from the front and ends, and being covered towards the

north by rising ground or plantations. It has no sun and as none of the offices rise so high as the level of cond floor, the principal rooms therefore command variety of prospect the situation affords, with as few walls as possible; the doors, windows, and chimneys are placed in the most commodious position for comfort and elegance. The offices are arranged in the most convenient situation for the performance of the operations suitable to each, with the least possible labour, and the whole kept in the most simple and economical form. All the chimneys go up the walls of the main building; which, with proper attention in the construction of large-sized vents, will keep all places free of smoke. A green-house is placed on the vent-wall of the service whence, by proper management of the flue, it may be made to give all the heat wanted in winter, and it would form an agreeable addition to the drawing-room, if connected with a row of the windows. On the other side, and on the vent-wall of the kitchen, it would be proper to construct a hot-house which would receive the warmth from the chimneys, and save the trouble of requiring the further forcing of a separate fire. As the hot-house slopes back to the wall, the window of the kitchen would be above it.

The roof of the house, which admits of its being vaulted, might be covered with the Minto composition, (see Appendix, NO. II.). If built in a place where good materials can be got, all the stones of the outside of the walls should be rough hammer dressed, and laid in level courses, with joints square, and the stones for the corners and window sills completely dressed, and built in a line with the face of the wall. The bands or belts, the cornice, and the porch, ought to be of polished freestone. The entrance, hall, and stairs should be laid with polished pavement; and the back parlour and offices with droved pavement. Drains, with covers at the bottoms of pavement, in the form of a V, should be carried all round the house and offices, with cross drains to the courts, and from the water-closets, &c. The whole

to have a declivity, of not less than three inches in every twelve feet in length, with air-traps at all the openings into them, and a cesspool at the junction of the small drains into the main drain, which conveys off the whole. The bottom of this cesspool should be grated with iron, to prevent vermin getting through the drain. The whole of the offices should be finished in the most plain and simple manner, with square-framed doors and shutters, beaded facings and sciftings. The stables, and inferior offices, ought to have two coats of plaster. The kitchen, hall, laundry, bed rooms in the offices, three coats. The sashes of their windows should be hung, and glazed with second crown glass, and the bed rooms in them should have plain cornices. All the walls, both of the house and of the living apartments in the offices, should be standardised and lathed.

The principal rooms of the house should be finished with mouldings round the doors and windows, and base and surbase mouldings round the rooms. The doors and shutters moulded framed, with framed ingoings, breasts, and soffits. The windows double hung with patent lines, the pulleys placed at the counter check, with the lines within, so as not to be seen from the room, and glazed with first crown glass. The bed rooms finished similar to the principal rooms, but without surbase mouldings, and with simpler mouldings round the doors and windows. All the doors of the rooms, in the main house, should be two inches thick, have mortice locks, and hung on centre hinges; the doors sunk two inches within the face of the architrave. The railing of the staircase should be made of cast-iron, and the hand rail of mahogany. The floors over the principal rooms are to be deafened with forge ashes and dried sand, mixed with as much wrought lime as will hold them firmly together, and laid all over at two inches and a half thick, filling up every opening and chink. When the floors are laid, before putting up the sciftings all the space, at the bottom of the walls, between the wall and the

back of the scifing board, is to be made up closely with plaster lime, or chips of stones and glass, to prevent lodging for vermin. The earth under the principal floor should be cleared out, at least to the depth of two feet, and a drain or drains made across it; if the situation be the least damp, the empty space should be then filled up with dry stones, and forge ashes, to within a few inches of the bottom of the sleepers; the sleepers should be charred and covered with boiled tar.

The plastering of the main house should be done in the best manner, with three coats; the principal rooms to have enriched cornices; and the bed rooms plain ones.

The whole of the wood work should have two coats of oil paint, as soon as put up; and all the outside wood work should be finished with four coats of oil colour, as soon as it can be done. The inside finishing of the main house ought to have four coats; two to be given when ready to receive it, and the other two after it has stood one season, in order to give time for the wood shrinking.

In estimating the expence of such buildings, it is absolutely necessary to have as a data the price of all sorts of materials, at the place where the building is proposed to be erected, without which, any detailed estimate must be quite useless and delusive. There is, however, a mode of ascertaining the expence of buildings in a general manner, which will, in most cases, be found very near the truth; it is, by taking the cubical contents in feet, of whatever buildings are wanted to be estimated, and calculating the amount at a certain price *per* cubic foot.

Thus, houses of the above description are found to cost sixpence *per* cubic foot, when in favourable situations for materials, such as in the Lothians of Scotland. Stable offices, and such kind of buildings, may be fairly rated at fivepence *per* foot; and farm-offices and cottages at fourpence.

Upon this data, the expence of the house and offices, as shown in NO. VII, will be as under :

Length of house, 50 feet,	}	The contents 60,000 feet, at 6 d.	£.1500 0 0
Width of ditto, 40 feet,			
Height of ditto, 30 feet,			
The offices, 180	}	72,000	
breadth, 20			
height, 20			
ditto lower part, 60	}	1,080	cubic feet, at 5 d.
breadth, 14			
height, 12			
		73,080	1522 10 0
Total price of house and offices,			£.3022 10 0

GENERAL OBSERVATIONS REGARDING BUILDINGS OF AN AGRICULTURAL DESCRIPTION.

In all buildings where economy is studied, and the object is to inclose the space required, with the least quantity of walls, roofing, &c. it should be understood, that although a circle contains most space, within the smallest possible inclosure, yet, with few exceptions, it is the least adapted for subdivision, and the most expensive in execution, and that a square and parallelogram will be found the least expensive and most commodious for all purposes.

The square form contains more space, within the same extent of walls, than the parallelogram, and this difference increases, in proportion as the length exceeds the breadth; thus, a space of forty feet square contains sixteen hundred feet, and requires one hundred and sixty feet of wall to inclose it; while a space of eighty feet by twenty has the same contents, but requires two hundred feet of walls. In all buildings,

therefore, where the external walls are, from their height, and the expence of the materials, a principal part of the building, such as dwelling-houses of several stories, the least expensive form will be that which approaches nearest to the square. In low buildings, where the roof and joisting are the most weighty articles, the oblong form will be preferable, particularly when such a form is more suited to the purposes wanted.

In all buildings for common purposes, where there are no division walls lengthwise, it will be found most convenient to have them below, rather than above, twenty feet wide inside, as, when they exceed that width, it becomes necessary to have trussed beams for the joisting, and trussed rafters for the roof, articles requiring more expence than is commonly allowed for such buildings.

The cheapest buildings are such as are contained within four straight lines. All projections add considerably to the expence, by the extra corners, breaks in the roof, &c.

It has always been found of great service, in preventing the spreading of fire, to have the cross division walls of any range of buildings carried up through the roof, and coped above the covering*.

Although in buildings of the description here treated of, economy in their execution is the most essential point to be attended to, yet, even in these, a person of improved taste will always so dispose them, as to have a good appearance; and in villas, for the gentleman farmer, this should be particularly observed, for which purpose the introduction of roofs, covered with the Minto composition, will be found a great acquisition.

* Sir J. Sinclair's Account of the Husbandry of Scotland.

CHAP. IV.**ON THE OCCUPATION OF LAND IN SCOTLAND.**

BY THE REV. DR GEORGE SKENE KEITH.

PRELIMINARY OBSERVATIONS.

THE mode in which the territory of a country is occupied, is an object of the utmost consequence to the community. It is not merely a matter of speculation, but of practical importance; and it involves several questions, (respecting the mutual interests of the proprietors of the soil on the one hand, and its cultivators on the other), concerning which there is great room for diversity of opinion.

In order that so important a subject may be fully elucidated, it is proposed to state how land is actually occupied in the several districts of Scotland, and to compare the relative advantages and disadvantages attending each mode of occupation. Where a more minute detail of circumstances, or a more full discussion of disputed points, is considered to be either necessary or expedient, the reader will be pleased to consult the numbers in the Appendix, respectively referred to in this Chapter.

The lands of Scotland, in so far as regards the soil or surface, are; 1. Occupied in common; or, 2. Cultivated by the actual proprietor; or, 3. Rented in severalty by farmers.

PART I.**OF LANDS OCCUPIED IN COMMON.**

LANDS, in some cases, are still held and possessed in common. As, in this state, they are of the least service to the community, it fortunately happens, that only a small portion of the land in Scotland is now occupied in that manner. Anciently, the barren hills, the high mountains, the extensive peat-mosses, and the greatest part of the uncultivated land, were held in common by the proprietors, and either occupied as common pasturage, or used for digging fuel by the farmers and other inhabitants of the neighbouring districts. Sometimes one landholder had the *præcipuum*, or feudal right of property, while the neighbouring proprietors, from immemorial practice, or written documents, had a claim to certain servitudes, such as a right to fuel from the peat-mosses, or to pasturage on the barren lands. Sometimes each proprietor had an exclusive right to the pastures on the moors immediately adjoining to his arable fields, while the more remote hill or mountainous district, was either accounted a king's forest, or was occupied in common by all the proprietors or farmers in its vicinity. Even in the low country, and most fertile districts, in some cases, royal boroughs or other communities, and in a multitude of instances, individual proprietors, both held and occupied lands, which were in run-ridge, or run-dale, when subject to the plough; but were used as common property, when, after being exhausted by cropping, they bore a scanty produce of natural grass. But, in consequence of two acts of the Scotch Parliament, for dividing lands in run-ridge and commons, already specified, (see Chap. II. p. 100.), scarcely any arable land is now in that situation, and the extent of uncultivated soil remaining in common is constant-

ly diminishing. Some instances, however, of holding and possessing land in common, shall be stated, as these prove the disadvantages attending that mode of occupation.

1. It has been already observed, (Chap. II. p. 92.) that in the two extremities of Scotland, namely, Lochmaben near the English border, and the remote islands of Orkney and Zetland, lands were held by possession merely, without any written document; and formerly the arable lands were cultivated in run-ridge, and the uncultivated or barren lands were used as common pasturage by all the neighbouring proprietors and small farmers. But in the first-mentioned district, the king's kindly tenants of the four towns of Lochmaben, have lately got their small portions of land divided, and they are now both held and possessed in severalty. While they remained common property, it was impossible that they could be cultivated to advantage. Now that they are divided, all those portioners or small proprietors, who have skill and capital, will improve them; and those who have neither, can sell their lots at a much higher price than they could formerly have obtained, and probably may soon be obliged to dispose of them to more opulent and industrious persons, being too small to afford alone the means of subsistence*. In the islands of Orkney and Zetland, a considerable proportion of the surface continues undivided; but agriculture cannot prosper, till the lands be both held and occupied in severalty, under leases of a reasonable endurance, and till the profession of the farmer be separated from those of the fisherman and kelp manufacturer.

2. On the Western Coast of Scotland, the town of Newton-upon-Ayr contains forty-eight burgesses or freemen, each of whom possesses about four Scotch, or five English acres of arable land; and a common of 150 Scotch, or 190 English acres of uncultivated soil, is used as pasture by all the burgesses. If a division of this common were to take place, each free-

* See Dr Singer's Survey of Dumfriesshire.

man or burghess would be the proprietor of nine English acres of arable or pasture land, which would soon become valuable when possessed in severalty. Unfortunately, however, the constitution of the burgh is not favourable to the improvement of the land belonging to it; for the lot of a burghess neither be inherited by a female, nor sold for payment of debts of the possessor; but in default of male heirs, reverts to the community. So that all the evils attending forty-eight entailed estates of the greatest extent, are here experienced by forty-eight small proprietors, (with the additional advantage of being partly occupied in common); and the annual produce or real value of 480 English acres of land is not more than the third part of what it probably would be, if the whole were possessed at a fair rent, and on a lease of thirty-one years (which would be necessary for improving the hitherto uncultivated common), by an intelligent farmer*.

3. In several of the mountainous and imperfectly cultivated districts of Scotland, where the land belongs to a single proprietor, the unarable or mountain pastures, are occupied in common by all his tenants. What is arable, and under corn crop, is possessed in severalty by the small farmers; and each of these has a right to send a certain number of oxen or sheep, proportioned to his rent, to those common pastures of the estate; and care is generally taken, both that the pastures are not overcharged with live-stock, and that every farmer shall enjoy the privilege of mountain pasture, in proportion to the rent which he pays to his landlord for the *possession*, as it is called, (for it is seldom denominated a farm, the extent of arable land being generally inconsiderable). Here the want of capital among the small farmers, is the cause of their occupying the hill pasture in common. When more capital is acquired, and either more land is

* See Statistical Account of Scotland, vol. ii, p. 262, and 581, where observations are made on the peculiar political constitution of this small barony, pointing out the disadvantages attending it, and fully proving what may be plausible in theory may not answer in practice.

proved, or sheep-farming, on a large scale, introduced into these districts, the whole surface will be occupied in severalty.

4. Burgh-roods, or lands lying within the precincts of burghs, were excepted from the obligation of dividing in the acts of Parliament above alluded to. Hence the moors, or uncultivated land, within the liberties of some of the smaller burghs, still continue undivided *. By far the greater part of such waste, or comparatively unproductive territory, has, however, been either feued or sold by the magistrates and town-council of most of the burghs, or by other communities which held property of this description : and in many places, such land, though of little value before it was divided and improved, is now let at from L. 3 to L. 5 *per* acre, and in some cases at even a higher rent. While these lands were held in common, the inhabitants either carried off the surface for fuel, or sent the half-starved cows of the burgh to pasture on them, with but little, if any real advantage.

On the whole, the extent of land occupied in common, is rapidly diminishing, and, it is to be hoped, that this mode of occupation will soon cease to exist.

* The burgh of Fortrose, in Ross-shire, has a right of common on the waste lands in the district called the Black Isle; and, on that account, a tract of great extent, and very capable of improvement, still remains in a state of nature.

PART II.

OF LANDS OCCUPIED BY THE PROPRIETOR.

A CONSIDERABLE proportion of the lands in Scotland, (probably from one-fifteenth to one-twentieth part of what is arable), is in the actual possession of the proprietors of the soil. The amount varies in different estates. Landholders, whose properties are small, sometimes cultivate the whole; whilst others, either occupy none, or retain only a very small proportion. It is proposed briefly to explain, the various modes of occupying land, 1. By proprietors who have small; and, 2. By those who have considerable estates.

1. *On the Occupation of land by Proprietors of Small Estates.*

When proprietors of *small* estates follow no professional employment—are possessed of as much floating capital or ready money as will enable them both to stock their lands in a proper manner, and also to defray the expence of their improvement; and when they have a turn for agriculture, have been trained to the practice of it, and are willing to submit to the same industry and unwearied attention as if they paid rent for their lands, they certainly may cultivate them to advantage. This has particularly been found to be the case, when a farmer, by his industry and economy, has been enabled to purchase a small estate, and at the same time could command the capital necessary for stocking and improving it. While his active powers were not impaired by age, he could then farm his own lands with peculiar advantage, from his uniting skill, experience,

and capital, to his former habits of attention and frugality. When a small landed proprietor, on the other hand, has *only land*, and instead of spare money, is incumbered with *debt*, he cannot in that case advantageously occupy his own estate. It has often indeed happened, that a small proprietor, who has improved his land with money borrowed for that purpose, has been obliged to sell his property without obtaining any adequate remuneration for his improvements, although the estate was sold at its full value. The reason is, that a landed proprietor, cannot always be at the head of his servants, nor execute improvements so cheaply as they are done by a farmer.

2. *On the Occupation of land by Proprietors of considerable Estates.*

In this case, five modes have been adopted by proprietors, according to the circumstances in which they are respectively placed. 1. Some occupy a part of their estates as a park or forest for deer; 2. Some as a farm chiefly in grass; 3. Some as an arable farm; 4. Some as an experimental farm; and, 5. Some *have taken in succession*, the whole, or the greater part of their estates, into their possession, for the sake of improving it.

1. To occupy land merely for the purpose of feeding deer is not profitable, the quantity of human food produced on that extent of ground, being much less than if it were pastured by sheep or cattle. At the same time it is extremely desirable, that great landed proprietors should have every inducement to reside, for at least a considerable part of the year, on their estates, where their presence is so useful, and on that account, the moderate extent of ground hitherto allotted for the maintenance of fallow deer in Scotland, is not to be regretted. In regard to those extensive forests, for the maintenance of the wild or red deer, with which the Highlands of Scotland formerly abounded, they have been great-

ly diminished, and many of them are now appropriated to the feeding of sheep.

2. Where a proprietor possesses a considerable landed estate, a part of which he proposes to occupy, it has been found more advantageous for him, to raise only as much corn as is necessary for his domestic purposes; and, after inclosing his lands, and laying them down in grass, to let them to farmers or graziers, reserving only what is absolutely necessary for his own accommodation.

3. Some proprietors have cultivated a considerable tract of arable land, but seldom successfully. They rarely attend to all those minutiae which a corn-farmer must not neglect. Neither do they regularly oversee their servants, examine the state of their working cattle, attend fairs and markets, nor personally superintend the progress of all their farming operations. These duties therefore commonly devolve on a bailiff, who is seldom sufficiently qualified for them all, or able to manage his master's affairs with that economy and frugality, which a prudent and well-informed farmer, whose personal interest is concerned, must exercise in all his transactions. The other avocations of a great landed proprietor, must also preclude him from paying that attention to minutiae, without which it is impossible that he should farm to advantage upon a great scale.

4. In the more remote and unimproved districts, some landlords have found it necessary to take farms into their own hands, with a view of showing an example of correct husbandry to their tenantry; and they look for profit, not from the produce of the farm they occupy, but from the general improvement of their estate. Others are of opinion, that instead of this kind of experimental farming, it would be of more advantage, both to the proprietor and to the district, to encourage a farmer from another county to set the example, as farmers are, in general, more ready to imitate the practice of their equals, than that of a large proprietor, who is so far

removed from their own station in society, and, as they observe, who pays no rent for his land.

5. In some cases, proprietors in Scotland have attempted improvements on a still greater scale. When their estates have been in bad order, the farms ill arranged in regard to extent, figure, and boundaries, and the farmers dispirited, poor, and unskilled in agriculture, they have taken a considerable tract of country into their own hands, and after improving it, have let it to enterprising and skilful farmers. They have then removed their servants, cattle, and implements of husbandry, to another part of the estate; and, after treating this in the same manner, they have proceeded to others, as far as circumstances rendered it expedient. But it should ever be remembered, that the cultivation of a great estate, requires capital, energy, and constant attention, otherwise it cannot be carried on to advantage; and that it is one thing for several intelligent and enterprising farmers, to cultivate a tract of country, and another, for a great landed proprietor, to improve, or to put in a train of improvement, a considerable estate. Without specifying instances of persons now living who have carried on improvements on this plan, it may be sufficient to allude to an individual, whose memory, for his successful exertions in husbandry, must always be respected. It appears from the Report of Kincardineshire, that the late Robert Barclay of Ury improved thoroughly, and at a great expence, above one-half of his paternal estate, and partially improved the remainder. He was undoubtedly the best practical farmer in that part of the kingdom, and possessed uncommon energy of character, uniting a vigorous frame of body to a comprehensive mind. In the decline of life he let his estate, at a very advanced rent, to farmers of his own training, who have pursued the system which he laid down to them. It is well known, however, that he derived most profit from those farms which he improved partially. Indeed it seldom happens that a landed proprietor can thoroughly improve a

farm, without incurring much unnecessary expence; whereas a judicious farmer, with more attention and economy, can accomplish the same,—or nearly as much improvement, on far more moderate terms.

It may be proper in this place, to pay that tribute of gratitude which is due to the memory of other distinguished friends of agriculture, by shortly stating what they did to promote the improvement of their country. Nearly seventy years ago, John Earl of Stair, (who was much respected both at the court and in the camp), upon his retiring from the army, in the year 1743, took the lead in the cultivation of his native soil; and was the first who raised, in any considerable quantity, turnips, carrots, cabbages, flax, and artificial grasses, (as clover and rye grass, sainfoin, and even lucern), in the field, on his farm at New Liston in West Lothian. In Galloway also, by furnishing the cattle with better food, he increased the size, and improved the breeds of that district. Archibald, Earl of Islay, afterwards Duke of Argyle, was eminent for his attachment to agriculture in general; and, in particular, for the improvement of peat moss, sowing artificial grasses, and planting oaks, the different kinds of fir, and also the larch, which he introduced into Scotland, first on his property as Earl of Islay, and after his brother's death, on his extensive estates in Argyleshire. The Duke of Athole, the Earls of Eglinton, Loudon, Hopetoun, and Findlater were animated with equal zeal; and were great promoters of agriculture in the different counties in which they resided. A number of other landed proprietors followed the example of these distinguished noblemen; and rivalled them both in the science and practice of agriculture. Three Lords of Session, viz. Lord Milton, Lord Drummore, and more lately Lord Kames; also three other most respectable gentlemen, Mr Cockburn of Ormiston, in East Lothian, one of the first improvers in Scotland; Mr Craig of Arbigland in Dumfriesshire, and Mr Scott of Dunninould in Forfarshire, have conferred, as most spirited improvers, important benefits on their country.

On this subject it may likewise be proper to add, that it is not only a healthy, but a useful employment, for gentlemen residing in the country, to have some land in their possession, for the purpose of accommodation or amusement, and to provide themselves with the various articles which their establishments may require. Perhaps those articles might often be purchased fully as cheap at market, and it might be more profitable to the proprietor, 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. It is well observed in one of the county reports *, 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 superintendance of agricultural pursuits, united with attention to the improvement and embellishment of his estate, by inclosing and planting.

* Survey of Berwickshire, p. 53.

PART III.

OF LAND OCCUPIED BY FARMERS.

By far the greater part of the land in Scotland is rented by farmers, and in general it is most beneficial to the public that it should be occupied in that manner. The tenant who cultivates the soil as a profession, has but one object in view, and must therefore manage the concern better than a proprietor, who has often other avocations to distract his attention. Not only is the tenant necessarily more attentive to his business, but he carries it on at less expence, his cattle and servants do more work, the produce of his farm is more carefully looked after, and no money is expended without the prospect of an adequate return. Substantial improvements, as erecting commodious buildings, making roads, draining, inclosing, and perhaps an extensive application of calcareous manures, may be executed advantageously by the landlord; but in regard to raising the products of the soil, by judicious rotations of crops, complete aration, plentiful manuring, selection of the best seeds, &c. an intelligent farmer has evidently the advantage.

In explaining the mode of occupying land by farmers, the following points require to be discussed: 1. The size of farms; 2. The characters of those who occupy them; 3. The nature of the leases, or the tenure by which they are held; 4. The rent which they pay to the landholder; 5. The other burdens to which the occupier is liable; and, 6. The expence and profit of farming.

SECT. 1.—*Size of Farms.*

It has long been a subject of much discussion, whether large or small farms are best calculated to promote the interests of agriculture; and in other respects most beneficial to the community. It seems, however, to be a question that in a great measure depends on circumstances, and the answer to it must vary as these change. Hence, what is expedient or beneficial at one time, in any district, may not be so, at another period, even in the same district.

The circumstances on which the size of farms principally depend are these: 1. The nature of the country; 2. The size of the estates in it; 3. The capital, skill, and industry of the farmer; and, 4. Local circumstances.

1. *Nature of the country.*—Scotland is a hilly country, and contains much broken ground. It has not only a great diversity of surface, owing to its numerous mountains, hills and valleys; but it is divided by abundant streams of water, into very unequal portions of territory. In some districts, where the hills or mountains press upon the banks of the rivers, and where the valleys or meadows are narrow, only a small proportion of the land is arable, and the district is adapted by nature, for large sheep farms, as in the counties of Peebles, Selkirk, Dumfries, part of Roxburgh and Galloway in the south; and in Ross, Argyle, Inverness, Sutherland, and part of Caithness, on the west and north of Scotland. In the more flat and level districts, as in the south-east part of the shires of Roxburgh and Berwick, and in the three Lothians, arable farms, from 300 to 900 acres are found in many places; and there we may look for an improved system of agriculture.—In other districts, there is greater diversity of surface: rivers of different sizes sometimes run through extensive meadows; and sometimes only through narrow glens. Thus, in the maritime parts of the counties of Aberdeen and Banff, the farms containing from 100 to 300 acres of arable land, are marked out by natural boundaries. In the inland and highland districts, owing

to the narrowness of the straths or glens, farms of still smaller dimensions are frequently found, not planned by a land-measurer, but divided by rivers, lakes, and other natural boundaries. These are best adapted for rearing cattle. The lowlands of Scotland, from Berwickshire to the great valley of Strathmore, are divided by hills and rivers, into portions of arable land of considerable dimensions. The breadth of the valleys, and the course of the rivers which flow through the straths or glens in the counties of Kincardine, Aberdeen and Banff, and, in general, along the east coast—have assigned various limitations to the size of farms; and the intermixture of arable and uncultivated land, has adapted these districts both to the rearing of cattle and the raising of corn. Even Berwickshire, Roxburghshire, and the Lothians, where the largest arable farms in Scotland are to be met with, do not contain so many large farms of this description, as are found in Norfolk, and in other English counties; and the north-east Lowlands of Scotland, are so much divided by hills and rivers, that they rarely contain such an extent of land in one farm, as is frequently seen in the south-east division of North Britain.

2. *Size of estates.*—The landed property of Scotland is divided into very unequal portions. The number of proprietors amount to about 7800, whose possessions are of various sizes, from a few roods to above half a million of acres. Where estates are small, it is impossible that any number of farms can be large. No person would possess 300 acres of arable land, if he could obtain no more than five or ten acres from any one individual; nor would thirty proprietors agree to let their small portions to one farmer. When property therefore is much subdivided, there must be a corresponding subdivision of occupancy.

3. *Capital, skill and industry of the farmer.*—Without a sufficient capital, a large farm cannot be successfully cultivated. Without skill in husbandry, even capital will not enable a farmer to prosper; and without industry, no large concern, more especially in a business so complicated, as that of agriculture, can be managed to advantage.

4. *Local circumstances.*—These are various, but they are principally connected with the following particulars: 1. The elevation, climate, and quality of the soil;—2. Vicinity to great towns or markets;—3. Advantages of conveyance;—and, 4. Easy access to manure.

After these remarks on the causes of inequality in the size of farms, we shall now proceed to give a general view of their extent in the several districts into which Scotland is divided, according to the arrangement in this work.

In the 1st district, which contains the greatest proportion of arable land, and where the cultivation is conducted in the most correct manner, with a considerable variety in their dimensions, the farms, in general, are larger than in any other district, in which the land is chiefly under the plough. Several farms exceed 1000 English acres; and, excepting in the vicinity of Edinburgh and other towns, there are not many below 100. The average of the whole is nearly 300 acres. Yet in Roxburghshire, a few farms exceed 2000; a single farmer occupies at present four farms, containing in all 3300 acres; and in Berwickshire, a single farmer has been known to occupy, in four or five farms, 4000 acres. In East Lothian there are also farms from 500 to 1000 acres, and in some cases as much as 1500, and even 2000 acres; and a few in West Lothian extend from 500 to 600. But the number of smaller farms in Mid Lothian, (many of which are below 100, while few exceed 300 acres), joined to the moderate extent of the farms in the other two Lothian counties, reduce the general average to 200 English acres.

In the 2d, or Pastoral District, (which though more southerly than the first, contains a much smaller proportion of arable land, and is chiefly adapted to the raising of live stock), the sheep farms are seldom below 600 or 700, and sometimes reach to 7000 acres. The arable farms are from 50 to 600 acres; though this last number is only found in Dumfriesshire. But three or four farms in Selkirkshire extend to 500 each; while, in the two Galloway counties, (*viz.* Wigton and

Kirkcudbright), farms of 300 arable acres are rarely to be met with; and in Peebles-shire only a few amount to 200. The average extent of arable farms is rather below 100 acres, and that of sheep farms, in this district, exceeds 800 acres. But a number of farms contain a mixture of arable and pasture lands: and many farmers rent a sheep farm in one district, and a corn farm in another.

In the 3d, or Manufacturing District, the quantity of arable land, though very different in many farms, seldom exceeds 200, and more frequently falls below 100 acres. In Ayrshire, corn farms in general are from 50 to 250 acres. In Renfrewshire they seldom exceed 100. A few in Lanarkshire amount to 200. In Dumbartonshire the average is only about 70 arable acres. Yet sheep farms of great extent, valuable dairies, and the rearing of one of the best breed of horses in the kingdom, distinguish these Western Lowlands; though the multitude of hills, rivers, and lakes, and other causes, limit the size of the farms, and the moisture of the climate is unfavourable to the raising of corn.

In the 4th, or Central District, there is the greatest variety in the size of farms. In Fifeshire, in the neighbourhood of towns, there are many small *pendicles* of from 8 to 10 acres, while farms are of all sizes, from 80 to 500. In Stirlingshire, arable farms vary from 40 to 500 English acres; and the size has increased of late in that county, although in the rich carses it rarely amounts to 100 acres. In Kinross-shire the arable farms contain from 100 to 400 acres. In Clackmannanshire, from 50 to 200. In Perthshire, from 50 to 650. And, in Forfarshire, from 40 to 600. The average of the whole is probably 200 English acres of arable land; (though there are extensive sheep farms in the inland or mountainous parts;) and the central district, generally speaking, both in regard to the progress of improved agriculture, and the size of its arable farms, approaches nearer than any other district to the first or the South-east Lowlands.

In the 5th district, or North-east Lowlands, (where the

rearing of live-stock is a principal object, though corn is also raised in great quantity), farms in general run from 120 to 150 acres. In Kincardineshire several are below forty, and some amount to 400. In Aberdeenshire a few exceed 500. In the shires of Banff, Elgin, and Nairn, several farms are below 30, and others exceed 300 acres. In this district also, a few small *pendicles* are found near towns; and, in the vicinity of Aberdeen, a number of small farms have been trenched with the spade and mattock at a very great expence, and are rented by nurserymen and gardeners. In the mountains of Marr there are some very extensive sheep farms. One of these contains 40,000 English acres, twenty-three only of which are arable. Indeed, in such situations, a farm must be of a large size, as it cannot otherwise be attended with much profit to the occupier.

In the 6th district, or West Highlands, there is the greatest disparity in the size of farms, with a very small proportion of arable land. The two largest sheep farms, the one in Inverness, and the other in Argyle shire, contain each nearly 60 square miles, or 38,000 English acres; but the small arable farms, in the occupation of the native farmers, rarely exceed 30, and are often below 8 acres. A great part of these two counties is let to tacksmen, who generally cultivate from 30 to 50 acres, and sublet the rest to the natives. Sheep have also been partially introduced in place of horses and black cattle. The sheep farms are of great extent, and are generally rented by farmers from the south country.

In the 7th, or North Highlands, the size of arable farms is generally very small. In the counties of Ross and Cromarty, the average extent is below 20 acres. In Sutherland, with the exception of the wadsetters, who generally occupy from 30 to 50 acres each, the farms let to the natives are of still less dimensions, probably below 15 acres at a medium. And in Caithness, (where a few arable farms, from 130 to 600 acres, are let to tacksmen, and several farms, from 100 to nearly 400 acres, are occupied by the landhold-

ers), those rented by the native farmers are from 12 to 50 English acres.

In the Hebrides, or 8th district, and in the Northern Isles, or 9th district, the fishery, the kelp manufacture, and the system of *tacksmen*, (an intermediate body of men between the landholders and native farmers), all occasion the occupation of land to be limited to farms of very small extent. More are below than above 10 acres of arable land.

On a general view of Scotland, the largest farms are occupied by those who rear live-stock, particularly by sheep farmers in the south and west; but in the south-east counties, farms are from 600 to 2000 acres of arable land; in the other lowland districts, farms from 100 to 400 arable acres are pretty general, from the Firth of Forth to the north-east of the Moray Firth. On the west coast of Scotland, the extent of arable farms declines gradually from Ayrshire to Sutherland; and on the east coast, the northern and Highland counties have generally small farms of arable land. In regard to the size of farms in the islands, the greatest difference exists in Islay, Bute, Coll, Lismore, Gigha, part of Skye, Colonsay, Mull, Jura, Lewis, and Harris. But, in general, the farms, both in the western and northern isles, are smaller than on the main land of Scotland, excepting when they are rented by tacksmen.

On the whole, it appears, that in an extensive tract of country, there must be, owing to a variety of circumstances, a considerable diversity in the size of farms; but at the same time there is, in some degree, a regular progress in regard to their general extent.

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. Besides, a feudal chieftain is desirous to increase the number of his followers; and for want of other sources of employment, a father has no other means of providing for his sons, when they remain at home, than by giving them a share of his farm. In the course of a

few generations, therefore, a farm of even a considerable extent, is thus frittered down into very trifling possessions. Hence there is a strong tendency, in the first stages of agriculture, to diminish the size of farms, and to establish what has been called the village system*.

In process of time, however, as capital increases and skill improves, farms are enlarged; and it is found by experience, that one man can cultivate any given extent of country, (say 300 or 500 acres), at less expence,—can raise a greater produce,—and can afford a higher rent, than a number of small occupiers. During this stage of the progress, farms are conjoined, and the farmer of skill and capital, not only rents tracts of country in his own immediate neighbourhood, but is also tempted to speculate even in remote occupations. Farms thus increase to a very large extent, and indeed attain a size which appears calculated, (unless where it is the practice to have married servants), materially to diminish the number of persons deriving their subsistence from the cultivation of the soil.

Two circumstances, however, afterwards take place, which have a strong tendency again to diminish the size of farms.

1. As the great inducement of any individual to enlarge, as far as he can, his concerns in agriculture, is owing to the cheapness of land, and to the great profits he derives from that employment in which he unites skill to capital; so, on the other hand, when, by competition, the rent of land increases, and when, from various causes, many competitors appear, he has then no inducement to continue in the occupation of more than what he can conveniently and profitably manage. He diminishes, therefore, the extent of his concerns, by giving up some of his farms to the proprietors, or establishing branches of his family on them.

2. In the vicinity of towns, and on all lands approaching to garden culture, the occupier has so many minutiae to at-

* See Farmers' Magazine, NO. LIV, (May 1813), p. 195.

tend to, that a large farm becomes unsuitable. In such situations, farms necessarily become smaller; and, indeed, as the rent of land increases rapidly, a great extent of it would prove a most hazardous speculation.

The size of farms must thus depend on the circumstances of a country; what is a proper size in one district, is not so in another; and what is a proper size at one time, is not so at another, even in the same district*.

SECT. 2.—*Character of the Farmers.*

In a work of this nature, it is impossible to give a minute delineation of all that variety of character which is to be found among the Scottish farmers; but a few general outlines, established on the authority of the County Reports, may deserve the reader's attention.

In the 1st District, where agriculture is carried on in the most correct manner, the farmers, in general, possess at once skill, industry and capital. Their skill is neither the mere theory of science, nor the discoveries of accident, but arises from observation and experience, and a happy union of knowledge with practice. Their industry is not mere servile labour, or incessant drudgery; it is the persevering energy of mind which stimulates and superintends the labour of others. The

* For that reason, proprietors should not allow their buildings and fences to go to ruin; for though the present occupier may have little occasion for them, they may be required by his successor.

In regard to the relative advantages of great and small farms they will be explained in Appendix, NO. III. It appears from that discussion, that if the natural order of things is allowed to have free course, as stated in the text, the size of farms, (large or small), can never be injurious in this country, where so great a part of the population is engaged in commerce, manufactures, &c. Size must ever, and in every situation, depend upon the ability of tenants, (which again is determined by their skill, capital, and industry), and that size is always the best, for which in the state of any district there is the most effectual demand at the time, be it large or small. That demand ensures the highest rent, and the highest rent is a proof of the greatest produce that circumstances will admit of.

capital of many of these farmers, partly acquired by their own industry, and partly inherited from their ancestors, might be sufficient for the purchase of small landed estates, on the rents of which they could barely subsist, and which at their deaths must be sold to make provision for their children. But it is, in general, much better employed in the occupation of large farms, by which they are enabled to add yearly to its amount, by well-directed industry, or to make provision for their children, from time to time, without injuring their operations in farming. Hence they form a most respectable class in society; and they both are, and deserve to be held in high estimation. The only exceptions to the general character of the farmers in this district, (which may properly be termed the South-east Lowlands), are those in the more inland parts, whose morals are equally pure, and their manners more simple than those of the general body; but who are distinguished by parsimony, rather than by professional skill or extensive knowledge.

In the 2d, or Pastoral District, the farmers are particularly attentive to the rearing of sheep and cattle; and are more noted for their skill in buying and selling, and by their general character for probity, than their knowledge of farming, or uncommon exertions in the cultivation of the soil. Yet here also we find several spirited improvers, who set an excellent example to their neighbours; though it seldom happens that the same farmer is equally successful in raising of corn, rearing of live-stock, and disposing of the produce of his farm to the best account.

In the 3d, or Manufacturing District, the farmers are hardy and industrious; but they are neither so opulent, nor so intelligent, as the farmers in Berwickshire and the Lothians. Their farms are much inferior in point of extent, still more in respect of fertility of soil, and are likewise exposed to the variations of an unfavourable climate. On all these accounts, though they make great exertions in reclaiming waste land, are very attentive to live-stock, particularly to the rearing of

an excellent breed of horses, and are successful in the management of the dairy; nay, though they derive many advantages from the great population of the district, and the constant demand for the produce of the soil, they do not in general hold the same rank in society, which the farmers do in the South-east Lowlands.

In the 4th, or Central District, the farmers in the rich Carse of Stirling, Falkirk, and Gowrie, and in the fertile valleys of Fife, Clackmannan, Strathern, and Strathmore, approximate to those of the first district; and are distinguished by their intelligence, their integrity, and their extensive capitals. In the more remote parts of the shires of Stirling, Kinross, Perth, and Forfar, simplicity of manners, skill in rearing live-stock, rather than the knowledge of improved agriculture, and parsimony, rather than active exertions, mark the character of the Highland farmers; while a particular class, namely, a number of tradesmen, dwelling in or near the numerous towns and villages which are interspersed through this district, are distinguished by their industry and exertions in managing small occupations of from 5 to 10 acres.

In the 5th district, or North east Lowlands, (where, since the introduction of the turnip husbandry, both the rearing of live-stock, and the raising of corn, have been carried on with great success), a number of intelligent, enterprising, and active farmers, raise excellent crops of corn, turnips, and sown grasses. Others are remarkable for their knowledge of the diseases of cattle, and their skill in rearing them; but they are rather good market-men than active improvers. Several farmers from the southern counties have been introduced into this district, where their example has been beneficial. But the most useful improvements have been carried on by young farmers, natives of the district, by whom great exertions have been made in reclaiming barren land.

In the 6th District, (with the exception of gentlemen farmers, or tacksmen), the natives, from the small size of their farms, the shortness of their leases, and their want of capital,

are too generally in a dependant, and even in a depressed situation. They excel in the rearing of live-stock, and in the knowledge of the diseases of their cattle ; but they are deficient in general industry, although they labour very hard in seed time and harvest ; and though a spirit of improvement is certainly gaining ground in the West Highlands, their skill in agriculture is very limited.

In the 7th District, owing to the smallness of the farms, the general want of leases, and their dependence on the tacksmen ; the character of the farmer, though often marked by acuteness and intelligence, is not distinguished for habits of industry, nor skill in agriculture. The eastern divisions of Ross, Cromarty, Sutherland, and Caithness, contain both farms and farmers superior to those in the Western ; and in many parts, where the soil and climate are at all favourable, agriculture is in a prosperous state, and the farmers active and intelligent.

In regard to the Hebrides and Northern Isles, there is a considerable variety in the character of the native farmers. But short leases, (or often their having no leases at all), the system of tacksmen, the fishery, the attention required in the manufacture of kelp, and an unfavourable climate, depress the mind, distract the attention, and injure the professional character of the farmer. The gentlemen farmers, or tacksmen, who act as *middlemen* between the landholders and the smaller tenants, rent large districts of country, are men of good education, unexceptionable morals, and respectable on many accounts : but they are not in general distinguished as skilful cultivators of the soil, and the system of tacksmen, is considered by Mr Macdonald, in his Survey of the Hebrides, as prejudicial to the agriculture of these districts.

In regard to the Scotch farmers in general, it may be observed, that it is impossible to do sufficient justice to the numerous individuals who have done credit to their profession. Mr Dawson of Frogden, near Kelso, is the individual, to whom the agricultural world is indebted for the excellent system of

drilled turnips. Mr Arbuthnot, a native of Scotland, who resided at Mitcham in Surry, and afterwards went to Ireland, is 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 Curwen of Workington-Hall, in Cumberland, who had travelled over England as well as Scotland, in search of agricultural information, declares, that the beauty and the 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 to excellence of soil and management, it exceeded every 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. He adds, where all are so excellent, any discrimination would be invidious*.

Let this suffice for a general description of the character of Scottish farmers, a more particular account of which will be found in the Appendix, NO. II.

SECT. 3.—*Leases.*

The general prevalence of leases, in the best cultivated districts of Scotland, is the chief cause of the improvements in Scottish agriculture; and indeed, without the encouragement which they afford, the land must in many cases have remained in a state of nature, or it must have been improved at the expence of the proprietors. If all seasons were equally favourable, if all farms were completely cultivated, and uniformly fertile, and if the produce of the soil always fetched the same price, leases would be less essential; but as there is a great diversity in regard to all these circumstances, leases become absolutely necessary, both for promoting the im-

* Address to the Workington Society, An. 1810.

provement of the land, and for giving the farmer a chance of a fair average proportion of its produce. In regard to barren land in particular, no prudent man would attempt to manure and cultivate a rugged farm, at a great expence, without the security of a lease; nor will any farmer give nearly so high a rent for a good arable farm, if he is to remain a tenant at will, as if he enjoyed a lease of a reasonable duration. In every case, therefore, in which a proprietor of land has not a particular turn for agriculture, or does not possess an active mind, and a large moveable capital, instead of occupying his land himself, he lets it to a farmer; and he must give a lease, if he expects that any man, who possesses skill, industry, and capital, will pay him an adequate rent.

As this subject is of such peculiar consequence to the agricultural interests of Scotland, it is necessary to consider it at some length.

A lease is properly a contract, founded on the principles of equity, between two men, for their mutual advantage. The one possesses an absolute right in the property of a certain tract of land, and its produce. The other purchases the temporary right in the produce, and *usufruct*, at a certain stipulated price, which forms the just compensation to the landlord for the privileges conveyed to the tenant. Unless the return be adequate to the grant, or the value of the one be commensurate to the value of the other, the transaction is not founded in equity, and therefore cannot long subsist.

The proprietor of an estate may thus be considered as in the possession of a certain capital in land, which is capable of producing a certain annual value, when duly cultivated. The cultivator of the soil, on the other hand, possesses a capital, consisting of the necessary funds for stocking a farm, his knowledge in the art of agriculture, and his industry. Thus situated, the parties, like other men who wish to enter into a joint concern, are induced, by the prospect of mutual advantage, to agree to unite their capitals, for the purpose of manufacturing human subsistence; and their respec-

tive interests having been mutually considered, their agreement constitutes the terms or specific articles of the lease. On this plain principle depends the connexion between landlord and tenant. The capital invested by the cultivator, the rent he pays, his skill and labour, the contingencies, and chance of loss that may arise from the inclemency of seasons, must all be compensated by the value of the produce of the soil. Where this principle is fully understood and acted upon, both proprietor and tenant will be placed in the most favourable situation of which the nature of the transaction admits. But where that is departed from, the interest of the one, or of the other, or perhaps of both, must suffer, in proportion to the degree of aberration from that equitable line, which so distinctly marks their respective rights and obligations*.

In granting leases, besides the rent, a subject to be afterwards discussed, two particulars are generally attended to by the proprietor: 1. The duration of the lease; and 2. The regulations of cropping, manuring, and other covenants.

1. *Duration of the lease.*—When the land is arable and generally fertile, a lease of only a moderate duration is usually given. Where the soil is inferior, and a considerable proportion of the surface uncultivated, a much longer lease is required. Where the ground must be improved at a very great expence, by inclosing, under-draining, and manuring; or where it is very rocky, by trenching with the spade and mattock,—either the rent must be very low, or the lease very long. A landholder, who is poor, naturally wishes for a considerable rent, but will grant a lease of long duration. If he be rich, and zealous for the improvement of his estate, he will be contented with a more moderate rent, but is seldom willing to give a very long lease. In fact, a lease of nineteen years' du-

* Remarks by Mr Walter Thom, whose observations on the subject of leases in general will be found in the Appendix, NO. III.

ration is more general in Scotland than that of any other term of years. The probable reason of this was, that as this is the period of the metonic cycle, our ancestors supposed that it contained all the varieties of the good and bad seasons; and when very long leases were given, they were given for two, three, or more revolutions of nineteen years. It deserves, however, to be remarked, that, in the Highland districts, the tacksmen, who have long leases themselves, generally give short leases, or no leases at all, to their subtenants; that in the midland districts, where long leases are given, two or three rises of rent are stipulated, and that in some of the more improved counties of Scotland, leases of only twelve or fifteen years are granted by a few proprietors. On sheep farms, the leases are generally very short, varying from nine to thirteen years.

In the improved districts of Scotland, where the land has long been well cultivated, and, in general, is in good order, and where the object of the lease is, both to give the farmer security for a certain number of years, and at the same time to prevent the landholder from suffering too much from the depreciation of money, and from the greater demand for the produce of the soil, a lease of nineteen, or at the most twenty-one years, is sufficient; and while a much higher rent is paid, fewer restrictions are necessary. Here the simple rule may be laid down, that no more than one white crop shall ever be taken in succession, without the intervention of a green crop: this and a few general regulations towards the conclusion of a lease, with respect to the proportion of fallow, of grass, and other green crops, will amply protect the interest of a landholder, and are all that can reasonably be imposed on a farmer, who pays the full rent for his farm. Yet even on improved farms, the lease should continue for nineteen or twenty-one years, as it is an inducement to the farmer to devise every method to render it more productive.

The most intelligent landholders and judicious farmers

thoroughly understand the principles above stated, which indeed have been deduced from their practice. But, on the other hand, there are many proprietors, in other respects well informed, who insist on inserting a number of minute restrictions in their leases, when they really are unnecessary, and even sometimes oppressive; and there are many enterprising and skilful farmers, especially in the southern districts of Scotland, where correct agriculture is both known and practised, who are averse to restrictions in any case, and who will not submit to such limitations as may be necessary to protect waste land lately reclaimed, or poor arable soil, that has been lately filled with calcareous matter, from being completely exhausted by severe cropping.

2. *The regulations of cropping, manuring, and other improvements.*—The right of the proprietor to regulate the management of his own land, cannot be questioned; but, how far it is *expedient* to exercise this right to a greater or less extent, must depend upon a variety of circumstances, respecting which no general rules can be laid down. Much must depend, 1. Upon the condition of the farm;—whether it is in a high or in a progressive state of improvement, or whether it consists of barren land to be reclaimed; 2. Upon the character and capital of the farmer, and the confidence to be placed in him; and, 3. Upon local circumstances;—for instance, a prohibition of selling straw, though a proper covenant in a lease of a farm that is remote from manure, would be absurd, if inserted in the lease of a farm near Edinburgh or Glasgow, where night-soil or street-dung can be purchased in great quantities, and straw can be sold at very high prices. There are, however, some general regulations which are common to all leases that have been drawn up judiciously; such as, that the farmer shall never be allowed to take more than one white crop in succession; that he shall always have a certain proportion of his land in sown grass; and that he shall adopt a particular course of cropping during the last four years

of his lease *. The covenants which are generally approved of by the most intelligent proprietors and farmers, together with the form of a lease, in which they are contained, will be found in the Appendix.

It is necessary, however, in this place, to make some observations on a point of peculiar importance, namely, the exclusion of all subtenants and assignees either legal or voluntary. This is made in several instances in most definite terms, and the law prohibits to subset or assign, where the lease contains no such prohibition. In some cases the tenant is not even allowed to name any of his children or grandchildren, whom he wishes to succeed him; but the eldest son, as heir-at-law, must succeed as a matter of course; and if he does not choose to reside or cannot reside, or has taken any other line of life than that of a farmer, the lease falls to the ground, or the farm must be managed to great disadvantage. Certainly every farmer ought to have it in his power to assign his farm to any child, grandchild, or nephew; and to render one of his family accountable to the rest, for their share of his fortune that has been expended upon the improvement of the farm, or to appoint trustees for the behoof of the whole; and in the event of his dying suddenly, and without children, or of his becoming bankrupt from a calamitous season, in consequence of spirited and expensive improvements, his creditors ought to be empowered to sublet his farm, or assign his lease until all his debts be discharged, and the surplus should then revert to his heirs. Is it not enough that the heir of an entailed estate

* The error of proprietors consists in *prescribing*, seldom in *prohibiting*. Every prudent landlord *ought* to prohibit, and no well-disposed tenant can justly complain, unless the prohibitions are injudicious. There is good reason for such clauses in reference to the currency of the lease, as well as for the last three or four years. But to prescribe an invariable mode of cropping, for a whole lease, is generally absurd and injurious, always ineffectual in promoting improvement, and imposes an obligation to which no good tenant will or ought to submit.

is tied up for ever, by irritant and resolute clauses, from the alienation of that property which cannot be affected by his debts, and restricted even in the management of his entailed estate, to the injury of agriculture? Must the farmer also, in a nation in which the principles of commerce are so well known, be bound to a kind of entail, and to irritant clauses, to the injury of his family and of his creditors in particular, and of improved agriculture in general? This is certainly a case that calls for the interposition of the legislature.

There is not the least danger to be apprehended by proprietors from regulating the present law, or rather the practice of the country, (for statute law is silent upon the subject), regarding assigning, and subletting, and leaving the question to the stipulations of the parties. There can be no good reason for permitting the right in the case of liferents and long leases, and refusing it to a lease of ordinary duration.

It would be easy to obviate any objection to granting this right which the most jealous landlord could urge—to demonstrate the equity of permitting assignation and subletting under certain conditions—and to prove the advantages that would result from such permission, both to the public at large, and also to the parties concerned.

Until a transference of the lease be permitted, it is in vain to expect that the capitals of merchants and manufacturers will be employed extensively in agriculture, and that operative manufacturers, in a time of stagnation of trade should find relief in the labours of cultivation.

It would be doing injustice to the great body of farmers, and to the interests of agriculture in general, not to call the attention of the legislature to this important question.

SECT. 4.—*Rent*.

The price paid by the occupier to the owner of the land, is called its rent. It varies, not only according to the

quality of the soil, but also to its relative situation and circumstances. In the vicinity of populous towns, where manure can be had in abundance, and where there is a constant demand for the produce of the soil, the rent even of poor land is very high. In remote districts, where the climate is unfavourable, even though the land be naturally fertile, the rent is comparatively low. Rent also, like the price of every commodity, is higher or lower, according to the demand for farms, which depends in some measure upon the circumstances and abilities of the competitors, as well as the price of produce.

The rent formerly consisted of a great number of particulars; for, besides payments in money, various articles, as grain, lambs, pigs, poultry, &c. were demanded in kind, and frequently personal services were exacted. Nothing could be more injudicious. The grain and other articles paid in kind, were uniformly of inferior quality, and the burden of personal service, whilst it was oppressive on the tenant, (obliging him to keep a greater strength of men and horses than his own farm required, and often interrupting his most important operations at home), was of little advantage to the landlord. Rent in Scotland is now in general restricted to money payments, and every intelligent proprietor is convinced, that the imposing of any burden should be avoided, which has a tendency to impede the industry of the tenant, or to withdraw his attention from the management of his farm*.

The proportion of produce paid to the landholder, for the privilege of occupying the soil, must, of necessity, be different on lands of different quality. Some have supposed that one-fifth of the produce was a reasonable proportion. Others have supposed that a fourth, or even a third part of the produce ought to be paid as rent. The truth is, that the farmer ought always to be allowed a reasonable profit for his labour, his

* See Dumbartonshire Report, p. 48, 49, &c.

attention, the interest of his capital, and all the expences of cultivation; and nothing can be more absurd, than to talk of any proportion of produce, as a fair rent in every situation. An extensive sheep farm, in the second district, and a good corn farm in Berwickshire or the Lothians, yield not only different rents *per* acre, but very different proportions of the produce of the soil. Two shepherds are sufficient to attend a thousand sheep on 1500 acres of land; but an arable farm of 1500 acres requires not only a far larger capital, but a greater number of servants, of horses, and of farm implements. An acre of sown grass, and an acre of onions, must also pay different proportions of their produce as rent; and all fertile and level lands, can pay a much higher proportion of their produce, than what can be paid from a poor soil with a great declivity. There is therefore no fixed relation between produce and rent.

From a variety of causes, the rent of land paid to the proprietor, is higher in Scotland than in England. But in comparing the English and Scottish rents, it is necessary to distinguish between the rent received by proprietors, and the rent paid by farmers. The Scottish proprietor receives all the rent which his lands can afford, out of which he pays the clergyman, the land-tax, and where there are assessments, one-half of the poor's rates: But the church and the poor divide the English rents with the proprietor, often in equal portions, which makes the real rent paid by the farmer, in both countries, more nearly equal than is generally imagined. Within the last 30 years, the rent of good arable farms in Scotland has been doubled, and in many cases tripled, while the land-rents in the sister kingdom, though raised in many places, have not increased in the same proportion. The Scotch farmers, in general, have leases for nineteen years or more; and are not liable to the great tithes or poor's rates. Where they are subject to assessments for maintaining the poor, or small sums in lieu of vicarage tithes, both these charges are very trifling. Hence a Scotch farmer, especially in those counties in which the farms

are large, can afford to pay a much higher rent to the proprietor, than he could pay in England for land of the same quality; because his improvements and mode of cropping are not checked by the tithe-owner, and because, by the length and security of his lease, he is protected against oppression from the proprietor. In many districts of Scotland, there is a great competition for farms, when the current leases are about to expire, more especially if the land is in good condition; and even where it is of indifferent quality, or in bad order, the farmer, from *the hope* of raising an increased produce by the improvement of the farm in the course of a long lease, frequently agrees to give a higher rent, than he could afford to pay during the first five or six years, if he expected even a small profit in the beginning, instead of a considerable addition to his capital towards the end of his lease.

The whole land-rent of Scotland, twenty years ago, did not exceed two millions of pounds Sterling. It is now nearly five millions; and as leases expire, the rent is increasing at the rate of from L. 100,000 to L. 200,000 *per annum*, partly owing to the gradual depreciation of money, but chiefly to the improvements that have been executed during the currency of the old lease, and to such as are meditated under the security of the new one. Its rental, therefore, in 1812, may be estimated at about 29 shillings *per Scots acre*, of all its arable land. In a few years it will be at least 6 millions, or 24 shillings for every English acre that is arable. But it must not be supposed, that the arable land, by itself, would yield this rent, as there are above three acres of uncultivated land for every arable acre, and the amount of rent includes the whole. Besides, this is the gross rental, from which there must be made considerable deductions,—for public burdens,—for buildings, and repairs,—and for the expence of those improvements which are partly by agreement defrayed by the landed proprietor. But these deductions will not increase in proportion to the advance of rent; as farm-houses and other buildings are now more durable than they were formerly. In the Appendix, a

particular account will be given of the rent in the different counties. A general view of the land-rents of the nine districts is all that can be given in this place.

The 1st district, though it contains only one-sixteenth part of the extent, yields very nearly one-fifth of the land-rent of Scotland, or a million of pounds annually. This is about 34 s. for every English acre of arable, and 4 s. for every acre of uncultivated land. But some farms in Roxburghshire rent at L. 3, and a few at L. 4 *per* acre. In Berwickshire, L. 4, and sometimes L. 5, and even L. 6 are given for good arable land. In East Lothian from L. 5 to L. 6, 10 s. are given, in new leases, for farms of 200 acres, and upwards*. In Edinburghshire the rent, *per* acre, is from L. 5 to L. 7; and in small farms, L. 8 and upwards, near the city. In West Lothian it varies from L. 3 to L. 5 according to circumstances; but in old leases the rent is much lower. Besides, in the Lothian counties, and more especially in the vicinity of Edinburgh, so much of the surface is occupied by roads, inclosures, and pleasure grounds, that a landed proprietor cannot draw the same rent *per* acre from his whole estate, as he obtains for particular farms, or for fields of excellent quality.

The 2d district, (though more southerly, and containing above one-half more extent of surface), has only four-fifteenths of that extent in cultivation, and yields only about L. 500,000 of rent, or half of what is drawn from the first district; or, with one-tenth of the surface, yields one-eighth of the land-rent of Scotland. This is only about 18 s. for every English acre of the arable land, and 4 s. for the acre of mountain pasture; but several old leases are below, and many new leases are much above these average rates. In Peebles-shire or Tweeddale, the arable land is from 30 s. to

* The highest rented lands in East Lothian are the farms of Hawkhill and Eweford, near Dunbar, the property of Sir George Warrender, containing 530 Scotch acres of arable land; the rent is L. 8, 4 s. *per* Scotch, or L. 6, 10 s. *per* English acre.

L. 3 and L. 4, and, in some cases, L. 5 *per* Scotch acre, or from 24 s. to L. 4 *per* English acre. In Selkirkshire, from 24 s. to L. 2 : 12 : 6. In the interior parts of Dumfries-shire, it is only 20 s.; but from L. 3 to L. 5 near the towns, in small lots. In Wigton and Kirkcudbright, it varies from 16 s. to L. 3 *per* acre, according to its quality and situation. The mountain pasture is not valued by its extent, but by the number of sheep which a farm maintains; and three acres at an average may support two sheep.

In the 3d district, (though exposed to all the disadvantages of a wet climate), from the great demand for the produce of the soil, the rent of the arable land is much higher than in the second; and with only one-thirteenth part of the extent, it yields above a sixth part of the whole land-rent of Scotland. Its gross rental is about L. 820,000, which is nearly 22 shillings for every arable, and four shillings for every uncultivated English acre. But in recent leases, arable land, in Ayrshire, is from L. 1 for poor land, to L. 5, and sometimes to L. 8. Near Glasgow and Paisley, the arable land and also rich pastures rent at from L. 4 to L. 9 *per* Scotch acre. In Dumbartonshire the rent for arable land is from 10 to 35 shillings *per* acre. In this district, in favourable situations, for temporary tillage, land has rented as high as L. 8, and even L. 12 *per* Scotch acre, but the mountain pasture is only at from 2 to 4 shillings *per* acre.

In the 4th district, which contains nearly two-thirteenth parts of the extent of Scotland, the whole rent is one-third part more than that of the first district, or L. 1,350,000; but in this sum is included the rent of the carse of Falkirk and Gowrie, and the fertile valleys of Fife, Clackmannan, Kinross, Stirling, Perth, and Forfarshires, as well as of the extensive, but uncultivated Grampians, and other mountains; which are as barren as the others are fertile. In Fifeshire, the arable lands are from L. 2 to L. 5 *per* acre. In Kinross-shire, from 15 shillings to L. 3. In Clackmannanshire, from L. 4 to L. 5. In Stirlingshire, from

25 shillings to L. 3 for loams, and L. 5 to L. 5, 6s. for best carse lands. In Perthshire, from 10 shillings for poor arable land, to L. 5 and even to L. 6, 10s. for some rich carse farms. In Forfarshire, in the interior, from 15 to 50 shillings, in large farms, according to their quality; and near the principal towns, from L. 4 to L. 7, or L. 8. But the mountain pasture in this district varies from 3 to 10 shillings. The average rate of arable land may be estimated at 20 shillings *per* English acre over this very extensive district.

The 5th district contains an eighth part of the surface of Scotland; and nearly the same proportion of its total rent, or more exactly L. 550,000. As nearly two-thirds of this is uncultivated, the arable land at an average is only 12 shillings *per* acre. But in the vicinity of Aberdeen, land trenched from the barren moor within these fifty years is rented from L. 5 to L. 10, and some of the old arable land is rented on leases for years by nurserymen and gardeners, for above L. 15 *per* Scotch acre. The great quantity of poor arable land in the interior and highland districts reduces the general average; but near the sea-coast and in the fertile valleys of the Howe of the Mearns in Kincardineshire—of the Garioch, Formartin, and Buchan, in Aberdeenshire—of the Boyne, Enzie, and Strathisla, in Banffshire, and in the maritime parts of the counties of Elgin and Nairn, no good arable land is let under 30 shillings, and some of it is let above L. 3 *per* acre. The barren mountains in the Grampians are rated below sixpence; and the hill pastures in general are valued from 2 to 3 shillings, in the lower parts of the district.

In the 6th district, or that part of the counties of Argyle and Inverness, that lies on the mainland, (which contains above one-sixth part of the surface of Scotland, but of which not one-twentieth part is arable), the rent of land is comparatively low, though all that the natives can afford to pay; but in many cases is high, where sheep-farming is introduced. In the vicinity of Inverness and Campbeltown the arable land rents from L. 2 to L. 3, or L. 4 *per* acre; but the

average of the whole that is ever ploughed is not above ten shillings *per acre*, and the pasture is below two shillings at a medium. The rent of both counties, as far as they lie on the main land, is very nearly L. 300,000, or one-sixteenth part of the land-rent of Scotland.

In the 7th district, which includes the four counties of the North Highlands, the total extent is also nearly a sixth part of the whole area of Scotland. Its whole rent is above L. 160,000, or one-thirtieth part of the rent of Scotland; and the average rent of arable land is only about 6s. 6d. *per acre*: But in East Ross and Cromarty, the best arable land near towns is from L. 2 to L. 3; and in Caithness, near Wick and Thurso, it is from L. 3 to L. 5, for small lots. Sutherland contains only a small proportion of arable land; and excepting on the east coast, does not pay a high rent. The mountain pastures are now, in many places, rented by sheep-farmers.

In the 8th district, or Hebrides, which contains nearly one-eleventh part of the surface of Scotland, the payment of the rent depends chiefly on the kelp manufacture, the fishery, and the price of live-stock. The whole rental does not much exceed L. 100,000, or one-forty-eighth part of the rental of Scotland; yet, near Stornaway, some fields are rented at L. 2 Sterling; though the rent seldom exceeds 5s. *per acre*, except where the kelp manufacture is carried on.

In the 9th district, the Orkney and Zetland Islands, (which contain one twenty-third part of the surface of Scotland,) the rent of the land is still lower, not exceeding L. 50,000; even when the *skat*, (the old duties to the crown) the feu-duties to Lord Dundas, the land-rent to the proprietors, and the profits from selling fish by the landholder, or his factor, are all included. Land is not here rented by the acre, but by very indefinite measures; and is valued chiefly from the portion of sea-coast for making kelp, and the profits of the fishery; yet some fields, near Kirkwall, are rented at L. 3 *per acre*.

Taking a comprehensive view of the whole land-rent, nearly one-half of it is paid out of the 1st and 4th districts, which reach from Roxburghshire to the south-east boundary of Kincardineshire, and contain only two-ninth parts of the extent of Scotland. The 5th district added to the 1st and 4th, make a little more than one-third of that extent, with five-eighths of the rent of the kingdom; and if Scotland were divided into two equal parts, the western division, from the Solway to the Pentland Firth, would not yield above one-fourth of the rent of the kingdom, or one-third part of the rent of the eastern division. What alteration the introduction of sheep-farming may make in that proportion cannot yet be foreseen. But, on the whole, the land-rent of Scotland has increased,—is increasing,—and if agriculture shall continue to receive the support of the legislature, it may increase to a height which cannot be calculated, and perhaps would not be credited at the present moment.

The following is a general view of the rents of lands and houses in Scotland, as they respectively stood for the year ending 5th April 1811, in the nine divisions into which Scotland is divided in this work.

Divis.	Rent of Land, L.	19	2	Houses, L.	12	5
1.	1,004,065	19	2	432,334	12	5
2.	489,748	3	4	25,407	15	0
3.	818,532	3	10	420,924	15	7
4.	1,349,260	1	1	171,309	10	4
5.	527,157	5	10	83,276	8	3
6. Besides the Islands,	300,000	0	0	14,441	0	10
7.	161,333	12	1	5,223	8	10
8.	106,508	18	4	2,310	1	7
9.	16,236	9	6	3,546	14	6
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Total land rent,	L.4,792,842	13	2	L.1,158,777	7	4

SECT 5.—*Burdens to which the Occupier is liable.*

Besides the rent paid to the landholder, certain taxes are imposed by law on the farmers of Scotland. These are, 1. National; 2. Provincial; or, 3. Parochial.

1. *National*.—The property-tax, as imposed upon the farmers of Scotland, is found to be both oppressive and unequal.

The principles assumed in the property-tax act are, that a farmer in Scotland, who pays L. 300 of rent, and an English farmer, who pays L. 200, can afford to pay the same tax to government, as if he had L. 150 of free income from landed property. These assumptions are not founded in fact, even in the richer country of England; yet the English landholder, as such, pays no tithes, no poor's rates, and no land-tax. All these are paid by the farmer, besides the stipulated rent to the proprietor; and in many cases, they are equal to that rent. In both countries, there is the greatest disproportion between the profits of farming and the rent which is paid to the landowner. But in order to proportion the tax on property, to that on occupation, with any degree of fairness, the Scottish farmers should either be charged with a tax, corresponding only to one-third of their rent; (and, in fact, they do not, at an average, possess a capital corresponding to this ratio), or should be charged according to their *real income*, which is always inconsiderable for some years at the commencement of a lease, where any improvements are necessary.

But the great objection to the property-tax on its present footing, is the septennial revaluation, by which the return of the farmer's capital is taxed, whatever proportion of that capital be repaid, and which is exigible even though no part of it should be returned.

It is certain that the property-tax will ultimately fall upon the landlord; for the tenant who takes a new lease, will offer less rent, in proportion to the public burdens with which he is likely to be affected. But the tax was severely felt by

those who had taken land at a high rent, without any idea of being made liable to such an imposition; and the septennial revaluation is unquestionably a great check on expensive improvements.

The tax on horses employed in husbandry is also hurtful to agriculture. It is particularly severe on the small farmers, who can seldom afford to employ *good* horses only; and it has also a tendency to discourage *cultivation*, and to promote the extension of grass husbandry. As grass lands do not raise one-third of the food for man that is raised by lands under the plough; and as Great Britain, which formerly *exported*, now, owing to the great increase of its population, *imports* corn, this deserves the particular attention of the Legislature.

2. *Provincial*.—The tenants are obliged to pay a share of the assessments for the wives and children of militiamen; but this, it is to be hoped, is only a temporary burden. There are also county assessments for roads, bridges, &c. which generally afford accommodation, and access to markets, equal to their amount.

3. *Parochial*.—These are, 1. Tithes, or ministers stipend; 2. Poor rates or assessments; 3. Proportion of the school-master's salary.

1. The ancient tithe laws of Scotland were oppressive to the farmer, and injurious to agriculture. But by an act of the Scottish Parliament in 1633, every proprietor may value his tithes, which value can never afterwards be increased; and he can force the sale of his free tithes at nine years' purchase, except where the king and universities are titulars. Tithes are now levied in Scotland only where they have not been legally valued; and a farmer is liable in payment of the minister's stipend, when the landholder is bankrupt; and even here he can retain his rent till reimbursed. The whole stipends of the Scottish clergy do not amount to a shilling of

the pound of the land rent in Scotland. For more minute information, the Appendix NO. IV. may be consulted.

2. *Poor-Rates.*—The poor in Scotland are supported chiefly by weekly collections made at the parish-churches, and by charitable donations to the church-session. But when these fall short, assessments for the poor are appointed to be paid, one half by the landholder, and the other half by the farmer, or occupiers of land in the country, and of houses in towns. They are rarely levied except in populous towns. For particulars consult the Appendix NO. V.

3. *Schoolmaster's Salaries.*—Of these also the occupier of land pays one half; but they rarely amount to twopence in the pound of his rent. And at an average both poor-rates and schoolmaster's salary do not exceed threepence in the pound, even where both are paid by the farmer.

SECT. 6.—*Expence and Profit of Farming.*

THIS may be calculated, with a reasonable degree of accuracy, on a particular farm, where the nature of the soil, and its general situation and circumstances are previously known: but it is extremely difficult to estimate the probable expences and profit in a whole parish, and still more so in a county or large district, even although the rents of the various farms were previously ascertained; and it is altogether impossible to state, with any degree of correctness, either the average expences, or the average profits of farming in Scotland. In some districts, where there is a great competition for farms, the profits of the farmer, who takes a new lease, are reduced to very moderate limits. In others, where the competition is less,—where the farm belongs to a landed proprietor, whose manners are harsh,—and who is accounted severe,—farmers under such circumstances are shy in making offers for a lease; and the person who, with skill, industry, and capital, has spirit enough, not only to improve a stubborn soil, but, trusting to the security of his lease, to bargain with a landholder of this description, will sometimes make a very

advantageous bargain. Hence a landlord of popular manners and a benevolent disposition, who is known to deal honourably with his dependants, often draws a higher rent for his estate than the other,—because there is a competition among the farmers, not only for the lands,—but also for being placed under such a landowner. For a similar reason, land that is favourably situated, easily cultivated, and of good character for the fertility of its soil, is eagerly sought after, upon the demise of a farmer, or the expiration of a lease; while land that is not so much favoured by climate, situation, or circumstances, is seldom desired by a substantial and skilful farmer, except when the rent is moderate, and the lease of considerable duration. It is in no small degree owing to this preference for fertile lands, that comparatively high rents are paid in the 1st district, or South-east Lowlands, and comparatively low rents in the 5th district, or North-east Lowlands. It is said that the best land, even at a very high rent, is generally the cheapest, in every part of Scotland. Very poor land is seldom a good concern, even though only a trifling rent is paid for it; unless it can be improved for laying down to grass. Bad land, except in the vicinity of large towns, where manure can be purchased at a reasonable price, will pay nothing in tillage. Yet such are the advantages of capital, ready access to market, and a constant demand for the produce of the soil, that not only much more profit is made in the first district, where rents are very high, than is generally made in the fifth district, where the rent, even of fertile soil, is moderate. But the farmers in Berwickshire and the Lothians must be induced both by a low rent, and a long lease, to rent a farm in the North-east Lowlands; and this inducement must become higher, before they will take the lease of a farm in the northern or Highland counties. In every county in Scotland, there is a wide difference between the profits of one who has an old lease, and consequently a moderate rent; and the profits of another farmer who has a new lease, and whose rent is consequently much higher.

Yet profit does not altogether depend upon rent: the man who enters upon a new lease with a higher rent, in a few years often gains more than his predecessor. The difference between the profits of these two cultivators of the soil, upon two farms in every other respect equal, ought to be exactly the difference of the rent. But, in fact, this is not found to be the case, where the farm under the new lease is not over-rented.

The expences of farming vary considerably in the different districts of Scotland. In Berwickshire and the Lothians, for example, the expence of a pair of horses, including their prime-cost,—their maintenance, the plough, cart, and all other implements of husbandry attached to them, with the wages of the farm-servant who attends them, is equal to that of twelve Highland garrons, with three ploughs,—and their corresponding imperfect implements of husbandry—with six attendants, viz. three men and three boys, in the North Highlands or Islands. Yet the single ploughman, and his pair of horses, in the first district, will cultivate as much land as is done by six men and twelve horses in the Highlands; and the land which he cultivates will yield a far greater produce—and, after paying a higher rent, will leave a greater profit to the farmer, than what is made in those districts, where both the farms and working cattle are small, and the soil and climate inferior to those of the South-east Lowlands.

In the Appendix, (NO. V.), some statements will be found of the expence of farming, and the profit attending it. Were an opinion, founded upon all the data that are given in the different County Reports, to be hazarded, it might be urged, that the profits of farming do not probably much exceed 10 *per cent.* of the capital employed in agriculture. On small farms they rarely amount to 10 *per cent.*; and on the largest, except where there are old leases, they seldom exceed 15 *per cent.* But as the rent of lands, and the value of money, over the whole of Scotland, have undergone so great changes, in the course of the last twenty years, it is impossible to ascer-

tain, in any one particular year, what are the average expences and average profits of the farmers of Scotland.

It may be proper, however, to allude to a species of profit which is not commonly attended to, namely, the profit—not of the farmer, but of the landholder. When, by judicious covenants in leases, by encouraging his tenants to reclaim barren, and improve rugged land, and by exacting a fair, and no more than a fair rent, his farmers are enabled to leave their farms at the end of their leases, able to bear thrice the former rent, his lands, supposing money to be depreciated one half, are worth 50 *per cent.* of more real value than what they were twenty years before.

CONCLUSION.

PERHAPS a comprehensive view of the Mode of Occupation of the lands in Scotland, at the end of the year 1813, compared with the manner in which lands were occupied at former periods, may deserve to be read with attention.

Previous to the Reformation, the Romish clergy, partly from the rents of the church lands, and partly from the tithes, which were payable in kind, drew at least one-half of the land-rents of the kingdom; and the occupiers of land were obliged to give three weeks' notice to the rector, or tithe-holder, before they could carry their corn into the stack-yard. In this situation agriculture could never prosper, whatever proportion of the produce was paid to the land-owner. The decret-arbitral of Charles I. followed by the act of the Scots Parliament 1633, rendered the tithe laws no longer injurious, as they had formerly been to Scottish agriculture.

But till after the Revolution, a great proportion, in most districts one half, of the territory of Scotland, was occupied

in common, or in run-ridge; and the farmers had no inducement to cultivate the soil in any correct manner. Two acts of the Scottish Parliament, in the reign of William and Mary, empowered the Court of Session to divide commons, and all the lands that lay in run-ridge, with the exception of those belonging to royal boroughs. By these legislative enactments, great facility was given to the division of lands, and to the holding them in severalty; and great encouragement was held out to the improved cultivation of the soil, by the valuation of the teinds, (which prevents the tithes from ever increasing), and by rendering the stipends of the clergy, though a debt upon the land, no longer a burden upon the farmer or occupier.

Leases had several centuries ago been introduced into Scotland, but had not become general till after the Union of the kingdoms in 1707. (Wadsets, those ancient enemies of an improved cultivation, were too prevalent till that period). And as lease-holders, by the Scottish laws, have no right to vote at the elections of a Member of Parliament, the landed proprietors had no inducement to withhold leases, in order to secure their political influence; but were, from many motives, led to grant leases, to promote the improved cultivation of their lands.

These three concurring causes,—exemption from tithes,—possessing the land in severalty,—and holding their farms by the security of leases,—were all very favourable to the agriculture of Scotland; and the union of the two kingdoms in 1707, occasioned the improvements in cultivation, (which were then practised in England), to be more generally known than they formerly were in Scotland, and to be imitated in some of the southern counties.—But it was not till after the accession of his present Majesty, that, from the division of labour, from the increase of our commerce, manufactures, and population, and, consequently, from the great demand for the produce of the soil, that the agriculture of Scotland received the greatest improvements, from a few public-spirited landed

proprietors, and from many intelligent, industrious, and enterprising farmers. Nay, it was not till after the calamitous season of 1782, that the turnip husbandry, and the raising of artificial grasses, were generally known in the northern counties.

At present, from Berwick to Inverness, the agriculture of the east coast of Scotland is in a state of rapid improvement: even in the pastoral districts, an improved cultivation of the arable land, and a better mode of managing land in pasture, is spreading, not only in the southern counties, but on the west of Scotland, and in the Hebrides; though the great proportion of mountainous surface, and the humidity of the climate, render the counties, which border on the Atlantic, more proper for rearing or fattening live-stock, than for raising corn.

The size of arable farms has not only been enlarged in the principal farming counties on the east coast, from Berwick to Aberdeenshire; but the farmers have reclaimed much barren land, have greatly improved what was formerly under an imperfect cultivation: and, profiting by their experience, have increased both in skill and in capital. Hence they have been able to pay a much higher rent to the landholder, by raising a much greater *real* value of produce from the soil. Nay, in the northern counties, where the farms are of smaller dimensions, viz. from Banff to Inverness, an improved agriculture, (evidenced by sowing turnips and artificial grasses), has become very general; and although the system of tacksmen, (and, in some places in Sutherland, of wadsetters), still prevails, yet many examples of good husbandry are to be found in East Ross, Cromarty, and Caithness.

The expence of farming has no doubt increased, in a much higher ratio, than that either of the depreciation of money, or the rise of rent to the landlord: but this has been accompanied by such improvements in farm buildings, inclosures, implements of husbandry, and, in the more correct cultivation of the soil, that Scottish farmers in general have

reasonable profit for their capital, labour, and attention; and indeed, generally, have most profit, where their expences are greatest, and where their operations are conducted in the most spirited and judicious manner.

It is not saying too much for the great improvements which have been made in Scotland within the last 30 years, when it is affirmed, that the occupiers of the land in that country, now raise at least *50 per cent.* or one half more food for man and beast, than what was produced before the year 1782. Not only has the population increased considerably, within that period; but the people eat much greater quantities of butcher-meat and wheaten flour. Nay the horses now receive as great a quantity of oats annually, as was formerly allowed for food to one-fourth part of the inhabitants: And, from the spirit for improved agriculture that is now generally prevalent, it is probable that both the population, and the produce of the soil of Scotland, will continue to increase in nearly the same proportion, for many years to come, perhaps for ages, if not counteracted by injudicious laws, adverse seasons, or national calamities.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to ensure the validity of the results.

3. The third part of the document describes the different types of data that are collected and analyzed. It includes information on both quantitative and qualitative data, as well as the various sources and methods used to obtain this information.

4. The fourth part of the document discusses the various statistical methods and techniques used to analyze the data. It covers topics such as descriptive statistics, inferential statistics, and regression analysis, among others.

5. The fifth part of the document discusses the various applications and uses of the data. It highlights the importance of using the data to inform decision-making and to identify trends and patterns in the data.

6. The sixth part of the document discusses the various challenges and limitations associated with data collection and analysis. It highlights the need for careful planning and execution to ensure the accuracy and reliability of the data.

7. The seventh part of the document discusses the various ethical considerations and standards that must be followed when collecting and analyzing data. It emphasizes the importance of transparency and accountability in the data collection and analysis process.

8. The eighth part of the document discusses the various tools and software used to collect and analyze data. It highlights the importance of using reliable and secure tools to ensure the accuracy and reliability of the data.

9. The ninth part of the document discusses the various best practices and guidelines for data collection and analysis. It provides a comprehensive overview of the key principles and practices that should be followed to ensure the highest quality of data collection and analysis.

10. The tenth part of the document discusses the various future trends and developments in data collection and analysis. It highlights the importance of staying up-to-date on the latest research and developments in the field to ensure the accuracy and reliability of the data.

CHAP. V.

IMPLEMENTS OF HUSBANDRY.

BY MR ANDREW GRAY.

PRELIMINARY OBSERVATIONS.

THE object of this branch of the General Report is, to describe the principal agricultural implements, at present generally used in the more cultivated districts of Scotland*. These may be considered under the following general heads:

- SECT. 1. Implements of tillage.
2. Implements for reaping corn.
3. Implements for harvesting corn.
4. Implements for threshing and cleaning corn.
5. Implements of conveyance.
6. Implements for draining.
7. Rollers.
8. Drill-machines.
9. Miscellaneous articles.

It is proposed to conclude with some observations on, 1. The materials of which the implements of husbandry are

* In the Appendix, NO. 1. to this Chapter, will be given, some general observations on implements of Husbandry, and an account of the principal implements formerly made use of in Scotland. Likewise a minute description of each implement, with reference to the engravings given of them.

made; 2. The means of preserving and repairing them; and, 3. The means of improving their construction: To which will be added, a list of the machines and instruments most essential to a Scotch farmer; and an account of their prices in Berwickshire and in the vicinity of Edinburgh.

SECT. I.

IMPLEMENTS OF TILLAGE.

THese consist of, 1. Ploughs; 2. Harrows; 3. Horse-hoes; and, 4. A recent invention, known under various names, as the Scuffler, Scarificator, Cultivator, Grubber, &c.

1. *Ploughs.*

In describing the machines and instruments now made use of for cultivating the ground in the more improved districts of North Britain, it is proper to begin with the plough, as being the first or chief of all the implements employed in the extensive art of agriculture. There are several instruments employed in husbandry which perhaps might be dispensed with, but land can hardly be cultivated to advantage, at least to any considerable extent, without the plough. There is, however, a very great difference in the formation of ploughs, as they vary in almost every county, according to the nature of the soil, and various other circumstances.

It is evident, that in constructing the plough, whatever may be its particular purposes and properties, there are a few general principles invariably applicable; such as, that the sock or share, and those parts which enter and cut up the

earth of the furrow-slice, should be of an equal, sharpened, tapering form, and occasion the least resistance in passing through the ground; and the mould-board, of that regular uniform twist, which shall not only lessen friction, but also place the furrow-slice in the most proper position. The beam and bridle, or muzzle, should be so constructed, that the cattle may be most advantageously attached to the plough, in the proper line of draught. The stilts, or handles, also ought to be of a convenient length, and fixed to the beam, so as to give the ploughman the greatest power to direct its motion.

The only plough made use of in Scotland, till within the last sixty or seventy years, was what is generally termed the Old Scotch Plough. It may be therefore necessary to give an account of it, *not only because it is still occasionally employed in some districts*, but is also considered by many, as the foundation or ground-work of the improved plough now in general use. It is a strong heavy machine, about thirteen feet in length, from the farthest end of the stilts or handles, to the extremity of the beam; and about four feet from the back-end of the head to the point of the sock. When well made, it is very proper for breaking up or tilling rough uncultivated grounds, especially when incommoded with stones; the sharpened point and long taper of its sock goes easily past any obstacle; the great length of its head takes a firm hold of the ground; its weight prevents it from being easily thrown out by stones, or any other cause; the length of the mould-board lays the furrow-slice regularly over, and its long stilts or handles give the ploughman great command in directing its course in the ground.

This plough was doubtless invented during the infancy of husbandry, and it is well adapted for ploughing lands of a rough description. But in tender soils it is not so profitable, for, by its great weight, the friction is increased, on which account more power must be required to draw it, than what is necessary with a lighter and better formed plough.

Besides this fault of the old Scotch plough, whoever attends to its structure, will soon observe some other defects; the coulter is commonly fixed into the beam in an oblique position, with its lower end standing to the left hand, or land-side, so that the furrow is not cut square, or at a right angle to the surface of the firm land; the upper side of the sock is frequently made high in the middle, round in the sides, and its point is often placed in a straight line with the middle of the head; and this kind of sock not having a fin or feather to cut under the earth of the furrow slice, of course it must require the more power to raise, shift to a side, and turn over that slice.

There is another material objection to the shape of this plough. The farthest end of the wrest, or back-end of the lower edge of its mould-board, is generally raised about five or six inches, and sometimes more, above the under side of the head, so that the soil, which lies immediately below that hinder part, is not sufficiently raised and turned over. This form must tend to increase the friction, while at the same time the ground is imperfectly ploughed. It is therefore evident, that the old Scotch plough stood in need of great improvements, though these are but of recent date in many parts of Scotland.

The improved Scotch Plough.

Notwithstanding the antiquity and importance of the plough, its form continued nearly the same till about the year 1763, at which period a plough of a superior construction was introduced into Berwickshire by Mr James Small, plough and cart wright*. This ingenious artist, aided perhaps by some hints he may have received from others, improved the implements of husbandry in a very great degree; and there is every reason to believe, that he was the first mechanic in

* For an account of James Small, and of his improvements in making instruments of husbandry, see Appendix to this Chapter, NO. 2.

Scotland, who published proper rules for constructing them. His merits becoming soon known to John Renton, Esq. of Lammerton, who at that period was a most zealous promoter of agricultural improvements, that gentleman established Mr Small at Blackadder-Mount in Berwickshire, where he resided many years, and carried on the manufacture of ploughs, harrows, carts, waggons, and other useful implements of husbandry, to a considerable extent; his ploughs especially, being much admired, were sought after, not only throughout the greater part of Scotland, but also in several parts of England. Indeed, the construction of Small's plough is admired and approved of to the present day; and if well made, is superior, for ploughing every variety of soil, not only to any plough that has hitherto appeared in Scotland, but perhaps in any other country, for it tills the ground in the best manner, and with so little friction, that only two horses are sufficient to draw it, both plough and horses being directed by one man.

The farmers of Scotland, are not partial to wheel-ploughs. The observations made by Small on this subject, in his Treatise on Ploughs, p. 176, seem to be decisive. He concludes his remarks on that head with observing, that the advantages of wheel-ploughs are but inconsiderable, and by no means equivalent to the great additional expence, to the risk of going out of repair, and the trouble of keeping them in order. He adds, that they possess no advantage over the swing plough, as they cannot be used except in well-dressed ground, free from stones; and in such soils there is no use for them, for the principles upon which a plough operates, are so certain, that a swing plough may be made, which will perform its work with ordinary attention on the part of the ploughman.

2. Harrows.

Implements of this description are necessary in the practice of husbandry, both for pulverizing or preparing the ground for the reception of the seed, and for covering it when

sown. It must appear plain to every one in the least acquainted with farming, that no one of these instruments, of whatever construction, can be suitable to every soil, or state of the ground; harrows, therefore, ought to be adapted to the particular purpose intended to be accomplished. In soft, tender land, light harrows may answer; but with strong, stubborn soils, such as have been newly broken up from old leys, or from a state of nature, harrows which possess great weight and strength, furnished with long strong teeth, are absolutely necessary. When the land is full of root weeds, it may be requisite, not to set the bulls or buns too thick with teeth; for if the teeth are too near to one another, the harrow is soon choked up with the weeds, and thereby prevented from operating in a proper manner, by which means the land must be imperfectly pulverized.

The object of harrowing being to break the soil, to drag out weeds, to pulverise the land, and to cover the seed, it is obvious, that harrows of different sizes are absolutely necessary for these purposes; because strong obdurate land, when ploughed wet, becomes afterwards so dry and hard, that a light harrow makes very little impression upon it. To reduce such ground, a large heavy harrow, generally termed a *brake*, is commonly employed. There are different kinds of this instrument; one kind is of the same shape with the common harrow, but much larger and heavier, and furnished with long strong teeth. Some of these brake-harrows are constructed with hinges, so as to bend; and accommodate their shape to the curvature of the ridge. There is another sort of brake, made in the form of an equilateral triangle, having a row of strong teeth inserted into two of its sides; the third side, which, when using, is farthest from the horse, being left without teeth, in order that it may work more freely. These brake-harrows are commonly made heavier or lighter, according to the nature of the land for which they are designed; some of them, indeed, are made so heavy as to require

two or three, and sometimes four horses to draw one of them.

In lands under good management, there is no need for the brake, it being superseded by the use of the oblique harrow. There is also a small light harrow, with a greater number, and likewise shorter teeth, than the common sort, but in other respects made in the same form; its purpose is for harrowing in grass seeds, when sown among wheat, or any other kind of grain. In harrowing, much time is often lost in turning at the ridge-end, especially when two or more harrows are employed together, by their pitching on the top of each other. To remedy this in the turnings, or when the harrows are employed upon rough land, sometimes a piece of wood is fixed on the two outside bulls that are contiguous to each other, and raised about eight or ten inches above the upper surface of the harrow. But it seems preferable to couple every two harrows together with hasps and hooks of iron, in such a manner as to allow each harrow to rise or fall according to the inequality in the surface of the ground whereon they are employed. By this mode of connecting the harrows, they are kept at a proper distance from one another, besides being prevented from starting on the top of each other in the turnings.

To prevent any two teeth of the harrow from moving in the same track, various methods have been attempted. The most simple seems to be, that of making the harrow of a rhomboidal form, the angle of which must always be according to the number of teeth, or the distance between these teeth and the spaces between the bulls, so that the teeth may divide the surface which the harrow covers into equal small parts, and move in lines equidistant from one another. But as the harrow generally made use of is of a square form, and drawn by one corner, so that it must move in a diagonal direction, and as several of the teeth in its hinder part move almost in the same track with those going before, and others move in lines at a considerable distance from one another,

the ground which this sort of harrow covers cannot be equally pulverized. Some farmers are of opinion, that the teeth of the harrow should incline a little forward at the lower end; others suppose it of little moment though they be placed at a right angle to the surface of the harrow; but all agree that not any two of the teeth should move in one track. These tracks ought also to be at equal distances from each other, which enables the implement to perform much more work in the same time, and to more perfection, by the teeth dividing the soil into equal small parts.

It may be an advantage to have the teeth, at least of the brake-harrow, fastened into the bulls, either with screw-nuts, or by an oblong hole in that part of the teeth which rises above the bull: and into this hole a wedge may be driven, in order to keep the teeth firm, so that they may not drop out and be lost. The latter method seems the best, because screw-nuts are apt to rust, and of course are not easily taken off when necessary. Sometimes the teeth of the harrow are of unequal lengths, the front row being about half an inch longer than the second, the third row being about one inch shorter than the first; so that each row backwards is about one half inch shorter than the one which precedes it. Harrowing, in general, is best performed by the driver walking behind the harrows, directing the horses by long whip-reins, which he can perform with more safety to himself. By this method he is also enabled to rectify or clean the harrows when requisite, and to proceed with greater dispatch.

3. *Horse-hoes.*

The Horse-hoe is a very useful and necessary implement in agriculture, not only for destroying weeds, but also for pulverizing the soil between the rows of any kind of plants that are set in straight lines, such as turnip, potatoes, grain, or any sort of seeds that have been sown in drills, at a proper distance from one another. Several kinds of this instrument are used in North Britain, but those most approved of

consist either of three flat triangular shares, each of which are welded on the under end of a strong iron coulter, the upper part of each coulter being fastened into a frame fixed upon a beam furnished with two handles, by which a man directs the machine when using; or are composed of one flat triangular share, welded on the lower end of an iron coulter, the upper part of which is placed in the beam of a light sort of plough: To this coulter is joined, by hinges, two lateral oblong shares, the hinder end of each share being fastened on the lower end of an iron arm; and the upper part of these arms are fixed into a curved plate of iron, by which they are attached to the beam of this small plough. The backmost shares of both these machines can easily be set at a greater or less distance from one another, according to the distance between the rows or drills. Either of these machines is easily drawn by one horse; both horse and machine are always directed by one man; and it not only cuts up, in its progress, all the weeds a few inches below the surface, but also loosens the soil between the drills. They are both very simple and effective implements, by the use of which a great deal of manual labour is saved; nevertheless, the hand-hoe may still be necessary for cutting up weeds, and pulverizing the earth between the plants, which neither of these machines can reach, without injuring the crop. The small plough with a broad share, and two lateral bended coulters, is also a very useful implement for hoeing: it is so constructed, that the lateral coulters can easily be taken off, and two mouldboards applied in their stead. By this means it answers the purposes, both of cutting the weeds, and laying up the soil to the roots of plants that are sown in drills, or set in straight lines at a proper distance from one another.

4. *The Scuffler, Grubber, Cultivator, &c.*

This is a very useful implement in husbandry, especially on light lands, that are free from stones, and of a plain surface, because it not only cuts up all weeds, but also pulverizes the

land to a small depth; and when the ground does not require ploughing, this machine will perform much more work, in a given time, than could be accomplished by the plough. The construction of this instrument ought to be such, as to contain a greater or less number of shares, so that they may easily be increased or diminished at pleasure. A machine of this kind acts both as a sort of plough and harrow at the same time. It sometimes consists of a square wooden frame, into which the arms of the shares are fixed: this frame is attached to an axle furnished with a small wheel on each end, and on this axle is also fastened a pair of shafts, by which the machine is drawn. The other sort is composed of a triangular frame, into two sides of which are fastened the arms of the cutting shares; upon one of the angles is placed a bridle or muzzle, and to it the cattle are attached when working the machine. There is also a small wheel placed at each angle of this frame, which rolls on the land, and regulates the depth that the shares are intended to penetrate the ground. In East Lothian, an instrument of this sort has lately been improved upon, which is known there under the name of *Grubber*.

SECT. II.

IMPLEMENTS FOR REAPING CORN.

IN North Britain, the crop is generally cut down with the sickle or reaping-hook; but in some districts, the scythe is occasionally made use of for that purpose. When the crop admits of being cut down by the scythe, the expence is rather less than if cut down by the sickle: it is, however, objected to that instrument, that it does not lay the ears of the corn so re-

gularly as when cut by the reaping-hook; this, no doubt, is the fact, and must be a very great disadvantage where the threshing-mill is employed. There is another objection to the scythe, when the crop is thin, and at the same time completely ripened,—if the stalks have acquired a degree of hardness, sufficient to bear the stroke of the scythe, then the shock will be so great, as to shake out many of the grains; or if the straw be of a soft texture, in place of being cut and gathered by the scythe, the crop will be beat down, and great part of it left uncut.

In regard to the sickle, it is not yet fully ascertained whether the narrow light sickle, or the broad heavy hook, is the best; neither is it ascertained if this implement should have teeth in its cutting edge. But whether the narrow or broad heavy hook is the most proper for cutting down the grain, it would seem that those with teeth are preferable to the smooth ones, because much time must be lost in sharpening them often; whereas those having small teeth may be constantly employed for several weeks in cutting, without being sharpened.

Many attempts have been made to invent reaping machines, but hitherto without much success, though the importance of such a discovery cannot be questioned. Every encouragement should be given for the invention of so important an implement; for the discovery of which, the Dalkeith Monthly Farming Club have very laudably offered a premium of five hundred pounds.

SECT. III.

IMPLEMENTS FOR HARVESTING CORN.

It is the common practice in Scotland, to carry home the crop either in double or single horse carts, as they are found to be more easily managed than waggons or wains, and also by using carts, the carrying home of the crop goes on much more expeditiously. One of these carts will carry from ten to twenty threaves at once, according to the size of the sheaves, or the distance and nature of the roads; and are likewise easily loaded and unloaded.

The crop thus brought home, is almost universally built in round stacks; and, in a few districts, each stack is placed upon a frame of wood, supported by seven or nine stone pillars, from eighteen to twenty inches high, and each pillar is furnished with a bonnet, or thin circular stone, about twelve inches in diameter, placed upon its top. By this means, mice, or any sort of vermin, are prevented from getting up to the stack; and it being clear from the ground, the corn is kept perfectly dry.

There have lately been invented, near Alloa, cast-metal pillars, for supporting the frames on which corn-stacks are to be built: this must be a very useful invention, especially where stone pillars cannot be readily obtained. These pillars are generally about two feet in height, with a rim or fledge about one foot diameter, on which they stand, each pillar having a thin plate of iron about nine inches diameter, placed on its top, which prevents mice from getting up among the grain. After levelling the ground where the pillars are to be placed, that they may stand upright, and be all level on the top, one

pillar being set in the centre, and from six to nine placed round at equal distances from the middle one, and also from one another, a frame of wood is laid upon their top, which reaches from one pillar to the other. The pillars and frames being placed in this manner, are easily removed, when necessary, with very little expence, and vermin have no way of getting up among the grain; so that neither rats nor mice are to be seen in any corn-stack built on wooden frames, supported either by stone or cast-metal pillars. The advantages resulting from the use of these frames may be estimated at from one boll to one and a half in thirty; and in wet or late seasons, they are found of great advantage for preserving the grain from spoiling, when put into the stack in a damp or wet condition, as they allow a free circulation of the air below, so that the corn is not injured by imbibing moisture, as it must certainly be when set down on the wet ground.

There is another invention, supposed to be peculiar to Scotland, called *Bosses*, which, either with the cast-metal or stone pillars, and frames placed on their tops, are admirably calculated for harvesting any sort of corn in a wet season, or when the crop is late in cutting down. It consists of a triangle, nearly the height which the stack is intended to be built, and about three feet wide at the lower end, tapering to ten or twelve inches at the top; small spars of wood are nailed across this triangle, so near to each other as to prevent the sheaves of corn from being pressed into its boss, or hollow; but if spars are not at hand, a strong rope made of hay or straw, plied round the outside, may answer in their place. The boss or triangle is placed on the middle of the frame, and the grain built round its circumference, so that the air has freedom to circulate up the boss or hollow, nearly to the top of the stack, which must be of very great service in preventing the grain from spoiling, if it is not fully dry when brought home.

SECT. IV.

IMPLEMENTS FOR THRESHING AND CLEANING CORN.

THE Threshing-machine is unquestionably one of the most valuable implements that has either been invented or introduced into Scotland, or any other country, in the present age. The saving of manual labour, and that of a very severe kind, by means of this invention, is perhaps beyond calculation, while the grain is separated from the straw, in a more perfect and expeditious manner, than what has hitherto been accomplished by any other sort of instrument hitherto adopted. It is absolutely impossible to form an adequate idea, of the advantages obtained by this important implement, without considering the manner in which the threshing of corn was formerly executed.

Prior to the introduction of this useful machine, the operation of detaching the grain from the straw was generally performed by that well-known tool *the flail*, and that often to the manifest injury, not only of the husbandman, but also of the community; for although, in some instances, the work might be tolerably well executed, yet, in a great majority of cases, it was far otherwise. It is generally supposed, that a quantity, equal to the seed over all North Britain, was annually lost, even in the best instances; but where the allowance to the thresher was either a proportion of the produce, known by the name of *lot*, (commonly a twenty-fifth part), or when he was paid in money at so much *per boll*, the temptation to execute the work in a slovenly manner was so great, that probably twice the quantity required for seed was lost upon many farms. This evil could not escape the notice of intelligent

men, by several of whom attempts were made to construct a machine, that would perform the operation of threshing more correctly. The earliest attempt in Scotland to construct a machine for that purpose, was made by Mr Michael Menzies, brother to the then sheriff-depute of East Lothian. The machinery was driven by a water-wheel, which put in motion a number of flails, of a similar kind with those used in threshing by the hand. But, owing perhaps to the velocity required for performing the work correctly, the flails were soon broken in pieces, and the invention by this means went totally into disuse.

About the year 1758, another attempt was made by Mr Stirling, farmer in the parish of Dunblane, Perthshire. This machine was constructed upon principles similar to that of the flax or lint mill, having a water-wheel and perpendicular shaft or axle, into which were fixed four arms, inclosed in a cylinder about three feet six inches high, and eight feet in diameter; within this cylinder, the shafts and its arms were driven with considerable velocity. The corn being presented by the hand, was let down through an opening in the top of the cylinder, in order to receive the strokes from the arms or scutebers, by which the grain was beat out, the straw passing outward, through an opening in one side of the cylinder, and the corn falling down into the fanners, was separated from the chaff or refuse. Though it is evident, that this sort of machine does not separate the grain from the straw in the best manner, yet, in some parts of the country, they are still made use of, and driven either by water or by cattle.

But those which chiefly engaged the public notice, were two threshing-machines erected in Northumberland, about the year 1772; the first by Mr Ilderton at Alnwick, and the other by Mr Oxley at Flodden. The machine invented by Mr Ilderton acted upon the principle of pressing, or rubbing out the grain, and the work was very imperfectly performed. But Mr Oxley's attempt had the appearance of being more successful: indeed, some people have alleged, that the

threshing-machine now in general use was borrowed from it. It is evident, however, that this is a very great mistake ; for it is positively affirmed, by those gentlemen who had full access to know the truth, that Mr Meikle, the inventor of that approved implement, never saw or heard any thing of Mr Oxley's machine, till a long time after it was taken down. Indeed, every person acquainted with practical mechanics, is now convinced, that the principles of the two machines were altogether different ; and it seems, that in practice, the operations of each were as different as in their principles.

Having thus detailed several of the laudable, though unsuccessful attempts, to construct a machine capable of threshing corn in a satisfactory manner, it may be proper to narrate some of the circumstances, which led to the construction of that valuable machine now in general use. That every former attempt had failed, does not require a proof. The former machines are generally laid aside, and the merit of the invention of a completely effective machine, certainly belongs to the individual to be afterwards mentioned.

The late Sir Francis Kinloch, who, it is well-known, possessed a large stock of mechanical knowledge, and had paid great attention to country affairs, in one of his tours through Northumberland happened to see two machines which had been erected by Mr Ilderton at Alnwick, and Mr Smart at Wark, for threshing corn, and ordered models of them to be made for his own use, upon which he afterwards made several improvements. As he had no opportunity of trying a large model which he caused to be made, it was sent by him to Mr Andrew Meikle, civil engineer at Houston Mill, near Haddington, in order that its effects might be ascertained by means of the water-wheel of Mr Meikle's barley-mill. The trial was accordingly made, but in a few minutes the model was torn in pieces ; and the like fate befel a machine of full size, which Sir Francis erected for one of his tenants a few years afterwards.

Mr Meikle, having had the subject of threshing corn under his contemplation, was at this time induced to try, if that work could be accomplished upon a principle, which had not been previously acted upon by any other person. It is evident, that the power required to thresh corn in a perfect manner, or even in any quantity, must be considerable; for no machine is capable of performing this operation correctly, if the scutchers do not move with a velocity of two thousand five hundred feet in a minute. He therefore resolved to attempt threshing by means of a cylinder or drum, placed in a horizontal position, upon the circumference of which threshers or scutchers should be fixed, in such a manner, as to endure the necessary motion; being quite satisfied, that corn, without velocity in the threshing-drum, could not be detached from the straw in a satisfactory manner. The attempt was made, and the success completely answered his expectations and wishes.

The first threshing-machine erected by Mr Meikle, was on account of Mr Stein, at Kilbagie, in Clackmannanshire, about the year 1786; and a certain proof that such a machine was then altogether unknown, may be inferred, from the agreement about this erection, it being therein stipulated, that Mr Stein was to furnish the materials, and if the machine did not answer the intended purpose, Mr Meikle was to receive no payment for the workmanship. It appears, however, that the machine, when finished, performed the work to the satisfaction of both parties. This threshing-machine being successful, another, on the same principles, was erected for Mr Selby, at Middleton, in Northumberland, which was immediately copied and imitated by several mill-wrights in that county; one of whom had the singular modesty to claim the invention, because he had previously made a model of Mr Hder-ton's machine, which was constructed on quite different principles.

The utility of Mr Meikle's machine being satisfactorily ascertained, a patent for the invention was obtained, securing

its benefits to him and his heirs for the period of fourteen years. It is a singular circumstance, that though this patent was obtained at considerable expence, it was not acted upon. When ten years of the patent were expired, some of Mr Meikle's friends stood forward, and endeavoured to put it in force; but there was then such a number of erections by others, that the design could not be executed, without risking an expence, which would not have been compensated by any profits that could have been gained during the unexpired years of the patent.

Since the invention of this valuable machine, various improvements have been introduced, not only by the inventor, but also by others, all tending to simplify the labour, and to augment the quantity of work performed. When first erected, though the corn was equally well separated from the straw, yet, as the whole of the corn, straw, and chaff, were indiscriminately thrown into a heap, the work could only be considered as half executed. But, by the addition of shakers and fanners, all driven by the same power, the different processes of threshing, shaking, and winnowing, are now all performed at once, and the grain immediately prepared for the market. When it is added, that the quantity of corn gained from the superior powers of the threshing-mill, is fully equal to a twentieth part of the whole crop, and that, in some cases, the expence of threshing and cleaning corn is considerably less than what was formerly paid for cleaning it alone, when threshed by the flail, the immense savings arising from the use of this machine may at once be ascertained.

Where farms are of a small size, it would be very improper to erect large machines, as the interest of the original outlay would be a heavy drawback from its advantages; but in large concerns, a machine of great powers, provided with two revolving shakers, and also two pair of fanners, must be the most profitable for the husbandman; and when water or wind is substituted instead of cattle, the saving is considerably increased. Where coals are abundant, and at hand, steam may

be advantageously used for turning a threshing-mill. A respectable farmer in the county of East Lothian works his threshing-machine in this way; and being situated in the neighbourhood of a colliery, he is enabled to thresh his crop at a trifling expence.

By the threshing-machine the toil of manual labour is materially lessened, the stock of agricultural produce is greatly increased, and the facility of managing large concerns wonderfully promoted. The duty of rewarding the inventor was therefore a debt incumbent upon the whole landed interest of the country; and, by the successful exertions which were made for that purpose, Mr Meikle and his family were placed in a state of comfort; and thence ingenious mechanics, of all descriptions, must be stimulated to employ their talents in making useful discoveries, from the expectation that their interests will not be neglected.

It may be proper to add, that, on the principle of Meikle's threshing-mill, a small machine has been made by Mr William Johnson, an ingenious mechanic of Langholm, in Dumfries-shire, which costs only L. 8, is driven by the hand, and will thresh from fifteen to twenty stooks of common grain *per* hour. This may be of use to small farmers, who cannot afford the more expensive implements.

It was before stated, that Mr Menzies was the first in Scotland who made an attempt to thresh grain by the use of machinery. Though it was unsuccessful at that time, there is nevertheless no doubt that it proved of public benefit; because the attention of ingenious artists was thereby turned to the same subject, till at last a perfect one was constructed. The like result, we hope, will follow the many attempts of artisans to construct a reaping-machine; and though these attempts have hitherto proved unsuccessful, yet, when it is considered, that the period of at least forty years intervened betwixt the first attempts, and the erection of a complete threshing-machine, there is no just cause to despair of a proper reaping-machine being in time obtained.

In the appendix to Sir John Sinclair's work on the Husbandry of Scotland, (NO. VI.), there is given a description, with figures, of a machine for dressing or *hummelling* barley or bear, constructed by Mr George Mitchell, mill-wright at Bishopmill, near Elgin. This useful machine has already been attached to many threshing-mills, and has been found to answer the intended purpose so well, as to have been recommended by those who have used it, as a very great improvement. There must be some additional stress on the power by which it is moved; but this has been found so trifling that it may be added to any threshing-machine, whether driven by water, by wind, or by horses.

Fanners or Winnowing-machine.

FORMERLY, the only mode of separating grain from the chaff in Scotland, consisted in its being exposed to the wind, by dropping it from a sieve or basket between the two doors of a barn; by that operation the chaff and light refuse was blown backward, whilst the clean grain dropped on the barn-floor. This process answered the purpose pretty well, with a steady wind and great care; but as the former could not always be depended on, it must have been found very inconvenient, when the grain was wanted, either for seed, or for the market. This disadvantage, however, is completely removed by the winnowing-machine, or fanners; by which the husbandman can clean his corn at any time when necessary. This useful machine was introduced into Scotland about a century ago, by Mr James Meikle, father of Mr Andrew Meikle, inventor of the threshing-machine. It appears that he went to Holland in the year 1710, in consequence of an agreement with Mr Fletcher of Salton, a character well known in the history of Scotland. The object of Mr Meikle's mission was to learn the art of making pot-barley, and erecting barley-mills. He not only accomplished his design in a perfect manner, but, after he returned, constructed the first fanners for winnowing grain that were ever seen in Scotland. The use of this

excellent machine, however, was not generally adopted in this country, till within the last fifty years. The original construction was extremely simple, consisting only of a wheel, with four vans of thin boards, or sheet iron, made to revolve with considerable velocity within a drum, or hollow cylinder, so as to occasion a strong wind, which issued out at an opening in one side of the drum, the grain being exposed to it, by falling gradually through a narrow aperture. This artificial wind blows the chaff and light grain backwards; at the same time the good grain falls, by its superior weight, directly down through the streams of air. Fanners have been greatly improved since their first introduction, and are now to be seen, not only in every corn-mill, but almost in every barn, where the farm is more adapted for tillage than pasture. Since threshing-machines were introduced, fanners almost in every case are annexed to them; and in many instances, where they are fitted internally with suitable riddles or harps, it is perfectly practicable to measure and market the grain, as it comes from the machine.

SECT. V.

IMPLEMENTS OF CONVEYANCE.

It is not a great many years since almost every article in Scotland was carried either on horseback, or in very awkward machines. Distant carriages of bulky commodities were executed with what was termed a *Hurdle*, an open-spoked frame, one of which was placed on each side of the animal, and fastened to a crooked car-saddle. Less bulky goods were carried in hampers, or baskets, fixed upon the horse's back with the same sort of car-saddle. Carriages for a short distance,

such as the in-gathering of corn and hay, were performed with a sledge, which consisted of two shafts or limbers, reaching from the collar on the horse's neck, in a sloping direction down to the ground, having cross spars, which connected their hinder part, and served as a bottom; there were also several erect rods placed near the back end, to keep on the load. The sledge, it seems, succeeded the hurdle, and evidently required some sort of road; whereas the hurdle could be used wherever it was possible for a horse to walk. Instead of carts, with wheels revolving on the axle, that clumsy machine, in which the wheels were fixed upon its arms, was very common in many parts of the country. These wheels had no naves, spokes, or felloes; they were composed of three sections, of solid plank, fastened together and rounded; the axle was fixed in the centre going through the middle section. The shafts had each two pins of wood placed in their under-side, that embraced the axle, and, when drawn forward, made these awkward wheels tumble along; from which circumstance they were called *tumblers*. This sort of implement is still made use of in some districts of the Highlands and islands, especially where the roads are so rugged and uneven, as to render the use of proper carts impracticable; but they are now going out of use, where the public roads, or bye-roads in any farm, are passable with carts of a better construction. They were only employed through necessity, arising from the want of proper roads, with other peculiar circumstances of the country, and therefore must disappear when that necessity is removed. It is evident, that one improvement leads to another; for no sooner were the roads in North Britain attended to, than wheel-carriages and carts were introduced; and no sooner was improved husbandry learned by common farmers, from observing the practice of farmers in more highly cultivated counties, than they were emulous to follow the example set before them, not only in the construction of the various machines and tools they employed, but also in the execution of their work. In some se-

questrated corners of Scotland, where the tenants are poor, and the ground barren, or difficult to be reclaimed, the dawn of improvement, either in the implements or practice of agriculture, is only beginning to appear. But these forlorn spots bear little proportion to those happier districts, in which cultivation is cherished by the benignity of the proprietors, and the industry of the tenantry; by which means the art of husbandry is ascending to its meridian.

Thus we have given a short account of the implements of conveyance which were formerly made use of in Scotland, and shall next proceed to describe the carts, or wheel-carriages, now generally employed in that country.

Carts, or Wheel-carriages in general.

WHEELS have long been applied to carriages for various purposes; and they are of very great utility, not only for dispatch, but also for diminishing labour. But, whether high or low wheels are of most advantage, or most easily drawn, has long been, and still is, a subject of dispute, even among persons skilled in mechanics. It is evident, however, that whatever difference there is in the diameter of two wheels, if their centres are on a level with the moving power, the one will require the same force to roll it along on a hard smooth surface, or horizontal plane, as the other; so that, in this case, the high wheel has no advantage over the lower one. It is therefore only in different circumstances, that one diameter of carriage-wheels is preferable to another; because in some situations, the high wheels have the advantage, and in others the lower ones. For it is obvious, that a wheel of large diameter will pass over any obstacle more easily than a less one, supposing the centres of both on a level with the moving power; it would therefore seem, that carts should have wheels, whose centres are nearly the height of that point on the shoulders of the cattle where the draught is fixed. This, however, will only hold good when the cart is on a horizontal or level road; for, in going up a steep path, the distance of the point of draught

from the ground is lessened ; because, when a horse is pulling up hill, his height is inclined to the declivity of the road, though it must be perpendicular to the horizon. For which reason, the centres of cart-wheels should be somewhat less from the ground than the point of draught, but the exact difference depends on a variety of circumstances ; it ought, however, to be such, as to make the line of draught nearly to a right angle with the slope of the horse's shoulders, which gives the animal the greatest advantage in pulling. It is at the same time the opinion of those who have paid great attention to this subject, that from four feet to four feet ten inches, is a very convenient diameter for cart-wheels ; and, in general, the different heights between these two diameters have been, and still are, preferred.

The great disadvantage in very high wheels is in going down hill ; because the cart and load being raised high, the pressure must be more severe on the cattle, as the support they can then give the cart is too low placed ; therefore the low wheels, in this case, have the advantage over the higher ones. If the declivity of the road be such, that the weight of the cart and load is sufficient to overcome the friction, the greater this is, the less force will be necessary to resist the weight when going down hill. In going up hill, the weight and friction act both on the same side of the centre of the axle ; therefore, the less the friction is, the less power will be required to overcome it. But in going down hill, the weight and friction act on different sides of the centre ; therefore, the less the friction is, the greater force must be necessary to resist the weight. From which it appears, that in going down hill, the lower wheels have greatly the advantage ; because the weight being lower placed, the cattle have more power to resist the pressure, by that power being applied in a proper direction.

In the choice of carts or carriages, much depends on situation ; there is, however, one certain rule that will always hold good in every place, which is, that they ought to be of a sim-

ple construction, of good materials, and as few in number as circumstances will permit; because the fewer carriages that are kept, the less must be the expence; for even when these machines are not in use, they are constantly going to decay. Some people, however, may be fond of having a great variety of carriages to do their work with; whilst others prefer only one sort: and in this way, the farmer may do all that is necessary; he may carry his corn or his manure with the same cart; and when hay is carried, by using what is called a long or sparred cart, the business will be satisfactorily executed. Waggons are very rarely used in Scotland.

Carts are, beyond a doubt, the cheapest, and also the best kind of carriages for the farmer, and may be used almost in every situation. In a flat country, they are preferable to any other sort; in a hilly country, some objections may be made to the cart, especially when the load is high or bulky; because, in going either up or down hill, they may be both troublesome and dangerous. But in most of the mountainous counties, the inhabitants are more or less under the necessity of using some sort of them, because no other carriage can be dragged up hill more easily. It is also obvious, that a cart is not so expensive, and requires less power to draw it, than a waggon; and if properly made, having a light frame, or what is termed *Hay-tops*, occasionally placed upon its upper side, it will then contain a sufficient load of corn in the straw, hay, or any other bulky commodity. But these carts are often very improperly constructed, especially in the less improved parts of the country. Carts should be made of the very best materials, in order that they may be the more durable; they ought also to be as neat and light as possible, consistent with the necessary strength. The body should be of as great width as the wheels will admit between them; by which means, the sides can be kept lower, and the body notwithstanding hold the full load, besides being so much stronger. The sides and fore-end should not be perpendicular to the bottom, but sloping outward gradually toward the top; and by side-boards

being occasionally added, which is sometimes the practice, for enlarging the cart, it is made to contain a greater load when necessary. This is certainly the best means of making the cart contain a greater quantity at once; as these side-boards can easily be fixed on or taken off at pleasure.

The carts or wheel-carriages employed in husbandry are of various dimensions, and different forms, but are often constructed without sufficient attention to the sort of materials to be carried, or the nature of the roads and grounds on which they are to be employed. It appears, that the first carts made use of in North Britain were small, and generally drawn by one horse; in the lower districts, however, large carts have been since introduced, drawn by two horses. A person who has not made exact trial of these different carts, if he would judge from experience, must attend to the practice of those who are chiefly employed in carrying goods from one place to another. Among these people, a cart drawn by two horses is seldom to be seen; indeed, in many places of the country, where two-horse carts were formerly employed, one-horse carts are now generally preferred, two of them being always driven by one man.

It becomes, therefore, a proper inquiry, whether one large cart, drawn by two horses, or two small carts, each drawn by one horse, be most advantageous. No doubt one large cart can be more cheaply purchased than two small ones; but the small carts, carrying less weight, will perhaps last longer, and require less repair. The expence of working is the same, for both require two horses and a driver; it may, however, be observed, that in the larger cart, the two horses have only the friction of two wheels to overcome, whereas the same number of horses have the friction of four wheels in the two smaller ones. But the difference of friction, perhaps, may not be so great as at first sight it appears; because the smaller carts having less weight to carry, the axle-arms on which the wheels revolve may be made smaller, in proportion to the weight they have to carry, by which means the friction will

be diminished; so the two less carts having smaller axle-arms, and less weight to support, it is probable they will carry more weight than one large cart with larger axle-arms, and have no more friction. The most material difference between these carts seems to be this, that the power applied to the small, or one-horse cart, can always be properly directed, which is not the case with the larger, or two-horse cart; because in the single-horse cart there is only one power applied, which is easily directed in the proper line of draught; but in the larger one, there are two or more powers applied, and these generally in different directions. Besides this, it is very seldom that both or all the horses draw constantly or equally, according to their strength: even with the greatest care in driving, each horse will be often on the watch to relax, and save himself, so that the labour becomes extremely harassing and distressing to each horse in his turn. It is therefore extremely prudent in those who are employed in carrying materials or goods from one place to another, to make use of single-horse carts, in preference to carriages drawn by two or more horses. Indeed, the one-horse cart has been minutely examined in different points of view, by accurate observers, and found, in almost every instance, (when the load can be divided into small parts), greatly superior to the two-horse cart.

In the one-horse cart, likewise, the height of the wheels can easily be adapted to the height of the horse, and the load more correctly placed in regard to the centre of gravity, by which means the draught will be considerably lessened. In the most improved carts of this sort, the bottom frame, when placed upon the axle, projects on each side over above the inner heads of the naves or centre blocks, so as to be only a little clear of the spokes of the wheels, which in a great degree prevents sand, soil, or mud, from falling on the axle-arms and naves at their inner ends.

A very intelligent gentleman, who had paid great attention to the importance of carts in husbandry, found, in construct-

ing single-horse carts, that the capacity of a two-horse cart was no just criterion, for a cart containing twenty-two cubical feet was as easily drawn by a single horse, as one containing thirty cubical feet by two horses, both carts being loaded with the same sort of materials. From this it appears, that the power of a horse is much greater, when working in a cart by himself, than in a team of two or more together; which shews the great advantage that one-horse carts have over those with two or three horses, in regard to the difference in the quantity of work that can be performed by the same number of horses, in using the smaller carts, when the load can be adapted to the power of one horse*.

Notwithstanding the evident advantages of employing single-horse carts, in preference to double ones, yet, in many districts of Scotland, from the nature of the roads, and grounds on which they are to be used, as well as other circumstances, they cannot always be had recourse to; for the construction and strength of carts, like every other sort of implement made use of in husbandry, must be regulated according to the purposes for which they are employed.

In some parts of the country it is the custom to have different carts for different purposes; those of the close kind being chiefly employed in carrying dung, and all sorts of manure, or such kind of materials as are heavy; while others are made open-spoked, and of a light construction, occasionally placed upon the axle and wheels of the close or coup-carts to be used for carying corn in the straw, hay, or any other similar substances, and are generally termed corn-carts. Sometimes the close or coup-carts have a light frame, or what is called *hay-tops*, occasionally fixed upon them, and are very convenient for carrying corn, hay, straw, or any bulky light articles.

* For some recent improvements in the construction of farm carts, see Appendix to this Chapter.

Many intelligent farmers think, that the wheels of carts, for the various purposes of husbandry, should not be of too large diameter, because low wheels are not only cheapest, but also strongest and most lasting. But whatever may be the opinion of different people in regard to the most proper height of wheels, it is unquestionably evident, that, for the preservation of the roads, and the grass lands on which they are to roll, their rims should not be less than five inches in breadth, even for single-horse carts, and broader in proportion to the load or weight they are intended to carry, and the number of cattle requisite for the draught; the rims ought also to be nearly cylindrical.

Though a single-horse cart carries less at once than a double one, yet it is probable, that more work may be performed, in any given period of time, with the same number of men and horses, by the one than the other, in the general process of husbandry business, especially when the distance is small between the loading and unloading. It has also generally been found, that small loads are the most convenient, and are seldom attended by any misfortunes in the load, shooting or tumbling out; besides, they are less injurious to the roads and ground over which they pass. Some very useful improvements have lately been made on carts, in order to prevent the great rapidity of motion when going down hill; also for adjusting the centre of gravity of the load, so as to preserve an equal bearing on the animal in the shafts. The first has been effected by friction upon the rims, or felloes of the wheels, by the application of a lever, commonly called a *friction-drag*, one end of which is placed on a bolt, fixed in the cart or waggon, and upon this bolt it has liberty to move; its middle part rests or bears on the rim of the wheel, and either a screw or toothed rod or pinion, may be applied to its other end, by means of which the friction can either be increased or diminished at pleasure, according to the declivity of the road.

The second is by a toothed rod fixed upon the front or fore-part of the coup or turn-up cart; and on the shafts a small pinion is placed, served with a handle, by which it is turned round, at the same time its teeth acting upon the teeth of the rod. By this means, the fore-part of the cart can easily be elevated, in proportion to the slope of the path, or surface of the ground; the weight of the load is thus thrown more upon the axle, and the pressure on the cattle employed on the shafts is less severe in going down hill. Another very simple method of accomplishing this, is by a piece of iron, fastened on the fore-part of the cart, and perforated with several holes for the admission of an iron pin or bolt, by which the body of the cart can easily be kept at any position or angle to the shafts that may be found necessary.

As, in general, the shoulders of draught horses, or that part of their neck on which the collar rests, has a slope or inclination, which forms an angle with the perpendicular of between fourteen and eighteen degrees, it is evident, that the line in which they draw, should form the same angle with the surface of the road or ground on which they walk, so as to make a right angle from the slope of their shoulders; because in that case, the animal must pull in a direction, by which the different parts of the shoulders are equally pressed, or acted upon by the collar; the pressure must, of course, be less severe on the body of the horse employed in the draught.

There is a cart of a particular construction, made use of in the quarry of Kingoodie, by Dundee, which merits the attention of those who have works of a similar nature. This cart is furnished with a bended iron axle, which brings its body within twelve or fifteen inches of the ground, the wheels being between five and six feet in diameter. The ease with which this machine is drawn, loaded, and unloaded, is greater than in the common cart in a considerable proportion. There is also a cart in this quarry for carrying large stones, such as

millstones, or any heavy blocks of stone: the wheels of this cart are only about two feet diameter; its axle is but five feet in length, so that the wheels run under the body of the frame, which is perfectly flat on the upper side, and may be made of any length or breadth found necessary, for carrying long, broad, thin stones. These machines must be made very strong, in order that they may support a great weight without being in danger of giving way under the load.

SECT. VI.

IMPLEMENTS FOR DRAINING LAND.

THE instruments generally made use of in Scotland for cutting drains, are the spade and the mattock, or pick; and where the ground is very hard, or full of stones, these seem to be the most proper implements for that purpose. In some districts, though very rarely, a drain-plough is adopted; this machine consists of a beam, three coulters, a share, two mould-boards, a sheath, and two directing handles, with a cross frame of wood fastened upon the upper side of the beam, near to its back-end. One of these coulters is fixed into a mortice in the beam; this being the middle one, the other two are placed into mortices in the cross frame, equidistant from it on each side; these two coulters can easily be shifted, and fixed at a greater or less distance from one another, and also set more or less oblique, according as the drain is wanted wide or narrow, and more or less sloped in the sides. The share is fixed upon the fore-part of an inclined plane, and the fore-ends of the mould-boards are attached to the sheath with iron hinges, by which means they may be easily expanded or contracted, in proportion to the width of the drain. When the

machine is drawn forward, the beam-coulter makes a cut in the middle of the drain, and the other two a sloping cut on each side, so that, as the plough advances, the share cuts up the earth below; and being thus cut from the firm ground, it is raised gradually by the inclined plane, and by the fore-end of the mould-board following in the track of the middle coulter: the soil so raised is turned to each side by the mould-boards, and laid on the firm ground, leaving the drain quite open.

A mole plough has been lately constructed by Mr Wilson, an ingenious mechanic, at Coldstream in Berwickshire, and is likely to be of service in draining land free from stones.

SECT. VII.

ROLLERS.

THE Roller is an implement frequently made use of in husbandry, and it is the most powerful machine ever yet invented for breaking hard clods expeditiously, and also for smoothing the surface of land, either when in tillage, or when laid down in grass for hay. There are several kinds of rollers used in Scotland, some of which are made of wood, some of stone, and others of cast metal. But the one which is easiest procured consists of a wooden axle, having two or three rows of spokes placed into it, according to its length. Upon the extremity of these spokes are fixed felloes, in the form of a cart-wheel; and on the felloes are fastened planks or boards of wood all round, forming a cylinder. The only essential difference in these rollers is, their length, diameter, and weight; for though, in some cases, a short, small, light

roller may answer the purpose, yet in others a heavy one is necessary. The roller, therefore, ought to be so constructed, that its weight can easily be increased or diminished at pleasure. If the roller be long, and of a large diameter, then it ought to have the greater weight in proportion; for the larger the roller, the more of its surface will touch the ground at once, which consequently must lessen its impression on the land when rolling. This is a good objection to the wooden rollers just mentioned. Stone or cast-iron are preferable. It is therefore of importance that the weight of the roller be in proportion to the extent of surface on which it rests, and the nature of the land on which it is rolling.

In the opinion of intelligent farmers, the roller should not be less than twelve, nor more than thirty inches in diameter; because if the roller is too small, it is apt to push the hard clods before it; and if too large, it has then little effect in breaking the clods. The roller generally made use of is from five to seven feet in length; this great length, however, is not only very severe on the cattle, when turning at the end of a field or ridge, but there is also danger of tearing up part of the crop, because, in turning short, the long roller does not move round its axis, but is dragged along. To prevent these great inconveniences, it would seem preferable to have two rollers, each about three feet in length, and both placed into one frame, so as to roll clear of one another. These two short rollers would serve equally well as a long one for breaking the clod, and smoothing the surface of the land, when rolling straight forward, and be more suitable for particular purposes, such as corn crops, or sown grass, as, in turning short, they neither tear up the tender soil, nor injure the young plants. Each of them in turning moves round its own axis, the one rolling forwards, whilst the other is rolling backwards. By this means the surface of the land is not broken, and the young plants are left uninjured. Besides, the labour in turning is much less severe on the cattle.

Every farm ought to be provided with rollers of different diameters and weights, so as to suit the purpose to which they are to be applied. Rollers made of granite are much approved of; and in some cases they are made of iron.

SECT. VIII.

DRILL-MACHINES.

DRILL-MACHINES are generally used in the improved districts of Scotland, chiefly in sowing turnips, beans, and pease. Till within these few years, these machines were made to sow only one drill at a time; but now they are so constructed, as to sow two or three, and sometimes a greater number, at once. For turnips these large ones answer very well, and save much labour; also for beans and pease, when the land has been previously ridged up, especially when the soil is dry, and free from root weeds. But in cases where beans or pease are put in after the plough, which is the common mode, then the single drill-barrow, worked by one person, is the only one which can be used with advantage. The drill-barrow is often attached to the handles of the common plough, and the seed deposited as the furrow is turned over. Two common ploughs follow, each taking a breadth of about nine inches. By this means the rows are twenty-seven inches distant, and when the beans are above ground, they are cultivated as if they had been sown in drills.

Drill-machines for sowing grain are but little used in Scotland, the broad-cast husbandry being generally preferred.

SECT. IX.**MISCELLANEOUS ARTICLES.**

THE principal of these are, 1. The bruising-machine; 2. The straw-cutter; and, 3. The mill for making pot or pearl barley.

1. There are different sorts of machines for bruising grain for the feeding of horses, one of which consists of two cast-metal rollers or cylinders, between twelve and sixteen inches long, and generally from six to nine inches in diameter. These rollers must be turned in a lathe perfectly cylindrical, and quite straight in a longitudinal direction; they are both placed into one frame in a horizontal position; and, when driven round, the circumference of each rolls upon that of the other, by which means the grain is bruised or crushed, as it passes down between them. Cylinders of this sort may be attached to any machine that is driven by water, by wind, or by horses; there is a sloped hopper placed above them, for containing the grain, from which it is conveyed by a suspended board, in between the two cylinders. The frame in which these cylinders revolve is furnished with screw-bolts, by means of which they can easily be placed at a greater or less distance from each other; and of course the grain can be more or less bruised, as may be found necessary. There is another form of this machine, composed of one cylinder, from nine to twelve inches long, and betwixt five and seven inches in diameter; there is a concave breast equal in length to this cylinder, and about five inches in breadth, by one inch thick; they are both made of malleable iron, case-hardened, and fluted, or have small sharp teeth in a longitudinal direction. This breast is fixed in the frame with its concave or fluted

side presented to the cylinder, the teeth being parallel, and about one-eighth of an inch distant from one another. The cylinder and breast are both placed in a horizontal position, the grain being cut in passing through between the sharpened edges of the flutes in the cylinder, and those of the breast. If the grain is dry, and the cylinder driven at a proper motion, which should be about three hundred and sixty or seventy revolutions in one minute, either of these machines will bruise or cut five or six bolls (from 30 to 36 bushels), of oats, wheat, or barley, and seven or eight bolls (28 to 32 bushels), of beans and pease, in the hour. This mode of preparing corn for horses must be of great advantage to those who have a number of these useful animals; it having been found from experience, that in feeding horses with grain, when bruised or cut, seven bolls of the same, or of as good grain, are equal, if not superior, in nutriment, to eight bolls, when given to them whole. The practice, therefore, deserves particular attention, especially in the British empire, where so great a number of horses are now employed, not only in husbandry, but also in working various sorts of machines, and wheel-carriages, besides those kept for the saddle and other purposes.

2. The *Straw-Cutter* is made use of in some parts of Scotland, not only for cutting straw or hay, but a machine on the same principle is employed, for cutting oak-bark used by tanners. It consists of a wooden frame about six feet long, two feet nine inches high, and from twelve to fifteen inches in breadth. A strong box, open above, is fixed on the top of this frame, and into it are placed two small rollers of wood, round which passes a piece of double canvas; so that, when these rollers are turned round by the motion of the cutting-wheel, the straw, being spread upon the canvas, is conveyed forward more or less, according to the length the straw is to be cut. This implement is made of different constructions, one of which has the cutters or knives fixed upon a wooden wheel about four feet diameter; others have these cutters fas-

tened upon the arms of a cast-metal wheel. Some of these machines are furnished with three cutters, others with two, and sometimes one is preferred; these knives are also made so as to cut in a sloping direction outwards from the centre of the axle, and others placed so as to cut inwards to that centre, which seems preferable to the former method. There is generally a crank, or bended handle, fixed upon the axle of the wheel on which the cutters are placed, and by this handle they are turned round; but as the principal object is expedition in cutting, and lessening of manual labour, it is therefore obvious, that it will answer these purposes much more effectually, when attached to any machine which is driven either by water, wind, or cattle, as has been done in some instances.

3. *Pot-Barley Mills*.—In Scotland, prior to the use of barley-mills, this grain was prepared for the pot by manual labour. The rough bear or barley, being put into a concave or hollow stone, in which was dropped a small quantity of water, was beat by a rounded wooden mallet, until the husk was separated from the kernel. This was evidently a very laborious and defective process, the barley never being sufficiently cleared of the husk or chaff.

The making of pot-barley by machinery, as has been already observed, was first introduced into North Britain from Holland, by Mr James Meikle, about the year 1710. The construction of the machine for that purpose, it seems, was then nearly the same as that of the corn or meal mill, having a water-wheel and two stones placed in a horizontal position, the lower one being a common millstone laid flat upon a strong wooden frame. The running or upper stone was of a coarse free quality, and revolved horizontally within a circular case, or frame of wood, the circumference of which was covered with sheet or plate iron perforated with holes, in order to allow dust and small seeds to pass through.

It appears that this form of the machine, and position of the millstones, were retained for a considerable time in ma-

king barley, without any material alteration; as it does not exceed forty or fifty years since any improvement was made on the construction of barley-mills.

The above kind of mill seemed to answer the purpose tolerably well; but, nearly about that period, machines of a much better construction for making pot-barley were erected in this country, which not only clear the grain of its husk, in a very superior manner, but also produce a greater quantity of clean barley.

CONCLUSION.

1. *Of the Materials of which the Implements of Husbandry are generally made.*

THE wooden part of these machines consists chiefly of oak, ash, elm, sycamore, and fir; their other parts are either of malleable iron or cast-metal. Ash-wood is the most approved of for ploughs, harrows, framing of carts, felloes of cart-wheels, shafts of carts, and handles of many other necessary instruments of agriculture. Oak, however, is preferred for the spokes of carriage and cart-wheels; elm or oak for the naves or centre-blocks of these wheels; but of late they are sometimes made of cast metal, which is a great improvement. The insides of close carts, wheel-barrows, and such articles, are commonly covered either with fir, willow, or any other sort of soft light wood; but whatever kind of wood may be thought most proper, doubtless it should be of the very best quality, well seasoned, and perfectly dry when joined together. The different parts ought to be firmly fixed to each other; they should also be well finished, or properly cleaned off, and carefully laid over with linseed-oil paint.

On this important subject, the celebrated Lord Kames, in *his Gentleman Farmer*, has the following useful observations:

“ I begin with examining at what age a tree is in perfection for the purpose of a farm. At the age of sixty, it is sufficiently large for every farm-purpose, being, when cut to the square, from twelve to fifteen inches each side. I must except the oak, which, even for the purposes of farming, improves till it be a hundred years old. Every oak consists of red and white wood, the former the finest of all wood, the latter good for nothing. Ash, after the growth of sixty years turns short and brittle.”

“ The proper season for cutting a tree is when it has least sap, which is precisely in the middle between the time of shedding the leaf and that of budding; in that interval it is toughest, and fittest for every farm purpose. When cut in the sap, the wood is short, and apt to split with drought.”

“ For preserving wood after being cut, there are three methods. One is to dry it in the air; another to immerse it in water; and a third is to cover it with horse-dung. Ash, when sawed green, never fails to split. Before applying an instrument, it ought to be exposed eighteen months in a dry situation, that all the sap may evaporate; during that time, both ends ought to be covered from the air; the bark prevents the body from splitting; but when the ends are exposed, they will split into the body five or six inches. When ash is designed for uses that require splitting, let it be split immediately after cutting, and the parts laid up where the air has not free access, in order that they may dry by slow degrees; for sudden drought makes them warp. Oak and elm require the same treatment. The Huntingdon willow, and other willows that rise to a large size, turn extremely tough when dry; and therefore, if intended for planks or boards, they ought to be sawed directly after being cut. But as in this case they are apt to split, great care ought to be taken to dry them slowly. Alder and birch ought to be managed in the same manner.”

“ The immersing in water, and covering with horse-dung, are far from being the best methods for drying wood. It is always harder and tougher when dried slowly in the air. Therefore these methods are only for expedition, in order to extract the sap more quickly, when the wood is wanted for immediate use.”

2. *Of the Means of preserving the Implements of Husbandry.*

As some parts of these machines may receive damage unperceived, their several parts should be minutely inspected at times ; and when any part is observed in the least damaged, or in danger of giving way, it should be immediately repaired ; otherwise the fabric of the whole implement may, by a small neglect, be destroyed ; by which means considerable loss, and also inconvenience, may be incurred. There is another thing deserving of particular notice,—any implement that is not wanted for use during the season should be carefully laid up ; but before laying it aside, it ought to be well cleaned, perfectly dry, quite entire, and ready for use when necessary. Upon every farm there should be one or more places, or offices, for holding these implements ; a cart-house, or shade, for keeping ploughs, carts, harrows, rollers, &c. is now a very common and proper house on most farms ; but for containing the smaller tools, some less exposed and secure place must be requisite. Those machines that are exposed in the fields great part of the season, would perhaps require to be new painted at least every two years, which defends them not only from drought, but also from rain.

3. *Of the Means of improving the Construction of Implements of Husbandry.*

THE implements of husbandry may, no doubt, be best improved in consequence of minute observation, and by experiments carefully made; for though many new-invented models have been presented to the public, yet, before a full trial is made of any implement when of full size, it must always be doubtful whether the invention will prove successful or not. If proper encouragement, however, were given, persons of genius and experience would devote their time and attention to this most important subject, and exert themselves, either in improving the various sorts of old implements now made use of, or in the invention of superior ones, as circumstances may require.

List of the most useful Implements used for the purposes of Husbandry in the more improved Districts of Scotland ; with a note of the prices.

It would be very difficult, or rather almost impracticable, to ascertain the prices of agricultural instruments in the several districts of this country, as they vary not only in different counties, but also in the various parts of the same county. This is no doubt occasioned by the difference in the value of wood and workmanship, and in the quantity of iron made use of, some requiring their implements strong and heavy, others more slender and light.

As improvements on the construction of these instruments were introduced into Berwickshire at an early period, it may not be improper to give the following comparative view of the price of the most material implements of husbandry in that county about the year 1750, contrasted with those in 1808 : and the prices in the vicinity of Edinburgh in the year 1811.

Agricultural Implements made use of in Berwickshire.

	Prices about 1750.		Prices in 1808.	
	L. 0	L. 1	L. 1	L. 2
Plough fully mounted,	0 15 0	1 2 0	1 15 0	2 2 0
Wood and work only,	0 5 0	0 7 0	0 9 0	0 10 0
Pair of harrows fully mounted,	0 10 0	0 12 6	1 0 0	1 5 0
Wood and work only,	0 2 4	0 2 6	0 5 0	0 6 0
Brake fully mounted,	<i>Few or none.</i>		1 14 0	2 2 0
Wood and work only,			0 7 6	0 10 6
Rollers fully mounted,	0 10 0	1 0 0	5 5 0	6 6 0
Drill-plough with two mould-boards,	<i>None.</i>		0 12 0	1 1 0
Turnip-drill single,	<i>None.</i>		0 9 0	0 15 0
Drill compounded with roller,	<i>None.</i>		2 2 0	3 3 0
Hoeing plough,	<i>None.</i>		0 12 0	1 1 0
Close cart fully mounted,	3 10 0	5 5 0	8 8 0	10 10 0
Wood and work only,	1 10 0	2 0 0	3 3 0	3 15 0
Long cart fully mounted,	3 3 0	4 0 0	6 6 0	8 8 0
Wood and work only,	1 15 0	2 0 0	2 10 0	3 10 0
Waggon fully mounted,	<i>None.</i>		24 0 0	30 0 0
Weighing-machine,	<i>None.</i>		6 6 0	21 0 0

*Prices of Agricultural Implements in the neighbourhood of
Edinburgh, in the year 1811.*

Two-horse coup-cart complete, -	L. 16 16 0	to L. 18 18 0
One-horse coup-cart complete, -	14 14 0	16 16 0
A frame placed occasionally on the coup-cart, for carrying corn in the straw, or any other bulky commodity, -	2 10 0	2 15 0
A two-horse chain or swing plough complete, -	3 13 6	
A plough for tilling the sides of steep hills, -	10 10 0	
A one-horse plough complete, -	1 11 6	
A scuffle or weeding-plough complete, -	2 15 0	3 10 0
A pair of rhomboidal or improved harrows complete, -	3 10 0	3 15 0
A pair of brake ditto complete, -	5 5 0	7 7 0
One set of swing or horse trees for ploughs or harrows, -	0 10 0	0 14 0
Coupling horse trees, and mounting, -	0 6 6	0 7 6
A pair of grass-harrows complete, -	2 10 0	3 3 0
A drill-machine drawn by a horse, for sowing two or more rows at once, -	8 8 0	10 10 0
A hand turnip-barrow, -	2 5 0	2 19 6
A hand bean or pease barrow, -	1 8 0	1 11 0
Barn fanners complete, -	3 10 0	10 10 0
A frame for building corn-stacks on with bosses, -	3 3 0	5 5 0
A threshing-machine of three horses' power, -	60 0 0	70 0 0
A threshing-machine for four horses, -	120 0 0	130 0 0
A threshing-machine driven either by water, or six horses occasionally, -	150 0 0	160 0 0
A threshing-machine driven either by six horses, or by wind occasionally, -	450 0 0	470 0 0

In the above estimates for threshing-machines, the appondages of straw-shakers, or rakes and fanners, are included; but all buildings, roofing, and flooring, are excluded.



CHAP. VI.

INCLOSING LAND, AND THE NATURE AND ADVANTAGES OF FENCING.

INTRODUCTION.

Among the important subject allotted for this chapter in the general Report of Scotland, two distinct objects represent themselves for consideration, because the term has very different meanings in the rural and legal sense of Scotland and England. In England, the conversions of lands held in common, either for pasturage or cultivated to severalty, or exclusive individual property, must be accomplished by a separate act of Parliament, and has obtained the name of an *Inclosure Bill*, because Commissioners, appointed for dividing and allocating the lands, are subjected to their authority, among those having interest in the land, and hence they are termed Commissioners of In-

closure. The matter is far otherwise managed in Scotland, where no separate expedient has not been found necessary. The practice of this country, above an hundred years ago, procured a general law for that purpose, which has been so univer-

sally acted upon, that common-field lands, and common wastes or pastures, have both become very rare in Scotland. In Scotland, common-field lands used to be known by the name of run-rig or run-dale, because the alternate lands or ridges belonging to different proprietors or occupants run alongside of each other; while the term common was restricted to wastes or pastures not occupied in severalty. These are indeed still to be found in various parts of Scotland; but the run-rig or common-field lands have almost entirely disappeared, except in places where the crown has an interest, or in such as belong to royal burghs, which were exempted from the operation of this most salutary law.

The conversion of commons in Scotland into severalty has been already considered, (see Chap. II. Sect. 5.); and the various modes of improving waste lands, will be discussed in a subsequent part of this work, (Chapter XI.). It is therefore proposed, in a great measure, to limit the object of discussion in this chapter to the meaning affixed to the term Inclosure in the rural and legal language of Scotland, or the methods of dividing and fencing different portions of land from each other, *already held in severalty*. Yet, as some common land still exists, it has not been deemed proper, entirely to overlook this subject in the present chapter, because connected in some measure with fences and subdivisions.

PART I.

ON THE LAWS OF SCOTLAND RESPECTING THE DIVISION
OF PROPERTY HELD IN COMMON, AND THE INCLOSURE
OF LAND.

SECT. I.

GENERAL VIEWS ON THIS SUBJECT.

WHETHER the use of lands be enjoyed in direct and exclusive property, or by servitudes; and under the former, whether the owner wish to ascertain his own exact proportion, or to make straight boundaries or marches, or to fence and inclose his own land; the proprietor has power in Scotland, in all these cases, to accomplish his purpose, by means of a simple action at law, before the civil judge, without the necessity of applying to the Legislature for a special enactment.

In all such cases, the laws of Scotland have given the civil courts full power to decide, at the suit of any of the parties interested. The mode of procedure is simple and well known, and the necessary expences are very moderate. Had it been necessary in Scotland to procure acts of Parliament for the several divisions of common lands, or of lands lying in *run-rig*, and for their inclosure, it may safely be affirmed, that many of them would have been found not worth the expence. But, owing to the facility of applying the general law on these subjects, most of these lands have been long since divided and appropriated in severalty, to the manifest and great advantage of the proprietors, the occupiers, and the public. It may also be remarked, that a process of division in Scot-

land does not necessarily carry along with it an obligation to inclose the several allotments; otherwise another great obstacle to the ascertainment of property in severalty would have come in the way, as the value of wastes or common pastures, even after division, is often too small to warrant the expence of inclosure. After division, the procedure for inclosure is easy and simple, for those who wish that convenience.

The principles of the law of Scotland, in regard to the division and inclosure of landed property, are few and simple, as well as equitable and enlightened; and are well deserving of attention and imitation in England, where the common lands are more extensive and more valuable, while the means of division and inclosure are far more arduous and expensive. It is proper, however, to observe, that the whole procedure of division and inclosure in England, under the management of commissioners, is more complete than is the case in Scotland; as their powers usually extend to the construction of fences, roads, drains, and bridges, to the establishment of irrigation where practicable, and sometimes to the appropriation of situations for mills, the establishment of embankments, and other beneficial improvements*. In England also, the interests to be adjusted upon these occasions are generally more numerous and complicated, than in Scotland.

In Scotland, the division and inclosure of land are subject to regulations both of statute and of common law; or may be effected by arbitration, or by private agreement between the interested parties; and of these we propose to give some general account, each in their order.

* It was the object of the *General Bills of Inclosure*, so frequently submitted to the consideration of Parliament, to give the Commissioners nominated by the parties interested, the same powers and authorities with which they are invested by the private acts, which would have rendered the system both economical and complete.

SECT. II.**OF THE STATUTE LAW OF SCOTLAND, AS APPLICABLE TO THE
DIVISION AND INCLOSURE OF LAND.**

THE Legislature of Scotland appears to have contemplated the advantages derivable from inclosure, at an early period, long even before the propriety of dividing common lands into severalty seems to have been deemed necessary or advisable. By act 1457, ch. 80, all freeholders, or proprietors of land holding directly from the crown, were ordained to cause their tenants to inclose and plant in certain places; and by ch. 83. of the same year, dead hedges were interdicted. By act 1500, ch. 74, every landed proprietor was directed to make parks for deer, fish ponds, warrens, orchards and hedges, and to plant some wood. These acts were enforced, with additions, by posterior statutes, as by 1535, ch. 10, and 1661, ch. 14. And, from the year 1424 down to 1693, the Legislature of Scotland manifested a marked attention to protect inclosures and plantations, by a number of statutes, in which penalties are imposed upon those who injure them. From this it appears, that the protection and extension of inclosures formed an object of legislative care in Scotland, from the reign of James I. contemporary with Henry VI. of England, down to the Revolution. The open and naked state of the country appears to have dwelt continually on the mind of the Legislature; and, owing to this chiefly, some of the ancient Scotch statutes ordain the sowing of broom seeds, to form what were called *broom parks*, as a shelter for live-stock, and partly also as a supply of food for sheep in severe weather, for which this plant is very useful, although its use, at first, is liable to induce a species of intoxication.

Protecting statutes, in favour of woods and plantations, have been repeatedly made of a later date, by the British Legislature; as in the reigns of George I. and of our present venerable Sovereign. But all the statutes for the division of landed property in common, and for the erection of march-fences, are of a more ancient date, having been enacted by the Parliament of Scotland before the Union. These acts, which are still in force, for the division of landed property from common into severalty, relate either to commons, or what are called in England wastes of the manor, or to lands in run-rig, which the English denominate common-field lands. There are other statutes in force, for straighting and fencing marches, or boundaries between properties already in severalty, and for the protection of existing inclosures. Of all these, and of the common law of Scotland, as applicable to these subjects, and of the devices for attaining the same ends by arbitration, or by private agreement, without having recourse to legal process, it is now proposed to give short general views, each in their order, summing up the whole by a few general remarks.

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er attorneys. That Court is empowered by the act to discuss the relevancy or legal competency of the application; to determine upon the rights and interests of the parties concerned or claiming concern; and to grant a commission for perambulating the lands, and taking all the requisite proofs, both of the extent of the common, and of the individual interests of the respective claimants. The whole proceedings of the commissioners must be reported to the Court, which pronounces an ultimate decree by which the whole is determined. The interests of the individual heritors, or proprietors having rights on the common, are directed to be respectively estimated in proportion to the valued rents* of their respective property lands, proved to have rights over the common; and the portions to be allocated to each, are to be made contiguous or convenient to their respective properties. The court has also power to divide the mosses or peat-bogs, if any, among the parties; or, if these cannot be conveniently divided, they are to remain still in common, with free *ish* and *entry*, (*egress* and *regress*), whether divided or not.

In virtue of this act, the Court of Session is in the practice of dividing commons among proprietors having interest, in proportion to the valued rents of the several lands and properties having rights upon the common. When the question is among those who claim rights of servitude only, such as common pasture, or of turf, feal, and divot †, on the surface, the court estimates their respective interests, and limits their

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† These are thin parings of turf, made by means of a *slaughter-spade* or *breast-plough*, and applied of old to various purposes in rural economy; as for fuel, the reparation of cottage roofs, barn-yard dikes, the walls of hovels, bot-toming of dung-hills, and the like: all of which have fallen of late much into disuse, as greatly deteriorating the surface.

rights of servitude accordingly, leaving the extent of claim arising from property undetermined, unless that be clearly proved.

The owners of lands contiguous to a common, may acquire indefinite rights to its pasturage, by prescription, or by forty years' uninterrupted exercise. But this right may be limited by what is called a process of *sowming and rowming*, proportionally to the land rents of the respective farms exercising that servitude, and to the numbers of cattle that each can respectively support with fodder in winter on his own lands. By this excellent regulation, the overstocking of commons is prevented, which would otherwise render them of little value, and sometimes even a source of positive loss.

As commons belonging to the Crown or to royal boroughs, are not liable to division under the above-mentioned act; it were desirable that commons, so far as royal boroughs are concerned in them, were susceptible of being laid off in severalty to the boroughs, apart from the other proprietors and claimants. By this means, the portion of land so laid off might be improved and laid down in rich pasture, at the expence of the borough, to be afterwards enjoyed by the burgesses, for the pasture of their milch cows*. In all other respects, the law of Scotland, respecting the mere division of commons, leaves hardly any thing unprovided for.

* This has actually been done by the borough of Lauder, and perhaps in other places.

SECT. IV.

OF THE DIVISION OF RUN-RIG LANDS.

THE origin of those intermixed patches of property in arable land, called *run-rig* in Scotland, and common-field lands in England, has been endeavoured to be accounted for in different ways. Some have conceived that it was on purpose to establish a common interest in the defence of their lands or their productions, among the occupants: But it was more probably occasioned by the poverty of our ancient peasantry, requiring two, four, or even more, to unite in furnishing the numerous oxen then requisite for working a plough. However this may have been, it is certain that much of the arable land was anciently laid out in alternate ridges, belonging originally, we believe, to different vassals, and often afterwards becoming separate properties in perpetual feu-rights, similar to copy-holds of inheritance in England.

The division of these run-rig lands proceeds upon the act *anno* 1695, ch. 23, by which it is provided, That any one having interest may apply to the sheriff or steward, as the judge-ordinary, to divide the lands, after lawful citation of all parties concerned; the judge having power to assign to each heritor his share in land lying nearest to his dwelling-house. Acres belonging to boroughs, and other incorporated bodies, are exempted from the provisions of this statute, or rather excluded from its benefits. By a liberal interpretation of this statute, the division has been extended in practice to pieces of land of a larger size, not in separate ridges, amounting perhaps to four Scots acres or five English, and lying intermixed.

 SECT. V.

OF STRAIGHTING AND FENCING BOUNDARIES.

THERE are three statutes of the Scottish Parliament in force, for straightening and fencing the *marches* or boundaries between separate properties, dated in the years 1661, 1669, and 1685. These not only provide for the construction of a march or boundary fence, at the mutual expence of the conterminous proprietors, and for building, ditching, and planting on the line of that fence; but also for making straight and convenient marches or boundaries, giving and taking lands of equal value on either side, as may be necessary.

By a common process, denominated “for straightening of marches and half fence,” before the Sheriff of the county, any proprietor wishing to fence his property, can speedily accomplish that object, and at a moderate expence, as the conterminous proprietor has to bear one half the costs of suit, and to defray half the expences of erecting and supporting the mutual fence or boundary, whence the process gets the name of *half-fence*. This action at law is grounded on the acts 1669, ch. 17, and 1685, ch. 39, and is frequently enforced.

 SECT. VI.

OF THE PROTECTION OF INCLOSURES.

FOR this important purpose, the statutes of the Scotch Legislature are numerous. By act 1695, ch. 39, it is provided,

That no person shall break down, or fill up, any ditch, hedge, or dike, by which ground is inclosed, neither shall leap over, nor suffer their horses, cattle, or sheep, to go over them, under the penalty of L. 10 Scotch, or 16 s. 8 d. Sterling, for each and every offence; half of this fine to the party aggrieved, and the other half to be applied for repairing bridges and public roads in the parish, under the direction of the sheriff or justices, before whom the trespass is prosecuted.

By act 1686, ch. 11, all heritors or landed proprietors, liferenters, tenants, cottagers, or others, are ordained to cause herd their horses, cattle, sheep, swine, and goats, during the whole year, in winter as well as in summer, and to cause them be kept during the night in houses, folds, or inclosures, that they may not eat or otherwise destroy any thing, in the grounds, woods, hedges, or plantations of their neighbours, under the penalty of half a merk Scots, or 6 $\frac{1}{2}$ d. Sterling for every beast that shall so trespass, over and above payment of any damages they may have done. The heritor or occupier of the ground trespassed upon is likewise authorised to detain or impound the trespassing animals, until paid the penalty and expences of keeping them.

Posterior statutes have chiefly in view the protection of trees and shrubs within inclosures, which are guarded by much higher penalties. By the 6th of Geo. III. ch. 48, a fine of L. 2 is leviable for the first offence, L. 5 for the second, and for the third, the offender is to be deemed an incorrigible rogue and vagabond, and punished accordingly. If these penalties are not paid on conviction, the offenders are to be committed to hard labour, one month for the first offence, and three for the second; and also to be whipt, once in the former case, and thrice in the latter.

 SECT. VII.

OF THE COMMON LAW OF SCOTLAND IN THESE CASES.

IN some Scotch statutes, the Roman or civil law seems to be indicated as the common law of Scotland; but, in this place, the usage or consuetude is meant. By this usage or practice of the courts, the principles established by positive statutes are supported and even extended. A landlord gives up the buildings and fences of a farm to his tenant in proper order, and the tenant is bound to maintain them in the same, during the currency of his lease, and to deliver them up in the same state when his lease expires. Neither the proprietor nor tenant are at liberty to erect new fences, or to take down old ones, during the lease, without the consent of the other party, unless there are some clauses in the lease authorising such measures.

 SECT. VIII.

 OF ARBITRATION, FOR ATTAINING SOME OF THE
 PURPOSES ALREADY MENTIONED.

ARBITRATION is not unfrequently resorted to in Scotland, instead of an action at law, for *excambing* or exchanging small parcels of land, for drawing the lines of march fences, and ascertaining how these shall be erected, and even for effecting the division of commons. An arbitration bond, or deed of

PART II.

OF THE ADVANTAGES DERIVABLE FROM INCLOSURES,
AND THE PRINCIPLES ON WHICH THEY OUGHT TO BE
CONDUCTED.

PRELIMINARY OBSERVATIONS.

ALL the Reports from the different counties in Scotland, with hardly a single exception, concur in stating, that inclosures are attended with numerous advantages, and are even indispensably necessary for the introduction of agricultural improvements, as, without their aid, nothing effectual can be done, or even attempted in that way. It has been alleged, that inclosures are least necessary in those districts of the Lothians, which are peculiarly adapted for the growth of grain, owing to circumstances in their soil and situation. Yet even in these districts, in which pasturage is comparatively much limited, it is difficult to conceive how improvements could be carried on, if all the rich crops of grain, clover, and rye grass, turnips, and potatoes, were left open to every turnpike and district road, to be trespassed upon at the pleasure of every dishonest passenger or stray animal. It has likewise been asserted by very intelligent persons, that inclosures would become of very inferior importance, if the whole kingdom were susceptible of being continually cultivated under alternate white and green crops, and all the live-stock could be profitably maintained by the soiling process, so that the soil required no pasturage for preserving and restoring its fertility.

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or attorneys. That Court is empowered by the act to discuss the relevancy or legal competency of the application; to determine upon the rights and interests of the parties concerned or claiming concern; and to grant a commission for perambulating the lands, and taking all the requisite proofs, both of the extent of the common, and of the individual interests of the respective claimants. The whole proceedings of the commissioners must be reported to the Court, which pronounces an ultimate decree by which the whole is determined. The interests of the individual heritors, or proprietors having rights on the common, are directed to be respectively estimated in proportion to the valued rents* of their respective property lands, proved to have rights over the common; and the portions to be allocated to each, are to be made contiguous or convenient to their respective properties. The court has also power to divide the mosses or peat-bogs, if any, among the parties; or, if these cannot be conveniently divided, they are to remain still in common, with free *ish* and *entry*, (*egress* and *regress*), whether divided or not.

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By act of Parliament *anno* 1695, ch. 38, all commons, except those belonging in property to the king, or to royal boroughs, may be divided at the instance of any one having interest, by instituting a process of division before the Court of Session, the supreme court of civil law in Scotland; which is done by summoning all persons concerned to appear in court for their interests, personally, or by their procurators

during the occupancy, providing they have a reasonable time allowed them for reaping the consequent advantages.

Even the appearance of inclosures indicates comfort and security; and landlords never fail to draw very advanced rents from well-inclosed lands, which generally let from 20 to 50, and in some cases, even 70 *per cent.* higher than open lands of the same description in the neighbourhood; the value or rate of rent continuing to advance, as the inclosed soil goes on to improve. By means likewise of inclosure, the landlord often has an opportunity to appropriate many waste spots, and otherwise useless corners, for plantations; to the great embellishment of his property, and the solid emolument of himself or his successors. These patches are of very little value to the occupier, and pay scarcely any rent to the proprietor; and the ultimate value of the plantations may therefore be considered as clear gain after the expences of inclosing and planting are defrayed. Indeed, instead of diminishing the rental, the plantations, after a few years, will render the contiguous farms more valuable, and capable of paying a higher rent than before, when these spots were attached to them. It is the universal and equitable practice in Scotland, that no charge is made upon the farmer for so much of the fencing as is necessary to the protection of young plantations, and these fences are always upheld afterwards by the landlord.

SECT. III.

ADVANTAGES OF INCLOSURES TO FARMERS.

FARMERS derive many important advantages from judiciously disposed and well constructed inclosures. Their value, however, materially differs, under particular circumstances;—owing to errors in the original plan, defects in the

formation and upholding of the fences, or improper management of the inclosed live-stock or growing crops; by means of which defects, all inclosures may be rendered comparatively worthless. If, however, the abuse of any thing were to become an argument against its usefulness, no circumstance whatever, in the economy of any country, could escape this mode of objection. It is from the aggregate of all the advantages derivable from judiciously planned, well constructed, and well managed inclosures and fences, that farmers are enabled, at the same time, to pay more liberal rents, to advance the value of their live-stocks and crops, and finally to augment their own individual profits. Of these advantages we propose to take a rapid view, in their order.

In the pasturage of live-stock, the farmer is relieved, by means of inclosures, from the very considerable expence of herding and attendance; which is materially diminished in the management of sheep, and almost entirely saved in that of cattle, when the fences are all good. The farmer has it in his power to arrange his live-stock, according to their age, condition, and other circumstances, by means of his inclosures, without which his management cannot be correct. This arrangement, especially in sheep-stocks, is often absolutely necessary for the preservation of a part, and is almost always important for the prosperity and improvement of the whole. By means of inclosures, the pasturing stock is protected from being perpetually teased, harassed, and interrupted in feeding, by dogs or other violence, and is allowed in peace to eat up the food upon the pastures to its utmost limits; and thus it improves much better and faster on the same extent of land, and of course returns more ample profit to the farmer.

The mere prevention of poaching in wet weather, by the trampling of cattle when chased by dogs, is an advantage of no small importance derived from inclosures or fence divisions. Even the warmth derived from inclosures to the live-

stock, in cold and stormy weather, is stated by one intelligent observer *, as running from five to eight degrees of the thermometer above that of bleak unsheltered lands in the same neighbourhood. It is of the utmost importance, to the comfort and consequent thriving of live-stock, that, in inclosures, they can always have a sheltered place in which to sleep or ruminatè: and it is well known, that the grass is both earlier and more abundant in inclosures, than in bleak exposed open lands, of similar soils, and in the same neighbourhood.

In the management of his arable lands, the farmer derives other solid advantages from inclosures. The important idea of security against trespass, from his own live-stock and those of his neighbours, gives a stimulus to his exertions towards improvement, enabling him to adopt a correct rotation of crops, to proceed with vigour in their cultivation, and to reap their fruits in safety. The case is widely different on open lands; in which wheat, sown grasses, turnips, and other crops, are constantly exposed to trespass in winter, and cannot therefore be cultivated to advantage.

In addition to the foregoing important advantages, a judiciously planned and well executed fence, often operates as a most useful drain to the land in its neighbourhood. Were the entire advantages, derivable by farmers from good inclosures, capable of being correctly estimated in contrast with uninclosed land, it would probably appear, that an acre of inclosed pasture land, is worth twice as much as an acre of the same kind of land, and in the same climate, if not inclosed. When the whole of a farm is under tillage rotations, as is the case in the Carse of Gowrie, and on the best land of East Lothian, subdivision fences, though still very advantageous, cannot indeed be supposed to add so much to the value of the soil.

* Aberdeenshire Report.

SECT. IV.

ADVANTAGES TO THE LABOURERS.

LABOURERS find a great source of employment, in the first instance, in the execution of plans of inclosure, and afterwards in upholding them: besides which, there is a great extension of work provided for them, in consequence of the various improvements required upon inclosed land, far beyond what is called for in open lands; for the same waste that afforded only the miserable wages and bare subsistence of a herd-boy, and that only for a portion of the year, becomes capable, when inclosed, cultivated, and improved, to give employment and bread to many.

Even from the division of commons in Scotland, there is no injury to be dreaded by the labouring class, as their cottages give no right to keep cows on these wastes; and, where they have a right of fuel, that is always guarded in a process of division. Wherever extensive inclosures are forming, there is always a very considerable source of employment and subsistence for industrious labourers; and the prospective advantages, afforded by the future improvements on the land when inclosed, are still more considerable and encouraging.

SECT. V.

ADVANTAGES OF INCLOSURES TO THE PUBLIC.

IN regard to the public, the advantages arising from inclosures, are numerous and important. By means of them, the

country is, at the same time, partly drained, and considerably sheltered, which latter improvement upon the climate is rendered more extensive and more remarkable, when plantations of trees are formed along with inclosures. No person acquainted with the naturally bleak, moist and ungenial climate of Scotland, can refuse to acknowledge the great improvement it has received from plantations.

Although all inclosures do not add to the ornamental or picturesque appearance of a country; yet all that are judiciously planned and well conducted ought to have this effect, more especially in a country so much diversified with hill and dale. Accordingly, and with few exceptions, inclosures have added much to the ornament of Scotland; and particularly such of them as have been conjoined with plantations. By the latter also, as connected with inclosures, which they always necessarily require to a certain extent, weedings of young trees are procured for various useful purposes, and timber may be furnished hereafter for our wooden walls and commercial ships, together with oak bark for the purposes of the tanner.

From what has been already stated, respecting the wages and subsistence, afforded by means of inclosures, to a numerous set of labourers, and the subsequent great increase of food for mankind, which the inclosed land afterwards produces, it necessarily follows, that the population of the kingdom must be proportionally encouraged, increased, and supported, and that a numerous and hardy peasantry will thereby be trained up in the most productive and most valuable species of labour. As the physical strength of the nation evidently depends on the numbers of its hardy peasantry, every thing that tends to increase their numbers, and to contribute towards their comfortable subsistence, is deserving of the utmost encouragement.

SECT. VI.

PRACTICAL ILLUSTRATIONS OF THE ADVANTAGES OF
INCLOSURES.

THE best illustration of the advantages derived from inclosures, is to be found in comparing the management, produce, and value of inclosed lands, with those that still remain open, and more especially with such as are occupied in run-rig, including in that comparison the conditions of the tenants and their cattle.

“ The farmers of open lands were wretchedly poor ; their crops late and scanty ; and their half-starved cattle and horses stood exposed, like themselves, shivering at every blast. The Quiggs, a barony on the estate of Keir, on the road between Stirling and Crieff, immediately south from the bridge of Ardoch, having been in the situation above described, was some years ago inclosed and sheltered by the proprietor. The climate became milder, the soil more productive, and the tenantry more comfortable, and even affluent in their circumstances ; as there is hardly now a farmer on the whole of that barony, who is not able to purchase the fee-simple of his farm *.”

“ In a cold and northern climate, the benefit of inclosure is very great ; and their effects, when well planned, and properly executed, in sheltering the land, and rendering it more productive, are hardly credible by those who have not experienced them †.”

“ Although inclosing is not binding upon the Hebridian proprietor, he will yet find it for his interest to pay most par-

* Report of Perthshire.

† Report of Aberdeenshire.

ticular attention to that *first of improvements*. The isles are deplorably naked and open. None, excepting five or six of the most southerly, and a few farms in Skye, are furnished with any thing which merits the name of inclosure; and accordingly their agricultural state is miserably bad. On Arran, Islay, Jura, Mull, Skye, and the Long-Island, there are about 800,000 acres of land totally destitute of fences of any kind; but which, by being properly inclosed, instead of their present average rent of *two pence* an acre, might yield *three shillings*, and thereby bring an additional rental of above L. 113,000*.”

In the report of the Hebrides, from which the last observation is quoted, the total amount of moors and waste lands is stated at 2,800,000 acres; of which the reporter seems to consider the above-mentioned quantity as capable of, or fitted for inclosure; being two parts in seven for inclosure, and five parts to remain open.

Want of inclosure, in many situations at least, infers want of shelter also. The consequences of this want may be estimated from the following facts. It is not uncommon in the county of Dumfries, during severe weather in April and May, for particular farms to lose a third part of the lambs, of what is called the Cheviot breed. In the parish of Eskdalemoor, in the night of the 24th January 1794, above 4000 sheep, several heifers, and one or two people perished. In the same year, a respectable farmer in Lanarkshire sold L. 50 worth of skins at 8 d. each, having lost 1500 sheep, probably worth from L. 750 to L. 1000.

Innumerable other practical illustrations might have been stated in favour of inclosures, as promoting the interests of the landlord and tenant directly, and that of the public indirectly. But what has been already brought forward, may suffice for the object in view; and the reader is requested to

* Report of the Hebrides.

compare such facts as may have occurred to himself on the subject, with the foregoing observations.

SECT. VII.

OF THE PROPER MEANS TO BE EMPLOYED, IN THE INCLOSURE OF LAND.

HAVING considered the propriety and advantage of inclosure, an equal degree of attention is necessary in regard to the means to be employed for accomplishing that end, by executing with propriety the plan which has been adopted, after due deliberation on all the purposes it is meant to serve.

Mountain sheep require stone-walls for their confinement, at least five feet high, and built on a good plan. The materials for these are not always easy to be found; and sometimes the stones that can be had crumble down under the influence of the atmosphere, when the expence and labour is not only lost, but the soil becomes covered with rubbish. But, on most sheep-farms, an ordinary degree of active search and intelligent observation will lead to the discovery of excellent materials in abundance; and on all farms it would be an obvious and important improvement to clear the surface from stones, and to raise and remove such as obstruct the operations of husbandry.

Fences being provided, shelter ought to be the next object of attention in the planning and execution of inclosures; and, especially on sheep-farms of considerable extent, to secure protection from the extremes both of heat and cold, nothing is so effectual as plantations. In arranging the fences for the inclosure of fields, either for cultivation or pasture, it is almost always possible so to adapt them as, at the same time, to secure the crops, to confine the live-stock, and to afford

the requisite degree of shelter, by the judicious employment of ditches, hedges, or walls, or by a combination of all these, according to the nature of the soil, and other circumstances.

In regard to wet soils, though very generally neglected, and very unpropitious both to crops and live-stock, the means of inclosing them, by fence ditches so disposed as to receive the contents of all the drains, are natural and obvious; and such, after judicious drainage, often become peculiarly fertile.

SECT. VIII.

OF THE EXPENCE OF INCLOSURE.

IN the calculation of the expence of inclosure, it is not only necessary to consider the first cost, but the future charges of repairs require also to be held distinctly in view. It is remarkable how much cheaper and better an intelligent person can get such things executed, who is accustomed to employ and oversee work people, and with persons who are used to erect fences, than can be done by others less qualified for superintending, and with inexpert labourers. Much also depends on situation and materials, on the judicious plan and dimensions of the fences, on the proper selection of the kind of fence adapted to the particular ends in view, on the complete execution of the work at first, on the protection and attention given to it in the sequel, and even on the season of the year when it is executed.

Contractors, for the most part, pay little or no regard to any thing beyond the conditions of their agreement, it being none of their concern whether the fence answers a good purpose or not. They expect a low estimate to be preferred; but the future cost and disappointment, to those for whom

they work, very seldom enter into their views. A landlord, therefore, ought to have nothing doubtful or ambiguous in the agreement, respecting the plan and sufficiency of the work, otherwise he will often find the lowest estimate attended, in the end, by the most serious expence. It is of the utmost importance to his interest, therefore, to trust as little as possible to the workmen, either in regard to the plan or materials of the fences, or to the season for executing the work; all circumstances respecting these ought, accordingly, to be maturely and deliberately considered, and clearly specified in the contract.

SECT. IX.

MISCELLANEOUS CIRCUMSTANCES, TO BE CONSIDERED IN FORMING A WELL DIGESTED PLAN OF INCLOSURE,

HITHERTO the principles that have been adverted to are all of a general nature, as no plan can be well digested and arranged, without duly considering the advantages to be attained, the means of accomplishing them, and the expence necessarily to be incurred. There are, however, a variety of subordinate considerations that require to be kept in view, and of which we propose to treat briefly in this section.

1. *Uniformity of soils* in the separate inclosures deserves to be attended to, as otherwise one part of a field may be quite unsuitable for the crops or rotations that answer best for other parts.

2. *A supply of water* is an object of the most obvious importance, in every field in which there is a prospect of pasturage. For this purpose, if there happens to be a small rivulet on the lands, it may often be distributed in branches so as to water many of the fields. Springs, or the collected dis-

charges from drains, may also be applied to the same purpose. All pastures intended for the grazier require to be well supplied with water at all times.

3. Access to every field is to be duly provided for; not only that the live-stock may get easily out or in, without damage or fatigue, but regard also must be had to the necessary and convenient carriage of manure and produce.

4. In all arable soils, the inclosures ought to be judiciously laid out, with a view towards facilitating their cultivation. For this purpose, short ridges, requiring frequent turnings, ought to be avoided; and, when the lands are steep, the opposite extreme of too long a draught should be guarded against. In laying out the lines on slopes, or the faces of hills, it is of importance that the direction of the plough in ascending should incline to the right hand, in order to lessen the draught, by making the furrow to fall gradually and easily off the mould-board, while the plough goes diagonally up the hill.

5. In arranging a plan for inclosure, a judicious landed proprietor will take various prospective objects into consideration. Thus, he may propose hereafter to bring more land under cultivation and improvement, than the present occupant intends, or is able to improve. He may have a view towards new roads, or alterations in the present allignments. He may intend to form plantations at a future period.

6. In determining the lines of fences, care ought to be taken to adapt the line, and the species of fence in view, to each other. Thus, if it is to be a stone-wall, that it may stand every where equally firm; if a ditch, that it may carry off all superfluous water; if a hedge, that it may prosper equally well all along the line. When this last point cannot be easily attained, instead of adapting the line to the fence, the species of fence must be adapted to the line, and thorns, beech, larch, or other hedge plants are to be put in, according as the soil is suitable for their growth; or great pains are to be

taken to enrich the beds for the young hedges, so as to make up for natural defects in the soil.

7. In removing excess of water, or land stones, with a view towards cultivation, it ought to be considered how far these may be rendered useful auxiliaries, instead of enemies to the farm. The former may often be rendered valuable for irrigation, or the supply of drinking pools, or for driving threshing-machines: the latter for assisting in the construction of the intended fences, or for filling up covered drains. It very frequently happens, in constructing the fence ditches of inclosures, and in clearing the soil from obstructions to cultivation, that very material advantages may be obtained by keeping these objects in view.

8. In arranging the forms and lines of inclosures, an accurate plan of the grounds ought always to be in view; besides which, the whole ought to be repeatedly and carefully gone over, and examined in every possible way, making sketches of the proposed fences, which are to be altered and amended repeatedly, after due consideration, examining the tenants as to the utility of the general plan, and all its subordinate parts, and afterwards taking frequent views of the whole on the grounds, and from different positions.

It is always of importance, to endeavour to combine utility with ornament. It may therefore be observed, that this may in general be attained, by combining plantations with inclosures, if well contrived and arranged. Irregular and varying forms answer best for plantations; but a more open and more uniform arrangement suits better for arable lands. Plantations are most serviceable for shelter when placed on ridges, by protecting the lands and live-stock on either side. When they occupy the summits of eminences, and are contrasted with intermediate and opposite belts, clumps, or strips, they contribute most effectually towards ornament.

PART III.

OF THE VARIOUS MODES AND SIZES OF INCLOSURES.

GENERAL VIEWS.

IN this part of the subject, the principles and advantages of inclosure, as exhibited in the practice of Scotland, are chiefly to be considered. It is much to be regretted, that, in some cases, the greatest advantages, and the most correct principles, have not been judiciously combined in practice.— In all cases of inclosure, the number, size, situation, and form of the several fields, and the nature of the fences, ought to be carefully arranged, in connection with a distinct view of the most approved mode of occupancy, the most suitable stock, and the most profitable management of the soil. To construct fences without mature views of these important subjects of consideration, is to lay out money at random, and perhaps materially to injure the prospect of future and valuable improvements, and greatly to obstruct the operations of good husbandry in these lands.

SECT. I.

OF INCLOSURES ON LOW AND RICH SOILS.

IT must depend greatly on circumstances, whether hedges or stone-walls may be most suitable for such soils. It would be an imprudent waste to occupy much land of this description with ditching or plantation; and, if drains are wanted, they

ought invariably to be covered, that all the valuable soil that can possibly be obtained may be turned to profitable use. If stones be plentiful, and at an easy distance, a low wall of four and a half feet high may answer sufficiently to confine cattle, horses, and Leicestershire sheep. If finished by a ragged coping, of rough stones set on edge and firmly impacted, after the form of the Galloway dike, four feet of wall, besides this coping, will effectually turn almost any kind of live-stock, the mountain breeds of sheep excepted, unless impelled by the cravings of hunger, or some other powerful incentive.

In soils of this description, white thorn soon makes a fence, and is in most cases preferable to every other on such soils, where stones are seldom plentiful. The most approved plan is to secure the growing hedge from injury, by a sufficient ditch on one side, and a dike on the other, till it has become sufficiently fencible; after which, the dike may be removed, and the ditch filled in.

On such lands of this description as contain much clay in their composition, and retain surface water, as is commonly the case with carse soils, the fences may be formed by open ditches, which should be regularly cleared out, and sufficiently wide and deep to prevent the passage of live-stock. The same observation applies to low rich meadows, or swampy grounds, and in many cases to improved mosses. But unless a great width of ditch is required for the purposes of drainage, it might be more advisable to occupy a part of the space with a hedge, which, without augmenting the unproductive surface, would afford greater security than any open ditch, and shelter at the same time. All the interfurrows and surface drains, and all covered drains, ought to open into the fence ditches, which must be regularly cleared out from all obstructions, and the scourings applied either to the formation of compost dunghills, or spread on the surface as top-dressings. In carse lands, and other low rich soils, the crops of corn or hay require free admission to the sun and air. If, therefore, the fence ditches have the addition of live hedges

on one side, these ought to be trained close and low, and hedge-row trees ought generally to be avoided.

SECT. II.

OF INCLOSURES IN THE VICINITY OF TOWNS AND VILLAGES.

PROPERTY held in severalty near towns and villages is generally inclosed. In these situations, it is seldom advantageous to make the inclosures on private property large; as many persons are desirous of possessing small ones, and two or three of such are usually more valued than one of a large size. To make them too small, would be to err on the opposite extreme, and, besides the great additional expence, to waste much valuable land. For the ordinary purpose of these situations, from five to ten acres appear to be the most convenient sizes. The most advisable fences for such inclosures are stone-walls, or quick hedges dressed thick and low. Palings of wood are frequently carried off. Hedge-row trees are liable to depredations, and likewise have an injurious effect, by confining the fields too much.

Common property near towns and villages requires to be very differently inclosed from that which is the property of individuals. This ought to be well inclosed and fenced, by a ring fence of stone-wall or hedge, or both, and adorned by hedge-row trees. The whole inclosure ought then to be levelled, drained, improved, and dressed up for public uses, especially for the common pasture of milch cows belonging to the inhabitants, and in part also adapted for bleaching and other uses. The whole ought also to be accessible for walking over in fine weather.

SECT. III.

OF INCLOSURES IN LOW ARABLE FARMS.

THE chief purposes of inclosures, in lands of this description, are for the due arrangement of crops and pasturage in judicious rotations, and for the protection of the various crops from trespass. If the farms be laid off in suitable sizes, it is a great waste of expence to make the inclosures too small and numerous. This is likewise productive of interruption to field labour, and retards the winning of grass cut for hay, and of grain crops, by preventing the free circulation of air. In extensive low arable farms, oblong inclosures, of from twenty to thirty acres, are generally most approved; and the most eligible fences in such situations are either stone-walls, or hedges trained close and low; the latter, when skillfully laid out, are certainly the best on several accounts.

In a farm of this kind, consisting of five hundred acres, it will generally be found more convenient to have it subdivided into twenty inclosures of twenty-five acres each, than ten of fifty acres. The smaller inclosures are of sufficient size to admit of being cultivated without inconvenience or interruption; and are more useful and manageable for being manured, or for double rotations. In them likewise, the soils can be more uniformly arranged and laid together; and some of the fields can be kept in old grass.

SECT. IV.**OF INCLOSURES ON UPLAND ARABLE FARMS.**

IN such situations, a material purpose of fencing is to obtain shelter for the produce and live-stock, which ought therefore to be a leading object in arranging the plan of their inclosure. Upland farms are generally cold, and their fields must necessarily be often placed on slopes, where the soil in general is neither so deep nor so rich as in low-lying lands. To secure early and rich grass, and to shelter the live-stock, the inclosures ought to be made considerably smaller than in low farms. These observations are not meant to apply to sheep farms, though a few sheep may enter into the plan of their management. Belts of plantation judiciously planned, with fences of high stone-walls for their protection, together with beech-hedges in proper places, and clumps or larger plantations interspersed, are of essential service in giving shelter to such upland farms, besides contributing greatly to beautify the country.

Although white-thorn grows vigorously at a considerable elevation, and even on very high grounds, when it meets with deep rich soil, it cannot be expected to answer on extensive slopes and ridges, nor equally well all along extensive lines of inclosure. In many cases, larch will be found to succeed better. Beech is greatly superior to either; and, although not of quick growth, it prospers on dry gravels, where thorns would certainly fail. The defects of shelter from the fences may be very effectually remedied, by mixing a due proportion of ever-greens, especially Scots firs and Norway spruces, among the deciduous trees.

Considerable judgment and taste are requisite, for the due arrangement of inclosures on high arable farms; for inter-

mixing them with clumps, belts, and hedge-rows; for defending them in points of more serious exposure, by means of large plantations of forest trees; for intersecting the whole by convenient roads; and for taking judicious measures to carry safely away all superfluous water from springs, or that which is produced by rain or melting snow.

For the due management of pasture, in the rotations on such farms, it were always necessary to have at least eight or ten inclosures or fields in each farm; perhaps it might be better to have a considerably larger number, as some of them might be usefully preserved as hay meadows, or in old grass.

SECT. V.

OF INCLOSURES ON SHEEP-FARMS.

THE rude and mean ideas of those who approve of leaving all sheep-farms in the state of mere open wastes, hardly deserve attention in the present day. Those who wish to see extended to this valuable animal, a proportion of care in any degree corresponding to its worth, must be sensible, that the benefits arising from judicious inclosures are of the greatest importance on sheep-farms, and are even indispensably necessary.

Without inclosures, it must be a most arduous task to confine the rams, and to keep them separate from the ewes till the proper season arrive. Accordingly, even the rudest managers now stipulate to have a *tup park*, or inclosure for the rams. It is hardly less necessary to have proper inclosures in which the lambs may be safely weaned. And every sensible person sees the necessity of having an *hospital park*, or inclosure for such unfortunate or diseased sheep as are unable to provide for themselves in the common pastures or *flock-*

rake. When the flock is to be collected and assorted, nothing can be more difficult and harassing to the farmer, than to conduct the various operations necessary on such occasions, if without the convenience of inclosures; and this difficulty is much increased, when these operations have to be effected in bad weather, after much labour and delay in collecting the sheep.

The strong, active and healthy individuals of a sheep-flock, may possibly become tolerably fat on the common pasture. But those which it is the chief object of the farmer to fatten, such as the drafts or culls of his flocks, have little chance of becoming so, unless removed to superior pasture; and when obliged to be sold in low condition, their worth is very small. It is also an object of great importance, to be able to preserve and cherish the weak ewes and lambs of the flock, during severe weather in April or May. Yet all these important objects cannot be attained, unless by the assistance of inclosures. Neither, without these, can the farmer ever attempt to obviate or prevent the baneful effects of fatal distempers; to improve the breed or character of his flock; or to maintain his sheep during hard weather, when they are unable to dig through the frozen snow for subsistence; or to protect them from general destruction, during snow drifts or heavy storms, in a farm which is entirely open.

For these obvious reasons, every sheep farm that is capable of being so accommodated, ought to possess several inclosures, or grass fields, well fenced with strong walls, constructed in the most effectual and approved style, and having the convenience of water. Some recommend that one of these fields, of considerable size, should contain rich old grass; another either irrigated land, or cultivated grasses, for early and rich pasture; and that in different places the farm ought also to possess effective shelter for the sheep in bad weather, with good grass well sheltered, for the sheep in the end of spring; also well arranged plantations, for effectually pro-

tecting the sheep from snow drifts and heavy storms. Others reckon sheep-cots likewise necessary*.

Besides all these conveniences, no sheep farm can be reckoned complete, unless it possesses some inclosures of arable land, and meadows. One ploughgate of land in cultivation, divided into a series of well-inclosed fields, and kept under a judicious rotation of crops, will add very highly to the value of the farm; by furnishing turnips and artificial grasses for the support and improvement of the sheep stock, which will afford manure, in return, for fertilizing the soil of the cultivated land.

Supposing a sheep farm to be arranged according to the principles of the foregoing observations, all its fences ought to be composed of well-built stone-dikes or walls, at least five feet high. The common pasture or flock-rake ought to have various plantations of forest trees, especially pines, similarly fenced. And there ought to be extensive belts of forest trees fenced in the same manner, having good pasture contiguous, for the ewes and lambs in the season of parturition. To these ought to be added various inclosures under grass; as a tup-park, an hospital-park, an inclosure containing watered meadow, or other early grass; and, lastly, the inclosures for cultivation, and the hay meadow. Those intended for the plough ought not to be fewer than four, but more if possible; and ought to contain as much land, at least, as one plough is capable of labouring. The hay meadow should consist of drained bogs, or other coarse pieces of land, richly improved by means of top-dressings, and appropriated to the production of hay for cattle. It may farther be observed, that the whole or most of these inclosures may be separated from the common sheep walks, by means of the substantial dike formerly described; while the subdivision fences may be constructed in a less expensive manner.

* Such cots are now erecting by Lord Somerville, at his sheep farm in Lammernuir.

This admirable mode of inclosure on sheep farms, is calculated to render them in the highest degree safe and productive, as well as comfortable and beautiful. It requires, however, a considerable degree of judgment, taste, and attention, to arrange the plan for the several purposes, and to adapt it to the grounds; and is attended with considerable expence, in building the several fences, and forming the requisite plantations for shelter. In many situations, it must be admitted, that such accommodations cannot be obtained. But money laid out in this way with judgment has always made liberal returns to the landlord in advanced rents; while the character of such farms is sure to rise in the estimation of the country, and the plantations become in time a source of emolument. By these improvements, while the lands undergo progressive amelioration, the tenants are furnished with the means of acquiring comfort and profit.

So great is now the value of sheep farms, under judicious arrangements, as to suggest new ideas for their improvement, both to landlords and tenants. And, whatever may be the obstacles towards the accomplishment of this system, it is certain that a plan of inclosure, similar to that now detailed, would add greatly to the value of the sheep-walks of Scotland, where fences are of such great importance, and where, for the most part, good materials for their construction are to be had in abundance.

Were this plan adopted, as far as circumstances would permit, and surface-drains*, already carefully formed by the most intelligent farmers of sheep walks, more universally attended to, many tracts, immense and desolate as they appear at present, would be converted into safe, beautiful, and productive sheep farms; accommodated with grain, turnips, and sown grasses, and giving ample and productive employment, and great additional food, for an increasing population.

* These are small open cuts, about two feet wide, drawn across the declivities of wet land in sheep pastures. They are soon and cheaply executed, and frequently render a farm quite sound and healthy, that was formerly notorious for the deadly *pole* or rot.

SECT. VI.

OF INCLOSURES IN PLEASURE GROUNDS.

It may perhaps be considered an invasion on the province of taste, for any observations to be introduced on this subject in this place, but no such object is intended. There is not a purer or more gratifying exercise for taste, than is furnished to the country gentleman in the general improvement and decoration of his lands, and particularly of his pleasure grounds. In these, unsightly fences, and dead walls, and whatever may interrupt the view, are generally avoided. Light ornamental fences of wood or iron, elegantly constructed and painted, are often used in certain cases, and especially in the neighbourhood of the proprietor's residence. In others, and at a moderate distance, the sunk fence is adopted, which gives no interruption to the prospect. Where thorn-hedges are planted, they are trained carefully, yet naturally, and are sometimes enriched with eglantine, honeysuckle, convolvulus, or other ornamental shrubs and flowers; and beech or holly are planted in proper situations, to afford permanent shelter close to the ground. In our northern climate, the garden-wall requires the subsidiary protection of external plantations of wood; and at a distance from the house, park fences frequently consist of stone-walls, along with thorn-hedges.

SECT. VII.**OF INCLOSURES ON NEW FARMS.**

IN the planning and arrangement of these, there is required much deliberate attention, and prudent consideration, before determining ultimately upon their designs. On lands that are already under culture, fences and inclosures are generally to be found in part; and the soil to be planted with hedges, for additional inclosures and subdivisions, may be prepared for the purpose, by means of fallow and manuring. But in the inclosure of a new farm, every thing is to be arranged, and the soil, in general, can only be prepared for the proper reception of the hedge-plants, by a judicious use of the spade, and by the application of manures as the work advances. To allow the houses to be set down as it were at random, and the roads and fields to be laid off in a careless manner, without correct views and mature reflection, must greatly injure the value of the farm. Access, water, and shelter, have all to be duly considered; the size of the farm and the most advantageous mode of occupancy, have next to be taken into consideration; and, as in connection with these, the number, extent, and position of the inclosures; and then, in due regard to all these, the use of ditch, wall, or hedge, for the purpose of fences, has to be carefully applied, according to circumstances. The plan of inclosure requires to be formed with much deliberate judgment, and has then to be carried into effect with vigour.

1. If there be a great extent of land requiring to be separated from mountain pasture, a ring-fence must be applied to this purpose, within which is to be comprehended the arable land, the meadow, and the cow-pasture. This ought to

consist of a strong fence of stone-wall with a snap-coping, as formerly mentioned; and contiguous to this general fence, plantations are to be established in proper places, for shelter and ornament. After the completion of this ring-fence, subdivision fences are to be designed and executed on the principles already discussed, having due regard to all the circumstances formerly recommended for consideration; and along with these, and on the outside of the ring-fence, clumps of trees may be formed in convenient and useful places.

2. When the new farm is in a bleak situation, but may be brought under cultivation, a different arrangement is necessary for its inclosure, as the whole requires to be fenced and subdivided. In this case, the necessary shelter should be obtained by belts of planting on the most exposed parts, and by means of hedges in the subdivision lines.

3. Another mode of subdivision has been proposed, in which the fields are all made quadrangular, but having all their corners planted with trees, in those parts which could not be got at by the plough, and by which considerable shelter may be obtained, through these clumps*.

SECT. VIII.

MISCELLANEOUS CONSIDERATIONS, CONNECTED WITH INCLOSURES.

In addition to the principles of inclosures, which it has been endeavoured to illustrate, as applicable to the soil, climate, and circumstances of Scotland, in the foregoing discussion, the following observations connected with this important subject seem deserving of consideration.

* See Account of the Systems of Husbandry in Scotland, by Sir John Sinclair; Part. I, Sect. 3 and 4, illustrated by an engraving.

1. With respect to *Roads*, the fences require to be planned and managed afterwards with judgment; as otherwise they may prove injurious or even dangerous. By close lofty hedges, especially if intermixed with hedge-row trees, a free circulation of air is excluded from the roads, which are kept continually wet and uncomfortable: and if deep fence ditches are made contiguous to the sides of roads, they must often occasion danger to carriages and passengers. It is therefore very properly provided in turnpike acts, that the ditch and hedge be placed on the field side of the fence, and not on the side next the road; and that hedges along road-sides shall be kept low by their proprietors, or by order of the trustees, at the expence of the owners.

2. The position of *Gates* in new inclosures is first to be duly considered, and afterwards their size, and mode of construction. Their position must be determined, by considering the roads and other communications with which they are connected, the size and form of the inclosures to which they lead, and the purposes to which these are intended to be applied.

In regard to *dimension*, no field gate that is intended for carriages ought to be less than eight feet wide; and if the resort of these be frequent, ten feet are little enough. The height, in order to form part of the fence, must be nearly the same with that which forms the inclosure; being about five feet, when the fence is a stone-wall, intended to confine mountain sheep; and may be somewhat less, when the fence consists of thorns or other live-hedge, and is intended for cattle.

With respect to *construction*, there may be room for selection, out of the various forms now in use, and which will be afterwards described. Strong and durable materials, however, ought always to be preferred for gates and posts in every instance; as weak and perishable materials are continually occasioning accumulated charges, in repairs and renewals. With this view, therefore, and considering lightness also as an object, stone-posts, when such can be conveniently and cheaply procured, and durable resinous timber for the gates,

carefully jointed and well painted, appear to deserve preference. Where living trees of some size can be procured, we have seen them transplanted for gate posts with their roots; and when such take root and live, their permanence is beyond any other material.

3. *Water* is a most important consideration in the planning and execution of inclosures; whether the object in view be its collection and distribution for the use of pasturing animals, or to convey it from the fields; or to direct it for other uses after passing through them, as for threshing or other mills, for irrigation, for ponds, bleaching, or other purposes. To accomplish every necessary end, and at the same time to prevent injury from this element, the drains, conduits, bridges, gates, fence ditches, and roads, require to be designed with skill, and constructed with attention. In conducting water through fields, it is of material importance to take care that the slopes be gentle, and not more than sufficient for easy transmission; as, when water is conveyed down fence ditches, or open conduits, of considerable declivity, it is apt to produce important injury in its progress, by washing away the sides of its channels, often to a great extent.

4. As the working of minerals may very materially interfere with the plan of inclosure, and become afterwards very inconvenient and hurtful; it would be prudent, especially in a mineral district, to make proper trials and surveys, in order to ascertain the mineral structure of the lands, before a plan of inclosure is finally determined on, and carried into execution, so as to adapt its arrangement to the circumstances of the case.

5. Before executing a plan of inclosure, it may be expedient to consider how far its materials may afterwards become useful in the adjacent country, and consequently profitable to the owner. In some districts hazels, and in others willows or osiers, are much wanted; in some the timber growing in hedge-rows is of much value; almost in all cases, the cuttings of thorn-hedges are useful for dead hedges; or any substance

capable of making bakers' faggots may be of some value. Even the wild fruit of crabs or other trees may be of use in hedge-rows, where also they are ornamental. These considerations ought never to weigh so far as to occasion material injury to the fences; but, if this can be avoided, they deserve attention in every plan of inclosure. Sometimes, by clearing the ground to be inclosed from stones, with which it is incumbered, the materials of inclosure may be very conveniently obtained.

PART IV.

OF FENCES, GATES, AND STYLES.

SECT. I.

ON THE NATURE OF FENCES IN GENERAL.

It is now proposed to describe the kinds of fences most commonly used in Scotland, more especially those best adapted for use, according to various circumstances in regard to soil, climate, situation and mode of occupancy; but as these subjects have been already illustrated, and at considerable length, in several well-known agricultural publications, it does not seem necessary to extend the discussion to any great length in this work*.

* The subject of inclosures and fences will be found treated of in detail, in the Communications to the Board of Agriculture, Vol. ii. Part I. p. 144;—in the Husbandry of Scotland, Part I. Chap. I. Sect. 3. and 4.; and in Essays relating to Agriculture and Rural Affairs, by the late ingenious James Anderson, LL.D. vol. i. pp. 1—198. All of these treatises on this important subject are fully illustrated by engravings, which likewise, in a great measure, preclude the necessity of giving explanatory figures in the present portion of the General Report of Scotland.

In regard to the form, size, and number of inclosures on any farm, these circumstances must be regulated by the nature of the soil, surface, and climate of the particular farm; the purposes for which it is chiefly to be applied, and the extent of the farm itself. In arable farms, the number of inclosures ought to be suitable to the plan of rotation intended to be pursued, and their size therefore must be regulated by an attention to that important consideration, combined with the size of the farm itself. Yet, on large arable farms, more especially if the soil be unequal in point of quality, it is generally found advantageous to have at least twice as many inclosures as the number of *breaks* or divisions in the proposed course of rotation. By this plan of subdivision, turnips, for instance, may be drawn from a rich inclosure, and consumed by sheep, on the surface of one that is poor: A richer field may be sown in wheat, barley, or early oats, according to circumstances; while one that is poorer in quality may be sown with bear or bigg, or with common oats: A richer field in sown grass or clover may be cut for hay or soiling; while one that is poorer may be devoted to pasture. By this plan, likewise, the farmer has it in his power to change his plans of rotation with more facility, or to introduce new, or improved, or double rotations. In a farm of various soils, so subdivided, each individual field may have, in some measure, its own separate plan of rotation, contrived to suit the nature and fertility of its own soil; the general wants of the entire plan of the farm always being held in view. This plan of subdivision, however, cannot be conveniently followed, unless the farm consist of two or three hundred acres; as on small farms, so great a number of inclosures would render each too small, and too great a proportion of the land would be occupied by the sites of fences.

In rich arable districts, where the soil is so extremely valuable, small fields are evidently productive of loss and inconvenience. The growing corns suffer materially from the too great closeness of the hedges, and the want of a free circula-

tion of air. The operations of the working teams are much obstructed and delayed by too frequent turnings, during which no work is performed. In high upland farms, devoted to grazing, it is necessary to secure shelter for the live-stock, with early and fresh grass at command; both of which important circumstances require a suitable number of inclosures. When, therefore, such upland farms are to be inclosed for the purpose of cultivation, or for the pasture of milch cows, or Leicester sheep, the size of the inclosures ought not to be large. But, on the contrary, when meant for the mountain breeds of sheep, the inclosures can hardly be too large, if suited to the various purposes of such farms, as formerly pointed out in the body of this Chapter.

In rich arable soils, like those of the Carse, and in the more improved corn districts, where pasturage does not enter to a great extent into the system of management, the general opinion seems to be, that the fields ought to be large. Their form, wherever cultivation is an important portion of the plan, ought to be in regular four-sided fields, square or oblong; and if the latter, their greatest length ought to be in the direction most suitable for laying off the lands or ridges. In these richer soils, all things duly considered, the fields ought seldom to be less than twenty acres each, and hardly ever ought to exceed fifty or sixty acres, even in the largest arable farms. In lighter soils, where pasturage comes in for some years, in every successive course of rotation, the fields may be made smaller, with much usefulness and conveniency, always having regard to the size of the farm. A carse land farm, therefore, or one on such rich arable soils, as to answer best under the six-course shift, cannot have less than six separate fields, as nearly equal in size as circumstances will admit. A farm of lighter soil, in which the course of rotation may extend to six or more years, three or more of these in pasture, must likewise have as many fields as will suit the intended rotation; and if large, double that number will be found useful and convenient. Besides, it will gene-

rally be found convenient upon most farms, to have a few small inclosures of rich *old turf*, or meadow, for particular purposes, connected with the accommodation of the stock; and one or two small inclosures may be useful for experiments, or for propagating new varieties of seed. This important subject has been elucidated, in the work already mentioned; on the Husbandry of Scotland.

SECT. II.

OF THE DRY STONE-WALL, AND GALLOWAY DIKE.

THE Galloway dike, or most approved form of the dry stone-wall, owes its name to the circumstance of its having been originally introduced into use in Galloway; and we believe, if not invented by the late Mr Macadam of Craigengillan, was at least much improved in its construction, and first brought into extensive use upon his large grazing estate in Ayrshire. This fence consists entirely of a stone-wall, built without the use of lime or any other mortar. Two-thirds of its height, from the surface upwards, are regularly and evenly built on both sides, well filled in or packed in the heart, and ought to be tied or strengthened, at short intervals, by long stones reaching from side to side, called *thorough-bands*, at least one such in every yard of length. When this first portion of the wall is finished, and regularly levelled at the top, the upper third part of its height is built of long rough stones, laid across the wall or dike, having firm hold of each other laterally, but not packed in the heart, the largest stones used in the lowest course, and gradually diminishing to the top. Large rough quarried stones of a durable kind, particularly whin-stone, moor-stone, basalt, or trap, are most suit-

able and lasting for this species of fence. Quarried sandstone, if durable in the open air, and not liable to moulder by the influences of the weather, answers sufficiently well for this fence.

Although, at first sight, the open portion of this fence may appear slight, long experience has established its efficacy in deterring animals from attempting to get over, in a greater degree perhaps than a more solid wall even of greater height, besides being less expensive. For sheep fences in mountain pastures, the height of this wall ought to be at least five feet, or five feet and a half. The solid double part at the bottom ought to be at least thirty-two inches thick, tapering equally on both sides to eighteen inches, and forty-four inches above the surface of the earth, where the regularly built wall ends, and the open work begins, which is to be carried twenty-two inches higher. The expence of such a wall depends on the facility of obtaining materials, and the distance of their carriage; but, on the average, may amount to eight or ten shillings the rood of nineteen feet in length, by five feet high. A lower wall of four and a half feet high, and its other dimensions proportionally reduced, may answer for cattle or Leicester sheep, in arable and pasture fields; but the Cheviot, the black-faced, or other mountain breeds of sheep, require the full size of the Galloway dike, which is sometimes made five and a half feet high, to keep them within their pastures, and to protect adjoining fields or plantations against their depredations. A few inches of additional height, in the open work of the Galloway dike, adds very little to the expence.

In the common practice of Scotland, the dry stone-wall is carried up double, like the under portion of the Galloway dike, to the height of four and a half or five feet, to which is added a turf or sod coping of six to nine inches; but if stones can be obtained for that purpose, they are now generally preferred. The best coping, now much used in the south-east of Scotland, is to finish off the double dike, by one range of large rough stones, set on edge, and firmly

impacted into each other, by driving in thin wedge-stones between them; and in several parts of Galloway, the same double dike is preferred to one that is partly single.

The construction of such fences often answers the double purpose of inclosing the land, and clearing away stones that incumber the surface of the cultivable soil; but it is of the utmost importance to debar the use of round stones, except in the upper part of the open work, or of any that are apt to moulder away; and the contractor ought always to be bound to warrant and uphold the fence for some years, against all defects in the materials or construction.

The Galloway dike may be called the sheep fence of Scotland, by way of eminence, and is peculiarly well calculated for the Highlands, or all mountain pastures, as there is no other so economical or more efficient, and the rocky mountains almost every where afford excellent and durable materials in abundance for its construction, either immediately on the surface, in loose blocks, or open crags and rocks, or by means of quarries. It is impossible to contrive any fence better adapted for the protection of fields and plantations, and for restraining the native wildness and wandering disposition of mountain sheep. Instances occur, in the county of Dumfries, of tenants on a lease of nineteen years, having erected fences of this kind, at their own expence, to the extent of 1000 roods in length. The building of this fence is usually about a third part only of the expence, the rest consisting in the charges of quarrying the stones, and leading them to the builders. It is obvious, therefore, that much attention should be given in procuring the stones as near as possible to the line of fence, and above that line if practicable, that the materials may not have to be carted up hill. If well executed, and of durable materials, the Galloway dike may stand good for twenty years, with very little repair. When the wall ceases to be straight and solid, it requires to be rebuilt; and, with a moderate supply of additional materials, may be then restored to its original state, for less than half of the first ex-

pence. In finishing off the ordinary dry stone-wall, with a ragged coping, in imitation of the Galloway dike, it contributes greatly to its permanence, if the stones composing the ragged or Galloway coping have a little lime mortar insinuated between each, along with their wedges or pins; and this adds very little to the expence.

SECT. III

THE SOD-WALL, OR FEAL-DIKE.

THIS species of fence was more common in Scotland formerly, than of late years. The folds erected for tathing or manuring lands, by collecting the cattle and sheep of the farm to remain there through the night, and during the heat of the day, were generally fenced by this species of wall, having a braiding of whins or gorse, or of cut thorns below the upper turf, as an additional fence to turn the inclosed cattle or sheep. This practice of folding is now much and deservedly fallen into disuse; yet the feal-dike is still used in some cases as a fence. The most common and proper use of it is in moors, for the protection of plantations of trees. In such places, the turf sod or feal is more tenacious and more durable for this kind of fence, than when erected on rich and friable soils. The pasture likewise of moors is of little value comparatively, and there is consequently less injury done by cutting up a portion of the surface to make such a fence, than in soils of more fertility and value. Where stones are to be had in plenty, and especially where these incumber the surface of the ground, the feal-dike ought never to be used. But where stones are scarce and expensive, this fence may often be of service, and is necessary for securing young plantations of trees. When a tract of moor land is in course of improvement merely for the purpose of being laid down to

pasture, this temporary fence is also often employed with advantage.

The seal-dike is often constructed in a hasty and careless manner, in which case it soon moulders down. When the sods are carefully cut, and attentively laid, each course made to cover the seams or joinings of that immediately below, together with ties or thorough-bands at frequent intervals, and the whole properly packed in the heart, with a sufficient coping of long sods on the top to keep out rain, this fence is tolerably durable. Frequent repairs are necessary, but, if these are carefully executed every spring, and when any breach occurs, this fence may occasionally answer a good purpose in particular situations; more especially as the original expence is very low, seldom amounting to a fourth part of the expence of stone-walls. It does not seem requisite to give any minute account of the method of forming this species of fence, as it is not in universal use, and falling fast into desuetude. A detailed description of the best mode of construction will be found in Anderson's *Essays relating to Agriculture*, vol. i, p. 7, and in the *Communications to the Board of Agriculture*, vol. ii, p. 76, Pl. v, fig. 38.

In several parts of Scotland, where the soils or circumstances are not favourable to the growth of thorns, and where stones are scarce, a kind of compound fence is used, consisting of a wall composed of sod, and stones, laid in alternate layers, and compactly built together. The stones are mostly small and rounded, the worst that can be conceived for building, and the rough grassy turf and surface earth are employed to hold them firm. If these walls are carefully constructed, the largest and heaviest stones forming the foundation, and the faces having a sufficient talus or batter, and built in spring when the sod is tough, it is surprising how long they will last, with occasional repairs. In peculiar circumstances, such fences often answer well for defending one side of a young hedge, while the other is guarded by the fence ditch, or even for protecting young plantations.

SECT. IV.

HEDGE AND DITCH.

THIS species of fence is the most frequent, and in the highest estimation in the arable districts of Scotland. In particular soils, and for particular purposes, it answers better than any stone wall; the ditch operating, at the same time, both as a fence and a drain, and the hedge giving more effectual shelter than a bare wall, and being more beautiful; and, in many instances, the hedge likewise contains a row of trees, at proper intervals, adding to the shelter and beauty of the fence. The expences of this species of fence are seldom above a third part, or a half at most, of those attending the construction of the Galloway dike, by the rood of nineteen feet. But the hedge and ditch require particular attention, and some expence is yearly incurred in training; and, after all, they do not make a fence for some years, perhaps not one time out of ten becoming at last so effective as a stone wall. Where they succeed, however, in proper soils, and under attentive management, they become excellent and permanent fences, improving every year in their value; while all other fences of dead materials are emphatically said to be *major* at their birth, and deteriorate every year, till they require a complete renewal.

To errors in executing the hedge and ditch fence, and negligence in its training and protection, the failure of this fence may in many cases be ascribed. When it succeeds, by being placed on proper soils, and by careful and judicious management, it becomes both durable, effectual, and ornamental. The white-thorn, hawthorn, or may, the *Mespilus oxycantha* of botanists, which is the plant most in use and estimation for live-hedges, grows naturally on the

slopes and mountain faces of many parts of Scotland, and in the highest elevations where any natural wood is to be found. “Thorns thrive to nearly twenty feet high at Wanlockhead, the most elevated village in Dumfries-shire, or even in Scotland, being more than 1500 feet above the level of the sea. One of the highest situated thorn-hedges in Ayrshire, on the farm of Waterhead, near the source of the Nith, is also one of the strongest and most luxuriant in that county. The trunk of a white-thorn, about a mile or two from the village of Wanlockhead, at four feet from the ground, is nearly five feet in circumference*.” Frequently on a mountain face, a patch of natural white-thorn protects a seedling ash, or other nursling tree, in its bosom from the pasturing flock, showing that both thorns and such trees would grow and thrive in such situations, if planted and secured from injury.

The foregoing instances of thorns thriving in such elevated situations, and in soils that had never been cultivated or ameliorated by human industry, even exposed to sheep and other animals, naturally suggest practical reflections to the planter. Yet, when planted injudiciously in soils not suitable to their growth, or which have not been properly prepared for their reception, thorns do not thrive; neither do they answer when planted on soils of very different quality in the same line of fence. They suffer injury likewise, if ill treated in removal from the nursery, or when planted in an injudicious manner, or at an improper season.

The common mode of propagating white thorns, for being transplanted into fences, is by sowing the seeds in nursery-beds, transplanting them from the seed-bed into training-beds, and setting them into fence-rows at three or four years old; yet it may admit of some doubt, if this be the best method of proceeding. When the soil in the line of fence is of good quality, it answers very well; if otherwise, the plants, which have been pushed into luxuriance in the nursery, finding lit-

* Report of Ayrshire.

the nourishment in their new situation, become dwarfish, and many of them languish or die. Where the soil in the line of fence is naturally poor, and no proper means have been used for its enrichment, the planter is often disappointed in the progress of the thorns. In such situations, the line of the fence having been previously cleared from weeds, and afterwards carefully manured, the thorns ought to be planted directly from the seed-bed; or some other species of plants ought to be substituted, more appropriate to the nature of the soil, such as beech in gravelly soils, or larch in those of a coarse nature.

It is well known that white-thorns acquire numerous roots, by training in a nursery; yet it might be an experiment worth trying, to place some of these luxuriant nursery plants, on an open and elevated mountain face, and to compare the progress they make with that of natural seedlings in the same situation. The result will not probably be in favour of the nursery plants; and it may therefore merit consideration, whether it might not be better to employ seedling plants, or even the seed itself, in the formation of new hedges, especially in elevated and poor soils, in preference to pampered nursery plants, accustomed to exuberant nourishment, and liable to become stunted when transplanted into a more barren soil. In the common way of employing nursery plants of three or four years old, the hedge planter ought certainly to have the soil in the proposed line of fence well selected, and properly prepared by manuring and the extirpation of weeds. Fence-ditches, especially when they are intended for thorn-hedges, ought to be made between the wet and the dry soils, for the purpose of draining, as well as for fencing. Judiciously placed on one side of the ditch, thorns are sure to prosper uncommonly well, because the soil is usually rich, and the ditch prevents it from being too wet. Thorns will not prosper on too dry soils, nor on those which are too wet.

When it is necessary to conduct the line of a fence

through soils of very different qualities, the hedge planter ought either to select such species of plants as are suitable for the respective soils, or he should endeavour, by drainage and manuring, to equalize the soils as much as possible all along the line of the intended fence. If these precautions are neglected, the hedge is sure to grow very unequally in different parts of the line, strong in some parts and weak in others; in which case, the whole ultimately turns out of little or no use.

Before planting out the young thorns in the line of fence, it is necessary to prune the tops, and to dress off any broken parts of their roots; and, for this purpose, a sharp instrument that cuts clean should always be employed. The ordinary practice of hedgers, to hash the roots and tops with a common spade, is barbarous in the extreme, as the parts are necessarily bruised, and do not grow freely afterwards.

The ordinary practice of placing thorns on the sides of high walls or mounds of earth, though these promise to secure the young plants from injury, often become the cause of total or partial failure. The root weeds often grow so luxuriantly out of this bank or wall, as to be incapable of extirpation, and choke the thorns in their growth. This bank of earth often becomes so poor and dry as to be utterly unfit for nourishing the young hedge plants; and after some years of feeble growth, they sicken and die out. Besides, this earthen wall or mound moulders down, and becomes entirely useless as a fence, long before the hedge plants are sufficiently grown to supply its place. It may likewise be observed, that the space of ground occupied by this earthen bank, and the ditch from which it is formed, is a considerable sacrifice of soil, that might be productive of emolument under cultivation. The only remedy, when a hedge begins to fail from want of nourishment, owing to the bank becoming poor and dry, is to throw down the old earthen bank, so as to admit air and moisture, and to secure the young hedge by means of a rail fence. By this plan of management, previously

cutting over the thorns, many a hedge that is now of little use might be recovered. As a corollary from this fact, it may naturally be asked, why should such walls of earth be erected, when such are their injurious effects: and why are not the thorns planted on a bed more judiciously formed, where they may be secured from the first by a rail? Perhaps the proper answer to this question is, that, in Scotland at least, sufficient materials for rails, both in quality and quantity, are exceedingly difficult to be procured, and there are no means so effectual for protecting the young hedge in the course of its growth, as the use of a fence ditch on one side, and a mound or clap-dike on the other, with such other aids as will be mentioned in the sequel. When the hedge is trained up to become fencible, the mound on one side may be thrown down, and the ditch on the other side filled up, unless the latter serves at the same time for the purpose of drainage.

In arable soils, the following plan may deserve consideration. Having cleared the soil in the intended line of fence from all weeds, and enriched it by manure, either by means of an effectual naked fallow, or a well dressed crop of potatoes or turnips, let it be gathered up by the plough into a narrow high crowned ridge, well harrowed; and again gathered and harrowed, till the line is made quite fit for the reception of the thorns. A small open drain may be run along one side of the line, or both if necessary; but a stout rail must be erected to protect the growing thorns. By this very simple mode of inclosing, very little expence would be incurred, very little land would be wasted, the thorn plants would probably grow much faster, and incomparably less expence would be afterwards incurred, in weeding and training up the fence. This plan will only answer, however, in extraordinarily favourable soils, and where abundant materials can be had for fence rails; and, generally speaking, the ditch and mound are necessary for protecting a young hedge.

In lands that have not been previously brought into culture, should ploughing and fallowing be considered as unnecessary or troublesome, every possible attention ought to be given to placing the thorn or other hedge plants in suitable soil, properly adapted for them by drains and manure, and the mould rendered clean and free from root weeds; after which they must be preserved clean, by attentive weeding in the course of their growth. Constant and effectual protection from the trespasses of cattle of all kinds, and especially from sheep, is indispensably necessary in all cases, and must be persisted in, till the fence is complete. It must however be observed, that the wild mountain breeds of sheep, particularly the black-faced and Cheviot breeds, are almost incompatible with thorn-hedges; as besides gnawing them with their teeth, they canker the growing thorns with their wool.

In order to render it equally close all along the line of fence, a young thorn-hedge should be cut all over with a sharp hedge-knife, a few inches above the ground, in the second year of its growth, early in spring. It ought afterwards, when it arrives at sufficient strength, to be pruned regularly in a sloping wedge-like form, the two sides meeting in a point about five or six feet high, the bottom of the hedge being left two feet and a half or three feet wide. "By this mode of dressing, the hedge gets the appearance of a steep roof, or of the hogged mane of a horse. Every twig receives its full share of rain, sun, and air, and the lower branches are not injured and destroyed by the dropping of water from those above. This plan of management is not however suitable, where there are not abundance of weedings from young plantations, for the formation of rails, because preventing a supply of sufficiently strong cuttings for dead hedges *."

The protection of thorn-hedges, during the period of their growth, till sufficiently strong to become a fence, is often difficult, on account of the scarcity of materials for rails, and

* Berwickshire Report.

the depredations which are frequently committed by poor people in the neighbourhood, in carrying away the materials of these rails for fuel. Mr Forbes of Callender, who has planted not less than six millions of thorns, and whose lines of fencing have extended to nearly four hundred miles, or about 74,000 roods of nineteen feet each, protects his young hedges, by means of a ditch on each side, of four feet wide, the intermediate mound standing on a base of five feet, so that the whole space occupied by the original fence is fourteen feet wide; or he builds on either side a turf or sod wall of four and a half feet high. When the hedge becomes sufficient for a fence, the walls are levelled, and the ditches filled up, the hedge alone being left to occupy the ground. Mr Forbes purchases the seedling thorns, which he trains up in a nursery upon his estate for two or three years, and plants them out in his fence lines at four inches distance, putting an oak, elm, or beech plant, or some other young tree for hedge-row timber at every three yards' distance.

The most convenient and generally useful mode, however, of planting a thorn-hedge in Scotland, is that which is most usually followed; which is to place the row of thorns in the face of a mound or clap-dike of earth, which protects the growing thorns on one side, while the ditch from which the dike is constructed, fences the young hedge on the other side. A powerful argument in favour of this plan, is derived from the general want in Scotland of fit materials for constructing permanent rail fences, without which it is impossible to rear thorn-hedges to any useful purpose upon flat unguarded ridges, in the manner hitherto proposed.

For this purpose, a ditch is dug in the proposed line of the fence, with the earth taken out of which a mound or clap-dike is formed on one side, leaving a shelf or scarcement of two or three inches broad, between the edge of the ditch and the foundation of the dike. The surface or manured soil of the ditch is first dug, and of it a banklet is formed, three or four inches high, having a slight slope

downwards and backwards. On this banklet, the young thorn plants are laid in a regular row, at regular distances of four or five inches between the plants, their pruned or shortened stems just peeping out from the face of the begun dike. The rest of the manured surface earth of the ditch is then dug out, and built into the dike, over the young plants, and behind their roots; after which, the subsoil of the ditch is dug out, with which the dike is completed. The ordinary dimensions of this fence ditch are four or five feet wide at the top, by two feet and a half deep in the former case, or three feet deep in the latter, and a foot or nine inches wide at the bottom, the sides having a regular slope or talus. By this mode of construction, the dike will occupy about five or six feet in breadth at its foundation, by three or three and a half feet high.

In this construction, the young hedge is guarded on one side by the ditch, and on the other by the mound or clap-dike, with the addition either of a rail, or a dead hedge of cut thorns, on the top of the mound. Sometimes the back of the mound is fenced by what is called a face-dike, either built entirely of dry stone, or of alternate layers of stones and sods. Either of these forms an immediate fence on that side, which will last with proper attention, and occasional repairs, until the young thorns on the other side become fencible. On strong clay soils, the face-dike is often made entirely of sod, without stones. When built with stone, the face dike will be much improved as a fence, by having a ragged or Galloway coping of dry stones.

In some instances, the hedge side of the mound is faced up with dry stones, as high as the banklet on which the thorns are laid in the ordinary mode of construction, the face-dike being backed up with surface manured soil, as a bed for the thorns. The young thorns are then laid at proper distances, of six or eight inches, the points of their stems projecting even with the face of the wall or face-dike. This

last is then carried up fence height, being regularly backed up with earth as it proceeds, the best earth laid over the thorns and behind their roots, small holes being left in the dike for the thorns to grow through. The mound is completed behind the face-dike, by the subsoil of the ditch, which in this case is usually made shallow, perhaps only two feet deep, or a mere slope from the field deepest at the side of the dike. This construction is an effectual fence from the beginning; and thorns planted in this manner require no weeding, and very little care of any kind, except switching or dressing the face of the hedge occasionally with a pruning knife. For a few years at first, the young thorns may be effectually guarded on their own side, from sheep or cattle, by filling the ditch or slope with cut old thorns. This compounded fence answers admirably for protecting young plantations, or along the sides of roads*.

Besides the expedients already mentioned, for the protection of a young thorn-hedge, till strong enough to serve as a fence; there is a practice in some parts of Scotland of sowing a row of the seed of whins, furze or gorse, along the top of the mound or clap-dike. With proper care, this becomes in a few years an excellent guard and shelter to the young thorn-hedge. Great care ought, however, to be taken in this case, to prune or switch the whin-hedge regularly, that it may never be allowed to run up to seed, which would scatter and grow among the thorns, to their great and irreparable injury.

In whatever way a thorn-hedge is planted or protected, it is indispensably necessary to attend to the young thorn plants in the progress of their growth. Early in the first spring after they are planted, it is proper that a labourer should go along the whole line with a spade, to remove any earth that

* Berwickshire Report.

may cover the points of the young plants, that they may feel the influence of the sun and weather, and be permitted to grow. They must afterwards be kept free from weeds, twice every year at first, till they acquire some strength, after which once yearly may suffice. After two or three years, the face of the young hedge may be switched or dressed up yearly, or once in two or three years, by a sharp pruning-knife or light hedging-bill. By some it is also considered to be a good expedient, to reduce the shoots on each plant to one upright leader*.

In consequence of repeated weedings, a considerable portion of the best soil of the mound is necessarily removed from the roots of the young thorns, leaving them bare, and partly filling up the ditch. To remedy both, it becomes necessary to scour out the ditch, and to replace the earth about the roots of the thorns. The latter part of this operation is termed tabling the hedge. After a thorough weeding, a shelf or scarcement is formed by the spade below the thorn roots, and one or two courses of sods are laid on this shelf, in front of the elbow of the thorns, where the upright stems and horizontal roots unite at an angle. The cleanest of the earth procured in scouring the ditch is now filled in behind and upon the sods, among and over the thorn roots, and the clap-dike restored to its original form by the remaining scourgings of the ditch.

After the thorns have acquired considerable strength, it is proper to dress the hedge into a regular form, such as is meant to be afterwards preserved. Some persons cut them over, when the fields they surround are under a course of tillage, either close to the ground, or at three feet high. Others cut the full grown thorns at fence height, between four and a half and six feet high, and dress up both sides close to the stems, continuing to dress up both sides yearly in the form of a sharp wedge, three or four feet wide at the bottom. In

* Anderson's Essay on Agriculture.

ditching or pruning a grown hedge, the branches next the ground on each side should be shortened to within eighteen inches or two feet of the main upright stems; those above being made shorter and shorter, in proportion to their distance from the ground. At five feet high, they are cut close to the stems, and the entire hedge is then reduced to one uniform height. By this mode of dressing, every thing receives a full share of rain, sun and air, and the lower branches are not suffocated, or destroyed by those above them. The only objection against this plan of dressing hedges, is, that it prevents a supply being occasionally obtained of sufficiently long cuttings for dead hedges, to assist in protecting other young hedges, and for temporary fences.

Thorn-hedges on favourable soils, which have been carefully trained, and occasionally cut over or dressed in the hedge shape, will last for ages. But when neglected in their original training, they are sure to become full of gaps and weak places, when they are nuisances instead of benefits to the occupier of the ground. Where they have been carelessly allowed to grow up like forest-trees, wild and unpruned, the stronger plants suffocate the weaker, rendering the whole hedge-row of thorn-trees with irregular wide intervals, instead of a fencible hedge.

Gaps in hedges may often be filled up, by laying down a long branch or stem of thorn, half cut through near the ground, and fixing it firmly along the surface, by notched stakes driven to the ground, and covering the extreme end with the earth. This extreme end strikes roots, and the horizontal stem or branch throws out upright shoots, which fill up the gap. This branch must be carefully guarded, by rails or dead hedges, till it acquire sufficient strength for its own protection.

Where gaps are too large for being filled up in this manner, it is necessary to insert either thorns or some other plants. In this case, the space in which they are to be planted ought to be dug over, and formed into a

flat bed, the new hedge plants inserted before winter, and carefully protected by a rail fence from trespass. They will afterwards require to be carefully trained, and the original hedge plants on each side must be so pruned as to prevent them from overgrowing the younger plants. For this purpose, besides thorns of five or six years old, crabs or beech may be used.

In the construction of thorn-hedges, some have recommended or practised the planting of two or even three rows of young thorns, at different heights, in the mound or clap-dike; but this plan does not seem at all advisable. In favourable soils, a single row of thorns will soon acquire sufficient strength to become a fence, with proper care in training; and even in such soils, a double hedge will certainly take longer time to arrive at perfection, besides being greatly more difficult to clean and train; much more so a triple row. It seems hardly necessary to observe, that a double or triple row can never be expected to thrive in an unfavourable soil.

On some occasions, especially for boundary fences between separate properties, or between farms on the same property, a double hedge and ditch is resorted to. In this case, two ditches are drawn at nine feet asunder from their inner sides. The soil from both ditches is thrown inwards, forming a large mound or double clap-dike, and a thorn-hedge is planted on both faces of this intervening mound, exactly as already described for the single hedge and ditch. In this case, the middle of the mound is the mutual boundary or line of march; and when by single hedge and ditch, the line of thorns is the march, the ditch being dug from the property on one side of the line, and the mound laid on the other.

Some persons are in use to insert plants of sweet briar or eglantine among the thorns, in the formation of young hedges, placing a briar at every two or three yards. This, however, is a very objectionable practice, wherever sheep of any kind are expected to pasture within the proposed inclosures, as the hooked prickles of the briars will catch hold of their

wool, and tear it off in great quantities, to the great detriment of the flock, and the serious loss of the proprietor *.

In good soils, and where not too much exposed to severe winds, hedge-row trees add greatly to the shelter and beauty of the country; but, on many accounts, planting the corners of the fields is considered to be a preferable plan. When it is proposed to set trees in hedge-rows, they ought to be inserted exactly in the line of the thorns, at distances of five or six yards from each other. It is a common practice to plant them on the top of the mound or clap-dike, but a very bad one, as their roots are there placed in the very worst soil, and are exposed to much injury from drought, and likewise are apt to be left bare even of that bad soil, by the natural wasting of the bank †. Hedge-row trees, however, especially ash, are great enemies to corn. The influence of their roots, in attracting moisture and fertility from the growing crops, are evident to a considerable extent, on every arable spot in their neighbourhood. When trees are cut down in hedge-rows, the thorns which grow among their dead roots generally die out, especially if the trees are of the pine or fir tribe ‡.

Hitherto the white-thorn only has been considered as the material of live-hedges; but as it does not answer in every kind of soil and situation, it may be proper to give some account of other trees and shrubs, which may be substituted in many cases. Many other kinds of plants are as beautiful as the thorn, and some of them are highly ornamental, while others are useful by affording fruits, or cuttings for various purposes; yet no plant that we are acquainted with, is at all comparable with the hawthorn for strong and durable hedges, when placed in suitable soils, and trained under good management.

* Anderson's Essay on Agriculture.

† Berwickshire Report. ‡ Systems of Husbandry in Scotland.

The *sloe* or black-thorn has been proposed as a substitute; and it is said, that the peasants near Thionville in France make a spirituous liquor from the juice of the sloe, fermented and distilled, which they prefer to wine. The plumb, gooseberry, bramble, elder, and rasp, may all grow in hedges, and all yield useful and agreeable fruits. The willow and hazel, being first interwoven when at a proper height for constituting a fence, and then pruned above that height, at proper intervals of time, may answer well in some cases as a hedge, and will supply valuable materials for the basketmaker and cooper.

Cottage gardens in Scotland used formerly to be surrounded by a fence or hedge of elder or bourtree, the *Sambucus nigra* of botanists. This is easily propagated by cuttings, and, though not armed with spines, if well trained and regularly pruned, soon makes a firm strong fence, in dry arid soils, where the hawthorn is not capable of thriving. It was formerly thought, that this species of fence was hostile to caterpillars, owing to its strong smell, or to some other quality.

The holly, or *Ilex aquifolium*, though of slow growth, forms a close and beautiful evergreen fence, and would be more commonly planted for that purpose, if the mode of rearing it were better understood, and more generally known. It ought not to be transplanted in November and February, like the hawthorn, but in May and June.

The larch, *Pinus larix*, grows luxuriantly in coarser and poorer soils than will suit the hawthorn, and is not so liable to be gnawed by the teeth of cattle and sheep. When the top is cut over, the lateral branches multiply and extend, and may be so interwoven as to form a strong fence. There are two species or varieties of larch, one having a whitish bark, which is of European origin, and was probably introduced into Britain from Russia, which is a well-known tree, producing a most valuable timber. The other has a dark brown bark, and has been introduced of late years from America, by the nurserymen, to supply the growing demand for larch

plants. The timber of this variety has not hitherto become large enough in Scotland, to ascertain its value; but the experience of several years has shewn, that this variety is peculiarly liable to a species of blight, by which its advancement is greatly deteriorated, and which, in some instances, has threatened the destruction of entire plantations. This disease consists of a white sweetish efflorescence, probably produced or occasioned by innumerable insects of the *aphis* tribe, owing to which the tender shoots are stunted in their growth, and die in the ensuing winter.

The hazel-nut tree, or *Corylus avellana*, if planted thick, and judiciously pruned and interwoven, may be formed into an efficient hedge. The shoots possess considerable strength, and are useful for making hoops, by their toughness and pliability; not to mention the nuts produced upon the more advanced branches.

The common medlar or *Mespilus Germanica*, the crab-tree or *Pyrus malus*, the wild service-tree or *Pyrus terminalis*, and the true service-tree or *Pyrus domestica*, may all be cultivated occasionally as hedge plants, and a gap in a thorn-hedge may often be occupied with some of these, where young plants of white-thorn would be oppressed. All the varieties of wild rose or briar may sometimes be useful to fill up gaps; but they are liable to the objection already urged against the sweet-briar, as injurious to sheep.

The *Sorbus aucuparia*, rowen or roan tree, or mountain ash, is one of the quickest growing trees known in Scotland, especially for a dry barren soil. It grows naturally upright, with a tapering stem; but when pruned is apt to rise thick from the root in very numerous shoots, which soon fill up an opening or gap, but it does not generally thrive in such soils, when planted in close rows as a hedge*.

In gravelly soils, and for the purpose of close and effectual shelter at a small height, the beech-tree or *Fagus sylvatica* is

* Anderson's Essays on Agriculture, p. 110.

preferable to all other species of hedge plants. In wet soils, a hedge may be formed of the birch, the alder, or some species of willow. The birch or *Betula alba* is to be reared and planted in the manner already described for the thorn. The alder or *Betula alnus*, and the willows, are to be planted in truncheons or cuttings. When of a proper height, as three feet high, they are to be interwoven, so as to form a strong hedge, and pruned afterwards above; but most of these trees must not be pruned too late in spring, as they are apt to bleed too freely.

The common whin, furze, or gorse, the *Ulex Europæus* of botanists, has been often used as a fence in Scotland, sown on the top of a bank. It comes very quickly to perfection, and grows in a soil where few other plants would thrive. The bank ought not to be raised too high, and the plants must not be allowed to grow up too long, or open at their roots, otherwise a severe winter frost is very apt to destroy them. If the whin be used at all, it ought invariably to be sown, as it hardly ever succeeds when transplanted; and it ought to be regularly and frequently pruned, which renders it close and effective as a fence, protects it against severe frost, and prevents it from forming seed, to scatter over and poison the adjoining ground. The best method of forming a whin-hedge, is by digging two parallel ditches of five feet wide, eight or nine feet asunder, raising an intermediate bank or mound between, which should be sown tolerably thick with whin seeds. These come up quickly, and in three or four years will form a sufficient barrier against most animals. In course of training, after the plants acquire some age and strength, those on one side of the bank may be cut over close to the ground, leaving the other side to serve as a fence for a year or two, when it likewise must be cut over in its turn. By these means, the bank will always have a strong hedge on one side, without ever becoming naked at the roots, or shedding seed. The young shoots, bruised and given to horses in winter, make a valuable and nutritious green food, which will abundantly

compensate for the trouble of cutting, and the waste of ground occupied by the wide bank and the whin-hedge *.

The *Cockspur-thorn* of America has lately been recommended for trial as a hedge plant, and has attracted the notice of the Board of Agriculture, which has wisely ordered the seed to be procured, in order to sow it in this country for trial. Others have recommended the French or the German tamarisk, as peculiarly calculated for growing in places exposed to the sea breeze. It is easily propagated by cuttings, and takes root and grows rapidly. This plant is already a native of the south of England, where it grows abundantly on St Michael's Mount in Cornwall, in the fissures of rocks, and on earthen mounds or banks, putting forth numerous elegant flowers, which are very grateful to bees. The German tamarisk is said to be fully more hardy, especially in the property of resisting severe frosts, which injure the other. Though rather a feeble plant for a fence, as not affected by the sea-spray, if it could bear frost, it might be useful in particular situations, by the shelter it affords. There is a thorny shrub mentioned in Withering's botanical arrangement of British plants, as growing on the coast of Lincolnshire, which stands the sea spray, and which might be useful in some situations †.

* Anderson's Essays on Agriculture.

† Sir John Sinclair's Systems of Husbandry, Part I. Ch. i, Sect. 4.

SECT. V.

OF WOODEN FENCES.

THE materials for these are not hitherto very abundant in Scotland ; but as plantations of trees extend, the weedings of these will furnish them where required. The moist climate of this northern country is injurious to wooden fences ; but this circumstance is favourable to the growth of live-hedges and as stones are usually to be had in abundance for stone walls, this circumstance is the less to be regretted. Yet, to protect young hedges and plantations of trees, wooden fences are often necessary. These consist either of coarse railing, or of what are usually called *stake and rice*.

The coarse pailing or rail fence, most commonly used for the protection of young hedges, consists of rude posts and rails, which are strengthened by an oblique rest or back-stay, at every second or third post, fixed to a short stake behind the rail. If the posts and stakes are of larch, and the rails of fir, this temporary fence may be constructed at a moderate expence, and may last until the young hedge acquire considerable strength ; but posts and stakes of fir soon rot at the surface of the ground, between the wet and dry. Oak for this purpose, certainly the best material, is seldom to be had in Scotland.

The *stake and rice* fence consists of rude stakes of any convenient kind of timber, driven into the ground nearly perpendicular, and interlaced by small branches of brushwood of any kind. This is closer than railing, and answers better for turning small animals. When placed on the flat ground, these temporary fences require to be from four and a half to five and a half feet high, according to the kinds of live-stock they are meant to confine. If erected on the top of a clap-

dike, or earthen mound, they may suffice of two feet or a little more. In this latter case, a dead fence or *cock-hedge* of cut thorns is often erected on the top of the mound.

Moveable temporary fences, called *flakes*, similar to gates, are often used for confining sheep or cattle to their regular allotments of turnips, or for other similar uses. Net fences, supported upon stakes, are also in use for the same purposes. All of these fences are so common and ordinary, as not to require any minute description.

SECT. VI.

OF THE EXPENCE OF DIFFERENT KINDS OF FENCES.

THE charges of the different kinds of fences are so much affected by a variety of circumstances, owing to the distance or scarcity of materials, the nature of the soil, the rates of wages, and the like, that no calculations entitled to the character of correctness can be offered. We are therefore under the necessity of confining our attention to a mere sketch, or approximation only on this subject.

If, by way of illustration, a light railing, or stake and rice fence, on the top of an earthen dike, of about two feet high, be estimated, for materials and workmanship, at sixpence the rood, of nineteen feet in length; a strong rail fence, or stake and rice, to answer as a fence on the flat surface, may cost from one shilling and sixpence to two shillings; a *feal* dike, including the top fence, from one shilling to one shilling and sixpence; a ditch and clap-dike, with a row of young thorns for a hedge, including thorn plants, labour, and manure for the soil, but independent of the railing or cock-hedge, from three shillings to three shillings and sixpence; a sunk fence,



OF BELONGING LAND

... and faced stone-dike, without hedge or ... to five shillings; an open ditch, six feet ... deep, without a hedge, from two shillings ... expence; a common Galloway dike, or ... five feet high, with a snab-work or open built ...; and a double Galloway dike of the best ... its full height, from ten to thirteen shillings. ... information upon this subject, extracted from ... reports, will be found in the Appendix.

SECT. VII.

OF FIELD GATES.

... in this place to confine our attention entire-ly ... common, most useful, and most durable field ... for various purposes; the usefulness and durability of ... much upon the quality of their materials, and ... their construction. Ornamental gates are out of the question on the present occasion, being infinitely various in their materials and construction, and entirely dependent on taste and fashion.

... or gate posts are now often made of single blocks of granite where such can be had of good quality and sufficient size, which are much preferable to timber, as not being liable to rot. Large blocks of granite are the best where they can be procured. Where stones of sufficient size cannot be procured, pillars are often built of stone and lime, having large stones set at that part of the pillar on which the gate hangs. These in strength and durability, are posts of sound oak or of black oak, which is often procured at the bottom of peat mosses. If none of these are to be had, larch

may be employed ; but even the best kinds of foreign fir very soon decay and rot, just at the surface of the earth. When gate-posts are made of wood, it is of use to cover that part which goes into the ground with a coat of pitch, or to char it slightly. The oaken ribs of an old ship answer well for gate-posts, where they can be procured. Some prefer living trees, transplanted with their roots at a proper season. When these take root and continue to grow, they may last for ages ; but as they do not continue of the same girth, though the gate may hang on such trees, it should not fold on them, otherwise the gate must be frequently altered in its dimensions.

The best material for a field gate is sound red fir, which is not very heavy, and is not liable to rot for some time. If oak be procurable, the gates ought to be made entirely of the red wood, and need not be nearly so massive as when made of fir. In regard to construction, gates admit of great variety, according to the places for which they are designed. For interior inclosures, the simplest and cheapest gate consists of a pillar at each side, and four moveable bars made so as to slip in and out at pleasure, consisting commonly of weedings of fir plantations. These, however, do not answer for more public passages.

As the loose bars, or the rails in this very simple gate, are often tossed aside and left to rot on the ground, Mr Easton at Springkell has improved the construction, by employing better materials for the rails, hanging each of them by an iron chain and hook to the right hand post, connecting all their other ends, a little off the left post, with a chain, and thus enabling the passenger in a moment, by loosing them at their insertion in the left pillar, to carry all the rails round at once, either in opening or shutting. This prevents another inconvenience, that of misplacing the rails, besides the saving of time, and preventing their being left on the ground, to be trampled on, and to rot. Mr Easton has farther improved this gate, by hanging a wooden bar by a chain from the top of the left post, which covers all the rails when placed

in it, and fixes by a catch near the bottom, keeping them all firmly in.

The folding gate, consisting of two parts, is best adapted to wide spaces, where one gate occupying the whole would be too large and heavy.

The swing gate, which turns on hinges at one side, and fastens by a latch at the other, or may occasionally be shut with a padlock and chain, is most common in fences.

For all places of considerable resort, this gate should be hung so as to open easily to the traveller, even on horseback, and then to shut of itself. It is also a matter of great importance to prevent it from sinking in the head, which very often happens, rendering the gate for a time useless. In addition to these objects, it should be well considered, on what construction the gate may be made most firm and durable.

The common swing gates in general are constructed so ignorantly, or with so little care, as to be liable to objections in all the above particulars. Of course, a great deal of expence and much inconvenience are incurred. The benefit of inclosures and fences, however, depend so much on the perfection of the gates, that a particular degree of attention to them ought to be more generally given.

In the Farmer's Magazine, vol. vi, p. 180, a paper on the best construction of gates will be found, accompanied with a plate, by Thomas N. Parker, of Hatton Grange. This paper and plate merit attention. An interesting paper on the construction of Mr Parker's gate was introduced into the same useful magazine, vol. x, page 492, the work of the late Professor Robison of Edinburgh. Mr Easton, factor at Springkell, in the county of Dumfries, having directed his attention to the same important subject, has examined both Mr Parker's and Professor Robison's papers, and has communicated the result, as follows :

“ As all the above gates differ from mine in the *construction* and *mode of hanging*, you will be able to judge, from the



SWING GATE
as Improved by M. Eisenstein



D
*Bottom Hinge
and Stop*

W E I
Top Hinge

Scale in Feet 0 1 2 3 4 5 6 7 8 9 10

drawing (see the Plate) and the following description, how far I have succeeded in improving both :

“ The hinged, or hind upright, or post, is drawn 6 inches broad and $3\frac{1}{2}$ inches thick ; and the fore upright $2\frac{1}{2}$ broad, and may be $2\frac{1}{2}$ thick. The upper rail should be the same thickness at each end ; the other rails may be $1\frac{1}{2}$ inches thick at the hind post, and $1\frac{1}{2}$ at the fore one. The middle-upright must be 3 inches thick, to receive all the rails, and is $1\frac{1}{2}$ inch broad. The diagonal, rising from the hind-upright, must correspond to the thickness of that post, the middle one, and top rail, for the same reason that all the rails pass through it. That diagonal and the middle-upright have both short tenons into the upper rail, and are jointed, as in the drawing. The diagonal rising from the middle-upright may be checked into the rails, and fixed with nails, and is likewise jointed, as represented. The nearer a diagonal brace can be brought to the perpendicular, the more weight will it carry. I have therefore preferred one supporting the top rail at the middle, to one running the whole length of the gate. This diagonal so completely supports ours, that we almost never add the other, rising from the middle-upright. It however prevents the rails from bending downwards from the middle, gives a degree of uniformity, and adds little to the weight. The hinges are of cast-metal ; the bottom one runs in a whinstone, and the centres are in the line of the post next the rails, so that nearly the whole weight of that post acts as a counterpoise to the rest of the gate. The tenons of the rails in the hind post, being 6 inches long, can scarcely give way ; but to prevent this altogether, a strap of plate iron is put round at top, and secured by two fastenings to the top rail. If the pillar upon which the gate hangs be stone, the top hinge is let into it, and batted with lead, as shown by dotted lines ; and if of wood, it must be sunk into it, and fastened by two staples embracing it at top. The fastening is a common lifting sneck and catch ; but in place of lifting up at the fore pillar, and rising over the catch, it lifts by the ball B, and

passes below the catch, the part behind the centre *A* being made sufficiently heavy to raise the other end, in shutting the gate. The advantage of this mode is, that when the gate sinks, which the best do a little, the sneck will continue to go with ease. You will observe, that although the gate is $8\frac{1}{2}$ feet long, the road-way is only 7 feet 9 inches. The gate should be stopped at a point about a foot beyond its perpendicular line when shut. Opinions vary as to the advantage of gates shutting themselves. If this should be required, it is easily done by altering the position of the hinges, so as to produce the effect in any degree. I got a top hinge made at Edgerston, to act in the same way as common fly ones do at bottom, and used the same centre point at bottom. In this way, the gate could not be disentangled as those acting at bottom, and the centre upon which the weight of the whole stood, was more secure than the crook at top, upon which that weight must hang. The dotted lines show the parts of circles described by the centre points: The black dot the position of the centre below, which is placed a little nearer the pillar than the upper ones, that the gate may not stop and open till it reach the dotted line.

“ Great care ought to be taken to guard gates and pillars by large stones, and to make the roads in passing them smooth. Low pillars are likewise a great advantage, being out of the reach of the shelvings of high-loaded carts. In place of *single rails*, which are frequently used in shutting up entrances seldom opened, I have hung these by a short chain upon hooks driven into a post, (see *a, a, a,*) connected there with a chain at the other end, *b, b,* to answer the distances of checks cut in another post, so that, by carrying them all round by the top one, and putting it into the upmost check, all the rest go into their respective ones flush with the post. They are then completely secured by a piece of wood, about three inches broad, one inch thick, and so long as to cover all the check which is hung to the top of the post by a small chain, *c,* and slipt behind two hooks, *d, d,* in the lowest of which is a catch similar to that given by Mr Parker in his plate marked H.

A pin fixed in the piece of wood raises the catch, goes behind it, and is prevented from returning by the falling of the catch.

“ A, catch and pin when the gate is shut.

“ B, ditto pushed up by the pin, and ready to fall down and fix the gate, or piece of wood.

“ C, horizontal view of the section of the pillar, piece of wood, catch, and hook ; also of the rail.

“ The castings, complete, to hang any weight of gate, cost about 3s. 7d. at the foundery, inclusive of the lifting sneck. Our smith, John Edgar, made them of malleable iron, sufficiently strong, weighing 7 lb. 4 oz. which, at 9d. *per* pound, amounts to 5s. 4½d., not a third part of the price of those formerly used here. Two pounds, or at most two and a half, would furnish out a set of iron-work for the three rails, or between 1s. 6d. and 2s. And this simple gate we find to be excellent for many situations. About three and a half feet of wood will make the gate above described, which, at 3s. *per* foot, is 10s. 6d. I got some made of larch, which could have been afforded for about 12s., or, inclusive of hinges, &c. 15s. 7d., rather of smaller dimensions than those of the drawing, which have been in use three years, and are very little the worse. Our blacksmith, who is a first-rate workman, made sliding bolts for fastening all the late Sir William Maxwell's gates, with a socket upon the hasp, inclosing a screw-pin, which, by a few turns of a key made to fit its top, is inserted into a dint in the bolt, and secures the gate equal to any lock.”

C. Grenville Stuart Monteath, Esq. of Closeburn, has the most simple plan of raising the head of a gate in case of its having fallen down a little, that can be contrived ; and as this intelligent and public-spirited gentleman has used it for years, and found this easy remedy of a very common fault in gates quite effectual, and has otherwise improved the common form

of gates,—his obliging communication on the subject follows, with the plan which accompanied it.

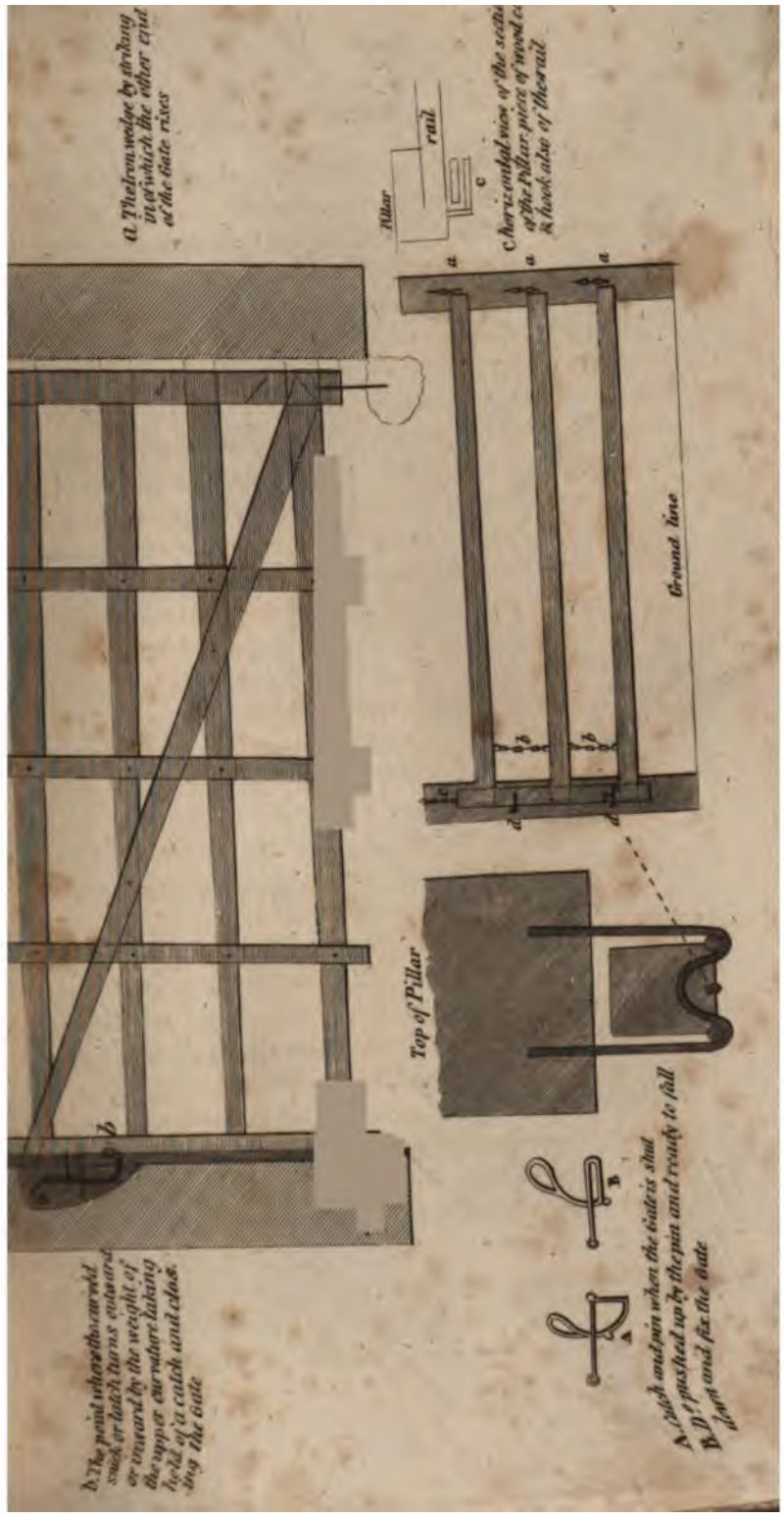
“ I have likewise sent you a sketch of the gates I use on my estate. I believe I mentioned or showed you them when at Closeburn. You may recollect that the sneck and iron going through the stone at the heel of the gate is all cast metal, which takes away from the temptation of robbing the iron from the gate, a thing that I have experienced when of wrought metal. The feather at the pin through the stone at the heel, enables one to raise the gate when it has fallen a little. Though the mechanism of a gate is simple, it has been little attended to in Scotland, even in the more improved parts of it.”

It appears from NO. 48, 9th December 1811, of the Farmer's Magazine, that iron gates are constructed in Ayrshire, the forms of which are exhibited in a plate, page 438. It is added, that these gates can be made fully as light as those of wood, and may soon be manufactured to any extent; but the names of the makers and rate of price are not specified.

SECT. IX.

OF STYLES AND WICKETS.

STYLES are passages contrived in fences, by means of steps, composed of wood or stone, in order to allow the passage of persons on foot, excluding sheep, horses or cattle. Some long stones or pieces of timber, are placed in a stone-wall, projecting at one end, like steps in a stair, by which the passenger ascends to the top, and descends again on the other side by



*A. The iron wedge by which
it is fixed to the other end
of the gate rises*

*Bar
rail*

*C. Horizontal view of the section
of the Pillar, piece of wood
to hook into of the rail*

Ground line

Top of Pillar

*b. The point where the curved
hook or latch turns outward
or inward by the weight of
the upper curved part taking
hold of a catch and close
ing the gate*

*A. Push and pin when the water is shut
B. D. pushed up by the pin and ready to fall
down and fix the gate*

1

1

similar steps. Sometimes a strong, rude wooden ladder is fixed at either side of the wall*.

The wicket, or turn-about, is intended for the admission of foot passengers, while it excludes horses and cattle. It consists of a low pillar in the centre, having two bars at right-angles to each other, on the top of the pillar, so placed on a central iron pin, as to turn round in any direction when a person wishes to enter. In another mode of construction, the passage is partially obstructed by two low posts, having a top rail, reaching from one side, a little past the centre; and parallel to these, two other posts with a similar top rail, at a little distance. Each of the rails go a little past the centre of the opening, but so far asunder as to allow a person to pass on foot between them, while they prevent the passage of horses or cattle.

CONCLUSION.

ALTHOUGH a great proportion of the lands in Scotland still remains open and uninclosed, though divided or appropriated in severalty, this is not to be considered as any evidence or argument against the utility of inclosures. To account for this, we need only to mention the great extent of these open lands, their low value in their natural state, the limited population of the country, and the scanty means of improvement possessed by many of the landholders. To a stranger, these causes may seem quite sufficient to account for the circumstance of so little being already inclosed; and such persons may perhaps think the progress of inclosure as rapid, under these circumstances, as could naturally be expected.

* There are various other contrivances for this purpose, several of which are engraven in the Communications to the Board of Agriculture, vol. ii, p. 114, plate xii, fig. 75, 76, and 77, and do not require to be here described.

There is, however, another powerful cause, by the operation of which that progress has been obstructed, and which is perhaps paramount to any other, perhaps to all the rest combined. This is the careless and ineffective, and of course the unprofitable manner, in which a very great proportion of the existing inclosures has been planned and executed, together with the gross negligence of those who ought to have been active in their preservation.

By these circumstances, landholders are discouraged, on considering how much expence has been already incurred, and how little permanent advantage has been secured. A farmer, having a set of inefficient fences, incorrect in their plan and deficient in their execution, so that he derives little real advantage from them, while they occupy a great deal of land, and occasion a continual expence in keeping them up, feels considerably discouraged in his attentions towards them. Many landholders do not reside upon their estates, and even seldom visit them. Of those who do reside, many do not take any active part in the improvement of their estates, and some are not very prudent or successful in their plans for that purpose. Yet, under every discouragement, a decisive argument in favour of inclosures may be deduced from the high estimation in which they are generally viewed, by all judicious farmers.

The proper style of inclosure, in order to be at the same time useful and ornamental, must vary according to circumstances. When well adapted to soil and climate, to stock, and to improvement, and when present and future advantages are provided for, combining utility and embellishment, inclosures possessing all these requisites and advantages must command admiration. Sometimes instances of such perfection are to be seen in Scotland; but not unfrequently the plans on which they have been undertaken are injudicious, and their execution imperfect.

On the sheep-walks of the south of Scotland, a well inclosed farm is occasionally to be seen, having its boundaries sub-

stantially and effectively fenced with dry-stone walls, and having clumps and belts of planting in different places and elevations, for shelter and ornament, protected by similar fences; having also a fence of the same kind for protecting the lower part of the farm from the trespasses of the mountain sheep, and within this main fence, a proper intermixture of arable land, with meadow and cultivated grass. This is a true picture of the perfect style of pastoral inclosure, and is highly worthy of imitation.

In large farms of good arable land, there is also an appropriate style or mode of inclosure, which depends partly on the nature of the soil, partly on the climate, and partly on the proportion in which pasturage enters into the plan of management.

The pine-forest lands of the north, likewise require a particular style of inclosure, by which the woods may be opened up, cultivated, and enriched, by means of buildings and roads of communication; while the young trees may be duly protected, and culture and pasturage properly introduced.

Too much wood in low and warm districts is productive of injury; but even there, a certain proportion of the soil, best adapted for the growth of trees, may be planted with great advantage, while trees are at the same time of great ornament. It is a common error in such situations, to incumber the vales with trees, while the ridges or heights are left bare. In general, the lower parts of Scotch farms, or those in vale land, may be sufficiently sheltered by means of the fences, with the assistance of a few clumps or belts of trees in particular situations. The main body of wood ought to be placed on the slopes or summits of the lower hills, and on ridges which intersect the vales. Beyond these, in the higher elevations, the mountain pastures or sheep farms, which in general have no plantations, need them most.

Should doubts occur on this mode of improvement, by means of plantations in elevated situations, it ought to be

known and considered, that many kinds of trees will grow and thrive in much higher elevations than is generally believed. If planted from the seed-bed, or even if the seed itself be sown, in these high situations, and in sufficiently large breadths to assist in sheltering each other, trees prosper much beyond common expectation. While plantations of trees answer admirably for shelter, upon the colder slopes and summits of the hills and ridges, they are of much less use for shelter towards the lower grounds; and it is very doubtful, how far it may be profitable to plant good arable soils with timber, even in mountain farms, where the arable spots are scanty and precious. It cannot possibly be doubted, on the other hand, that the occupation of barren slopes and elevated ridges with timber, is an important improvement in regard to profit, besides being an elegant embellishment to the property and the neighbourhood.

A well inclosed farm is not only of important value to the occupier, but is besides a strong inducement to him to exert his utmost energies in draining, cultivation, and improvements of all sorts, both in regard to his stock and his crops, owing to the security which these give him in reaping the fruits of his exertions. In a few years, the accumulating effects of these become notorious to every person around; and when the farm is again offered to the public for a new lease, numerous offerers are induced to come forward as competitors, encouraged by the success of the fortunate occupier, and the landlord is sure to derive large advantages, by greatly increased rents.

If, instead of the present open, bleak, and comparatively barren aspect of most parts of Scotland, correct plans of inclosure were every where adopted, from the low rich carse, and improved moss, through the lower arable lands, to the slopes and ridges of the hills, every part being inclosed and fenced according to the modes best adapted for each soil, situation, and manner of occupancy; it is not easy to appreciate the beneficial alteration that would thereby be effected,

not only in the improved appearance of the country, but in its climate, and productions of every description. That such a beneficial alteration is possible, is clearly demonstrated, by what has been already effected in many districts, equally liable to doubts and objections as those which still remain open.

To succeed in a work so truly great, requires the most correct and enlarged views, which must be gradually extended and followed out, so as to make returns as they advance, and to enable the landholders to proceed regularly to their fulfilment. By this progressive means, the increasing capital and population of the country, will be employed steadily and judiciously in the labour of improvement, and the work, and the means of its advancement, will go on steadily and regularly, the recompence following the labour, and inciting to new exertions, by the hopes of additional profit.

To such a progressive and regularly digested plan, of judicious and profitable inclosure, improvement and embellishment, no competent objection occurs. It would admirably accord with the growing opulence and population of Scotland, and with her increasing demand for the productions of the soil. Facts are demonstrative of the high improvement that has been effected, even in the value of mountain pastures, under such a plan, and of their increasing returns of produce and profit, at a diminished rate of expence and risk. The benefits derivable from the barren waste, when clothed in wood by means of inclosure, are most important under a variety of considerations, that do not require to be enumerated, being so extremely obvious. And when crops of grain, and other useful productions, make their appearance, in places which were formerly moors and wildernesses, even the most superficial observer must be struck by the beneficial change.

No country in Europe has derived, or is likely to reap, more numerous or more important advantages, from judicious inclosures, than Scotland. They are and must be useful in the highest degree, to improve her soil and climate, and to augment and ameliorate her various productions. They form

the most profitable source of employment and subsistence for her increasing population; and they may render her, at the same time, more productive, and more attractive, to her opulent landholders.

Now that inclosed lands have become of great value, or rather that their value has become better known and understood, and that by increased and increasing capital and population, the means of augmenting inclosures is daily becoming more efficient; it may be observed, that what is now most wanted in Scotland, is that intelligence in devising, according to circumstances and situation, and that vigour in executing plans of inclosure, so necessary to the interests of landholders, but which many of them so unaccountably overlook.

CHAP. VII.

ON THE MANAGEMENT OF ARABLE LAND
IN SCOTLAND.

BY ROBERT KERR, ESQ.

PRELIMINARY OBSERVATIONS.

It is proposed, in this chapter, to explain the various systems of managing arable land, as practised in the best cultivated counties of Scotland, and by its most industrious and enlightened agriculturists; and to point out what improvements it might be advantageous to introduce into districts, where those systems have not hitherto been tried, or at least been but partially adopted.

In the discussion of this most interesting subject, it is intended to consider the following particulars:—I. The principles of tillage in general, and the various operations connected with that fundamental department of arable husbandry.—II. The fallow process, with its comparative advantages and disadvantages.—III. The most eligible courses or rotations of crops on various soils, and under different circumstances.—IV. The articles principally cultivated for their seed, as the food of man or of domesticated animals.—V. Such as are principally cultivated for their leaves and stems.—

VI. Such as are principally cultivated for their roots.—And, VII. Any miscellaneous articles cultivated on arable land which do not fall under the former heads, or which are not commonly raised in Scotland.

In drawing up this chapter, the corrected Agricultural Reports of the several counties in Scotland were carefully consulted. But the principal materials have been derived from those of East Lothian, Berwickshire, and Roxburghshire, which are considered as forming the chief station of the best Scottish agriculture. There are, however, considerable districts in other parts of the kingdom, in which the same systems, in whole or in part, have been judiciously introduced, or are in the progress of being adopted; and every attention has been given to any useful practice which these districts can furnish. East Lothian certainly is the parent district of excellent tillage and of judicious cropping, among Scottish agriculturists; while Berwickshire, and the eastern lowlands of Roxburghshire, in addition to the good tillage and judicious succession of crops prevalent in East Lothian, have combined the most perfect system of alternate cropping and pasturage, and have thence become the pattern districts for excellence in the convertible management of arable land, and judicious management of stock; certainly not excelled, perhaps unequalled, for productiveness, economy, and profit, in any other part of the united kingdom.

The important subjects now to be discussed, are all of a descriptive or didactic nature, and do not admit of being resolved into canons or aphorisms of agricultural science, or of being abridged, without the almost certain danger of becoming obscure; nor could the systems of Scottish husbandry, as practised on arable lands in the best managed districts, be sufficiently explained in a smaller compass*.

* It is proper to mention, that, in the whole of this chapter, the English statute acre, and the Winchester bushel, are uniformly employed; and that the

PART I.

OF TILLAGE IN GENERAL, AND THE OPERATIONS CONNECTED WITH THAT FUNDAMENTAL BRANCH OF AGRICULTURE.

SECT. I.

OF PLOUGHING.

§ 1. *Introductory observations.*—In all the well cultivated districts of Scotland, the important and fundamental operation of ploughing is now uniformly executed by means of the improved *swing plough*, generally known by the name of Small's plough, from the person who first brought that excellent implement to a degree of perfection, which has not hitherto been surpassed for general utility. In every instance, except in first tearing up coarse wastes, incumbered with stones and the roots of trees and shrubs, this plough is drawn by two horses a-breast, directed by the ploughman with whips, and without a driver.

Before proceeding to the consideration of tillage and plough-

terms commonly used in Scotland are retained, as, 1. *Furrow-slice*, to denote every piece turned over by the plough; 2. *Furr* or *furrow*, the open space left by the plough; 3. *Open furrow*, the interval between the ridges; and, 4. *Water-furrow*, when this interval is cleared out to answer the purposes of an open drain. The general term *furrow*, as first, second furrow, &c. is used as synonymous with *ploughing*.

than proportional additional labour to their master's horses, which they ought not to have been made to exert.

The degree to which the furrow-slice turns over, as already mentioned, is principally regulated by the proportion between its breadth and depth, which is usually in the proportion of six inches in breadth, to nine inches in depth. 1. When the slice is nearly square, or, in other words, when the breadth and depth are almost equal, it will be turned nearly one half over; and a field, so ploughed, will have its ridges longitudinally ribbed, into angular drills or ridgelets. 2. If the slice is considerably wider than deep, it will be almost completely overturned, with its original surface downwards, and each successive slice will somewhat overlap that which was turned over immediately before it. 3. When the depth materially exceeds the width, each slice will fall over on its side, and be somewhat overlapped by the next, leaving all the original surface bare, and only laid somewhat obliquely to the horizon.

The *first* of these modes of ploughing, or the square slice, is the best adapted for laying up stubble land after harvest, when it has to remain during winter exposed to the mellowing influence of frost, preparatory to fallow or turnips. The *second*, or shallow slice of considerable width, as four inches depth by eight or nine wide, answers best for breaking up old leys, because it covers up the grass turf, and does not bury the manured soil. The *third* is a most unprofitable and uselessly slow mode of ploughing, which ought never to be adopted. The most generally useful breadth of a slice is, from eight to perhaps ten inches. The depth must depend upon a variety of circumstances, according to the nature of the soil, and the object in view; but ought hardly to be less than four inches on any occasion, and will seldom exceed six or at most eight inches of fast land, except in soils of uncommon depth and fertility, or for particular crops, such as carrots. For these, in such soils, a trench ploughing may be gi-

ven, by means of a second plough following in the same furrow, and throwing the second furrow-slice on the top of the first. In this case, the first plough may go eight inches deep, and the second four or five. Shallow ploughing, as four inches deep or less, ought always to be used when covering lime, which naturally tends to sink in the soil. When covering dung, a substantial furrow ought to be given.

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, the nature of the preceding and succeeding crops, and the quality and depth of the soil. The general rules regarding this subject are, to give the furrow for fallow or turnips as deep as possible, but after turnips are eaten on the ground, a very shallow furrow is to be preferred. After dung, the furrow must be sufficient to cover it. After lime, it cannot be too shallow.

The depth of ploughing, as already observed, must, in a great measure, be regulated by the soil to be worked. On thin soils, more especially on a rocky substratum, ploughing must necessarily be shallow; but where the soil is of a sufficient depth, it is material to give a substantial furrow 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 by some considered to be impracticable, in a dry season, to go to a sufficient depth afterwards, though it is desirable not to go deeper, than is required to clear the soil of every description of root weeds*.

In regard to the advantages of deep ploughing, (which is a most important branch of the Scotch system of husbandry),

* Others contend, that it is not impracticable, though certainly attended with difficulty and hard labour; yet some people plough shallow at first, and after cleaning the soil thus turned up of root weeds, go to the utmost depth they intend with the next furr, and clean the remainder.

they are thus detailed in a recent publication * ; 1. By bringing up new mould, deep ploughing is peculiarly favourable to the growth of 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 ; for 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 sun occasions ; 3. By deep ploughing also, the ground may be more effectually cleared of weeds of every description ; 4. By deep ploughing, animal and vegetable manures, which have such a tendency to rise to the surface, are properly covered, which is not the case with shallow ploughing, in consequence of which much of the value of such manures is lost ; and, 5. An intelligent farmer, after pointing out that deep ploughing increases the staple of the soil, keeps the roots of the grain from being injured by wetness, and likewise enables the crop longer to resist drought, adds,—“ *I have ever 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.

§ 3. *Of ridges and furrows.*—In ploughing a field, the furrow-slices are generally distributed into beds of various breadths, according to circumstances, which are called *ridges* or *lands*, and these are divided from each other by open gutters or *furrows*. These last both serve to guide the eye and

* Husbandry of Scotland, 2d edition, vol. ii. p. 219.

and of the sower, in distributing the seed regularly to the soil, and to direct the reapers in cutting down the crop. In soils of a strong or retentive nature, or which have wet or retentive subsoils, these furrows serve likewise as surface drains, or carrying off superfluous water, and are then named *water-furrows*. The ridges are various in their breadths, and are variously formed by different modes of ploughing, according to circumstances.

In Berwickshire, the ordinary breadth of ridges, more especially on all lands that require the assistance of water-furrows, is fifteen feet; while the farmers in East Lothian prefer eighteen feet ridges. On weak thin clays, having a retentive bottom, ridges of nine feet are preferred by some farmers, as better adapted for getting rid of superfluous moisture; while others maintain, that a judiciously formed eighteen feet ridge will drain off the water more effectually than the narrow *itches* of four feet, or four feet and a half, so customary in many parts of England.

On dry turnip soils, with a free bottom, it is usual to plough the land into ridges of double the before-mentioned breadths, either thirty or thirty-six feet, called *band-win* ridges, because reaped by a band of shearers served by one binder, as will be more particularly described in the twelfth section of this part. In finishing off this kind of soil, more especially before laying it down to grass, it is customary to cast up a narrow ridgelet, or single bout drill, between the broad ridges, which directs the eye and hand of the sower; and, when the field is harrowed to cover in the seed, all the ridgelets are obliterated, or nearly so, leaving no bare unproductive portions, and giving a more beautiful lawn-like appearance to the field, when afterwards under pasture. Where, however, this lawn-like entire obliteration of all ridges is wished for, the field may be ploughed entirely in one ridge or breadth, going constantly round the field, and slight traces may be drawn at proper intervals, to direct the sower, by the heel of

the plough. A turn-wrest plough, however, by laying the slices all one way, would certainly execute the work better, than ploughing round and round, which must make, at the best, but an awkward finish.

§ 4. *Of different kinds of ridges.*—In ploughing land, there are a variety of ways of forming the ridges or lands. 1. On dry soils, the plits of each ridge are sometimes all laid in one direction, while those of the next adjoining ridges are turned the contrary way. This is termed *casting*. 2. On what may be termed middle soils, the ridges are split out, in which way the crown of the old ridge becomes the furrow of the new one. This mode of ploughing is technically named *ridge and furrow*, or *crown and furr* in the agricultural language of Scotland. 3. It is indispensably necessary, on all strong soils, to form the ridges by twice gathering all the furrow-slices inwards in the direction of the crown; but in this case all the ridges are continually preserved in their original situation, and the inter-furrows in the same places. 4. When breaking up these twice gathered ridges, for being afterwards worked as summer fallow, it is customary to split or *cleave* them down, reversely to the former operation, by turning all the furrow-slices outwards, beginning at the furrows, and ending at the crowns: In this operation, the ridges are all reduced to half their original breadth; the old water-furrows are carefully opened up, to serve as surface-drains, and an additional intermediate series of water-furrows are formed at the cloven crowns. 5. In former days, land intended for barley next year, was often thrown up, after harvest, into a species of one-bout ridgelets or drills, leaving a slip of fast land unploughed in the heart of each, covered up by the two ploughed plits. This antiquated mode of half ploughing, was termed *ribbing*, or *rice-baulking*, and is now rarely met with in well-cultivated districts.

When working summer fallows, or reducing turnip-land to fine tilth, *cross* ploughing is indispensably necessary to pulverise the soil, both for the sake of effectual tillage; and for

enabling the industrious husbandman to remove the vivacious roots of weeds; but on this important subject, a more particular discussion will be called for in the second part of this chapter, which is appropriated to the subject of fallowing. In this operation, the lands or *feirings* are made of any convenient breadth, and the furrow-slices are turned either way, as best suits the convenience of the ploughman.

§ 5. *On ploughing steep land.*—In certain cases, the surface of arable land is sometimes too steep to admit of using the plough in any of the modes which have been enumerated. On these occasions, some husbandmen, from a desire to have their lands or ridges directly up and down the hill, draw all the furrow-slices down hill, and drag the plough up the hill empty; sometimes using a species of sledge for this latter purpose. But it is a much better plan to form the ridges in a diagonal, oblique, or slanting direction; by which, if conducted judiciously, the up-hill draught is rendered moderately easy to the horses; and in this way, likewise, the surface soil is not nearly so apt to be injured and run off, by the rapid descent of rain-water in the furrows, which will often burrow the soil and sand up the furrows at the bottom of the hill, when the ridges are formed directly up and down the hill. Cross-ploughing, in such situations, is readily accomplished by reversing the diagonal.

On extremely steep land, when it is considered advisable to cultivate such situations, it becomes necessary to plough directly across the hill, or nearly so, turning all the furrow-slices downwards: and, in doing this with the ordinary plough, it is necessary to carry the plough back again empty, in the open furrow. Where there is a considerable extent of such steep land to cultivate, it is better to have a plough made expressly for the purpose, having a mould-board that will shift to either side, called a *turn-wrest* plough, by which implement much time is saved, and a great waste of labour avoided.

plough, and sets up the second pole at twice its length from the slice; and proceeds in this manner to the extremity of the slice at the farthest pole, which he sets up again exactly as the rest; all the directing poles being now accurately set up in the line of the crown of the second ridge. To execute these operations correctly, it is however necessary to draw three cross furrows at right angles, otherwise there is a risk of the ridge getting narrower at one end than the other.

The ploughman now turns his plough short to the right *, and draws a second slice directly to meet or overlap the first, correcting by his eye and judgment any inequality or slight crookedness that may have been occasioned by the swerving of his horses in drawing the first slice. He then proceeds to the second line of poles, and repeats the series of operations already described, until the whole field is feired or marked off. The other ploughmen fall in successively, as the first has made room for them by feiring, and all the slices are turned inwards, or towards the crowns. When the first ploughman has finished feiring, he falls in along with the rest to the first unoccupied ridge.

Of late, another method, which seems to be very useful for less skilful ploughmen, has been adopted for this purpose. A stout lath or pole, exactly equal in length to the breadth of the intended ridge, is fixed to the plough, precisely at right angles to the line of draught, one end of which is placed across the stilts exactly opposite the coulter, while the other end projects towards the left hand of the ploughman, and is preserved in its place by a diagonal rope from the outer end of the lath to the collar of the near side horse. At the outer end of the lath, a coulter or harrow-tooth is fixed perpendicularly, which makes a trace or mark on the ground as the

* The method with other farmers is, to return in the same track, and to throw a furrow to the other side. The reason of this is, that there may be no firm land below. Then the two sides are thrown back, to form the crown of the ridge.

plough moves onward, exactly parallel to the line of draught. By this device, while the plough is *feiring* the crown of one ridge, the marker traces the line upon which the next ridge is to be feired.

Circumstances may render it proper or necessary to change the direction of the ridges in one part of the field, perhaps in several parts, to facilitate the discharge of surface water, by taking the advantage of natural hollows. In this case, the directing ploughman draws an oblique feiring, either perfectly straight or waving, according to circumstances, at the place where the alteration of direction is considered to be necessary. At this oblique feiring, all the ridges of the original direction terminate; and from it a new series commences; which is measured off and feired exactly in the manner already described, as if commencing a new field from that place. The new oblique feiring is either made the crown of a ridge or a water-furrow, according as the judgment of the husbandman directs. Those ridges which terminate obliquely upon the oblique feiring are called *butts*.

Where other circumstances admit of it, the best direction for the ridges is north and south, that the grain on both sides may enjoy equal advantage from the influence of the sun; but this must often be regulated by the slope of the field, or the direction of the fences. Any particular breadth of ridge that may be desired, is regulated by the length of the poles used in feiring, and requires no particular directions.

§ 7. *Of water-furrows.*—If there are any hollows, or wet places, from which the surface water cannot readily drain off by the ordinary water-furrows between the ridges, an oblique or a winding furrow, according to circumstances, is drawn across the finished ridges, in the most convenient direction for carrying off the water, which is called a *gaw-furrow* in the technical language of Scotch husbandry. Lastly, all the intersections of the furrows are carefully opened up into each

other, by the diligent use of the spade and shovel; and, if necessary, surface drains or cuts are opened across the head-ridge at the bottom of the field, in convenient places, to convey the water into the fence ditch, that none may stagnate in any part of the field. This implies the necessity of fence ditches being always kept scoured and open, for the ready conveyance of water from every part of the farm.

After a field is harrowed, by which process the inter-furrows, gaw-furrows, and cross drains must necessarily be more or less filled up and obstructed, every one of these must be carefully opened up again by the plough, followed by the diligent use of the spade and shovel. In fact, under no circumstance of husbandry, independent of improvements which do not fall under consideration in this chapter, is the difference between good and bad management more eminently conspicuous, than in the perfection with which arable land, of a strong retentive soil and subsoil, is surface-drained in the way pointed out. These attentions become peculiarly necessary on the commencement of a thaw, after a storm of snow; indeed gaw-furrows require to be continually looked after during the whole course of the year, as nothing is more injurious to land than the lodgment of water upon its surface.

§ 8. *Of crooked ridges.*—In all the best cultivated districts in Scotland, arable land is now formed into regular straight lined ridges of equal breadths, on the principles already indicated, with a very few exceptions to be noticed hereafter, and these are every year becoming less numerous. Formerly, the ridges were almost universally broad, high, crooked, and of unequal and irregular breadths, and frequently had strips of uncultivated land between them, named *baulks*, sometimes of considerable breadth, which were overgrown with brush-wood and weeds, and filled with every kind of rubbish gathered from the cultivated land. These last are now universally obliterated and reduced to cultivation on every well managed farm; and the few crooked ridges which

now remain, are only to be seen occasionally in heavy wet soils, with bad bottoms, or retentive silts. On thin, weak clays, there is no doubt some danger in raising these high crooked ridges to straight lands of equaling these high derate height; but on all fertile soils of this and moderate height; but on all fertile soils of this and moderate propriety of that great and obvious improvement, the to convenience, profit, and beauty, admits of no regard ever. Before attempting this operation, however, what ought to be carefully and effectually under-drained, and a complete efficient summer fallow, the soil ought to be thoroughly saturated with calcareous manure, that the tition which had been formerly buried, and is now brought to the surface, may be rendered equally fertile with the mured soil of the old surface*.

* It has often been a matter of speculation, to account for the original formation of the ancient crooked ridges, which are all invariably in the shape of a *U*, Italian *f*, but with the curvatures at both ends always reversed, as if that letter were written from the right hand to the left. The inquiry is merely a matter of curiosity, tending to no practical usefulness, but may perhaps be thus explained. The ancient plough, and the team by which it was drawn, were both of great length; the plough being drawn by three, or even four pairs of oxen; or even, as may still be seen in some parts of England, by six horses on end, in the *tandem* fashion; perhaps the whole extending to fifteen or even twenty yards in length. Had the main ridges in those days been drawn in straight lines, it would necessarily have required a head-ridge of enormous breadth on which the unwieldy implement and its numerous team could be turned. To obviate this inconvenience and difficulty, an oblique curvature or deflection became necessary at each end, to enable the team to draw the plough out upon a head-ridge of moderate dimensions. As the ridges were all gathered into high crowns, some of them to a prodigious height, the deflection to the left, and the subsequent turning to the right after the plough was drawn obliquely out upon the head-land, answered the purpose of the ploughman infinitely better than if the deflection had been to the right; because, when to the left, the ponderous plough was dragged round to the place at which it had again to enter by the team alone; whereas, had the deflection been to the right, the ploughman would have been reduced to the necessity of dragging back the weight of his plough, loaded with the harness, by main strength, to make it enter again at the proper place; which hardly any person could have been able to do with the large and heavy old Scotch plough.

§ 9. *Extent ploughed day.*—The quantity of land which can be ploughed in a day, by the modern swing plough, with one man and a pair of horses, must differ considerably, according to a variety of circumstances, such as the heaviness, tenacity, and the strength and pace of the horses. the furrow-slice or day's work, on heavy soils, technically A regular day usually consists of nine hours' actual work, called a *wo yokings*; that of the morning, when the divide-fresh, extends to five hours, and the evening yoking to four; but on light soils, when the days will admit, the days are worked ten hours, commonly from six to eight and from two to six. An English statute acre of ten chains, or 220 yards long, by one chain, or 22 yards broad. Supposing that acre to be ploughed in regular furrow-slices of nine inches each in breadth, it will require exactly 220 row-slices of 220 yards each, and the whole series of row-slices will extend to 19,360 yards in length. To each of these slices at least twelve yards may be added, for the ground rolled over by the plough in turning; so that the whole length of one acre may be estimated as extending to 20,416 yards, or eleven miles and nearly five furlongs.

In the strongest lands, and under the most unfavourable circumstances where ploughing is advisable, all extraordinary obstacles to tillage being supposed to have been previously removed, a pair of good and well-fed horses ought to plough three quarters of an acre, in one day of nine hours' continuance. In the subsequent ploughing of a summer fallow, at the full depth, one acre may be easily ploughed in a day. When the land is reduced to fine tilth, and when the plough is employed to give the seed furrow, by a shallow slice of four inches or a little more, an acre and a quarter may be accomplished. In the winter months, only a single journey or yoking of six hours is sometimes taken, in which time half an acre may be ploughed with tolerable ease. From these pre-

mises, one acre may be considered as a full average for a day's work throughout the year.

§ 10. *Expence of ploughing.*—In a succeeding part of this Report, (See Ch. XIV.) it will appear, that the actual expence of one efficient farm draught, or of a ploughman and a pair of good horses, properly fed, with all their concomitants, cannot cost the farmer less than from L.100 to L.130 *per annum*, or L.115 on the average. Deducting from the year 52 Sundays, and allowing other 13 days to be lost on various accounts, and supposing a draught to be used the whole year round in ploughing only, the expence of ploughing one acre of land, averaging the different states of the soil when ploughed, and the different objects in view, on the data already endeavoured to be established, cannot be estimated below eight shillings and sixpence, and in many cases the real expence is above that sum.

§ 11. *Comparison of Scotch and English ploughing.*—On a fair and impartial consideration of the circumstances above detailed, respecting the improved Scotch method of ploughing, and on comparing it with the four-horse, and still more with the six-horse plough teams, which are used in many parts of England, the result is so strikingly in favour of the Scotch draught, as forcibly to recommend the use of an implement so economical and efficient, where it has not hitherto been adopted. The expence of ploughing land with a four-horse team, having a ploughman and a driver, supposing wages and horse-keep the same in both countries, cannot be less than *seventeen* shillings, and with six horses not less than *twenty-four* shillings, which affords a striking proof of the expence at which corn crops are raised in England.

Impressed with a full sense of this enormous waste and expence of cultivation, many ingenious Englishmen have devoted their talents to the invention of double, and even treble ploughs: Most unmanageable implements, even inefficient in numberless situations, and exceedingly cumbrous in all. The

simplicity, economy, and perfect accuracy of the swing plough, with two horses and without a driver, needs only to be fully known, and impartially considered, to give it a decided preference. It would, however, be improper not to mention, that heavy ploughs and numerous teams were universally used in Scotland, within the memory of many people now living; and that the light swing plough was introduced from Rotherham in Yorkshire, though Small's improved plough, now so general in Scotland, seems to be rather an improvement on the old Scotch plough, than derived from the Rotherham. But the Scotch husbandmen, in all the improved and well-cultivated districts, have universally abandoned the ancient, cumbersome, and expensive draught; while, in many of the most fertile arable districts of England, with the exception of Norfolk, Suffolk, and Essex, in the south, and Yorkshire, Durham and Northumberland, in the north, it is obstinately adhered to.

SECT. II.

OF HARROWING.

HARROWING the land is executed in Scotland nearly in the same manner as ploughing. One man, or a boy, either leads, or drives with long whip-reins, two or three horses, each of which drags one ordinary harrow. The mode of driving with long whip-reins, deserves a decided preference; because, in leading young and restive horses, which are often employed in harrowing before they are broke to regular work, the person who *leads* is exposed to considerable danger. Besides which, the *driver* is always at hand, directly behind his harrows, to remove any obstruction that may occur, from the

accumulation of weeds or other extraneous substances among the tines, or by the harrows riding on each other. Three harrows to one driver is certainly the most convenient and economical method, as these entirely cover one ridge of eighteen feet broad at two times, without wasting any part of the labour.

There are a variety of harrows for different purposes. The heavy break-harrow, drawn by two horses, is used for reducing strong land, or soil which is much matted with the roots of couch grass. The ordinary harrows, each of which is drawn by one horse, serves for covering in the seed, and for most other farm purposes. Much lighter harrows are employed in covering grass seeds, among grain which has already sprung above ground. These different kinds of harrows, as commonly used in Scotland, are described in a preceding part of this Report.

The operation of harrowing is denominated single time, double time, and double-double according as the ground is gone over once, twice, or four times; and, as it is usual to overlap each of these successively in some degree at their edges, they are then called *close single*, *close double*, &c. respectively. Harrowing is likewise called end-long or across, according as the harrows move in the direction of the ridges, or transversely. Some farmers prefer finishing off a field by cross harrowing, especially in heavy land, under the idea of facilitating the descent of surface-water from the crowns of the ridges to the inter-furrows.

A pair of harrows, of the ordinary construction, completely covers six feet of ground, which is equal to eight furrow-slices of nine inches each. Consequently one man and a pair of horses, moving at the ordinary rate of the plough, as estimated in the former section, ought to single eight times as much land as they can plough in a day of nine hours. As harrowing is a much easier work, and the horses consequently step out better and more nimbly, one quarter may be added on that ac-

count, which would bring a day's work of single time harrowing to ten acres. Doubling will consequently extend to five acres; and what is termed a close double-double, or a full double end-long, and another across, will go over $2\frac{1}{2}$ acres in one day. Hence a single harrowing, on the data assumed in the former section, may cost $10\frac{1}{2}$ d.; a double 1s. $8\frac{1}{2}$ d. and a double-double, 3s. 4d. an acre.

SECT. III.

OF ROLLING.

THE operation of rolling is employed for various useful purposes in husbandry; as, for reducing turnip soil, or land intended for potatoes, or land under fallow, into fine tilth, and to admit the harrows to tear out the roots of couch grass and other vivacious weeds, such as knot-grass, docks, and the like; to break the surface clods on land sown with beans or barley, instead of the ancient and more expensive use of the clod-mell or beetle; for finishing off land which has been sown with mixed grass and clover seeds, to facilitate the future operation of the scythe, by making an even surface, bruising all clods, and pressing down small stones which it may not be thought necessary to carry off; to dress the surface of grass land, after mole hills have been spread; and for various other useful purposes, all of which will be noticed in the sequel. For these several purposes, some farmers have rollers of different weights, but those most generally useful are of moderate weight and dimensions, forming an easy draught for two horses, and constructed of two short cylinders of wood, stone, or cast-metal, by which great facility in turning is ensured.

This roller is drawn by two horses on end; and the operation is best executed across the direction of the ridges, because more adapted to ensure full benefit upon the furrows. The heavy roller, allowing for a slight overlap, and the time spent in turning, may roll about six acres *per* day, the expence of which will be nearly one shilling and ninepence *per* acre.

SECT. IV.

OF SCARIFYING.

THE scarificator or scuffler has hitherto been but little used, even in the best managed districts of Scotland, but it has been lately introduced, and even its form improved, in East Lothian, where it is known under the name of Grubber *. As it has a tendency materially to facilitate and economize several important operations in the cultivation of arable land, it is an implement which certainly merits to be more generally employed in Scotland. A scuffler fit to be worked by two horses embraces three feet at each stroke, and its work is consequently equal to four ordinary furrow-slices. It will therefore go over four acres in one day; and, upon lands that are already considerably advanced towards fine tilth, may even labour six acres. The expence, consequently, of scuffling or scarifying one acre of land may be estimated at from one shilling and sixpence to two shillings and threepence.

* A description of the Grubber is given in the Husbandry of Scotland, 2d edit. vol. ii, p. 163.

Having but little experience of this implement in Scotland, it would be improper to advance any decided opinion on this subject in the present work; but it is probable that one ploughing or even two, in working mellow turnip soil, or free fallow land, might be sufficiently well performed by its means, after the soil has become considerably advanced towards fine tilth, by a diligent use of the plough, harrow, and roller. The saving, therefore, in point of expence, would be very material; as much time, which is often of such infinite importance to the husbandman, would be gained. In an advanced stage of cultivation, 100 acres of land might be scuffled twice over for the expence of L. 15; which would probably be equal in efficacy to once and a half ploughing, which would cost with the Scotch draught from L. 36 to L. 40. The advantage is much more obvious, when compared with the cumbrous ploughs and numerous teams so common in some parts of England, where an equal extent of ploughing would cost from L. 72 to L. 100. This circumstance has probably contributed very materially to the invention and adoption of the scuffler or scarificator in England; and, though not so important, in comparison with the Scotch mode of ploughing, it is yet well worthy of being fairly tried. It may certainly be of use in preserving the sap or moisture in land intended for turnip, while it loosens the soil. It does not expose any new soil to the atmosphere, to promote a fresh vegetation of annual weeds.

SECT. V.**OF SOWING BROADCAST.**

OF this very general mode of putting in the seed, at least of the culmiferous crops, both in Scotland and England, hardly any thing requires to be said in this place. The measured step, regular handfuls, and artificial cast of the sower, can only be learned by inspection, imitation, and practice. A good and experienced sower regulates the prescribed quantity of seed to the acre with wonderful precision, and distributes the seed over the ground with the most exact equality; whereas, a careless or inexperienced person sows too much in one part of a field, and too little in another; and every step or throw that he makes at seed-time, can be distinctly traced at harvest, by the handfuls of seed not being sufficiently and equably scattered, and consequently leaving regular curves of thick growing stems, with alternate comparatively bare intervals, at every cast of the hand. This is not only an unseemly and wasteful practice, but is likewise injurious, in its consequences, occasioning always an unequal and imperfect crop. This egregious fault is peculiarly observable and injurious, in the subsequent vegetation of cultivated herbage, or mixed rye-grass and clovers, which require very small pinches of seed to each throw; and, when not equably distributed, by a judicious twirl of the hand in throwing them out, a third or even more of the land is often left unprovided with plants, while the *wales* or curves, produced by this bad sowing, are much overstocked with weakly plants, and the bare intervals are apt to grow up full of weeds. On ridges of 18 feet, where

rye-grass and clover are sown, three casts are necessary, The seed of the rye-grass, in particular, in very calm weather, does not spread abroad sufficiently, on account of its lightness, with two casts.

It is hardly necessary to observe, that all sowers in Scotland use a sheet suspended from the neck for carrying the seed; whereas, in some parts of England, a basket is employed for this purpose. Undoubtedly the sheet is more commodious and less cumbersome.

SECT. VI.

OF DRILLING.

As this subject will require to be resumed, when considering the several crops to which the drill husbandry is peculiarly applicable, it needs only to be treated of in a very general and summary manner in the present section. Drilling may be considered under two distinct views: 1. As applicable to what are usually called leguminous crops, for which it is admirably calculated, and therefore generally used for these in the best cultivated districts of Scotland; and, 2. As calculated for culmiferous crops, or what are commonly called white corn, as contradistinguished from pulse, which are named *black victual* in the language of Scotch husbandry.

The introduction of the drill husbandry into England has been justly ascribed to the ingenious Jethro Tull; who endeavoured to substitute a perpetual succession of drilled crops, in place of fallow and manure; the former of which he censured as a temporary and unnecessary abandonment of productive land, and the latter as a needless and heavy expence.

The consideration of fallow is appropriated to a separate division of this chapter, and does not therefore require to be discussed in this place. It is difficult, to a Scotch farmer at least, to discover the use which Mr Tull proposed to make of farm dung, which he considered as of no consequence in his system, as he no where explains that circumstance; perhaps he meant that it should be devoted to the meadows or hay land, which is its principal employment in many parts of England. It is somewhat singular that the drill system has been extensively adopted in some of the best managed districts of England in the cultivation of grain, especially of wheat, barley, and peas, while the broadcast method of sowing has been there persisted in for turnips, and even for beans; whereas the modern improved husbandry of Scotland has universally adopted drilling, with wide intervals, in the cultivation of turnips, and pretty generally for beans, and has almost as universally rejected the cultivation of white corn in rows or drills, even after a fair trial; except in some situations where the land is filled with seed weeds, in consequence of the extensive use of town manure.

§ 1. *Of drilled leguminous crops and roots.*—These, particularly turnips, ruta-baga, and beans, or mixed beans and peas, to which potatoes may be added, can only be cultivated with propriety by means of the drill husbandry, in order at the same time to ensure the best crops of each, which the land is capable of producing, and to do complete justice to the soil, by the extirpation of weeds. Farm land, having drilled crops of this description interposed at proper intervals, and efficiently managed, may be made, in some cases, to carry useful and profitable crops for a continuance, without the intervention of naked fallow. In other cases, by the same means, the recurrence of naked unproductive fallow, may be postponed or protracted to considerable intervals, with great propriety; much longer than could be done profitably without the adoption of this excellent system. Sandy, gravelly, or free soils,

having dry bottoms naturally, or provided with such by judicious and effective draining, or, to use a generic term, all *turnip soils*, are in the former predicament; and these, under a judicious application of the drill husbandry, more especially and essentially in regard to crops of turnips at proper intervals, can never require the intervention of a naked fallow. The successive process for preparing the soil, and cultivating the turnips in a proper manner, to be considered hereafter, are to such soils a most perfect and efficient fallow, and even a rich source of additional manure. All fertile clays and strong loams, which are adapted for the cultivation of pulse, that is, beans and peas, or both mixed, supposing them to have been effectually cleaned from vivacious root weeds in the first place, by means of a thoroughly wrought naked fallow, may legitimately allow the recurrence of that fundamental operation of all good husbandry on such lands, to be postponed for some time, with much propriety and considerable profit, by substituting a well cultivated crop of beans, or of mixed beans and peas, upon the drilled system.

§ 2. *Of drilled culmiferous crops.*—Wheat, rye, barley and oats, are differently circumstanced, in Scotland at least, in regard to drill husbandry, which, generally speaking, is not considered to be applicable to these grains. The climate is too variable and uncertain, especially at seed time, to admit of the minute nicety and slow progress which the drill husbandry necessarily requires, without considerable danger of losing the proper season for committing these crops to the ground. The soil is not generally well adapted for this nice operation, requiring to be very equably pulverised, and completely freed from the obstructions of clods or stones, to admit of the ready and accurate operation of the drilling implements. The roots of these grains, so long as any portion of the soil remains unoccupied, are also apt to continue planting out or tillering by means of suckers, by which the advance of the crop towards maturity, and consequently the season of ripening and of har-

vest, is dangerously postponed. || Drilled grain crops, from wanting an equable and general support among their own stems, owing to the distance between the rows, are likewise more liable than those sown broadcast, to suffer injury from heavy rains and strong blasts of wind, by which their stems are apt to be broken down irregularly, and interlaced among each other, which is technically denominated *knee-shackled*. Owing to the same circumstances, they are more liable to be root-fallen or wind-waved; their coronal roots becoming disengaged from the soil by a circular motion or waving, from the irregular and changing impulse of the wind, a circumstance which seldom or never happens to a regular close crop.

Upon the whole it is the general opinion of judicious and experienced Scotch husbandmen, after considerable experience in drilling, that more abundant crops of wheat, rye, barley, and oats may be raised in the ordinary broadcast manner of sowing, than by the drill machine: In regard to autumn or winter sown wheat, the doctrine is almost universally admitted*. It is contended, however, by other intelligent farmers, that spring sown crops, whether wheat, barley, or oats, are more likely to be productive on light soils, where annual weeds abound, when cultivated in drills, than when sown broadcast. It is questionable indeed, whether lands, which, from a long continuance of slovenly management, have become overrun with annual weeds, can be otherwise cleared of them, or the soil restored to its full productive powers, before these annual weeds are extirpated. By the adoption of the drill husbandry, the operation of hand weeding can be applied to such lands much easier, and that process may be greatly assisted by the more economical process of hand-hoeing, and even by means of the horse-hoe. Within these li-

* Some, however, do contend, that wheat drilled in autumn or winter will succeed as well as in spring. The greatest difficulty is in drying the pickled seed to run through the machine. It can certainly be laid at a more equal depth in the drilled than broadcast husbandry; and with a reasonable number of proper machines, seed may be as fast put in by the drill as by the hand.

mits, the practice of the drill husbandry is very generally confined in the best cultivated districts of Scotland, even among its most experienced and judicious husbandmen. Time and labour at all times, and especially during the seed process, are very important considerations to farmers, independent of expence. Their establishment of men and horses, the heaviest of the charges of this business, are economically proportioned to the work of the whole circle of the year; and, independent of all other considerations, that establishment is incompetent to accomplish the seed process by the drill system, in considerably more than double the time required for broadcast sowing.

§ 3. *Of dibbling*—This operation is so nearly allied to drilling, and is besides so little known in the practice of Scotch husbandry, that it is here placed as a subordinate division of that subject. The observations which have been made respecting drilling, will apply with increased force respecting dibbling, as a process greatly slower and consequently attended with more expence, and greater risk of losing the favourable season. The only argument of much weight that seems urgible in favour of dibbling, is that it may save a considerable portion of the seed. This may be a very material object on the introduction of new selected varieties of grain, but is of small importance when applied to the kinds of grain usually cultivated*.

* Wheat was dibbled to a small extent, many years ago, on one or two farms on Teviotside, particularly by Mr James Church of Mosstower, in the parish of Eckford. But it has never been a general practice, and, for the reasons assigned in the text, is not likely ever to become so.

SECT. VII.**OF PUTTING IN CROPS WITHOUT PLOUGHING.**

OF this practice no instance occurs in Scotch husbandry, unless sowing oats in spring, upon land which had been ploughed after harvest, or during winter, without a second ploughing, merits that denomination. If so, that practice is by no means unusual in Scotland; as oats are universally sown, when after grass or hay, on land which has been only once ploughed. But generally speaking, the sooner that seed is sown, after the land has been ploughed, so much the better both for that crop, and for the after condition of the land. When the land has been ploughed long before sowing, the vivacious roots of weeds, such as couch grass and docks, are encouraged to vegetate and get possession of the soil, before the seed can make its way, to the manifest detriment of the crop. The early ploughings, therefore, are generally given to those parts of the farm that are to be fallowed, or sown with turnips or pulse, or set with potatoes, after additional cultivation; and the ley, or grass land intended for oats, is reserved for the last of the early spring work. When the turf is old and tough, it is of consequence to plough it about the commencement of winter, or as soon as possible after the land for fallow or green crops, that the frost may diminish its tenacity, and give more mould for covering the seed in spring. The success of this practice may be promoted by the use of the scarificator, an implement which has only of late been introduced into Scotland; though now strongly recommended by that respectable body of intelligent practical farmers, "The Dalkeith Farming Society." It may be questioned, however, whether the scarificator would not reverse a good deal of the ley-turf to the injury of the oat crop.

SECT. VIII.

OF CHANGING SEED.

FROM experience, every attentive husbandman is convinced that it is of the most essential importance, frequently to change the seed of such grains as are cultivated on arable land. The various kinds of grain, even selected varieties, altered or improved by means of judicious culture, are all liable either to revert to the wild species or varieties, or to degenerate partially into other varieties, becoming what is termed *blandered* or *blended*, unless they are carefully kept up to their proper standard, by means similar to those by which they had been originally procured. All our cereal gramina, or culmiferous grains, were originally natural grasses, selected in ancient times by ingenious benefactors of mankind, and have been improved by cultivation and farther selection to their present standards of perfection. There can be no doubt that all of these, if negligently cultivated, would again degenerate, or return to their originally wild state. Thus, when the seeds of the best varieties of cultivated turnips happen to fall on an uncultivated corner of a field, they only produce leaves and flowering stems, without swelling into fleshy bulbs, their only valuable part in regard to husbandry. Oats, likewise, under slovenly management, and when frequently sown on the same land, gradually acquire long tails or awns, thick husks, and degenerate so much as to resemble wild oats.

The attention of husbandmen to the preservation of selected varieties of established character, is principally confined to the simple expedient of procuring changes of seed, of the best quality, from different soils and distant farms or dis-

tricts, and is chiefly attended to in regard to wheat and oats, and in a less degree to barley, pulse, turnips, ruta-baga, and potatoes. The seeds of the different clovers are seldom raised in Scotland, where the climate is not sufficiently genial for bringing them to maturity: but, as their seeds are imported every year for the use of Scotch husbandry, from England, Holland, or France, and may be procured from America, every year there is an effectual change, so far as they are concerned.

The production of seed of superior quality, by means of careful and judicious attention, is sometimes carried on as a peculiar and almost exclusive employment, especially on small farms; and those husbandmen who devote themselves in a particular manner to this object, can always command a much higher price than others for the grain produced upon their farms, by selling the whole of it for seed among their neighbours. Having once acquired a select unmixed variety of a particular grain, they carefully cull or hand-pick a small quantity of the crop every year, giving the most minute attention to remove every particle of admixture, that has the smallest tendency towards blending or deterioration. In potatoe oats, for instance, they pick out and reject every grain that is not plump and short, or that has the smallest appearance of a tail or awn. This culled or selected quantity is sown by itself, at some distance from any other crop of the same species of grain. Its produce is carefully preserved separate from the rest of the crop, and is sown next year upon a larger breadth of the seed-farm; and the produce of this is sold as picked or selected seed. The precaution of sowing at a distance from any other crop of the same species, is to avoid the danger of any *hybrid* or mongrel production, through impregnation from the polen, or fecundating dust of any other species or variety. This precaution is most essentially necessary in cultivating ruta-baga for seed, as that plant is peculiarly liable to injury, by growing in the neighbourhood of any other of the same order, that happens to be in flower at the same time.

For the introduction of new and improved varieties of selected seed, a more minute attention is necessary, especially at the beginning. Supposing, for instance, that a judicious husbandman wishes to acquire a variety of any particular grain that shall ripen earlier than usual. Having first, in the ordinary manner, procured some seed as nearly of that quality as he can, he watches his crop before harvest, and culls out a number of the earliest ripened heads. He sows or dibbles the grain from these ears next season, and carefully preserves their produce, rejecting all the ears that happen to be somewhat more backward in ripening than the rest. By persevering in this system for a few years, he may multiply this new selection so as to procure a full stock, both to supply himself and to sell to his neighbours; and he continues to keep up this selected variety, free from blending, by the precautions already detailed. It is obvious, that any other quality or combination of qualities, that may be considered as important, may be selected and multiplied by a similar consecutive attention.

In a manner somewhat similar to that just mentioned, were the two famous varieties of oats, called Church's oats, and Potatoe oats, first procured and multiplied. And a selected variety of wheat, now in high estimation in the south-east of Scotland, under the name of *Thin-chaffed* or Hunter's wheat, is said to have originated from a few ears accidentally observed by Mr Hunter of Tynfield, while riding past a farm at a considerable distance from home. From an experiment made by the celebrated Lord Kames, it would appear that the produce of changed seed exceeds that of old seed at the rate nearly of L. 26 *per cent* *.

* Gentleman Farmer, p. 327 to 336.

It is certainly advisable to change seed wheat or any other grain for seed, *provided better be obtained by the change*; but of this the farmer ought to be well assured, *from his own experience*, before he changes seed that has given him fair and reasonable satisfaction. It is not the fineness of the grain that can justify adopting it to any considerable extent as seed, till by observing it under cul-

SECT. IX.

OF HORSE-HOEING.

THE utility of this operation in the cultivation of all drilled crops, more especially of turnips, ruta-baga, potatoes, and beans, for destroying annual weeds in the intervals between the rows or drills, is too obvious to require any formal illustration; more especially as this process will require to be particularly noticed, when giving a detailed account of the several crops to which horse-hoeing is chiefly applicable. It may be sufficient to mention in this place, that the horse-hoe cuts over all the weeds which grow in the intervals of drilled crops a little below the surface, leaving only those that grow among the crop in the rows, and a little way on each side, to be afterwards extirpated by the hand-hoers and weeders. The horse-hoe, therefore, produces a considerable saving to the husbandman, both in point of time and in expence of hand labour. An acre of drilled turnips may be horse-hoed for two shillings or less, and afterwards hand-hoed for three or four shillings; whereas an acre, not previously horse-hoed, could hardly be effectually hand-hoed for less than eight or ten shillings.

ture, the farmer is satisfied of its possessing qualities suitable to his soil, situation and climate. Mr Hunter has cultivated his wheat for thirty years on one farm, and nobody will say it has degenerated. Experience, therefore, could alone justify him in making a change to any extent. Could the farmers of Scotland be assured of obtaining the particular species or variety of wheat they would wish to cultivate, they would find their account in ordering seed annually from Kent or Essex; as the produce from the wheat of the South, when of a right sort, and unmixed, is admitted to be greater and finer than from the same sort raised in Scotland, all other circumstances being equal.

Horse-hoeing, it is believed, has not been hitherto brought into use in Scotland, in the management of those few crops of drilled white corn that have been cultivated; the intervals being too narrow to admit of this operation with safety, yet the saving in the expence of weeding, from five to six shillings *per* acre, according to the above statement, would be material.

SECT. X.

OF HAND-HOEING.

THIS farming operation, in its general circumstances, is so entirely familiar to every person who has observed the ordinary culture of a garden, that it requires little illustration. It is intended for extirpating all weeds that grow among or near the rows of a drilled crop, and which the horse-hoe cannot safely reach. In this view, it is principally confined in Scotland to the cleaning of turnips, ruta-baga, potatoes, and beans; and is applied for singling out, at proper and equal distances, the plants of turnips and ruta-baga which are intended to remain for a crop, as these are always sown in close continuous rows vastly too thick to remain. Hand-hoeing is likewise employed for cleaning the intervals between the rows of drilled white corn, where such happens to be cultivated.

In Scotland, hand-hoeing is universally performed by women, and young people of either sex, but mostly by girls. These work in gangs, proportional to the extent of drilled crops upon the farm, under the superintendence of a steady overseer, who directs and assists learners, and controls the whole that their work may be effectually performed, and their time properly occupied.

The expence of this operation must vary, according to circumstances in the soil and crop, and to the exuberance of weeds. A first hand-hoeing to a crop of turnips, ruta-baga, or beans, may cost from two shillings and sixpence to five shillings an acre. Going over them a second time, may be done from a shilling to half-a-crown; and if necessary to run them over a third time, one shilling an acre may suffice. In beans, as the hoe cannot be admitted among the rows, the hand must be applied to draw out the weeds which are there situated.

SECT. XI.

OF WEEDING.

As it is intended to discuss this subject in a separate division of this Report, it is not deemed necessary to enlarge upon it here; yet as an indispensable concomitant of all good husbandry, some notices may be proper in this place.—Strict impartiality requires it to be stated in the outset, that this important process is too much neglected in Scotland, even in those districts which are in other respects exceedingly well cultivated. Extensive tracts of excellent arable land, capable of bearing heavy crops of grain and cultivated herbage, are to be seen in many places disgracefully overwhelmed by vast quantities of weeds, especially by varieties of radish, rape and mustard, besides other more humble plants, as chick-weed, yarrow, fat-hen, bind-weed, together with different kinds of thistles and other plants; by all which the grain crops are deprived of a large proportion of the moisture and nourishment they would otherwise derive from the soil, to the manifest and large diminution of useful produce, both in regard to quantity and quality of grain and straw. Were hus-

bandmen fully aware of the great injury they sustain from a profusion of weeds, and the profitable advantages which must necessarily accrue to them by the extirpation of these robbers of the soil, both by the amelioration of the individual crop among which they grow, and by preventing them from maturing and shedding their seeds to injure future crops, they would surely see the propriety of exerting their own superintending industry, and of expending a moderate sum, to cure the evil. It is not the operation of the best worked fallow or fallow-crop, once in a rotation of four or six years, that will free land filled with annual weeds, from the destructive ravages of these enemies; as the seeds when allowed to ripen and scatter themselves over the surface of arable land, are known to remain for many years torpid within the soil, till circumstances favourable to their growth call them into action. On this subject, there is an old rural proverb which ought to be held in remembrance by every husbandman:—*One year's seeding causes seven years' weeding.*

In land that is much infested with annual weeds, an industrious application of hand-weeding, combined with well wrought fallows, or fallow-crops, according to the nature of the soil, will do a great deal towards a cure in the first course of rotation, and render the cleaning process comparatively an easy task afterwards*. Among broadcast crops of grain, the expence of pulling up weeds by hand will vary according to circumstances, from perhaps ten shillings an acre down to half-a-crown, or even less. In the experience of the Reporter, a field that was well stocked with annual weeds cost six shillings an acre for their removal by hand five years ago; and it has not required any further weeding, though twice under grain crops, since that time. No husbandman would dream of permitting the live-stock of his neighbours to feed per-

* The most effectual mode of extirpating, or at least of repressing the growth of annual weeds, is by eating turnips on the ground by sheep, when the soil will admit of it. The subsequent grain crop is almost always free from annual weeds.

petually on his pastures, as the diminution of food to his own stock by that circumstance would be perfectly obvious. A little serious consideration might surely convince any one, that the mischievous effects of a multitude of weeds, among crops of any kind, are perfectly analogous. A given extent of land is only able to bring a certain limited quantity of vegetable growth to maturity, proportioned to its staple or natural fertility, and to the manure which it contains. If any proportion of the vegetative nourishment possessed by the soil, is usurped and appropriated to the growth of weeds, say a fourth, sixth or tenth part, a corresponding proportion of the intended crop must be deprived of its nourishment, and to that extent must the disposable or profitable produce be deteriorated or diminished. If two bushels only of additional produce are procured from the acre, in consequence of industrious weeding, the expence will be amply repaid with a handsome profit; how much more so, if one or two quarters of additional produce *per* acre are secured by means of weeding. One great benefit of weeding, the prevention of farther dissemination, may be insured by extirpating the weeds at any time before they have perfected their seeds; but to prevent the existing crop from being injured, they ought to be drawn at an early period of the season*.

Even in the best cultivated districts of Scotland, little more is ever done in the way of weeding the grain crops, than merely cutting thistles over close to the ground, by means of a very simple implement called a weed-hook; and even this

* In many instances, the hand-weeding of barley, and spring-sown wheat, cost 25 s. and even 30 s. *per* Scotch acre twenty-five years ago, and was more than twice paid by the extra produce of that crop, besides preventing the immense semination that would have taken place, had the weeds been allowed to perfect and shed their seed. The weeders begin whenever the annual weeds will bear pulling, and sit during the operation,—in the same way as if weeding onions, carrots or flax.

is performed in a rather careless and superficial manner, perhaps at the expence of a shilling or less *per* acre. In the south-western counties, instead of the weed-hook, the weeders are provided with a more effective implement, a pair of forceps or nippers with two long handles, by which the thistles are pulled up by the roots. There was a time, within the memory of old people, before the introduction of cultivated clover, when these thistles, even in the south-eastern district of Scotland, were carefully collected as the main support of the work horses during the summer months.

Where docks are very numerous, either among grain crops, or in cultivated herbage, they are, or ought to be, pulled up by the hand, after heavy rains, when the soil is soft enough to allow their long tap-roots to be drawn out without breaking, and before the seeds approach towards ripeness.

On lands which have been improved from furze, or whins, and broom, the seeds of these shrubs will lurk for many years under the surface uncorrupted, and will vegetate in great numbers after the land is again laid down to grass. In this case, a very moderate attention to have the seedling plants pulled up in the first and second year of the ley, will secure the land from again running wild, although kept in grass for a good many years. This operation, however, must always be performed when the soil is saturated with moisture, as the roots can only then be pulled up without breaking. In every subsequent rotation, at least for a good many years, the same attention must be used to eradicate the successive crops, which will arise from the dormant seeds remaining in the ground.

The extirpation of briars and brambles from arable land is attended with a little more trouble, as their vivacious roots are placed below the operation of the plough, and cannot be pulled up. To get rid of them, it is necessary to dig them out with great care.

SECT. XII.

OF REAPING AND HARVESTING.

IN the ordinary practice of the best managed districts of Scotland, all crops of grain and pulse are cut down by the common saw-edged sickle or reaping hook; though of late a smooth or sharp sickle has been introduced in some places. For the purpose of accurate superintendance, the whole reapers employed on a farm are marshalled into bands of six or seven reapers in each, having a binder to each band, and this company is called a *bandwin*, because they collect all they reap into the hands of one binder. When the ridges are less than 18 feet in breadth, three of the reapers are usually placed upon each ridge or land, the middle reaper making the bands or ropes with which the sheaves are bound up. These bands are formed of two small *rips* or handfuls of straw, twisted together or tied at the ear-ends, and are laid down on the bare stubble in the middle of the ridge. Upon them, the three reapers belonging to that ridge lay their handfuls or *cats*, and when filled, the binder ties up the sheaves carefully. He afterwards collects the sheaves of both ridges under his charge on the crown of one ridge, and sets them up into *stooks* or *slocks*. But when four reapers are placed on one ridge, as is usually the case when the ridge is eighteen feet broad, the approved method is to lay down two bands upon each ridge, in which way two binders manage twelve reapers placed upon three ridges, stooking the corn all in one row upon the middle ridge, by which practice the labour of carrying home is greatly facilitated. With strong crops, however, it is often found necessary to allow each binder to stook by himself, in which case he carries it to his *whole* ridge, or the ridge on

which four of *his* reapers are placed. The bands for wheat and rye are often made of single lengths of the straw, by which, of course, the sheaves are much smaller, and consequently become much sooner ready for being carried home to the rick-yard.

In harvesting oats and barley, each stook is formed of two rows of five sheaves each, their butts on the ground at a short distance, and their tops resting obliquely upon and mutually supporting each other. Two other sheaves are laid on the top, their butts meeting and somewhat elevated, while the ear ends are partly divided and spread over the heads of the standing sheaves, and hang obliquely downwards; and, on placing these head-sheaves, the two ends of the stook above are gently pressed towards the middle. This simple, but ingenious construction, enables the stook to stand firm against a considerable strength of wind, and to throw off even heavy rains; but a stook which has once been overturned by the wind, never stands so well afterwards, as the straw is partly bent and broken, and never can regain its original stiffness.

The plan which has been described, seems to be the best which can be adopted in general, for the purpose of *winning*, drying, or harvesting the corn and straw in good weather; and if wetted by rain, stooks will dry much faster than any conical heaps into which the sheaves could be formed. The stooks are usually set up, as far as the binder can judge, due north and south, that each side may enjoy equal benefit from the sun; or sometimes in the direction of S. S. W. and N. N. E. As the straw of wheat and rye is considerably longer than that of barley and oats, the stooks of these grains are composed of two upright rows of *six* sheaves each, with two head-sheaves. Consequently, a stook of oats and barley consists of twelve sheaves, and a stook of wheat or rye contains fourteen. In farming language two stooks are termed a *threave*; and in forming an estimate of their crops, farmers count the threaves upon an acre, and judge of the produce

in that way, sometimes threshing a few threaves of the various crops as proofs or trials.

Frequently half-stooks only are set up, especially when the crop is light or thin on the ground, by which the binder is saved a good deal of trouble, as he has not to travel so far for sheaves to make up the half-stooks. These, in oats or barley, contain two upright rows of three sheaves each, and one head-sheaf; while in wheat and rye, they consist of two upright rows of four sheaves in each, and a head-sheaf. Sometimes the head-sheaves are omitted, either in the whole or half-stooks, which answers well in steady good weather, when alone it is advisable, as it considerably forwards the drying or winning process.

In late harvests, or when it may be necessary to cut down the corn in damp raw weather, or even during rain, and in the mornings before the dew or hoar-frost is dried up, it is customary to set up the sheaves singly on their butts, which are spread out circularly to give them a firm standing. In this case, the bands are slightly tied near the ear-ends of the straw; and sheaves treated in this manner are called *yets*, *gettings* or *gaits*. Immediately before being carted to the rick-yard, these *gaits* must all be bound over again, in the ordinary way of sheaves, nearer their butt ends, and firmly tied. Wheat and rye are seldom, perhaps never, set up in the *gaiting* way, because they are seldom cut down when the weather is wet.

When it is necessary to cut grain in a green, or damp state, it is sometimes allowed to lie on the ground till it has become dry, before being tied; but it ought to be tied up if possible before the damps of the evening come on, for it is dangerous to allow it to remain long in what is called the *broad-band* state. If much clover be in the butts of the sheaves, these ought to be laid down, and exposed to the sun and air in dry weather, but not opened out. Or, when wet weather occurs after corn has been put up into stooks, so that the sheaves are soaked, they have all to be untied in the first good weather, and spread out to dry. It even happens that this broad-banded

grain has to be repeatedly handled, after heavy rains, to raise it from the ground, or to turn it over for the benefit of the air. When thoroughly dried, it has to be again bound up and stooked, or immediately carried home to the stack-yard. No circumstance can well prove a greater trial of the temper, patience, and judgment of a husbandman, than the management of a crop of grain during the bad weather which so frequently happens in Scotland during the harvest season. The circumstances however are so numerous and complicated, that no distinct directions can possibly be given for meeting them in the most advantageous manner. Every person must judge for himself under the difficulties of the moment, and store up his dear-bought experience for future and similar emergencies.

Oats and barley are sometimes cut by the scythe; but, so far as known, always *from* the standing corn, that is, beginning at that part of the field from which the corn leans. The scythe in mowing corn is often naked, though sometimes furnished with a bow, which probably assists to lay the heads more evenly in one direction. The use of the scythe can only be admissible when the corn stands upright, or with a regular inclination or slope all one way, or nearly so; as the scythe can neither act with efficacy, nor even with safety, when the crop is much lodged, or when it has been irregularly broken down or interwoven by squalls of wind or heavy rains. When mown, it is sometimes left in the swathe till nearly or altogether ready for being carried to the rick-yard. It is then taken up, bound into sheaves, and carted home with all expedition. But this is considered to be a dangerous as well as a slovenly practice, and every active farmer makes it a rule, to gather, bind, and stook it, if dry, as fast as possible.

Hitherto no Scotch husbandman has ventured to lead home any of his grain crops in a loose state, as is done freely in some parts of England; at least if some individuals have done this, it has never been adopted in the practice of the well cul-

tivated districts. Independently of the slovenly appearance of this procedure, and the considerable waste which must necessarily attend the several removals of the loose grain, both in the field and in the ricks, there is reason to believe, that a farther material loss by foul threshing, must be the consequence of this system. The practice may perhaps answer, where it originated, in cases where the crop is removed immediately from the field into large barns, into which the loaded waggons are admitted, and where consequently the grain shaken out is preserved; but in building loose oats, into large stacks in the yard, the loss would be very great.

After mown grain has been carried from the fields, the stubbles are always carefully raked. From experience, it has been found that the ordinary hand rakes, used in hay making, are very incompetent implements for this operation. Their use is expensive; as, in harvest, when wages are excessively high, and the working people maintained by their employers, it will not cost less than seven shillings to rake one acre by hand; besides which, the reiterated short strokes of the rakes, and the frequent tossings which are given to the rakings, beat out and lose a considerable quantity of the best grain, perhaps in a good crop equal to twice the value of the wages, or one pound in all as the expence and waste of hand raking an acre. By means of the *horse rake*, a valuable implement recently introduced from England, twelve or thirteen acres may be effectually raked in a day, by a man and horse, and at an expence not exceeding eight shillings, or about sixpence *per* acre, and the grain is very little shaken out during this steady and efficient operation. In fact, the horse rake is indispensably necessary on a large farm, if the mowing of grain is to be practised. For gathering mown corn into sheaves, some farmers have recently adopted a peculiar kind of rake made on purpose, having a few long wooden teeth and short handles, which they find to expedite the business considerably, and to save fatigue to the workers, by preventing the necessity of perpetual stooping; but it is a much better plan, to employ

gatherers, binders, and rakers to follow the mowers, and not to suffer any corn to lie loose upon the ground.

It may be proper to institute a comparison of the expence between reaping in the ordinary manner, and cutting by the scythe. A fair average crop of oats or barley will require a band-win of six reapers and one binder, to cut down, bind, and stook from one and a half to two acres in one day, if the cutting process is duly performed. At the ordinary rate of harvest wages in Berwickshire for some years past, two shillings and eightpence for men, and half-a-crown for women, and one shilling each for victuals, the expence of cutting and stooking will amount to sixteen shillings and eightpence *per* acre*. A good mower will cut down an acre a day; which, including victuals, will cost five shillings. Two expert women may take up and bind his day's work, which will cost seven shillings, and the horse rake will cost sixpence more, in all twelve shillings and sixpence, which is only four shillings and twopence less than the charges of reaping *per* acre. But the scythe gives at least two additional inches of straw above ordinary cutting by the sickle; by which not less than one cart load or ton of additional manure will be produced in the fold yard, from each acre of corn land that has been mown, worth at least seven shillings of immediate value to the husbandman; and this may be fairly reckoned upon as profit upon mowing grain, when properly conducted, in comparison with reaping. It is perfectly practicable, however, to cut nearly as low with the sickle as with the scythe, though certainly at a greater expence than what is above estimated.

It is worthy of notice, while engaged on the subject of reaping, that it has been fully ascertained, by comparative experiments carefully conducted in East Lothian, that there is much economy and profit in cutting wheat and all other

* In some districts the expence is less. Oats and barley may be reaped, in common cases, at from 10s. 6 d. to 12s. *per* English acre; but when lodged, or when the crop is wheat, it will require from 1s. to 1s. 6 d. more.

grains as low as possible. By this means, a great deal more straw is acquired, to serve both for fodder and litter, consequently an enlarged quantity of muck is procured, which is the source of future fertility; and a considerable quantity of additional grain is gathered into the barns, at least equal in value to the additional expence of low reaping, and giving the increased quantity of muck as clear profit.

It requires some experience and considerable attention to be able to ascertain when the reaped corn is properly *win*, or ready to be led home to the stack-yard in safety. Some persons judge of this circumstance by thrusting the hand into the centre of the sheaves; when, if the hand feels colder than before, they consider the straw as not sufficiently dried. Others judge by the lightness or heaviness of the sheaves, those that feel light being sufficiently dry in their opinion. Both of these criterions are liable to fallacy. The state of the hand before it is thrust in, is apt to give opposite results, according as it may have previously been warm or cold; and the weight of a sheaf may depend on its size as much as on its dryness or moisture. Perhaps the best means of judging is, to take out a small handful from the centre of the middle sheaf on the lee side of the stook, and to repeat this from a number of stooks in different parts of the field: if the knots or joints of the straw in all these are dry, brownish and shrivelled, the crop may be led home in safety; but if these remain succulent, the stacks may certainly be expected to heat, and the quality of the grain will consequently be materially injured.

The wages of reapers in Scotland are various in its different districts, according to the circumstances of population and demand. In Berwickshire, these have been already mentioned as two shillings and eightpence a day for the men, and half a crown for women, besides victuals. This applies to fixed reapers hired for the whole harvest; but before harvest becomes general, or after its principal hurry is over, reapers may always be had on lower terms. In some districts, however, where travelling reapers can be hired as wanted, the

wages vary from week to week ; changing in the course of harvest from ninepence or a shilling, up to three shillings, or perhaps higher for one or two weeks. Most farms have some reapers who live within their bounds, as every cottager is obliged to produce one ; but these are by no means sufficient, and the necessary number must be engaged at the markets. Where there are considerable villages near, these generally supply the surrounding farms ; but where farms are at a distance from such villages, the husbandman must have recourse to hiring markets for a supply. In some districts, particularly in East Lothian and Berwickshire, there are weekly hiring markets during harvest, while in others these are held only once in the season. Various other circumstances respecting reapers will occur in discussing the subject of their food or victuals, and their hours of work.

It might be tedious to trace the various modes of feeding reapers in harvest through different districts in Scotland, and it appears quite sufficient to mention the usual plan in Berwickshire. The reapers who live upon the farm, and those hired from the near neighbourhood, who all go to their homes every night, are supplied with two meals every full reaping day. They enter to their work at sun-rise, and get for breakfast as much *porridge*, or oatmeal boiled in water to the consistence of a firm pudding, as they can eat, averaged at a Scotch pint, or nearly two English quarts. Along with this, they have a quart of sweet skimmed milk to each person. After an hour's rest at breakfast, they resume work at ten o'clock, and at half past eleven are allowed a rest of half an hour. At one they have for dinner a loaf of good wheaten bread, from a pound to eighteen ounces in weight, and a quart of table beer for drink. Having rested an hour for dinner, they begin work again at two, have half an hour's rest at four, and they give over work at sun-set. They receive no supper at the time, but after harvest is over, they usually receive an allowance of half a *forpit* of barley, about one twenty-fourth part of a Winchester bushel, for each day's work

throughout the harvest, in name of supper barley. Reckoning the harvest at twenty-eight days, and the value of the bushel at four shillings and eightpence, this supper barley will amount to a bushel and a half, worth 7 s. for the whole harvest, or 3 d. for each supper, which used to be computed at 2 d. a few years ago*. Breakfast cannot well cost less money; and the dinner articles already mentioned have of late years cost sixpence, or even higher. The whole victuals *per* day, therefore, may be averaged at one shilling, and the total at twenty-eight shillings for an ordinary harvest. The money wages of a man for the twenty-eight days will amount to L. 3 : 14 : 8, and of a woman to L. 3, 10 s.

Reapers who come from a distance must be supplied with all their victuals, whether working or not, even upon Sundays, and must have the means of sleeping provided for them; but they are paid only for the days or fractions of days on which they actually work. Besides the breakfast and dinner already mentioned, these have porridge and milk for supper, similar to the breakfast allowance, or potatoes and milk. For sleeping, each person is furnished with a clean blanket, and abundance of dry straw, in a barn or hay loft. Some of the reapers engaged from distant parts, are hired at a fixed sum of money, instead of daily wages, for the whole harvest, be it long or short.

These minute circumstances respecting harvest management in Scotland, have been the more particularly noticed, because seldom touched upon in books of husbandry, and because they differ essentially from the plan so common during harvest time, in some parts of England, where the style of

* In many cases these reapers are also allowed barley for Sunday's victuals. The measure is more commonly regulated by the firlo than the bushel. In Roxburghshire they have $1\frac{1}{2}$ firlo for suppers and Sundays. Instead of one shilling a-day, the cost has been of late fully one shilling and sixpence. It is seldom in that county that the harvest for reaping, (shearing), lasts 28 days, commonly 24 days, and even less.

living is of a very different description. Except the single quart of moderate table beer, worth about twopence, allowed for dinner in harvest, the generality of husbandry labourers of Scotland have no other allowance of drink throughout the year. The people employed in leading home the crop to the stack-yard, and the stackers, have an allowance, in addition to what the other harvest labourers receive, of half a dinner loaf, and a second quart of beer in the afternoon, as they always work, when corn is ready, as long as they can possibly see, even by moon light.

It was once almost universal to give the harvest people a supper and dance, with a tolerable allowance of drink, at the end of harvest, called the *kirn* or *quern*. This is now much fallen into neglect, and the people in lieu thereof generally get each a shilling, a dram, a dinner loaf, and a quarter of a pound of cheese. In other places the whole is commuted into money. These *kirns* or *querns* frequently terminated in drunken frolics, but were, on the whole, a cheerful rural festival, and under proper superintendance might still be kept up.

SECT. XIII.

OF STACKING.

WHEN the crop is ready to be carried, as described in the preceding section, it is led home to the stack-yard in open spar-built carts, constructed on purpose, and is almost universally built into round stacks or ricks. The operation of forking into the carts, for waggons are unknown in Scotch husbandry, and the manner of building the sheaves in the carts, and of securing them from falling off while conveying to the rick-yard, need not be described. But the manner of build-

ing the ricks being materially different from any thing observed in England south of the Humber, appears to require some elucidation.

In the rick-yard a *stell*, stool, or stack bottom was formerly made of loose dry straw, of the size intended for the rick; seldom less than ten feet diameter, though sometimes extending to fifteen or even twenty feet; and this stell is often bedded on brushwood; but now the plan of pillars, either of stone or cast iron, is greatly preferred. When beginning to form a stack, a sheaf is first placed upright on its butt end, as nearly as possible in the centre of the stell, around which other sheaves are placed circularly, likewise upright, but with a small inclination of their tops inwards. Circular ranges of these upright sheaves are continued till the whole stell is nearly occupied. The stacker then begins to place his outside gang or row of sheaves, bending them by means of his knees, so that their butts become somewhat horizontal from the band downwards, while their heads lean obliquely upwards and inwards against the outer range of the upright sheaves. He continues to lay on circular layers or gangs of sheaves, their butts all outwards, till he has raised the outside of the stack nearly to a level with the tops of the original upright sheaves, which are now all forced into great obliquity inwards, and into considerable consolidation. He then fills up the heart of the stack; in doing which he does not place the sheaves in any very exact order, yet all are so arranged as to fill up the whole equably, the centre or heart being always highest, and the corn ends of the sheaves inwards, every sheaf or gang of sheaves having a regular and obvious slope downwards and outwards towards their butts. The stacker never steps upon the central part of the rick, by which means that part is always left comparatively open, or less compressed than the exterior of the rick, all the sheaves of which are pressed down by his weight. It is a matter of great importance to *heart well*, as by negligence in this respect a serious loss is often incurred.

stells already mentioned, (when those with straw are used), and the long drawn straw for thatch.

In laying on the thatch, the thatcher stands upon the sloping conical roof of the rick, as near as he can to the eaves, and lays on the thatch in handfuls, from sheaves of straw placed within his reach. He thrusts the inner end of his handful of thatch, gathered into a neck or wisp, into the butts of the sheaves, and spreads out the lower end like a fan, overhanging the eaves. Beginning at the eaves, and covering as much of these as he can reach at arm's length, he works upwards, causing each successive handful to overlap that immediately below; and he thus covers the roof in triangular portions, till he has gone round the whole backwards, that he may avoid treading on his work. When he has reached the top of all, he lays a considerable thickness of short straw upon the crown, over which a straw-rope is carried perpendicularly, dividing the roof into two equal sections. He then covers this topping of short straw with long thatch, drawn to a point at the summit, and ties the upper ends of this with a small straw-rope into a peak, giving this last part the resemblance of an umbrella.

With the aid of two assistants on the ground, while he remains aloft on a ladder, so as to be able nearly to reach the top of all with his hands, the thatcher now places a number of straw-ropes, which obliquely embrace the conical roof, to secure the thatch. The middle of each rope is fixed, by means of a small wisp of straw, to the perpendicularly transverse rope already mentioned, and the ends of all the oblique ropes are fixed below by the assistants, either to the butts of the sheaves in the cylindrical body of the rick, or to a circular belt rope which firmly embraces the body below the eaves. If this is too high for the assistants, each has a short ladder to enable him to reach up. This series of ropes has a considerable obliquity from above downwards, and they are placed at about a foot or fifteen inches distant from each other. In case of hurry, from the prospect of bad weather, this first series of ob-

lique ropes may secure the thatch from being blown off for some time; and in such emergencies, the whole ricks belonging to a farm may be left for a time in this state. The whole fabric is effectually secured by a similar and opposite series of straw-ropes, put in the same manner on the other side of the roof, and obliquely crossing the first series of ropes. When thus finished, the entire roof is covered by a net-work of lozenge-shaped meshes, all the sides of every one of which are in a direction obliquely downwards, to facilitate the descent of moisture, either from rain or melting snow.

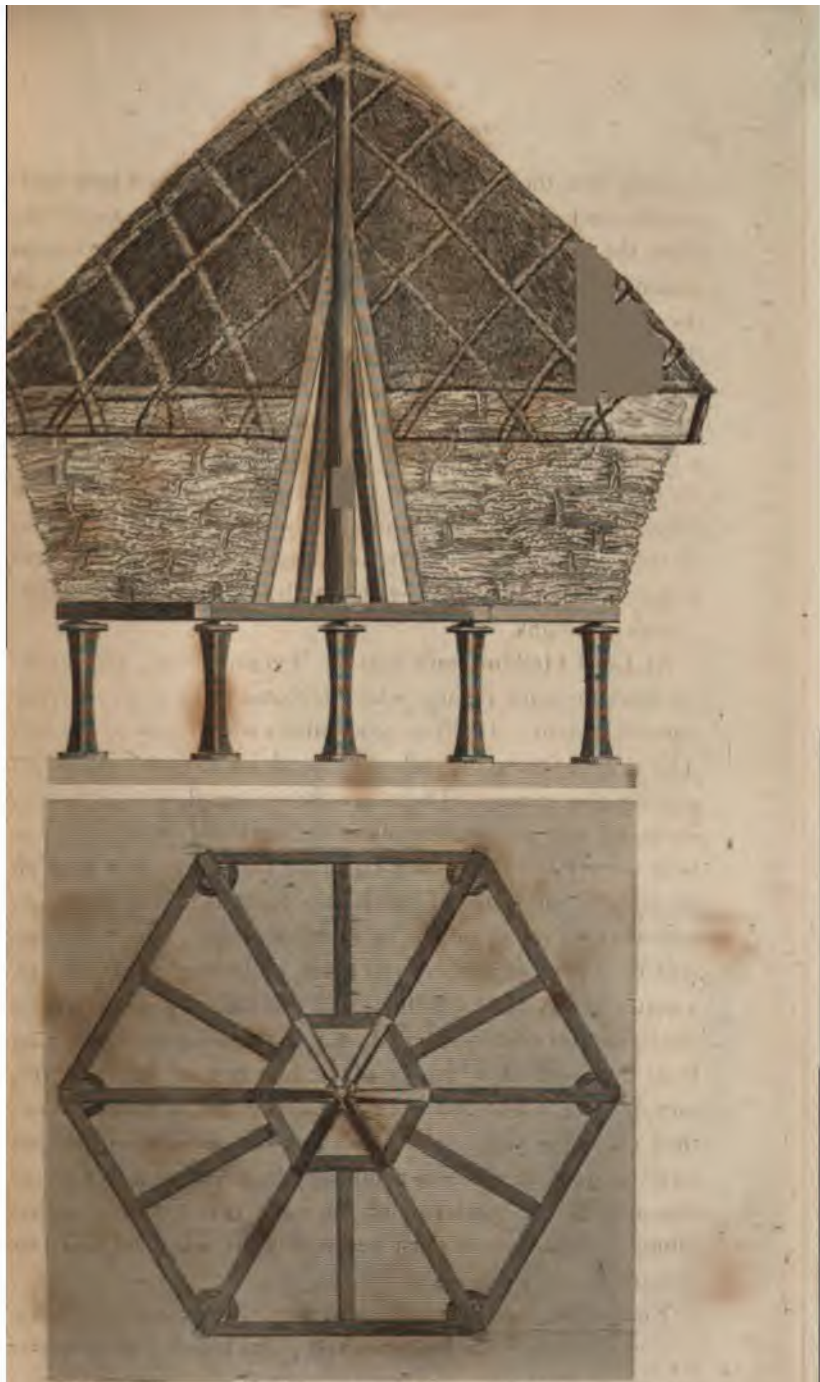
Some farmers use saddles, or circular frames of timber supported on feet, which are made of wood, stone, or cast-metal, so constructed as to prevent mice and rats from getting into the ricks, where they sometimes become very numerous, and produce great ravages. These vermin likewise contaminate the grain by their dried ordure, much of which cannot be separated in any of the after processes of threshing and dressing for market. These saddles are likewise extremely useful for assisting to preserve the grain crop from injury in damp weather. Being open below, and the timber frame on which the rick is built being likewise open, that is to say, composed of spars, they admit the air to circulate with great freedom through the bodies of the ricks; more especially when aided by a central funnel or air hole, carried up the rick while building, to be afterwards mentioned.

In damp harvests, it is often extremely difficult to get the grain sufficiently dry for being stacked in safety; and it is well known, that grain, which is put up in a raw state, is apt either to heat or grow mouldy, both of which are extremely injurious, whether the grain may be intended for the use of man or of domesticated animals. Heating in the stack is occasioned by the natural sap remaining in the straw, which brings on a vegetative or fermenting process, somewhat analogous to malting, and very much deteriorates the colour, flavour, and quality of the grain. If not checked in time, by

turning over the stack, or by the admission of air, it may even set the stack on fire. The presence of adventitious moisture, after the straw has parted with its natural sap, occasions mouldiness, and communicates a musty taste and flavour to the grain, and likewise to the meal into which it is ground. To prevent these evil effects from moisture, it is customary in damp harvests, to leave an opening in one side of the stack, at or near the ground, reaching to the centre, and held up by a pair of old harrows, an old cart-wheel, or some equivalent contrivance easily procured. From the inner end of this, a funnel or chimney is constructed in the centre of the stack, all the way up to the top, by building the rick around a firm bunch of straw, which is gradually drawn up as the rick advances in height.

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. These 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, they are found very useful for drying the corn, when not put into the stack in the best condition, by allowing 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.

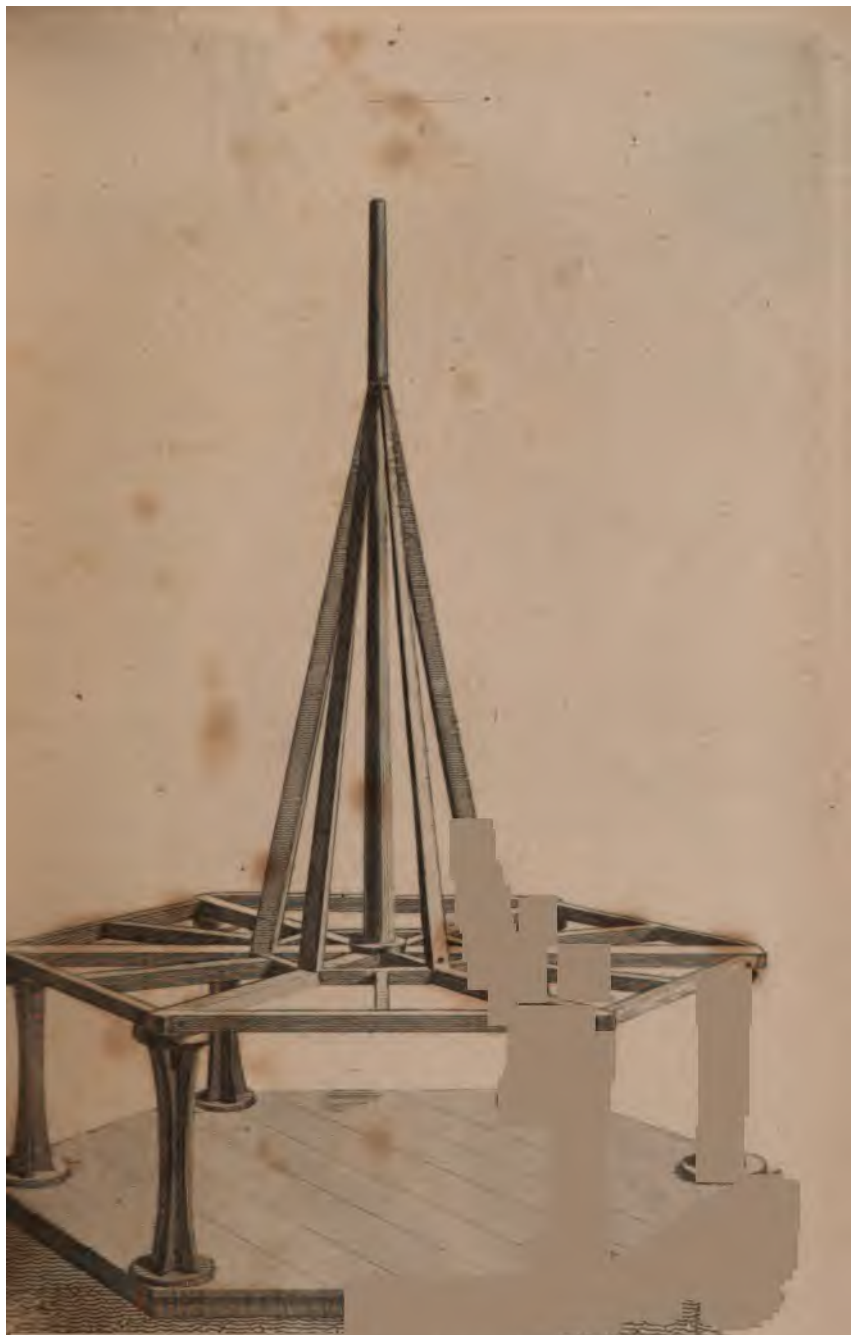
Near Alloa, cast iron pillars were lately invented for stacks, (an engraving of which is annexed), which seems to be a use-



*Corn Stack with Iron Pillars,
and a Boss in the Center.*

Plate II. View III.





*Cast-Iron Pillar Corn Stands,
with a Top made of Timber.*



ful 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 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 also have 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, peculiar to Scotland, called *bosses*, which when used in stacks placed on 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.—It is an important subject of inquiry, How soon beans can be put in, by means of bosses? That must greatly depend on what state the beans are in when harvested.—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 fal-

len 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 beans produced upon strong clay, or carse land, require longer time to fit them for the stack, than those produced upon dry land.

In describing the operation of stacking, one stacker only has been mentioned. But it is obviously necessary, in large farms, to have as many stackers, two, three, or more, as the farm teams are able to supply with corn in a fit state for being stacked. It is also necessary that there should be a boy or woman on each rick to hand the sheaves to the stacker as pitched up from the carts, and when the ricks are large, a full grown man is often employed for that purpose.

Round ricks have alone been mentioned in the preceding description of stacking, both because they are the most usual in Scotland, so much so indeed as to be almost universal, and because they are believed to be the best. Yet oblong stacks, provincially named *sows*, are to be seen occasionally; and these are sometimes built with contiguous interruptions at regular distances, called *lects*, for the convenience of taking them down in parts, without disturbing the remainder. The roofs of these *sows* are ridged, like those of houses, and are thatched in the manner already described, having their straw ropes stretched directly across. Though these oblong constructions certainly require considerably less time and labour, and a smaller proportional quantity of materials for heading, both straw and ropes, they are liable to one very important objection, as they interrupt the free circulation of air in the rick-yards, consequently are more liable to injury in damp wea-

ther, and unless carefully placed are apt to be overturned by wind.

It might appear invidious to offer any detailed comparison between the economy of stacking grain, so universally practised in Scotland, and the expensive establishment of those vast corn barns to be seen in some parts of England, allowing that sufficient data were known on which such a comparison could be accurately formed. It may not be improper, however, to mention, that there are many arable farms in Scotland, on which the barn-room necessary for containing the whole of an average crop of grain in the straw, could not be constructed for less than L. 4000, L. 5000, or L. 6000, and in addition to the expence of other farm-buildings, which are quite sufficient for all the necessary purposes of the farm, on the present system of stacking. This enormous additional expence, which is besides totally unnecessary, must either be defrayed by the landlord or tenant; and, in either case, must occasion a defalcation of rent, equal to at least seven and a half *per cent. per annum* of the outlay, for interest, repairs, and insurance, or from L. 300 to L. 450 a-year. Besides this, barns are excessively liable to the depredations of vermin; and they require that the grain and straw should even be drier than is necessary for the largest ricks, and consequently to be longer exposed to the vicissitudes of the weather, which is a matter of importance.

Engravings, explanatory of the most approved modes of stacking corn, with cast-iron pillars and bosses, will accompany this part of the Report.

 SECT. XIV.

OF THRESHING.

THE operation of separating the grain from the straw, or threshing, was universally executed in Scotland by means of the flail, till about twenty-four years ago. Since that period, a complete revolution has been effected in this branch of agricultural work, and the use of machinery has become universal in all the improved and well-managed districts of Scotland. Several ingenious men in different places, and at different times before that period, made attempts to apply machinery for the more expeditious and more economical accomplishment of that important rural operation. But the *first effective threshing-machine*, upon that principle which has since met with universal approbation, was erected by Mr George Meikle, in February 1786, at Kilbagie, in exact imitation of a working model invented and executed in the preceding year by his father Mr ANDREW MEIKLE, a most ingenious millwright near Haddington in East Lothian. Since that time, the threshing-machine has been gradually and rapidly extended through all the improved farming districts in Scotland, where there is not now an arable farm of any importance that is not furnished with this most useful implement.* Successive improvements of material importance have been made by the meritorious inventor, and others have been ingrafted by other artists upon the original invention; but the efficient principle continues invariably the same; and being both efficacious and perfectly simple, it is perhaps not susceptible

* In some parts of Scotland, more especially in the neighbourhood of Crif, skutching machines are adopted; but those on Meikle's principle are much more general.

of improvement. The inventor of this excellent and useful implement, Mr Meikle, assuredly deserves to be ranked among the greatest benefactors to agriculture; yet circumstances, foreign to the object of the present work, conspired to hinder him from deriving any adequate remuneration from this excellent fruit of his inventive genius. Though richly meriting an ample public reward, he had almost been permitted to descend in poverty to the grave; but a liberal subscription has been lately collected by the exertions of several public spirited individuals, by which his latter days were much comforted, and his family provided with a moderate competency.

The description of the threshing-machine belongs to a different chapter of this General Report; and its operation, in separating the grain from its straw and chaff, is all that can be considered in the present section. The threshing mill or machine consists of three principal working parts, which successively perform three separate operations, all of which are nearly connected with each other, and execute their several works almost simultaneously. In the *first*, the grain and chaff are beaten off from the straw. By the *second*, the straw is shaken out from the grain and chaff, and is conveyed into the straw-barn, where it remains till wanted for the various purposes of the farm. By the *third* operation, the mingled grain and chaff are separated from each other, while passing through attached fanners or winnowing machines, which likewise divide the best of the grain from that which is lighter and less perfect.

Upon all large arable farms, in the improved districts of Scotland, there are powerful threshing-machines, driven or worked by means of water, wind, or horses; and the average efficient strength or impelling power of these may be estimated at the working force or draught of six or eight good horses. It must be obvious, however, that the working power of water and wind machines must vary in proportion to the supply of water, or the impetus of the wind by which they are

impelled; and it is well known, that a threshing-machine never acts with sufficient efficacy, unless when the switchers or beaters of the drum are moved with considerable velocity. It has been ascertained by long experience, that the minimum of this velocity for clean threshing, is 2000 feet *per* minute; but a velocity of from 2500 to 3000 feet in the minute, is much preferable. Where coals are abundant and cheap, the power of steam may be advantageously substituted for working the threshing-machine, in situations where water cannot be procured for the purpose, and where windmills are ineligible; and this power has actually been had recourse to in several instances, and it is said with satisfactory results. In every instance where water can be procured in sufficient quantity, and at a moderate expence, that is unquestionably the best and cheapest, and most manageable moving power, and is equally well calculated for threshing-machines of the greatest required force, and even for the smallest. Wind is the next best for large arable farms; but both it and steam are quite ineligible for small or even moderate sized farms, owing to the great original expence which both require. In small or moderate sized farms, where water cannot be readily and cheaply procured, horses must be substituted, or oxen may be used with much advantage.

The only objection to the use of water, as the moving power of the threshing-machine, is, that it may be locked up from use during long continued frosts, at a time when litter and fodder are indispensably necessary, and that it is often deficient during the long droughts of summer and autumn. But where water can be had in sufficient abundance and constant supply, though certainly the most manageable and most economical power that can possibly be used, yet if the supply is deficient, the addition of a horse power is desirable. Wind is often deficient during harvest, and in hard frosts, when straw must be procured for thatch, litter, or fodder. On these accounts, when it is the moving power, it is necessary that the threshing-machine should be provided with a horse-wheel,

to secure a sufficient supply of straw upon every emergency; and this addition does not require any very material increase of expence, perhaps not exceeding sixty or seventy pounds. On their being first used by farmers, windmills were in a great measure new to Scotland, and the management of their sails was exceedingly troublesome and even dangerous; but by progressive improvements upon their machinery, they are now made to turn their sails to the wind, to reef and unreef their own sails in just proportion to every change of wind, and are almost as safe and manageable as watermills having back sluices.

In threshing grain by the flail, the customary payment in Scotland was one twenty-fifth part to the thresher or *lot-man*; besides which, it is estimated that a twentieth part of the grain crop, while threshed in that way, was lost, both to the individual farmers and the country at large, by imperfect work, being left adhering to the ears. A strong instance of this loss, and of the superior cleanness, and consequent economy of the threshing-machine, was communicated to the Reporter a considerable number of years ago, by an eminent collar-maker in Edinburgh. Before the introduction of the threshing-machine, the wheat combed out at his manufactory from wheat-straw, to be used in making horse-collars, was sufficient for the supply of a considerable poultry-yard. After threshing-machines became general around Edinburgh, this source of feeding his poultry entirely failed. What might have been the additional loss sustained by the farmer, in consequence of his grain crop being continually exposed to depredation by the dishonesty of his servants, it is altogether impossible even to guess at; but it must have been considerable.

Besides the losses and expences occasioned by flail threshing, there was a farther injury produced to the grain itself, by remaining on the damp earthen floors of barns for many days, owing to which it was very liable to acquire a disagreeable musty flavour. Added to all this, the unthreshed grain in the bay of the barn, and the threshed grain on the barn-

floor, in what used to be called the chaff-heap, was continually exposed to the depredations of rats and mice.

Upon small farms it would be obviously improper to erect large machines, as the interest of the original expence, and the tear and wear of the machinery, would more than counterbalance any advantages to be expected from their use. But on farms of moderate size, smaller machines are certainly advisable, and are fast coming into use; and though some doubts are entertained respecting their advantages, yet such is the security accruing from the use of a threshing-machine, that a person accustomed to employ one would feel himself most unpleasantly situated, in carrying on even a moderate sized arable farm, if obliged to leave his property exposed to the circumstances already mentioned as inseparable from flail threshing. It may be difficult to ascertain the proper limits in this respect, in proportion to the size of farms. Perhaps every arable farm which gives constant employment to four work-horses, ought to have a threshing-mill of that power, and such a machine will even be sufficient for a farm employing six or eight horses. All beyond ought to have water or wind machines, if circumstances will permit. Even where farms are of very small extent, such as those having two pair of horses or less, as in Ayrshire and other counties in the western part of Scotland, threshing-machines from L. 40 to L. 60 each, have been constructed, and answer well. Nay, at Langholm, a threshing-machine has been invented, that costs only from L. 8 to L. 15. In situations where small farms are considered to be useful or necessary, it might be exceedingly convenient, for three or more farmers, to collect their grain into one general farm-yard, with one common threshing-machine to serve them all, held up at their mutual expence, and worked by their conjoined strength, or to have ambulatory threshing-mills for the same purpose. Around country towns, it might be advisable to erect public threshing-machines; and in some instances, such have been established by speculative persons, serving at the same time to their own emolument, and to the material advantage of the neighbourhood.

From the great improvements which have been made in the construction of threshing-machines, the operations of threshing and dressing the grain for market are now reduced to much simplicity, and mostly carried on simultaneously, especially on large farms which have powerful machines, full and perfect in all their parts. In endeavouring to give a condensed view of these operations, the grain in the straw is presumed to have been previously conveyed from the rick-yard into the bay of the barn, as it used to be before the employment of machines; and this expence, therefore, is not meant to be considered in the following description and estimate. In many farms there is no bay, and the grain is carried directly from the rick to the threshing-stage. This, however, seems an objectionable arrangement, as it may often be necessary to thresh when the weather is so bad as to make it very improper to carry in a rick. It is better, therefore, always to have one rick in the barn, ready to be threshed when necessary; and to fill up the bay again either immediately, or on the first favourable opportunity.

In the corn end of the barn, one man feeds the grain in the straw into the machine, and is assisted by two half grown lads or young women, one of whom pitches or carries the sheaves from the bay close to the threshing stage, while the other opens the bands of every sheaf, and lays the sheaves successively on a small table close beside the feeder, who spreads them evenly on the feeding stage, that they may be drawn in successively by the fluted rollers to undergo the operation of threshing. In the opposite end of the barn, or straw-house, into which the cylindrical rakes or shakers deliver the clean threshed straw, one man forks up the straw from the floor to the straw mow, and two lads or young women build it and tread it down. In a threshing-machine worked by water or wind, this is the whole expence of hand labour in the threshing part of the operation; and as a powerful machine can readily thresh from two hundred to three hundred bushels of grain in a working day of nine hours, the expence is exceedingly small

indeed. Assuming 250 bushels as an average for the work of these people for one day, and their wages to be nine shillings, the expence does not amount to one half-penny for each bushel of grain. Even reducing the quantity of grain threshed to 150 bushels, the easy work of a good machine of inferior size and power, the expence does not exceed three farthings the bushel. Some English readers may suppose that the charge of beer is omitted in this calculation ; but that is an article in the expences of farm management which has no place in Scotland.

Besides being thoroughly threshed, and the grain and straw effectually separated, the grain is more than half dressed during the threshing process, by passing through two pair of fan-ners, or two winnowing machines, which are connected with the threshing machinery. Indeed, when the machine is very perfect, and the grain remarkably well ripened, if it has been harvested in fine order, it comes finally into the clean corn room, from the threshing-machine, entirely ready to be measured into sacks for market, or very nearly fit for that operation. This is the case at least with potatoe oats and some other varieties.

When grain is threshed by a machine worked by horses, the expence is necessarily and considerably enhanced. A powerful horse machine capable of effecting the larger quantity of work already calculated, will require eight good horses and a man to drive them, who may perhaps require the aid of a boy. The value of the work of eight horses in a threshing-machine for a day cannot be less than forty shillings, and the wages of the driver may be called two shillings and sixpence. Hence the total expence of threshing 250 bushels will amount to L. 2 : 2 : 6 ; or about twopence *per* bushel when the wages of the attendants are added ; still leaving a considerable difference in favour of threshing by the machine in preference to the flail. Were it even ascertained that the expence of threshing by horses, and by the flail, were nearly the same, horse-mills are to be recommended on other accounts, such as better threshing, expedition, little risk of pilfering, &c.

The expence of a steam engine, as applicable to threshing, cannot be estimated with any rigid accuracy, as the experience of that power in Scotland is very recent and much limited: But, from any statements on this subject which have been communicated, the expence of coals, and of a man to superintend the fire and the machinery, cannot much exceed the charge of horses, and in some instances may be below it. Fire, however, though a powerful agent, and a very steady one under good management, is a most dangerous neighbour to a farm-yard, and must be attended with considerable risk. There is, perhaps, another disadvantage attending the use of steam in threshing. The alternate heating and cooling of the steam apparatus, will probably occasion much loss and expence in repairing the furnace and boiler; and, in districts merely rural, it is hardly to be expected that work people can be readily procured who are sufficiently conversant in steam engines, for keeping the valves, leathers, and other parts of such nice machinery, in due order and repair.

As the threshing-machine is entirely of Scotch invention, that implement has been treated of in this section at considerable length. Any particularities that belong to the detail of threshing the various kinds of grain, worthy of attention, will be noticed in the more minute accounts of the different articles that are cultivated upon arable land, subjected to that operation, in the subsequent divisions of this Chapter.

SECT. XV.

OF DRESSING GRAIN.

IN the immediately preceding section, it was stated that the grain is delivered into the clean corn room more than half dressed, from the best constructed threshing machines; and

often, in peculiarly favourable circumstances, quite ready to be measured up into sacks for market. In general, however, and more especially on middle sized farms, where less powerful threshing-machines are employed, the grain has still to go through some part of the dressing or winnowing process, as shall be described in this section a little more in detail than may perhaps seem to be necessary, because the Scotch process differs materially from that which is followed in the midland districts of England. In doing this it is necessary again to attend to the threshing-machine, as a part at least of the process is carried on by a winnowing machine connected with the threshing-mill.

After having been beaten out from the ear by the first series of *gearing* in the threshing-machine, and separated from the straw by the second series, as already described, the grain and chaff pass through a grated hopper into the winnowing-machine connected with the threshing apparatus, by which the chaff is blown out into a separate chamber, called the chaff-hole, whilst the grain is delivered into the clean corn-room through two separate apertures. One of these delivers the best grain, and the other a secondary or inferior description.

In large and powerful machines, the grain is subjected to a second winnowing machine, after passing through the first, and the separation of the two qualities delivered at the two apertures is much more perfect. In some machines, a series of revolving buckets, resembling a chain pump, continually carry up all the secondary grain to the threshing stage; whence it passes again and again through the two winnowing machines. In this case, a woman in the clean corn-room, has only to riddle the more perfect grain very carefully into a separate corner, returning all that she thinks less perfect to the secondary aperture, whence it goes up with the rest to be winnowed repeatedly. But it seems proper in this section to bestow attention on the circumstances connected with the less powerful and most common threshing-machines, which have only one winnowing machine attached to them.

One or two women, according to the power of the machine, are stationed in the clean corn-room, to receive the grain, who riddle the deliveries into separate heaps; all the refuse of the first delivery, after careful riddling, being thrown back to the second delivery; and the refuse of the second delivery, likewise after being carefully riddled, is laid up by itself in a third heap. After having threshed all the grain from the straw, the third heap, or both the second and third, more especially in barley to beat off the awns, together with all sweepings, are returned to the threshing-stage, and have once more to undergo the operation of the threshing-mill.

When the business of threshing is over, a regular dressing is given to the grain in the clean corn-room, by means of a separate winnowing machine driven by hand, assisted by the industrious use of riddles, rees, and sieves, according to circumstances; and the steps of this final dressing vary according to the state in which the grain has been delivered from the threshing-machine. This winnowing machine might certainly admit of being driven by the gear of the threshing-machine, which would save the expence of one person's wages, and in the most perfectly constructed and powerful threshing-machines it is so. But generally speaking, the motion which is communicated in that way, can hardly admit of being nearly so well regulated as by hand; and every judicious husbandman, who wishes to secure at market a character for well dressed grain, will find it for his interest, to give the final dressing to his grain, in a deliberate manner, at a time when no other circumstances call forcibly for his attention.

There cannot exist a more egregious mistake, even in regard to profit, than imperfect dressing; as either the sample will not command the price at market that would be procured for perfectly dressed grain; or, if the stock, when delivered, is inferior to the sample by which it was sold, disputes will naturally arise, from the purchaser objecting to this breach of honesty in the seller. Imperfect dressing is a pitiful and absurd attempt to overreach, which always redounds

to the manifest loss of the person who practises it. One or two *per cent.* of bad grain left in the stock, will lessen the price from five to ten *per cent.* according as the market happens to be dull or brisk; and the imperfect grain, if dressed out, may either be sold separately, or used at home. In fact, grain can never be sold to advantage unless it is properly dressed.

In the course of dressing, all the small seeds of weeds are separated from the grain, by means of a sloping screen or harp, made of iron wires with small intervals, which constitutes a portion of the winnowing machine; or they are afterwards separated by means of sieves, or small meshed riddles, which allow the small seeds to pass through, but retain the grain. It is a proper precaution, to prevent all chance of these returning to the land, to give them to the farm poultry, and on no account to allow them to go to the dunghill. When there is any sand among the grain, it is separated by means of the rees, or by sieves which have still smaller meshes.

The hands required for dressing by means of the fanners, are two men and three women. The quantity of grain dressed by these hands in a day must vary, according to the state in which it is before dressing, and consequently according to the number of times it may require to be put through the winnowing machine. It may run, therefore, from 200 to 300 bushels; and, as the wages of the people employed may amount to seven shillings, the expence of dressing and measuring up for market may run from somewhat more than a farthing to less than a halfpenny for each bushel, according to circumstances.

The winnowing machine has been already described in Chapter V., along with the other implements employed in husbandry. The sieves and rees, mentioned as implements used in dressing, are finer species of riddles, for separating small seeds and sand from the grain. While the grain is passing through the riddles, small pieces of straw, and *clokes* and *capcs*, or grain to which the chaff adheres, are thrown to the top, by means of the circular motion of the riddles, and are skimmed off by hand. The winnowing machine,

and the measure, are filled by an implement called a *weight*, something like a drum head, or a riddle having a close bottom; being generally constructed out of the rim of an old riddle, and closely covered with parchment.

SECT. XVI.

OF GLEANING.

Nothing occurs on this subject worthy of notice; but it may be stated generally, that no gleaner ought ever to be permitted on any account to enter a field, until the crop has been led home to the stack-yard. Indeed the practice of all the improved districts, for some years past, has been, to prohibit gleaning till the crop was removed from the field.

SECT. XVII.

OF STUBBLES.

As the crops of grain, generally speaking, are cut close to the ground, no stubble is left that can be mown, or which can be applied to any particular use; except by turning in cattle and sheep to eat up any fallen ears, or any grass that may be on the ground, though that is a rare circumstance in the improved districts.

Except in the neighbourhood of large towns, when manure can be purchased in abundance, no straw is allowed to be sold, and the quantity of straw produced upon an acre of land, from

any of the crops commonly cultivated, has rarely been averaged*. Its value is ordinarily estimated at half the price of hay, weight for weight; but this only refers to such small quantities of straw as one farmer may occasionally procure from another for thatch, or when his own runs short.

The universal application of the whole straw produced upon every farm, in what may be called the more improved districts of Scotland, is for litter and fodder to the live-stock on the farm, so that it may be converted into muck, or for thatching houses and offices, and corn-stacks. For horse litter, the straw of wheat and rye is preferable; and of the culmiferous crops, the straw of oats is accounted the best fodder. The haum or straw of beans and pease, if well harvested, is an excellent food for work horses, and little inferior to good hay, perhaps superior to rye-grass hay that has been threshed. Indeed, when rye-grass is allowed to ripen its seed, and the seed is threshed out, what remains ought rather to be named rye-grass straw than hay. The haum of beans and pease is not thought good food for riding horses, being apt to thicken their wind; and when not properly harvested, it disagrees with some horses, producing botts, or severe gripes.

* Mr Brown of Markle estimates the average produce of straw from the different crops, as under :

Wheat,	160 stones.
Beans and peas,	130 —
Oats,	130 —
Barley,	100 —
	—
Total,	520 stones.

Or, on an average of these crops, 150 stones *per acre*, 22 lbs. *avoirdupois per stone*, in all 2860 lbs.; or 1 ton 5 cwt. 2 quarters and 4 lbs.

PART II.

OF FALLOWING.

SECT. I.

ADVANTAGES OF FALLOW.

IT is a singular circumstance in the history of British agriculture, that the ancient husbandry of England rested entirely on a constant and frequent recurrence of fallow, (probably derived from the time when the Romans occupied South Britain); while in the ancient husbandry of Scotland fallow was so totally unknown, that the first field in which that process was experimentally tried in East Lothian is still pointed out to strangers. In the ancient husbandry of Scotland, the cultivated land consisted of two unequal divisions, the smaller denominated infield, and the larger outfield. To the former the whole muck of the farm was applied, and it was kept under perpetual tillage. The latter never received any manure, except from folding, generally by cattle; and after carrying as many successive crops of corn as would pay for seed and labour, it was permitted to grow up into a mixed assemblage of weeds and natural grasses, named *lea*; in which state, by being pastured for seven or more years, it was said to *gather heart* for being subjected to a similar repetition of grain crops.

The fallow process consists in frequently turning over the soil by means of the plough, chiefly during the summer months, so that it may be reduced or pulverised, to that extent as to allow the harrows to tear out the vivacious roots of weeds, which are carefully to be removed or burned; and also,

by frequently exposing new surfaces to the influence of the sun and air, to bring into vegetation the innumerable seeds of weeds contained in the soil, which are destroyed by the subsequent operations of the fallow process. It is believed likewise, that the soil acquires some accession of vegetative powers by means of this process; perhaps by the successive destruction and consequent putrefaction of these crops of weeds, forming a species of manure in the soil, and combining with an absorption of some elementary principles from the atmosphere. The destruction of weeds is a palpable and obvious effect of fallow to every attentive observer; but the melioration of the soil, by the chemical influences of the atmosphere, belongs to theoretic reasonings and deductions, which are not perhaps sufficiently within the boundaries of our present knowledge. This much is however certain, that the soil, after a well-wrought fallow, has a mellow and fertile appearance familiar to every experienced husbandman, while that which has only been ploughed up after carrying repeated grain crops, or which has been carelessly and inefficiently fallowed, has a close, coarse, and sterile appearance to the eye. The difference between the crops produced on land managed in these several manners, is not less distinct and remarkable; as, all other things being equal, the well fallowed soil produces a healthy, vigorous, and abundant crop of grain, comparatively free from weeds; while the crop produced on the other, is weak and scanty, and often overwhelmed by a multiplicity of weeds, disgraceful to the cultivator, and injurious to his interest.

However strongly disposed, from experience and analogy, to recommend the use of well conducted fallow on all soils fitted for its application by their nature and consistence, there are certainly some soils which do not require this process, in the strictest application of the term; as on all light free soils the turnip husbandry, to be described hereafter, is perfectly sufficient for all the beneficial purposes to be derived from fallowing, and is indeed a real and efficacious fallow process.

Indeed a naked fallow should never be adopted, where the soil is not so wet, as to prevent the turnips from being partly drawn, and partly eaten on the ground during any part of the winter. The other crops usually considered as meliorating, namely pulse, cabbages, and potatoes, cannot be substituted advantageously in place of fallow, even on light soils, because the tillage necessary for them is given at a period of the year too early to admit of effectually cleaning the land of weeds. The grand advantage derivable from fallow, and which ought to be the invariable object of every judicious husbandman, is to keep his land free from weeds, which can never be done on strong clays, or even on soils of a lighter description which are incumbent upon clay, *till*, or other retentive subsoils, unless by means of a perfectly well wrought fallow at proper intervals. On middle soils, or strong loams, having a good bottom, the repetition of the fallow process is less frequently necessary; as after having been once effectually cleaned by a thoroughly well-wrought fallow, they may be kept long clean by the alternation of drilled crops of pulse, and in fertile condition by the judicious application of muck or other manures. The frequency with which the fallow process ought to be repeated, must depend upon the consideration of a variety of circumstances, which can only be appreciated on the spot by the judgment of the cultivator; such as the state in which the soil is in regard to weeds, and the power which the farmer possesses of applying manure. To conclude this branch of the discussion, the great advantage of fallow consists in cleaning the land from weeds, to enable it to carry profitable crops of grain and cultivated grasses, which cannot possibly be secured on strong clays by any other means. It is likewise essential in new, coarse, rough grounds, for pulverising, mellowing, and drying the soil, and converting the roots and other remains of vegetables into soluble matter, as food for succeeding crops.

SECT. II.

DISADVANTAGES OF FALLOW.

To a person long experienced in the management of land under the fallow system judiciously conducted, it is difficult to conceive that any disadvantage should be attributable to the process, unless, merely on theoretic views, it may be alleged that it is an expensive and unprofitable waste of labour without any product. Nature, it is asserted by the anti-fallowists, admits of no pause or rest in the production of vegetables from the soil, and why, therefore, should the husbandman permit his land to remain for a whole season unproductive, when by a judicious rotation, and a constant exercise of industrious management, it may be made to yield a regular and uninterrupted succession of profitable crops? Were it possible by any series of agricultural operations, within the compass of economical expence, to clean wet or strong soils from root weeds, as may be done in garden culture, the opinion of those who reprobate fallow as wasteful and unprofitable might be adopted. But, in the present state of agriculture, and in such a climate as that of Scotland, strong clays, under the best management known at present, can neither be made clean without having recourse to the radical operation of summer fallow, nor preserved in a clean state without the recurrence of fallow at proper intervals, which must be judged of by individual cultivators according to circumstances. A too frequent recurrence, however, would be destructive to old tillage lands, by allowing the soluble matter in the soil to escape in a gaseous form into the atmosphere; while little pulverisation is required, and few or no inert vegetable remains exist in this description of soil, to be converted into soluble matter.

 SECT. III.

RESULT OF THE DISCUSSION.

AGRICULTURE is assuredly an experimental art, yet as each individual experiment requires at least a whole year for its performance, the general results of any rotation system, and still more of opposite systems, require a considerable series of years before they can be compared and pronounced on with any tolerable certainty. There is perhaps no other art to which an ancient aphorism, *Art is long, and life short*, can be applied with equal truth. In the great and leading practices therefore of farming, the multitude follow certain general principles of practice which they have noticed from their infancy, almost without question or consideration as to their expediency, and scarcely ever think of endeavouring to make the smallest alteration or improvement. A few bold and judicious men, who occasionally travel into distant districts, fortunately observe new practices with a discerning eye, and introduce them into their own farms, whence they are gradually adopted by their neighbours. Occasionally, an adventurous philosopher dares to think for himself, and strikes out new and unheard of practices, some of which are unsuccessful and fall into oblivion, and others take firm root and are gradually disseminated. But, generally speaking, the principal improvements can only be traced as having travelled from one spot to another. Among original inventions in farming which can actually be traced, are, *first*, the drill system of Jethro Tull, firmly established in the turnip husbandry of Scotland, but with considerable modifications, by Mr Dawson, residing at Frogden in Roxburghshire; *secondly*, the various improvements introduced by Mr Bakewell, in the breeding of stock,

and of sheep in particular ; and *thirdly*, the threshing-machine, as invented by Mr Meikle. Of travelled improvements may be noticed the winnowing-machine brought into Scotland from Holland, by the father of Mr Meikle, and said to have originated in China. The plough drawn by two horses and guided by one person, recommended by an English gentleman, fifty or sixty years ago, to some proprietors in the shire of Edinburgh, and now universal in Scotland. And, lastly, in the opinion of the friends to fallowing, the introduction of that practice into East Lothian, about one hundred years ago, on the suggestion of an English traveller, to Mr John Walker, innkeeper and farmer at Beanston.

It may possibly be considered as presumptuous to pronounce decisively on the merits or demerits of the fallow system, without a consecutive series of comparative experiments : But in the opinion of the most enlightened agriculturists in all the well managed districts of Scotland, and confirmed by their experience, " A complete over-years naked fallow forms, on all clay soils, the indispensable basis of all good husbandry." In default of direct positive proof by experiment, the indirect negative proof may be considered as in a great measure conclusive of the question at issue. In the last years of a lease, a *way-going* tenant, as he is called, is naturally anxious to draw as much as he possibly can from his land, at the least possible expence. It is very customary, therefore, on such occasions, either to neglect altogether, or to slur over the fallow process, and to take as many successive crops as can be got, with as few ploughings as is practicable. On these occasions, it uniformly happens that the first crops of the succeeding tenant have to toil for a scanty subsistence amidst legions of weeds, and are proportionally worthless ; and that his first series of fallows, or fallow crops, have to be carried on at an unusual cost of time and labour, and consequent expence. On such occasions may be seen potatoes and turnips growing on land full of the roots of couch, and corn crops so overrun with weeds, that their stubbles have the ap-

pearance of grass fields. It may therefore be concluded, that land cannot be farmed to its utmost profit, without the industrious employment of naked fallow or of a fallow crop, according as it happens to be heavy or light: In other words, that wheat lands require to be thoroughly fallowed, and turnip lands to be carefully worked and cleaned for a drilled crop, once in every rotation.

The fallow process, as conducted by the most judicious cultivators in Scotland, may be thus described. Invariably after harvest, the land intended for being summer fallowed in the ensuing year, gets an end-long ploughing, which ought to be as deep as the soil will admit, even though a little of the *till* or subsoil is brought up. This both tends to deepen the cultivated or manured soil, as the fresh accession of hitherto uncultivated earth becomes afterwards incorporated with the former manured soil, and greatly facilitates the separation of the roots of weeds during the ensuing fallow process, by detaching them completely from any connection with the fast subsoil. This autumnal ploughing, usually called the winter furrow, promotes the rotting of stubble and weeds; and if not accomplished towards the end of harvest, must be given in the winter months, or as early in the spring as possible. In giving this first ploughing, the old ridges should be gathered up, if practicable, as in that state they are kept dry during the winter months, but it is not uncommon to split them out or divide them, especially if the land had been previously highly gathered. By this means each original ridge of land is divided into two half ridges. Sometimes, when the land is easily laid dry, the furrows of the old ridges are made the crowns of the new ones, or the land is ploughed in the way technically called *crown-and-fur*. In other instances two ridges are ploughed together, by what is called *casting*, which has been already described. After the field is ploughed, all the interfurrows, and those of the head-lands, are carefully opened up by the plough, and are afterwards gone over effectually by a labourer with a spade, to remove all obstructions, and to open up the water-furrows into the fence-ditches, wherever

that seems necessary, that all moisture may have a ready exit. In every place where water is expected to lodge, such as *dishes* or hollow places in the field, cross or oblique furrows are drawn by the plough, and their intersections carefully opened into each other by the spade. Wherever it appears necessary, cross cuts are also made through the head-ridges into the ditches with a spade, and every possible attention is exerted, that no water may stagnate in any part of the field. Upon the accuracy of these several operations, the efficacy of the succeeding fallow very materially depends; as stiff clay-land, which has been drowned with wetness during winter and spring, can hardly be brought into good tilth by the subsequent steps of the fallow process; while the most stubborn clay, if properly laid up by the winter ploughing, and secured from wetness by judiciously disposed water-furrows, works afterwards with a degree of mellowness resembling free loam.

In the state in which it is laid by this first ploughing, the fallow land remains all winter, to receive the influences of the weather, by which the soil acquires considerable tenderness, to the great facilitation of the subsequent work. This mellowness is probably occasioned by the freezing of water contained in the soil, which necessarily bursts open the tenacious clods, and enables them to be more easily broken into tilth afterwards. As soon as the spring-seed time is over, the fallow land is again ploughed end-long. If formerly split, it is now ridged up; if formerly laid up in gathered ridges, it is split or cloven down. It is then cross-ploughed; and after lying till sufficiently dry to admit the harrows, it is harrowed and rolled repeatedly, and every particle of the vivacious roots of weeds brought up to view carefully gathered by hand into heaps, and either burnt on the field or carted off to the compost midding. The fallow is then ridged up, which places it in a safe condition in the event of bad weather, and exposes a new surface to the harrows and roller; after which the weeds are again gathered by hand, but a previous harrowing is necessary. It is afterwards ploughed, harrowed, rolled, and gathered as often as may be necessary to reduce it into fine

tilth, and completely to eradicate all root weeds. Between these successive operations, repeated crops of seedling weeds are brought into vegetation and destroyed. The larvae likewise of various insects, together with an infinite variety of the seeds of weeds, are exposed to be devoured by birds, which are then the farmer's best friends, though often proscribed as his bitterest enemies.

Some writers on husbandry have condemned the use of the harrow and roller in the fallow process, alledging, that frequent ploughing is all that is necessary to destroy root weeds, by the baking or drying of the clods in the sun and wind; but experience has ascertained, that frequent turning over the ground, though absolutely necessary while the fallow process is going on, can never eradicate couch-grass or other root weeds. In all clay soils, the ground turns up in lumps or clods, which the severest drought will not penetrate so sufficiently as to kill the included roots. When the land is again ploughed, these lumps are simply turned over and no more, and the action of the plough serves in no degree to reduce them, or at least very imperceptibly. It may be added, that these lumps likewise inclose innumerable seeds of weeds, which cannot vegetate unless brought under the influence of the sun and air near the surface. The diligent use, therefore, of the harrow and roller, followed by careful hand picking, is indispensably necessary to the perfection of the fallow process.

When effectually reduced to fine tilth, and thoroughly cleaned from root weeds, the fallow is again ploughed end-long into gathered ridges or lands, usually fifteen or eighteen feet broad; which are set out in the manner already described in treating of striking furrows or *feiring*. If the seed is to be drilled, the lands or ridges are made of such widths as may suit the construction of the particular drill-machine that is to be employed. Any particular breadth that may be required, is set off by means of marking poles of appropriate lengths, as already explained. After the land has been once gathered by a deep furrow, proportioned to the depth of the cultivated

soil, the manure is laid on, and evenly spread over the surface, whether muck, lime, marl, or compost. A second gathering is now given by the plough; and this being generally the furrow upon which the seed is sown, great care is used to plough as equal as possible. After the seed is sown and the land thoroughly harrowed, all the interfurrows, furrows of the head-lands, and oblique or *gaw* furrows are carefully opened up by the plough, and cleared out by the spade, as already mentioned, respecting the first or winter ploughing.

In the opinion of some farmers, fallow land which is to be sown with wheat, ought not to be what they call too much reduced in its tilth, as they have a notion that the clods, by mouldering down in the succeeding spring, assist to nourish and earth up the young and tender plants, and to prevent them from being thrown out by frost. The necessity of breaking down all clods by the fallow process, as indispensable for the destruction of weeds, its grand object, has been already adverted to; and under good management, there will hardly fail to be a sufficiency of clods or lumps to serve these purposes; as there is almost every season, abundant rain in August, called provincially *Lamma's flooas*, to restore sufficient tenacity and cloddiness to clay soil, the only fit subject for fallow.

The operations of the fallow process which have been described and insisted on, as necessary to all good husbandry, on stiff clays and wet soils with a retentive bottom, are numerous, and consequently expensive: in few cases less than six, sometimes seven or eight ploughings, are necessary, with six or more complete harrowings. On the principles of computing the expences of culture formerly mentioned, these will cost from three to four pounds *per* acre, besides one year's rent and taxes extraordinary, merely as a preparation in the first instance for a crop of wheat. But, when the superiority of that crop is considered, as produced by an effectual fallow, in preference to a slovenly one, and more especially when the superior goodness of the subsequent ley is taken into account,

whether for hay, soiling, or pasture, and the richness of the land when again broken up for tillage, and during the remainder of the rotation till fallow becomes again necessary, there can be no doubt, of the propriety and economy of giving *strong land* a complete fallow once in every rotation or course of cropping.

If a fallow is judiciously and industriously conducted in the manner described, it may certainly carry repeated alternate crops of grain and pulse, without any intervening naked fallow, for a considerable period, perhaps for six or eight years; and when such land is to be fallowed a second time, it will require fewer ploughings and harrowings than stated as necessary for foul land. Such extended aration, however, as is here supposed, will generally require more manure than can be supplied from the direct funds of a farm; it is only advisable, therefore, near towns, where manure may be purchased, or where there is a full command of sea-weed. To preserve the beneficial effects of fallow on ordinary farm land, which has no opportunity of receiving manure beyond its own resources, it is certainly the best and most economical plan, to lay it down to grass with the crop immediately succeeding the fallow, and to take such successive crops of grain and pulse as its condition will allow, when broken up from ley, previously to the next fallow.

In the neighbourhood of towns and large villages, where manure can be procured, and where potatoes can be grown to advantage, as that crop cannot bear the expence of long carriage to market, soils of considerable consistency, and unfit for turnips, are often planted with potatoes instead of naked fallow. Yet even in these circumstances, a naked fallow must be occasionally interposed; as, though the culture of potatoes is excellently calculated to extirpate annual weeds, it does not admit of the perfect eradication of vivacious roots, because it must be completed early in the season.

On the whole, it may be foretold of every farmer *on a strong soil*, in such a climate as that of Scotland, that his affluence

and prosperity will always be in proportion to the excellent state of his fallows, every thing else being equally well conducted.

PART III.

COURSE OF CROPS.

INTRODUCTORY REMARKS.

IT is proposed to consider, in this place, what are the several plans of consecutive management from year to year, followed in the best cultivated districts of Scotland, under the various circumstances of soil, climate and situation; or what is, in ordinary farming language, the course or rotation of crops. This subject is of great consequence; as, upon the judicious establishment and industrious execution of this fundamental series of operations, which in a great measure constitute the philosophy of husbandry, the profits of the farmer, and the advancement and preservation of fertility in the soil, most materially depend. It is therefore of much importance, that the principles of this department of agriculture, should be rightly understood and acted upon; as, besides contributing most essentially to the particular advantage of each individual farmer, it would tend greatly to promote the interest of the landowners, and of the community at large. In every step of this highly important branch of practice, two circumstances of great moment are to be considered. 1. What crop is the particular field or break capable of growing to the greatest advantage? 2. What is the best succession of crops, consi-

dering the capabilities of the soil, and the sources of amelioration within reach, which, without exhausting the fertility of the soil, will give most profit on the long run? Were it possible to answer these two questions satisfactorily, it might perhaps appear advisable, on an imperfect consideration of the subject, that the course of crops should be prescribed in leases, so as to guard against injury to the patrimonial interests of the land-owner by the misconduct of the occupier. But as the best course of cropping for any particular soil, has not been as yet ascertained, upon any thing like conclusive evidence; and as the subject still is, and probably will continue, liable to almost endless variety, according to complicated differences in the nature and composition of soils and subsoils, situation, climate, seasons, elevation, exposure, market, demand, manure, and the like; all regulations with regard to specific rotations, must injure the farmer and land-owner reciprocally, by cramping the exertions of the former, and diminishing those portions of disposable produce, out of which rent is paid to the latter.

In the best managed husbandry of Scotland, as conducted on the alternate system of pasturage and tillage on arable lands, no absolutely fixed course or succession of crops can be said to prevail. Upon all the large arable farms, at a distance from towns, in which the breeding, rearing, and fattening of cattle and sheep form a very material object of attention, about half of the arable land is kept under grass for pasture, hay, and soiling, and the other half is under tillage. These portions are gradually interchanged, slower or faster according to circumstances; and this alternation may be considered as the fundamental principle in the system of Scotch husbandry, so far as succession or the course of crops is concerned. Even on this subject, however, no positive rules can be laid down with propriety for restricting the husbandman in the free exercise of his judgment and experience, without material injury and consequent injustice to him in the first place, and eventually to the land-owner and the public, by lessening

the prospect of a future rise of rent, and diminishing the disposable produce of the farm for market. A judicious husbandman will be guided in the extent of ground which he lays down to grass, and the age at which he breaks it up for tillage, by a variety of complicated considerations, which can only be stated in very general terms: The goodness of the pasture, or its falling off sooner or later; the profitableness of live-stock, as dependent upon the demand and price of sheep and cattle; the proportional profit to be derived or expected from the cultivation of grain, compared with that from rearing and feeding live-stock; the power of procuring adventitious manure, such as town muck, lime, marl, and many other circumstances. Combined with all these, the farmer has often to consider, the rules or restrictions contained in his lease, which sometimes prescribe the proportion of land to be kept under grass during its whole endurance, or perhaps they only specify that circumstance, for a certain number of the concluding years. Taking all these circumstances into due consideration, the farmer will naturally prefer keeping such portions of his farm longest in grass, as are best adapted to be so with profit, and the contrary, according to his judgment and experience.

Besides this alternation of pasturage and tillage, which is the fundamental principle of the best Scotch husbandry, a *second* general rule may be laid down, as forming an essential principle of good management in the tillage part of every farm; which is, that fallow, or fallow crops of turnips or potatoes, according to circumstances, or drilled pulse, or a crop of clover, should always intervene between every two crops of grain or white corn. To fallow in the most perfect manner, as often as the condition of the ground requires it, and then to carry on a judicious system of pasture and tillage, with a suitable rotation of crops, forms the essence of the alternate system of Scotch husbandry.

It is requisite, however, in this place, to give a detailed account of the usual tillage rotations, or courses of crops, as

followed by the most judicious husbandmen in the best cultivated districts of Scotland. Much experience and judgment are required before the husbandman can arrange and adapt these properly to local circumstances, and apply them to each particular field or division of a farm, in respect to soil, situation, climate, and the like. Hence every rule, or rather instance here adhibited, can only be adduced as general examples, and not as regulations that ought to be rigidly adhered to.

Some account of the usual rotations practised in the best cultivated districts of Scotland, upon different soils and under different circumstances, shall now be given, prefixing two general remarks.

First, Independent of the rules or restrictions which may be prescribed in leases, and which too frequently are arbitrary and injudicious, every farmer has necessarily to consider his own wants for the immediate use of his farm, in directing his plans, or adjusting his rotations or schemes of management. Thus a husbandman, in consequence of applying his attention more particularly to live-stock, either from situation or predilection, requires more grass than another, or the contrary. Or it may happen that, with the strongest wish to follow out prescribed regulations, in regard to the proportion of the land directed to be kept in grass by the lease, the new ley is suffocated by the grain crop among which the grasses were sown, and the regular rotation thus overturned in spite of the husbandman. Hence the propriety, or rather necessity, of giving a certain latitude to all farmers, even in the closest leases; otherwise an intolerable injury may be sustained, while every effort has been used to comply with the prescribed rules.

Secondly, It may also be proper to mention, that for the accurate and convenient management of every farm under a regular course of cropping, it were desirable, that it should be divided into a number of inclosures, according with the system of rotation that is meant to be followed; as it is both

inconvenient and unseemly, to have different crops in the same field at the same time. This inconvenience is more particularly obvious, when pasture and any grain crop happen to occur in the same field, on which occasion some temporary fence becomes indispensably necessary, as hurdles, flakes, gates, or the like. Under the supposition, therefore, of a rotation of six shifts, it would be very convenient that a small farm were divided into six fields of nearly equal size: a large farm may, on the same principles, be divided into twelve, or eighteen, or twenty-four fields. Two or more small fields near the dwelling of the farmer, not included in the system of rotation, in addition to the regular distribution, would add much to the convenience of the farm; as adapted for experiments, or as an hospital for sick cattle, sheep, and horses, or for separating show rams, and various other purposes.

SECT. I.

ROTATIONS ON CLAY SOILS.

ON all clay soils, a naked and well-wrought summer fallow, as already described in Part II. of this chapter, is considered to be the indispensable basis of all good husbandry. The particular steps of the rotation, its continuance, or the number and succession of alternate crops of grain, and green crops, which may be taken before laying the land down again to grass, and the length of time which it ought to remain in pasture, before it is broken up for a fresh course of crops, must depend upon a variety of circumstances which have been already adverted to, and need not be repeated. Clay soils are liable to a variety of depth and fertility, and, like all others, to material differences as to the power of the farmer to procure ad-

ventitious manure, and particularly as to the climate in which they are situated. Every other circumstance being favourable, good clay soils are particularly adapted to the production of wheat and beans, and may therefore be continued under these crops alternately, for a considerable time, or as long as the land can be kept clean from weeds by means of drilled beans. This is assuredly the most profitable course of crops that can be followed, providing a sufficiency of manure be procured, and the drilled beans attentively horse and hand hoed. Circumstances, however, may render it advisable, to interpose a crop of clover and rye-grass occasionally for one year, in place of the beans, which may be succeeded by oats. This course, therefore, may continue six or eight years, or even longer, according to circumstances, and will run thus : 1. Fallow ; 2. Wheat ; 3. Clover and rye grass ; 4. Oats ; 5. Drilled beans ; 6. Wheat. In this rotation, to preserve the full fertility of the soil, and consequent abundance and profitability of the crops, the soil ought to receive a recruit of manure every third or fourth year, muck being first given in the fallow year, and next to the bean crop. Whenever the soil, however, gets foul with root weeds, which it will sooner or later, in proportion to the nature of the weather which prevails during the course, another naked summer fallow must be resorted to for extirpating the weeds, and this begins a new rotation.

Where circumstances are not favourable to the execution of the before-mentioned rotation, the following may be advantageously substituted, which contains a greater variety of the crops usually cultivated in Scotland, and which, by dividing farm labour more equably throughout the year, may be carried on with a smaller number of horses, and consequently at less expence : 1. Fallow ; 2. Wheat ; 3. Drilled beans ; 4. Barley ; 5. Clover and rye-grass ; 6. Oats ; 7. Drilled beans ; 8. Wheat. After which a new fallow begins a fresh rotation. In this rotation it is absolutely necessary that the soil should have muck twice, and even thrice if it can be

procured, to ensure abundant crops through the whole course; and the proper periods of its application are on the fallow before the first crop of wheat, and on the clover stubble in the fifth year, and to the drilled beans the seventh year. If a sufficiency of manure cannot be commanded, the rotation should be limited to six years, ending with the crop of oats, and recommencing by a new fallow; otherwise the beans and wheat of the seventh and eighth years will be apt to become scanty, and the land will run much to weeds. To shorten the steps of the rotation, from an eight course shift, as it is technically called, to one of six shifts, the land may be continued in grass, for a second or even a third year, according to circumstances.

On thin clays, as possessing very moderate fertility, and consequently affording weaker crops both of grain and grass, a very gentle application of tillage is necessary, otherwise the soil would soon become exhausted, and the produce be unequal to the expence of cultivation. Where a sufficiency of manure can be procured for keeping these soils in a complete state of fertility, by giving them a dressing of muck once in four years, the following rotation of four shifts may be followed: 1. Fallow with muck; 2. Wheat; 3. Clover and rye-grass; 4. Oats; and so round again by a new fallow. But where such soils have to depend entirely on their own scanty resources, it becomes often necessary to keep them longer in grass than one year, so as always to secure a sufficient quantity of muck for the fallow break, on which the success of the whole rotation entirely depends. Such soils, it is true, do not improve much while under grass, neither is their pasture very valuable; but by no other means can they be refreshed and invigorated where muck is wanting; and though the pasture may not produce much profit, it is procured at little or no expence. Including, therefore, the protracted ley, this rotation for thin clays will stand thus: 1. Fallow with muck; 2. Wheat; 3. Clover and rye-grass; 4. Pasture; 5. Pasture; 6. Oats.

SECT. II.**ROTATION ON LOAMS.**

EVERY soil which is intermediate between absolute clay and burning sand or gravel, has received the denomination of loam; and as clayey loam and loamy clays in so far as regards the rotation or course of crops, may be ranked under the head of clay soils, they may be cropped exactly on the principles already explained in the preceding section, though they verge considerably towards that division appropriated to light land, from which they differ only in degrees of quality. Rich free loam is unquestionably the most profitable and most agreeable to cultivate of any description of soil, as it almost uniformly produces abundant crops of all kinds, and affords excellent pasture. The minutiae of its management, or the particular steps of its rotation, depend much on the nature of the subsoil. If that is of a retentive nature, the soil will require to be cleaned from root weeds, once in a rotation of six or eight years, by means of a summer fallow, exactly like clay of the best description, and the steps of the rotation itself, will be similar to those already proposed for that genus of soil. Whereas, when incumbent on a free bottom, a fallow crop of drilled turnips is perfectly sufficient for effectual cleaning, and is therefore greatly preferable to naked fallow. These circumstances being properly considered, the rotation on loam may be as follows: 1. Fallow or turnips, according to the nature of the subsoil; 2. Wheat on so much of the land as is laid bare of turnips in sufficient time for that crop, barley or oats on the rest; 3. Clover and rye-grass; 4. Oats after grass; 5. Drilled beans; 6. Barley; 7. Clover and rye-grass; 8. Oats; and this crop succeeded by fallow or turnips, introduces a fresh rotation. Many intelligent far-

mers, however, are of opinion, that it would be more profitable to stop at the sixth crop, and to make it wheat instead of barley; then commencing with a fallow or with turnips; clover and rye-grass will rarely succeed, but after a fallow or fallow crop, and if it fails, so will in a great measure the eighth crop, or the oats.

SECT. III.

ROTATIONS ON LIGHT LAND.

IN this section it is proposed to include, as light or turnip land, all soils called sandy loam and loamy sand, which are only gradations of the same nature; the former being the richer, as approaching to free loam, and the latter graduating insensibly into sandy soil and burning sand or gravel. The general principles of management, for this description of soil, are precisely similar to those already insisted on, and every rotation should be formed on the substantial basis of a thoroughly wrought turnip fallow, to clean the soil from weeds. The course of crops proper for light soil is, 1. Turnips in drills; 2. Wheat or barley; 3. Clover and rye-grass; 4. Oats; and so round again to a new rotation, commencing always with turnips. "In very good turnip soils, this course of crops may be repeated indefinitely with perfect success from four years to four years, on condition that the turnip crop is always eaten on the ground by sheep, and that the grass crop be pastured, or at least that the hay produce be returned to the soil in the shape of muck *."

The foregoing four-course shift, or rotation of four years,

* Berwickshire Report, p. 206.

may be varied thus: 1. Turnips; 2. Barley or oats; 3. Clover and rye-grass; 4. Wheat. When the soil is inferior, this course of four crops will require the grass portion of the rotation to be protracted for two or more years, to restore or to preserve the fertility of the soil.

On very good turnip soil, approaching towards the nature of rich free loam, especially with some command of adventitious manure, as on mill lands or those within reach of town manure, a system of alternate white and green crops, or culmiferous, and leguminous, may be successfully persisted in for a considerable number of years, similar to the following: 1. Turnips; 2. Wheat; 3. Drilled beans or peas; 4. Wheat or barley; 5. Turnips; 6. Wheat or barley; 7. Clover and rye-grass; 8. Oats, &c. But when a farm has to depend on its own resources for muck, perhaps the best rotation on good turnip soil is, 1. Turnips; 2. Wheat or barley; 3. Clover and rye grass; 4. 5. Pasture; 6. Oats, and so round again. On all good turnip soils, beans and peas are found less profitable crops than turnips; and the almost universal practice of the best farmers is, to manage according to a four years' course of corn and turnips, and corn and grass. Upon the greater part of turnip soils, however, this system cannot be long supported without injury to the soil; and it is therefore necessary to pasture for one, two, or three years, before ploughing the grass land for oats, which begin a new course.

Hitherto either fallow or turnips have been uniformly placed first in every rotation; but in some general observations meant now to be offered, as applicable to the management of land, when first taken up from old *ley* or old pasture, it will be necessary to arrange the course of crops in their natural order. This subject will be more amply discussed in the following Chapter on grass lands; in the interim, the attention of the reader is requested to the following remarks.

In former years not long past, on breaking up grass-land, it was almost universal in Scotland to take several successive crops of white corn, as two or even three successive crops

of oats, oats followed by barley, or oats succeeded by wheat. This is now almost entirely abandoned, experience having convinced all judicious husbandmen that a regular and lighter system of cropping is ultimately more profitable. Still, however, on breaking up rich old pastures, two successive crops of oats are frequently taken, as the first crop is often insufficient to rot out the matted grass roots, and the second crop is frequently even better than the first. This plan is often of great service to the husbandman on entering to a farm of which the former tillage portion is considerably exhausted, and full of weeds. It enables him to apply his strength and resources to fallow and manure the exhausted part of his farm, and to lay down to grass for amelioration. The soil, however, must be naturally good, and in high vigour, which will allow of this practice without injury. Perhaps on breaking up rich old pasture under these circumstances, it were better to interpose a crop of drilled beans or peas, or both mixed, between the two grain crops; thus, 1. Oats from old ley; 2. Drilled beans or peas; 3. Wheat; 4. Turnips, which begin a regular rotation or course of crops. Where there is otherwise a sufficient breadth of grass on the farm to supply the live-stock of the tenant, or for complying with the conditions of a close lease, this management answers the farther purpose of protracting the recurrence of grass on this particular portion. For this purpose likewise, on breaking up grass land that is not sufficiently rich to admit of the three crops above mentioned, the third year may be devoted to turnips instead of wheat, by which means the regular course begins one year earlier. The only objection to the above course is, that beans rarely thrive upon land that has lately been in old grass, till it is completely summer fallowed, and they are in all cases an unsuitable crop for light soils.

SECT. IV.**ROTATION ON SANDY SOILS.**

BURNING sand or gravel can hardly be considered in any respect as soil, in so far as tillage or husbandry is concerned, if taken in the literal sense of the arrangement. By sandy soils therefore, must be here understood, such species of loamy sand or gravel, as approach towards the nature of burning sand, having so little clay in their composition as not to possess any plastic adherence either in their wet or dry state. From these soils very little produce is in general to be expected, either under grain or grass, as they are prone, by even a short continuance of dry weather, to be so parched, as to stunt the growth of every thing they can be made to produce. If, however, situation and circumstances admit of their being largely dressed with marl, especially that which is called clay marl, or even clay itself, or alluvial compost, so as to give them some degree of body or tenacity, they tend proportionally towards loamy sand or light turnip soil, and are changed by that means into the kind of soil treated of in the preceding section. Peat also has been found an excellent manure for this description of soil*.

Such soils, when sufficiently manured, are well adapted for turnips, which ought always to be consumed on the ground, as these soils can hardly ever be made too rich; and from their nature they very soon expend all the muck which is given them. On them wheat or pulse can rarely be cultiva-

* Sir Humphrey Davy mentions an improvement of this kind,—namely, peat applied as a top-dressing proving a permanent improvement on a light sand, at Nannaw in Merionethshire.

ted to any advantage, and barley, oats, and rye, are sure to return greater profit than wheat. Rye is almost the only grain which can be expected to produce any thing like an abundant crop on dry sandy soils; the winter variety can hardly ever be sown in sufficient time after turnips to arrive at full maturity. It may therefore more conveniently succeed grass, which on such soils ought generally, if possible, to continue for three years. The rotation of six years, therefore, which is best suited for dry sandy soils with winter rye, is as follows; 1. Turnips with muck, and consumed on the ground; 2. Barley or oats; 3. 4. 5. Grass pastured by sheep; 6. Rye or oats. The variety of spring rye may be sown with advantage in March, or the two first weeks in April, instead of barley or oats, the second year.

There is a species of apparently dry and burning gravel, which frequently occurs in *haughs* or holms on the sides of rivulets and rivers, which seems almost entirely devoid of soil, and which yet may often be cultivated to some profit, although the plough and harrows rattle through them as among a bed of mere dry stones. Where such gravelly holms produce weeds with great luxuriance, the farmer may be assured of procuring tolerable crops of turnips, grain, and clover, by judicious management, which so nearly approaches to that already mentioned for dry sandy soils, as not to require being here repeated. In the cultivation of these, however, the husbandman must lay his account to meet occasionally with considerable disappointments; as floods often sweep away the produce entirely, or overwhelm it in a covering of sand or gravel. Lands so situated, might sometimes advantageously be converted into water meadows.

Soils of this description sometimes occur in more elevated situations, entirely free from the danger of floods, where they can be safely cultivated on the principles already mentioned. In these situations it is customary to gather and remove the surface stones, especially from the first crop of clover and rye-grass, when that is intended to be mown for hay or soil-

ing. It is proper, however, to be cautious in this operation, lest the depth of the scanty soil among the stones should become too much reduced, and the land thus exposed be burnt up by the too free access of the sun and air. On low holms, only such stones, as are so large as materially to obstruct the husbandry operations, ought to be removed, as the smallest lowering of the surface of the holm, increases the danger to be apprehended from floods.

SECT. V.

ROTATION ON PEAT.

THIS subject is more immediately connected with the chapter on waste lands, where it will be discussed. It may be sufficient here to remark, that the sooner such soils are laid down with grass seeds, and the longer they are retained in pasture, until breaking up becomes necessary, the more profitably is the land likely to be occupied.

SECT. VI.

ROTATIONS ACCORDING TO ELEVATION AND CLIMATE.

HAVING already treated of the rotations proper for different descriptions of soil, in situations that are suitable for tillage, as a principal object of the farmer, it may be proper to mention, such plans of tillage as are adapted for high situations, and humid climates, where improved grass for pasture ought assuredly to form the great and leading object, combined with

the means of securing ample stores of winter food for live-stock. With these views, there are *four* principal objects of pursuit in such humid and elevated situations: 1. The improvement of those portions of the land which ought to be devoted to pasture grass; 2. The cultivation and improvement of such portions as may be fitted for the production of hay; 3. The improvement of such parts of the land as may be fitted for the growth of turnips, or other green crops for winter supply to the live-stock; and, 4. The cultivation of potatoes for the food of man, and the incidental production of grain crops in the ordinary steps of the rotation which are necessary for securing the more immediate objects of the husbandman, hay, turnips, and improved pasture. A great portion of the circumstances pertaining to this section will fall to be considered more at large in other chapters of this General Report; particularly in regard to *grass land* and its improvement, *wastes, draining, irrigation*, and other heads of inquiry which do not belong to the present chapter. All therefore that can be said with propriety, in this subdivision, must be confined very much to a general sketch of these subjects, which shall be explained in as convenient an arrangement as possible.

1. *Of elevated pastures.*

In regard to these, hardly any thing can be said on the present occasion, as they do not in general admit of being broken up for tillage with propriety. On these occasions, draining and liming the surface have been put in practice with great success, for reclaiming and improving coarse heaths and moor pastures; but as the detail of these operations is appropriated to another chapter, such operations shall only be noticed as belong to tillage and the course of cropping.

Where elevated pastures are of such a nature as to admit of tillage for their improvement, they will generally be found to arrange themselves under one or other of the descriptions

of soils already treated of in the foregoing sections of this division, more especially thin clay, weak and shallow turnip soil, and hill moss, or moor; hence very little remains to be said on these subjects, except that they are to be laid down again to permanent pasture, after undergoing the rotation or course of improving crops already mentioned, as quickly as possible, following always the shortest rotations which are adapted for each particular soil. In such situations oats can be cultivated with greatest success, and the early varieties ought always to be preferred.

On the borders of Scotland, many thousand acres have been fallowed, limed on the surface, and the lime harrowed in along with the corn and grass seeds, with the best effect; and at the distance of half a century this management still displays its superior advantages.

2. *Of the edges of the moors.*

In the neighbourhood of these elevated pastures, there generally are, upon the lower slopes of the hills, or what are named in some districts the *moor edges*, tracts of soil of more or less extent of a better description, and more or less fitted for tillage. These are chiefly adapted for the purpose of producing turnips and artificial grasses, as winter and spring food for live-stock, and on them the cultivation of grain is a secondary consideration. In favourable years, the grain cultivated on these situations, may serve for the supply of the family, servants, and horses of the farmer; and from its straw, litter, and even in favourable years winter fodder, may be provided for cows, young cattle, and horses: But the primary object is, or always ought to be, the production of turnips and cultivated herbage. In the production of these, the general principles of the alternate system, as already detailed, are to be followed; and oats, of the early varieties, is almost the only grain that can be cultivated with any chance of success: Sometimes big or rough bear, *hordeum commune vel tetrastichon*, may be substituted.

the means of securing ample stores of winter stock. With these views, there are four courses of pursuit in such humid and elevated situations, with a view to the improvement of those portions of the land which are to be devoted to pasture grass; 2. The improvement of such portions as may be required for hay; 3. The improvement of such portions as may be fitted for the growth of the exhausting crop to winter supply to the live-stock, and the cultivation of potatoes for the food of man. For litter, however, the grain crops in the ordinary course are extremely valuable, and necessary for securing the soil. The crops which are cultivated than it is, in the ordinary course, are bandman, hay, turnips, &c. In the ordinary course of the rotation of the circuit, such as those now described, the mode of management of the farm, which must either be fenced or unfenced, is to be considered. The Report; particularly guarded by herding, are cultivated in the ordinary course of crops, proportioning the quantity of manure to the manure which can be supplied for the ordinary course. 1. Oats from old ley; 2. Turnips, with a proportion of potatoes, with the whole of the land cultivated by the farm; 3. Oats, barley or bigg, with grass and clover seeds; 4. Hay, and then rest the land for three or more years, so as always to have a breadth every year under turnips as can be easily managed and manured. For the more convenient management of this rotation, it were desirable that all the ground of a Highland farm, which can be profitably managed in the ordinary course, were permanently inclosed by means of stone walls, to prevent trespass on the cultivated crops by the live-stock of the farm, and to enable the farmer to appropriate the whole of the herbage, to such parts of his live-stock as he thinks proper. In the first course of breaking up and improving the portions of elevated pasture farms, the surface ought

* Macdonald's Report of the Hebrides, p. 220.

and freed from stones or other obstructions
soil, if possible, dressed with lime or marl.
on the principles endeavoured to be
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ed and moist situations, tillage can only
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the soil for pasture. The crops of grain, which ne-
y form parts of the rotation, can never be depended
n for profit, any farther than as the straw is useful and
necessary as litter and fodder for the cows and horses, and as
productive of muck for the cultivation of turnips.

3. *Of Water-sides.*

In all, or in most of these high situated pasture farms, there
are haughs or holms on the sides of rivulets, which are more
or less susceptible of cultivation or improvement. These
may either be managed in the same manner already pointed
out for the cultivation of the *moor-edges*, which of course need
not be here repeated; or they may be converted into hay
meadows by means of irrigation. But as this latter improve-
ment, as yet new in the husbandry of Scotland, is appropria-
ted for discussion to a different division of this work, it can
only be mentioned incidentally in this place.

It is a singular circumstance in the history of Scotch agriculture, that the cultivation of rye should be almost exclusively confined to the Hebrides or Western Islands, where, according to the late ingenious reporter of that district*, the natives have probably derived this article from the Norwegians, under whose government they continued for a considerable period. Probably rye is not, however, well calculated for the Hebrides, as it is an exhausting crop to the soil; and though its straw is well calculated for thatching, yet it is of little value as fodder. For litter, however, from the quantity it produces, it is extremely valuable, and on that account ought to be more cultivated than it is, in other districts.

In situations, such as those now described, the most favourable parts of the farm, which must either be fenced for the purpose, or merely guarded by herding, are cultivated under the following course of crops, proportioning the quantity under cultivation to the manure which can be supplied to the turnip break. 1. Oats from old ley; 2. Turnips, and the necessary proportion of potatoes, with the whole muck produced by the farm; 3. Oats, barley or big, sown up with grass and clover seeds; 4. Hay, and then restored to pasture; which is to be continued, according to circumstances, for three or more years, so as always to have as large a breadth every year under turnips as can be effectually laboured and manured. For the more convenient conduct of this rotation, it were desirable that all the ground, in every Highland farm, which can be profitably managed in this manner, were permanently inclosed by means of stone-walls, to prevent trespass on the cultivated crops by the live-stock of the farm, and to enable the farmer to appropriate the improved herbage, to such parts of his live-stock as he thinks proper. In the first course of breaking up and improving these portions of elevated pasture farms, the surface ought to be ef-

* Macdonald's Report of the Hebrides, p. 220.

fectually drained, and freed from stones or other obstructions to tillage; and the soil, if possible, dressed with lime or marl. If judiciously cultivated, on the principles endeavoured to be elucidated, such improved portions will never revert to a state of wildness; and the only extraordinary expence they will ever require is, occasionally renewing surface drains and repairing the inclosures.

In all these elevated and moist situations, tillage can only be considered as advisable, in so far as it conduces to the production of turnips and hay, and the permanent improvement of the soil for pasture. The crops of grain, which necessarily form parts of the rotation, can never be depended upon for profit, any farther than as the straw is useful and necessary as litter and fodder for the cows and horses, and as productive of muck for the cultivation of turnips.

3. *Of Water-sides.*

In all, or in most of these high situated pasture farms, there are haughs or holms on the sides of rivulets, which are more or less susceptible of cultivation or improvement. These may either be managed in the same manner already pointed out for the cultivation of the *moor-edges*, which of course need not be here repeated; or they may be converted into hay meadows by means of irrigation. But as this latter improvement, as yet new in the husbandry of Scotland, is appropriated for discussion to a different division of this work, it can only be mentioned incidentally in this place.

SECT. VII.**OF ROTATIONS ACCORDING TO THE STATE OF CULTURE.**

HAVING insisted at considerable length on rotations, or the leading principles of managing arable lands, under a considerable variety of circumstances, very little appears necessary to be said on this head of inquiry. The state of culture of arable lands may either call for, 1. The restoration of land to fertility which has been exhausted by overcropping; 2. The management of land which is extraordinarily rich by a long succession of pasture, and which is to be broken up for tillage; 3. The best way of laying down land, which has been long under tillage, for permanent pasture; or, 4. The improvement of permanent pasture by a short course of tillage.

In the preceding sections of this part of the present chapter, almost every circumstance relative to these has been already adverted to, as applicable to different descriptions of soil, and very little more can be attempted in this place than a short recapitulation of these, as generally applicable to the several enumerated states or intentions.

§ 1. For restoring overcropped lands to fertility, besides the employment of a thoroughly well-wrought summer-fallow, or an equally well conducted fallow crop of turnips, according to the nature of the soil, together with the application of fit manure, the land ought to be converted as soon as possible into pasture, and so continued for such a number of years as the pasture remains abundant. When the goodness of the grass falls off materially, the sooner the land is again restored to tillage so much the better; as all experience evinces, that land acquires little fertility while under scanty and unproductive pasture.

§ 2. In the tillage of rich old pasture, when converted into arable lands, the only material circumstance to be considered is, how best to get the *sward* completely rotted. For this purpose, two successive crops of grain have sometimes been taken, more especially when other parts of the farm are in a state of complete exhaustion, by previous overcropping, as the heavy crops to be expected from the newly broken up rich old pasture, will enable the farmer to make a sufficient quantity of muck for manuring the exhausted parts of his farm, before laying them down to pasture for recovering vigour. This plan of overcropping, however, ought not to be permitted by proprietors; and all things being duly considered, the sooner such land can be fallowed, or wrought for turnips, according as its soil happens to be light or heavy, so much the better. The reporter has known even three good crops of grain taken successively, and without manure of any kind, on newly broken up rich alluvial soil in the neighbourhood of Hamilton, in Lanarkshire, the land being trenched for the third crop to bring up new soil to the surface. Where rich old pasture had, from negligence, become overgrown with thistles, the seeds of which were expected to overwhelm a crop of oats, the land has been trench-ploughed, so as to admit drilled beans as the first crop, to allow of horse and hand hoeing to extirpate the seedling thistles; and the beans were followed by an excellent crop of wheat. In whatever way such land may have been brought into tillage, its after management must be regulated according to one or other of the preceding rotations, according to the nature of its soil.

§ 3. In laying down tillage land to permanent pasture, the circumstances that require particular attention are,—that the soil be previously made perfectly clean by means of fallow or turnips, according to its nature, and that it be made rich by means of muck, lime, or marl. The rotations for this purpose, have been already sufficiently explained, when treating of the several descriptions of soil, and the course of crops adapted for each.

§ 4. Very little remains to be said, as to the rotations by which lands, long under pasture, are to be improved, by temporary tillage, for being again laid down to permanent pasture. After being broken up in one or other of the ways already mentioned, they must be thoroughly cleaned by means of fallow or turnips, enriched by manure, either muck or calcareous, or both, and laid down again to grass in the best possible condition. In one instance, the reporter knows of a large field of old pasture, having been broken up for improvement, which was completely fallowed for two successive years, and having been thoroughly limed and dunged, was laid down again to grass along with the immediately succeeding crop. This instance cannot be considered as capable of general imitation, the quantity of muck required on that occasion, having starved the rest of the farm with which it was connected for several years, though the field, so treated, might certainly have been restored to good grass, without committing any injury upon its neighbours. It is well known that lands, which have been *long* under pasture, will carry much finer herbage, when restored to that state, after undergoing *two* courses of a rotation, and having been *twice* under a summer-fallow, or fallow crop.

SECT. VIII.

MISCELLANEOUS CIRCUMSTANCES.

HAVING in the foregoing sections treated of the principal crops that are grown on farms, and the rotations which ought to be respectively prosecuted, it may now be proper to add some observations regarding certain crops, as potatoes, tares, and flax, which, though forming essential portions of the cultivated crops on most farms, do not occupy any full divisions or breaks in their regular rotations. The particular

circumstances, likewise, connected with their cultivation, will be afterwards detailed in the following subdivisions of this chapter.

§ 1. Upon all the varieties of soil which have been enumerated in the foregoing sections, *potatoes* are cultivated yearly in every farm, for the supply of the family and servants of the farmer; and these necessarily fall into some portion or other of the several rotations which have been already mentioned. Some farmers grow potatoes on a part of their fallow land, or on the turnip break; while others prefer a portion of the land which has been broken up from ley, or of that which is devoted to pulse in any of the foregoing rotations. There is good reason for preferring this latter mode, because it is necessary to plant potatoes too early in the season for being able to clean the land effectually from weeds by the short previous fallow; and because, (especially in turnip soils), potatoes, which grow up among the ensuing crop, often prove a troublesome weed.

§ 2. *Spring tares* are likewise grown by most farmers every year, to be cut for soiling their horses in the interval between the two cuttings of the clover crop. These accordingly occupy a portion of one or other of the breaks in the rotation or course of crops adapted for every farm, and are generally sown on a part of that division of the farm which is devoted to pulse, in any of the rotations already enumerated; or when pulse crops do not enter into the rotation, they are sown on a part of the land broken up for oats after ley.

§ 3. A small quantity of *flax* is frequently grown on most farms where the soil is adapted for its cultivation, partly for the use of the farmer's family, and partly as constituting one of the customary stipulations with the hinds or married ploughmen in part of their wages. This is grown on any convenient corner of the farm; but always so as to be followed by turnips or fallow before the land returns to grass. Notwithstanding the excessive rise in the price of imported flax of late years, its cultivation has very materially diminished in

most of the well-managed districts of Scotland among the farmers, and even the hinds, or married ploughmen, frequently prefer some substitute instead of that portion of their gains.

PART IV.

OF THE ARTICLES PRINCIPALLY CULTIVATED FOR THEIR SEED.

THE articles of farm produce cultivated in Scotland, for their seed, are wheat, rye, barley, oats, beans, and peas; although the second of these, rye, is so little attended to in modern Scotch husbandry, that it scarcely merits enumeration. The first four of these grains, usually called culmiferous, or *cereal graminæ*, are considered as exhausting crops, or robbers of the soil; the two others belong to what are denominated leguminous crops, naturally tending to fertilize the soil, by preparing it for the production of culmiferous grain, and by furnishing an increased stock of manure, for profitably carrying on the alternate system of husbandry, in a successful manner. Of the various soils to be found in Scotland, those of a clayey or loamy nature are more particularly fitted for the production of wheat and beans, while the sandy and gravelly soils are better calculated for the cultivation of rye and barley. Oats will grow on either of these, but are apt to fail, on very dry soils, in warm seasons. Peas are not now much cultivated, in well managed districts, except when mixed with beans, and drilled and horse hoed. This pulse, however, still continues to be grown in upland situations, or upon soils where beans cannot be raised with advantage. It is said that they ought never to be reared on the same ground, above once in twelve years.

SECT. I.**OF WHEAT.**

THIS is assuredly the most profitable grain, when judiciously and industriously cultivated, being now so much in demand, that the soil of Britain is scarcely able, at least under its present management, to supply the quantity wanted for the food of the people, whilst its superior price to other grains, renders it an object of great importance to the individual cultivator and to the nation. In this section, it is proposed to give a detailed account of wheat husbandry, and to explain the several steps to be taken in its cultivation with more minuteness, than may be necessary with regard to other grains.

§ 1. *Soils best adapted for Wheat, and their preparation.*—The soils best adapted for wheat, the preparation for that crop, and the rotations in which wheat forms a prominent object, with its station in the course of crops, have been already detailed in the chapter on arable land. Wheat, in the system of good managers, follows naked fallow, or is raised after turnips, beans, or potatoes; and sometimes, but of late very rarely, is taken after a crop of clover to which one ploughing is usually given, or which has been rag fallowed. This last is a hasty reduction of the soil to good tilth by two, three, or more ploughings and harrowings after a crop of red clover alone, or clover and rye-grass, cut green for soiling or made into hay; but more than one ploughing is seldom practised by good husbandmen, except when the grass crop fails.

The richer descriptions of clays and strong loams are certainly best adapted for the production of wheat; yet every species of clay and loam may be made to produce excellent

crops of this grain, if judiciously cultivated, and enriched by a sufficient quantity of manure. In the opinion of an experienced husbandman, rich clays and strong loams, when situated in a favourable climate, and judiciously cultivated, may be made to produce profitable crops of wheat every second year, if the land is kept free from weeds and in good condition; for which purpose a thoroughly wrought summer fallow must be interposed once in every course of four, six, or eight years, according as seasons or other circumstances happen to be favourable, or otherwise, to the great object in all good husbandry, keeping the land free from weeds*. The rotation or course of crops for this purpose has been already detailed, as consisting of a regular alternation of wheat with fallow, beans, potatoes or clover. But such a rotation can never be attempted on the mere internal resources of a farm, as it necessarily requires the aid of adventitious manure to a large extent; such as sea-weed, alluvial compost, town manure, muck from barracks or distilleries, or the like. Lime, marl, shell-sand, or other calcareous articles, though they may largely contribute towards this plan of management, are not alone sufficient for its accomplishment, as the same beneficial effects do not follow frequent repetitions, at least not in any degree proportionate to the expence, without the assistance of putrescent manures.

In the application of manures to this rotation, the calcareous are perhaps best applied to the naked fallow which begins the course, reserving the dung for the wheat stubbles, which will secure a good crop of drilled beans. When potatoes are interposed instead of beans, which they may often be advantageously in the neighbourhood of large towns, or in situations near water navigation, the muck ought likewise to be given to that crop. In the case of clover forming the intermediate crop, which likewise is often very profitable near

* Brown's Treatise on Rural Affairs

large towns, the muck ought to be laid on the clover stubble, immediately before the ground is seed furrowed.

It has been already stated, when discussing the systems or rotations proper for different descriptions of soil, that no absolute rules can be laid down, *a priori*, for regulating the fundamental series of husbandry operations, beyond the general principle of alternation; and that every husbandman must adapt the particular steps according to circumstances, from his own judgment and experience, as connected with the nature of his soil and situation, and a variety of concomitant considerations. When the soil is fallowed, every fourth year, or under the following rotation: 1. Fallow; 2. Wheat; 3. Beans; 4. Wheat—two crops of wheat, and one of beans, are procured from once manuring. In this course some husbandmen apply the muck to the fallow for the first crop of wheat; while others prefer laying it on the stubble of the first crop of wheat for beans, in which way the second wheat crop is effectually secured. Again, when land is fallowed every sixth year, the foregoing course of crops is extended to, 5. Beans; 6. Wheat. In this six-shift course, a second dunging is laid upon the stubble of the wheat crop of the *fourth* year. If extended two years farther to a rotation of eight—7. Beans; 8. Wheat—muck is again laid upon the wheat stubble of the sixth year. In the *four* course shift of the above rotations, two crops of wheat and one of beans are procured by *once* dunging; in the rotation of *six*, three crops of wheat and two of beans are procured by manuring *twice*; in the rotation of *eight*, *three* applications of dung are required for four crops of wheat and three of beans. In the two latter rotations, it is hardly possible to go on with success, unless adventitious manure can be abundantly procured; because if such frequent applications of muck are taken from the home resources, other fields will necessarily be deprived of their due proportion of that necessary article. Even dunging once in four years, is fully as much as most farms can afford, unless great attention is given to the collection of ma-

terials for increasing the stock of manure, and to its economical application. A constant attention to these circumstances is of great importance to husbandmen; and it may be remarked, that the wheat and bean crops, produce more abundant materials for manure, than any others that are cultivated. If combined with the practice of soiling horses and cattle, and a sedulous attention to the collection of other materials, such as the scourings of ditches, scrapings of roads, and the like; and if at the same time the soil is of good quality, the four-course shift may certainly be supported by the ordinary resources of a farm. The two other rotations of six and eight years, can only be carried on to advantage, with the assistance of foreign manure, either town-muck, sea-weed, or the like.

On thin clays, and inferior loams of a strong description, the mode of cropping above mentioned cannot be carried on, and they must be managed by less exhausting rotations. For these soils, the following rotation has been recommended: 1. Fallow, with 12 or 14 double cart-loads or tons of muck *per* acre; 2. Wheat; 3. Clover and rye grass; 4. Oats; 5. Drilled beans and pease; 6. Wheat*. It may be observed, however, that this rotation cannot be profitably conducted on such soils, unless manure is afforded a second time in the middle of the course, as upon the oat-stubble, in preparation for the crop of beans, otherwise the crops of the fifth and sixth years will fall off materially. In such cases, therefore, either the fallow must succeed the oats of the fourth year, or the clover and rye-grass of the *third* year, must be continued in pasture for two or three years. All these particulars of practice, must depend on soil and other circumstances; and every husbandman must regulate his conduct by his experience and judgment, combined with the means which he possesses for amelioration.

All light soils of good staple may occasionally produce good crops of wheat of excellent quality, though they are not

* Brown's Treatise on Rural Affairs.

naturally adapted for the growth of this grain. Under good management, the recurrence of wheat crops, will therefore be much seldomer on such soils, than on those already mentioned; and at all events summer fallow need never be resorted to for cleaning them, as the turnip culture is perfectly sufficient, when properly conducted, for freeing them of weeds, unless where the field is very foul with root weeds, a summer fallow may then be necessary in the first instance. On these soils wheat can only be taken with propriety once in a rotation, and may follow the turnip, or, according to the Norfolk system, the clover crop. When wheat follows the turnip crop, it must in general be sown in the spring months, unless the turnips are drawn and stored, in which case the wheat may be sown in November. On sandy turnip soils of a weak staple, wheat ought never to be attempted, unless a complete dressing of clay, marl, or alluvial compost has been recently bestowed; in which case their nature or staple may be said to be changed towards loam. On the lighter descriptions of soil, where circumstances are favourable in other respects to the growth of wheat, it will in general be the best management, to take wheat after turnips that have been consumed on the land; in which case, it must necessarily be sown in spring, and the earlier the better.

§ 2. *Season of sowing.*—From what has been already said, the season of sowing wheat must necessarily be regulated by a variety of circumstances, such as the stage of the rotation at which it is cultivated, the quality of the soil, and the nature of the season. After fallow, as the season allows, it may be sown from the end of August to the middle of November. On wet clays it is proper to sow early if possible, as such soils, when thoroughly drenched with moisture in autumn, seldom are in a proper state for harrowing till the succeeding spring. In the opinion of many experienced husbandmen, the best season for sowing wheat, either on fallow, rag-fallow, or once ploughed clover stubble, is from the beginning of September to the 20th of October; but in regard to this par-

ticular, the state of the weather, and of the soil, must guide the judgment of the farmer. On good dry gravelly loams, in heart after a clover crop and well prepared, wheat has been known to succeed best in East Lothian, when sown in November.

After drilled beans, whenever the season will admit of ploughing and harrowing, wheat may be sown from the middle or end of September to the middle of November, after which the sowing of wheat ought not to be hazarded till the spring quarter returns. One of the greatest obstructions to the cultivation of wheat after beans is, the lateness, and consequent precariousness of the seed time, often greatly protracted by the length of time requisite for *winning* the beans, so as to remove them to the rick-yard; by which, in late seasons, and on wet soils, the land cannot be laboured in any reasonable time for the succeeding wheat crop. To obviate this difficulty, an intelligent farmer, Mr Mitchell, is accustomed to remove his beans, immediately after they are cut, either to a grass or stubble field that is not to be ploughed before winter*. This is an admirable expedient for securing the proper season for sowing wheat, and the only objection is, the expence of twice carting the bean crop, which may sometimes obstruct the other harvest operations. But in soils which are in a fit condition, as to their nature, state of fertility, and cleanness for bearing a good crop of wheat, the superior profitableness of that crop to any other which can be substituted, gives sufficient inducement to incur a little additional expence and trouble on that account.

After turnips, when the crop is consumed or led off, and the ground can be properly ploughed, wheat may be sown from any time betwixt the first of February and the middle of March, and it is customary to plough and sow the land in

* Husbandry of Scotland, vol. i. p. 272.

successive portions, as fast as the turnips are consumed. Wheat has been sown after turnips with tolerable success, as late even as the first or second week of April. Such a late period, however, cannot be recommended, as the crop is thereby exposed to much risk from late harvests and imperfect ripening, as was particularly experienced in Berwickshire in the year 1807, when the late-sown wheat after turnips, was exceedingly inferior in quality, and harvested with great difficulty very late in the season. The second week of March, in this northern climate, seems to be the latest time at which spring-sown winter wheat can be ventured upon with safety, and a reasonable assurance of reaping a full crop of well ripened grain. It has been already observed, that it is only on turnip soil of a good staple, verging towards loam, and in high condition, that winter wheat, sown in spring, can be cultivated with success; but when circumstances are favourable, it will generally happen that such lands, especially if wheat is not too frequently repeated, will nearly produce as many bushels of wheat as of barley; the wheat crop, therefore, will on an average of seasons exceed the value of a barley crop considerably, and thence its culture is an object which ought not to be neglected.

All the observations hitherto made, refer exclusively to one or other of the varieties of that species of wheat which has been called *triticum hybernum* by botanists, the Lammas or winter wheats of the husbandman. The wheat which is ordinarily sown in spring after turnips is of that species, and is called *spring wheat* in common language, merely because sown in the spring season. It consists, however, with the experience of all who have been conversant in the cultivation of spring-sown winter wheat, that it is of importance to use the produce of spring-sown grain as seed for sowing again at that season, as the crop of such grain ripens about a fortnight earlier than when the produce of the same wheat, winter sown, is employed as spring seed. This circumstance, there-

fore, deserves particular attention when spring wheat is cultivated; as a fortnight during harvest, more especially when that is in other respects late, may prove of material advantage or detriment to the crop.

There is another species of wheat, named *triticum aestivum* by botanists, because sown in summer, which is known in some parts of England by the name of *May wheat*, because usually sown in that month. This species of wheat was tried pretty extensively in Berwickshire and East Lothian thirty or forty years ago, and abandoned, as inferior in value to the varieties of Lammas wheat. It has since been tried in the years 1808, 1809, 1810, but not with satisfaction, insomuch that it is again almost universally given up for spring sown Lammas wheat. It will ripen its seed, though sown so late as the first week of May, in the lower part of Berwickshire, and on early land. In general, where it is proposed to cultivate this species of wheat, the third week of April may be considered as sufficiently late. When sown in elevated situations and backward climates, it may be sown, however, if there is no risk of frost, even earlier.

§ 3. *The modes of sowing wheat*—are either *broadcast*, by the hand from a sowing sheet, or *drilling*, as have been before explained in the *first* part of the chapter; but sowing broadcast is the mode almost universally followed in Scotland, and having been already sufficiently described need not be repeated. Ploughing the seed down by means of a shallow furrow, is rarely practised, though on light soils it has been done with success.

Where *drilling* is practised, and it is so by several husbandmen on lands that are particularly infested with annual weeds, the drill machine most generally approved sows at three several intervals, according to the judgment or pleasure of the farmer, of 12, 10 $\frac{1}{2}$, or 9 inches respectively, as it is regulated. It is used on lands or ridges expressly made on purpose, 12 $\frac{1}{2}$ feet broad, each of which is sown at one bout, going up half

the ridge and down the other half, the machine being guided both times by means of one of its wheels going in the interfurrow. This machine sows 6, 7, or 8 rows at once, as it is previously adjusted to one or other of the intervals already mentioned. The most usual interval is $10\frac{1}{2}$ inches between the rows, in which case the machine sows *seven* rows at once, or *fourteen* rows on a ridge of twelve feet and a half. On dry turnip soil the drilling is often carried on upon land that has been ploughed completely flat, or not formed at all into ridges. In this case the machine has a lateral implement or drag connected with it, which can be removed to either side, and which makes a deep scratch or slight furrow in the ground on one side of the machine, by means of which each successive *bout* is regulated, as the horse is made to tread exactly on the scratch made during the preceding bout. This circumstance requires considerable experience and very accurate attention in the person who leads the horse, that the work may be performed with perfect regularity; as otherwise unseemly and unprofitable blanks will be left in some places, while in others the bouts will come too close together, or may even cross each other very awkwardly. Perhaps the difficulty of guiding the drill machine with accuracy, is a material obstacle in the way of a more general adoption of the drill husbandry in grain crops; and there is reason to believe that the practice, on that account, has lost ground in the best managed districts of Scotland.

There has not been sufficient experience in drilling in Scotland, nor any comparative experiments carefully made and recorded, on which to found any decisive opinion respecting its superiority to broadcast sowing or otherwise. It may however be observed, that by the drill mode of sowing, all the seed is completely covered up from the danger of being preyed upon by birds, and consequently that somewhat less seed may suffice to the acre. It is not believed, however, that this circumstance is of sufficient importance in itself, to form a

substantial motive for the universal adoption of drilling, as the saving in this way cannot be very material; but on land that is much infested by annual weeds, there cannot be a question that drilling is a very important improvement; as by this means the farmer is enabled to have his crop hand-hoed between the drills, and to destroy one crop of annual weeds at least, before sowing clover and rye grass.

§ 4. *The quantity of seed.*—This must be regulated by the judgment and experience of the husbandman, in the inverse proportion of the fertility of his soil and the earliness of sowing, jointly considered; the richer the soil and the earlier it is sown, so much the less seed being required, and *vice versa*. Upon well prepared lands, in high condition, and perfectly adapted for wheat, the seed can hardly be sown too thin after fallow, if equably distributed. In such cases, two bushels of seed *per acre* is generally quite sufficient. On such soils, though the crop may appear thin during the winter, the seedling plants have time and vigour enough to fill up the field, by means of suckers or lateral plants, which branch out from the principal root, called *tillering* or planting out, and produce a full crop in autumn. When sown too thick, rich fields are apt to become overstocked with more plants than can come to perfection, which accordingly grow up weak, slender, and unproductive, not being able to nourish and bring to perfection the over-abundance, which crowds the field. Bean stubbles require more seed than summer fallows, and clover ley ought to have even more seed than bean stubbles. Turnip land sown in spring, must have a still more ample allowance of seed, as the shorter time of growth does not leave a sufficient interval for tillering, and many of the suckers that are produced never come to maturity. In these cases, from three bushels, up to rather less than four, may be necessary, *per acre*.

§ 5. *Pickling, or preparation of the seed.*—Before wheat is sown, it is almost universally *pickled* or steeped, and this

process is indispensably necessary for preventing or lessening the disease of *smut*, which in nine cases out of ten would certainly infect the crop in a greater or less degree if this were omitted. Though the crop produced from pickled seed, be sometimes partially infected with the disease of smut, this is entirely owing to inattention in executing the pickling process. There are various kinds of pickles employed, and even different ways of using them. Perhaps the best pickle is stale urine, where it can be obtained in sufficient quantity, and a little prudent foresight may surely be able to provide that article on every farm. The most correct and effectual mode of pickling may be described thus: Take four tubs, two smaller and two larger, the former of a size to contain about a bushel of wheat, and the latter large enough to hold the smaller within them, but the smaller to have wire bottoms. Fill one of the large tubs with water, and putting the wheat in the small one, immerse it in the water, and stir and skim off floating grains; renew the water as often as is necessary, till it comes out almost quite clean; then raise the small vessel in which the wheat is contained, and repeat the process with the other large tub, which is to be filled with urine. In the meantime put in more wheat in the water with the other small vessels. When thoroughly washed and skimmed, let it drain a little; then empty it on a clean floor, and riddle quicklime upon it, turning it over, and mixing it with a shovel, till it is sufficiently dry for sowing.

The rationale of this expedient to prevent smut is altogether unknown, but its usefulness is undoubted; by the application of the powdered quicklime, besides drying the grain sufficiently, volatile alkali in vapour is evolved from the ammoniacal salts of the urine; but whether the beneficial effects are produced by this decomposition, or in what way any of the chemical agents, employed in this process, act upon the grain, so as to prevent smut from infecting its produce, we have as yet no means even of guessing. The following

inch, or even less, to two inches or more; but this circumstance is probably in no respect material to the success of the crop, provided that the seed be sufficiently covered to protect it from the depredation of birds*. This opinion is powerfully corroborated and illustrated by the vigour with which shaken wheat, and indeed all other grain, vegetates in the ensuing year among sown grasses, although not at all covered by the soil.

§ 7. *The kinds*—or varieties of wheat cultivated in Scotland are numerous, yet may all be arranged under two denominations, *red* and *white*, both belonging to the Lammas or winter species, called *triticum hybernum* by Linnæus. The different sub-varieties of the red wheat are now rarely sown in the best managed districts of Scotland, because they do not bring a price in the market equal to what can be had for white wheats †. *Woolly-eared* or thick-chaffed wheat has hardly for ten years past been met with; and when it happens to be mixed or blended among other kinds, which is only to be known when growing, it is considered as a kind of weed, as its woolly husks retain moisture in wet harvests, and occasion it to be more apt, than the smooth-husked varieties, to chip or sprout in the ear; a very serious evil to a crop of wheat, as all the grains that are much grown are entirely lost, and those which are only chipped, or malted, as it may be called, injure the flour materially, and prevent the bread from rising in the baking process.

The names by which varieties of wheat are known in one district, convey no information whatever in any other place, being altogether arbitrary in their first imposition, and having perhaps no regularly distinctive marks by which they may be afterwards known. Of the white wheats there are

* Two inches will secure the grain from the depredations of pigeons, but more will be required as a protection from the long beaks of rooks.

† Brown's Treatise on Rural Affairs.

many varieties, which may be arranged under two divisions, *thick-chaffed* and *thin-chaffed* *. The former of these was formerly in greatest repute, as generally yielding the whitest and finest flour, and therefore in greater demand by the millers; but since autumn 1799, when mildew raged so extensively, to which the thick-chaffed varieties were found more peculiarly liable, these kinds have been gradually falling into disrepute, and are now nearly banished from the well managed wheat districts of Scotland. The thin-chaffed varieties of white wheat are found to be more hardy in their nature, are seldom injured, unless when the weather happens to be particularly unfavourable during the period of flowering or blossoming, and in the after stages of filling and ripening; and some even of these thin-chaffed varieties are found from experience to be better able to resist the ravages of mildew than others. "In the year 1799, when so much injury was suffered from mildew, few *thin-chaffed* wheats were seriously injured as to quality, and repeated instances occurred, in which the crops of these exceeded that of an equal extent of *thick-chaffed* wheat, not less than 50 per cent. quantity and quality considered. Since that year, the culture of thin-chaffed wheats has rapidly increased, and they now bear a deservedly high character †." Of late years, a variety selected and propagated by Mr Hunter of Tynfield, in East Lothian, has come into high and deserved repute, being considered among experienced husbandmen, as much superior, in respect to produce and hardiness, to any known variety. This variety preserves a green and healthy appearance in the coldest weather, when the others become sickly and of a yellow hue; and though it does not perhaps afford the fairest sample in the market, it is found to produce a-bundance of excellent flour. In the south-east of Berwickshire, and the north of Northumberland, another kind called

* Brown's Treatise on Rural Affairs.

† *Ibid.*

creeping wheat, which belongs to the red family, has of late years acquired considerable reputation, especially for coarse clays, and soils tending to a moorish nature. It derives its name from a belief that it is peculiarly disposed to plant out the ground by means of suckers, *creeping* as it were over the ground; and it is considered as peculiarly hardy and prolific, especially on inferior soils.

It were certainly desirable to have a distinct nomenclature for the several varieties of wheat; but at present nothing of that kind can be attempted with any prospect of success, more especially as the names which they bear among husbandmen, in the various districts of the kingdom, are altogether arbitrary, whilst the names used in one district, are not understood in any other. All that is distinctly understood at present, is their classification into white and red, thick-chaffed and thin-chaffed, woolly-eared and bearded, the two last of which are generally considered as bad varieties. In Dr Walker's account of the Hebrides, or Western Islands of Scotland, he enumerates the following varieties*: Grey wheat, *triticum turgidum*, called likewise duck-bill wheat, grey pollard, and Fuller's wheat. This is a strong and bearded variety, having a strong stem, and carrying large heavy ears. It is sown in Essex and other parts of England, and thought to be a variety of the *triticum ramosum*, or branched wheat, which is cultivated in Sicily.—Cone wheat, *triticum conicum*, having a conical and bearded spike or head, is of the same family, and is common in the west of England, where it is reckoned well suited for the drill and horse hoeing husbandry. Polish wheat, *triticum polonicum*, is bearded, having awns not less than six inches long. This is the kind of wheat usually imported from Riga and the adjacent ports in the Baltic. It is a very hardy grain, with remarkably long and heavy ears, but is very liable to lodge when

* Walker's Hebrides, p. 232, *et seq.*

rank, though esteemed in some parts of England.—One grained wheat, *triticum monococon*, is raised in the poorest and most exposed fields in Germany; and though it does not afford a very ample crop, it will grow in a soil and climate where the ordinary varieties cannot be raised with advantage. On one occasion, it was sown in Scotland on the 12th of May. It rose on the 27th of that month, flowered on the 15th of August, and was thoroughly ripe on the 1st of October; therefore seems worthy of a trial in the Highlands of Scotland.—Spelt, *triticum spelta*. This species, which is much grown in the most sterile parts of Germany, has been sown in Scotland, in a field 600 feet above the level of the sea, and it ripened in the beginning of September. These two varieties appear well calculated for an inferior soil and a cold climate, as they admit of being sown in spring, and are capable of ripening in the higher parts of the country, in soils and situations that are unfit for the ordinary kinds of wheat.—Smyrna wheat. This species was brought from Smyrna to Brittany in 1757, and is much sown in the northern parts of France, where it gets the name of *bled de Providence*, from its superior produce and fertility. One head or spike is said to produce from 150 to 200 grains.

Generally, or it may almost be said universally, the different varieties of the *triticum hybernum*, Lammas or winter wheat, are alone cultivated in Scotland; although when sowing is deferred till after the month of January, the crop gets the name of *spring wheat*; and it has been already mentioned, that the produce of spring-sown winter wheat, used as spring seed, ripens about a fortnight earlier than the produce of autumnal sowing*. Summer wheat, called on the

* Winter wheat, sown in spring, after turnips, frequently fails in the southern parts of England. That may be owing, 1. To the want of a sufficiency of seed, for the quantity should not be less than from three to about four bushels per

continent *triticum trimestre*, or three months' wheat, because it frequently ripens in three months after sowing, is much cultivated in various parts of France; and from the Address of the President to the Board of Agriculture in June 1810, it appears that specimens of above *thirty* varieties of wheat, principally the summer sorts, were transmitted to him, by the President of the Agricultural Society of Paris, which have been divided among several of the most distinguished agriculturists of England and Scotland for trial, that they may report to the Board how far their cultivation ought to be encouraged. The Reporter tried summer wheat for three successive years; but neither was its quantity or quality such as to encourage a continuance of it in preference to oats or barley. In his experience the crops did not exceed 18 bushels, which at 7 s. *per* bushel gave only a produce worth L. 6, 6 s. *per* acre; while equal land produced 36 bushels of barley, which at 4 s. *per* bushel were worth L. 7, 4 s. *per* acre. It is stated in the Report of the Hebrides, p. 228, that John Earl of Loudon introduced this kind of wheat from the island of Jersey into Ayrshire in 1766, where it was sown on a heavy clay soil on the 7th of April, and reaped on the 26th of September, yielding a produce of 32 bushels to the statute acre, of grain almost equal in quality to winter wheat. This instance cannot be considered as conclusive in its favour; as heavy clay soil, is peculiarly adapted to the culture of winter wheat, and would probably have produced four or more additional bushels from each acre. It is proper however to state, that for some years past, the true *triticum aestivum*, has been cultivated with much success by Mr Hunter of Tynefield in East Lothian, and has been found to answer, in several districts of England, more especially in Lincolnshire and Devonshire.

English acre; and, 2. To the not having seed of the sort that has been accustomed to that culture, and which would ripen a fortnight earlier.

As the well managed districts of Scotland do not afford a sufficient number of facts on which to ground conclusions respecting the culture of summer wheat, it would be improper to load this chapter with information from other sources, especially as such would be altogether extraneous in a general report of Scotch husbandry. It may only be added, that bread made of the flour of summer wheat is described as less white than when made from the better kinds of winter wheats; but in Lincolnshire, where it is best known, it is said to be more palatable. From experiments conducted by Sir Humphrey Davy of the Royal Institution, summer wheat appears to contain more gluten and more bran, but less starch, than good winter wheat. Hence it may be inferred, that bread made of the flour of summer wheat, is more nutritious than that made of winter wheat, because summer wheat contains a larger proportion of the gluten or half animalised matter. It is also evident, that a miller ought not to deduct from the price of summer wheat, more than 2 *per cent.* on the money price of winter wheat of the same weight, as the excess of the weight of insoluble matter, or bran, is no more than 2 *per cent.* when compared with good English winter wheat. The darker colour, and the more palatable taste of bread made of summer wheat, are both probably owing to the excess of gluten which it contains.

Perhaps one of the most valuable purposes to which summer wheat can be applied in Scotch husbandry, is to fill up in spring any blanks or thin spaces that may occur in winter-sown fields, from the effect of frosts, or the ravages of the wire worm; as it may be sown on these even in the first week of May, when it can be raked into the naked or thin spots, and will certainly ripen as soon as the winter wheat among which it is sown. This is assuredly a much better expedient than sowing barley among such injured crops of winter

* Commun. to the Board of Agriculture, vol. v, Part i, p. 184.

wheat, which practice has been occasionally had recourse to, in the knowledge of the reporter. In those parts of England where summer wheat is best known, it is preferred to all other corn as the nurse to a crop of clover and rye-grass; which is said to be owing to the small quantity of its leaf, and its short duration, as the leaf fades and falls down almost as soon as it has attained its full size; by which means the infant clover and rye-grass plants are better furnished with air to assist their growth*. In 1810, the reporter sowed a large field with clover and rye-grass, among several descriptions of corn, winter wheat, summer wheat, barley, and oats; and in 1811 the crop over the whole was equally good. The produce of the summer wheat hung long unsalable in the market, and was at length sold late in spring 1811 at an inferior price.

§ 8. *Culture while growing.*—In respect to this head of inquiry, little need be said in this place, as, except the operations of harrowing and rolling in spring, when the seeds of clover and rye-grass are sown among the growing crop, and the careful opening up of the water-furrows, so frequently insisted upon, the only thing done to growing wheats in Scotland, is to cut any thistles which happen to spring up among the crop. Hand-weeding is not often practised, though gaining ground among good managers on spring-sown fields which are infested with annual weeds. When sown in drills, wheat is for the most part hand-hoed; and when grass and clover seeds are intended to be sown among the growing crop, this operation takes place either immediately preceding the sowing of these, or sometimes directly afterwards to cover them in, according to circumstances.

§ 9. *Feeding on young wheats.*—The practice of feeding young wheats in spring by ewes and lambs is by no means

* Commun. to the Board of Agriculture, vol. v, Part i, p. 182.



customary in Scotland, neither does it appear called for in the alternate system of husbandry which prevails in the well managed districts. Every farm of any extent uniformly has a proportion of young clover and rye-grass every year, sufficient to supply the ewes and lambs when turnips and rutabaga fail in spring, and until the older leys or pastures have risen to a sufficient bite: and it is a general opinion that eating over young wheats, in a northern climate, might give a check to their growth and advancement towards maturity, so as to run the risk of occasioning the season of ripening and harvest to be somewhat later, which would be attended by dangerous consequences.

§ 10. *Reaping and harvesting.*—Having already, in the 12th section of the First Part of this Chapter, given a detailed account of *reaping and harvesting* in general, as practised in Scotland, it does not seem at all necessary to give any particular description of these operations in this place, as the harvest work for wheat, oats, barley, and rye, nearly resemble each other. Some observations on the subject, so far as wheat is concerned, may however be added, and these are principally derived from an agricultural writer of much experience in this branch of husbandry*.

There is some difficulty in determining, when a crop of wheat should be cut down, as it is necessary to distinguish between the ripeness of the grain, and that of the straw. In some seasons the straw ripens or loses its succulency, and turns yellow from the root upwards, giving the appearance of full ripeness to the eye, while the grain in the ear remains still in a very soft and unripe state. In such cases, some farmers contend, that though the grain can receive no farther nourishment from the root, it were yet improper to cut down the crop, as it would then be deprived of the benefit which it

* Brown's Treatise on Rural Affairs.

may still derive from the sun and air, both of which have great influence in bringing it to maturity. Whereas others are of opinion, that after the stalk has ceased to vegetate, it cannot yield nourishment to the ear. The state of weather, however, must at the same time be taken into consideration; because in moist and variable weather, every kind of grain that is prematurely cut, is more liable to receive injury than when completely ripened. It is advantageous, however, to cut wheat before it is in a state of the most perfect ripeness; because, when in that state, a great deal of the best grain is exceedingly apt to fall out from the ear in handling, while the processes of cutting, binding, stooking, and carrying to the rick-yard are going forward. To cut, however, in too green a state, is likewise injurious, both to the appearance of the grain, which shrivels in drying, and to the quantity of produce. *A green shear, is worse than a sore shake wind,* is an ancient agricultural proverb.

All these things require to be duly considered by a careful husbandman, as also the state of the season, and the dangers that may be incurred from wind, especially if the equinox be at hand. On the whole, therefore, it is the more prudent part, to cut down wheat before it be fully ripe, as hazarding less, than by adopting the opposite extreme. The best time for cutting wheat, and every species of grain, is, when no juice can be expressed from the straw immediately beneath the ear. The grain will then be comparatively clear-skinned and fine, and both the grain and straw will be much more valuable. In early harvests the wheat crop may be allowed to stand till more fully ripened; while in late harvests, which are usually attended by greater risks from winds and damp weather, it must necessarily be cut in a less ripened state. When wheat is what is called dead ripe, the ears are very apt to break off at their necks while reaping, to the great detriment of the crop. The grain also drops from the ear in the act of reaping the crop. It acquires a dead dusky

hue, much against it in the market, both as to appearance and real good quality, for the bakers do not find wheat make good bread when it has stood too long on the ground.

When the weather is dry and the crop free from succulent weeds, or rank growing clover, the crop of wheat may be carted to the rick-yard in a few days after it is cut down; and indeed if the straw is quite ripe when cut, it may be stacked almost immediately from the sickle. From the strength of its straw, wheat remains opener in the sheaves, both in the stook and rick, and therefore *wins* or dries better in both than either barley or oats, and may therefore be carried in earlier than either of these grains. The best criterion to judge of the fitness either of wheat, or any of the other culmiferous grains for being carried in, is to examine what are called the *corn knots* or joints of the straw. If these are succulent and full of sap, it were dangerous to carry the crop, while in that state; but when these are dried and dead, the crop may be carried in great safety, even although it may be at the time a little wetted by rain. If, however, the crop, or any part of it, is meant to be threshed early, as for seed or otherwise, it is necessary to allow it to remain in the field till pretty thoroughly *win* or dried. When the straw happens to be mixed with succulent weeds of any kind, or with rank growing young clover and rye-grass, the patience of the husbandman must be exercised till these are decayed and dried; otherwise the crop will be exceedingly apt to heat in the rick, when the produce will be materially injured.

§ 11. *Diseases of wheat.*—Wheat is subject to several diseases, particularly smut, blight, mildew, and rust; to all of which it were extremely desirable that adequate cures or preventives could be applied. In the present state of agricultural knowledge, however, very little indeed can be said to the purpose concerning these diseases; and in a report, such as the present, it would swell out this subdivision to an inconvenient size, were an abstract to be given even of what

has been written by several ingenious men upon such curious and interesting topics; in the present instance, therefore, attention shall only be given to what may lead to practical conclusions.

Smut is a singular degeneracy of the grains in the ear, by which the substance of the grain becomes entirely changed into a black powder, similar to that which is naturally contained in *lycoperdon globosum*, puff-ball, or dusty mushroom. When infected by this disease, the wheat is said to be blacked, smutty, or balled; and when to a great degree, the injury to the crop is very important, both by diminution of produce, and by the remaining wheat being tainted or dirtied by the black powder, which materially hurts the produce in flour unless previously washed. When smutted, many farmers wash their own wheat, by floating it in large tubs partly filled with water, skimming off the light grains and smut-balls; after which the heavy, sound, and washed grain is spread out on cloths to dry in the sun and air; or if the quantity be considerable, it is dried on a kiln. Where a farmer has a considerable quantity of smutted wheat, it were perhaps better to dress his grain as well as possible, and to leave the washing and drying to the corn-merchants or millers, who have kilns and other conveniences for that purpose.

Notwithstanding the violent and swift action of threshing-mills, it is a certain fact, that they do not bruise the smut-balls nearly so much as is done by the flail or swiple; so that wheat threshed by the mill, though containing a considerable proportion of smut-balls, is not blackened or dirtied in any degree equal to that which is threshed by the flail. Hence, by industrious dressing, all the balls may be cleaned out, and the wheat sent to market in good condition. Besides the circumstance of the flail breaking a great many more of the smut-balls than is done by the threshing-machine, flail-threshed wheat lies long on the damp threshing-floor, mixed among the broken smut-balls; during which the black pow-

der adheres to the damp grains, and can only be afterwards removed by washing; whereas, in the threshing-machine, the grain being dry, and instantly subjected to several strong blasts of wind, the black powder from the broken balls is all or mostly blown away, and the produce remains clean.

Of the cause of this disease little is known; but happily the disease can be prevented by careful pickling, as already mentioned. In what manner the pickling acts as a preventive of the smut is also but little known*; but the fact, that wheat, if clean fair seed be used, and if it is properly pickled, is not affected with smut, even in those years in which that disease most prevails, is undoubted. Some farmers, on a mistaken idea that pickling could be of no use, because the nature of the disease and the mode of operation of this salutary preventive were both unknown, chose several years ago to neglect pickling seed wheat. They afterwards candidly acknowledged, that their wheat crops were considerably deteriorated; while their neighbours, who pickled from experience without theory, comparatively escaped in a season when smut prevailed more than ordinary †. Facts are all that can in general be known to science; causes, and modes of operation, not being always within the reach of the human faculties: all that can ever be attained by the most accurate investigation, and by the most truly scientific genius, is a knowledge of the natural series of facts, as following each other in a chain, and which are

* An ingenious account is given in the Farmer's Magazine of the probable *modus propagandi* of the smut. It is supposed the black powder contains the seeds of a fungus so minute as to be taken into the circulation of the juices of the growing wheat; and to rest in the embryo grains in the ear, and there to vegetate, and living on the matter of the young grain propagates its species. The application of urine and quicklime destroys these seeds if attached to the grains of wheat; and if they be not so attached where the wheat is sown, but come afterwards into contact with it in the soil, which it is found they sometimes do, particularly near woods and hedges, they do not vegetate, unless the wheat be sown without pickling.

† Berwickshire Report, p. 220.

usually called causes and effects, according as they precede or follow each other. The sick man does not refuse the remedy offered by his physician, though neither of them can explain the peculiar nature either of the disease or remedy, or the manner in which the latter operates in curing the former.

There is another species of smut which frequently prevails on wheat, quite different from that already mentioned, and which is seldom described by authors on husbandry. In the former or smut-ball, the disease is entirely confined within a pellicle or parchment coat, occupying the places of the grains in the ear, and has the appearance of a small parasitical lycopodon or *puff-ball*, occupying and usurping the place of the seeds or grains of the wheat. In this other species the whole form of the grain is entirely obliterated, and nothing remains except a few irregular fibres of the husk or chaff; the black powder being altogether external, and divested of any envelop or skin. This disease exactly resembles the blackness which frequently infects crops of barley and oats, and is obvious and complete whenever the ears burst from the sheath or shoot-blade. It does very little harm, only destroying such ears as it infects, and these are seldom numerous, and it does not spread, neither does it at all injure the sample, as it is entirely blown away in the process of threshing and dressing. In 1807, the Reporter observed a good deal of this species of blackness in one of his fields of wheat. Just at the time when the grain was forming, and the flower going off, he tried the following experiment to endeavour to ascertain whether the disease was infectious. He pulled a number of these blackened ears, with which he rubbed a tuft of wheat growing on a bare or missed part of the field, so as effectually to dirty the whole ears of that tuft which was carefully marked. At harvest, the ears of that tuft were entirely free from smut*. Perhaps

* Berwickshire Report, p. 232.

this experiment ought to have been carried farther, and the grains from that tuft should have been sown in the ensuing crop, to determine with certainty whether they were infected.

It does not appear that the diseases of *blight*, *mildew*, and *rust*, are properly understood, and it is a doubtful point whether these diseases can be correctly distinguished by the most accurate agriculturist. Without pretending to any minute practical knowledge on this subject, *blight* may perhaps be defined as an internal disease in the ear or spike of the wheat, either affecting all, or only a part of the florets, producing an entire or partial deficiency of seeds; or, in a lesser state of the disease, rendering the grains small, shrivelled, and light. Mildew on the contrary seems to be an external disease, proceeding from the growth of a parasitical fungus or lichen on the straw or ear, or both, which robs the plant of its nourishment, and occasions the grain produce to be shrivelled, small, and hungry. The former of these diseases, *blight*, is probably produced by heavy rains falling at the time when the wheat is in flower; that is, when the anthers are protruded from the florets, and by which rains the *pollen farina fecundans*, or vivifying dust of the anthers, is washed away, before it has come to sufficient maturity to impregnate the *stiles* leading to the ovaries or receptacles of the embryo grains or seeds. The latter, or *mildew*, so far as the reporter can judge from his own observation, and the information of others, proceeds from the prevalence of heavy fogs or mists, or of cold drizzling rainy weather during the summer months, between the times of flowering and ripening; which, by encouraging and promoting the growth of the parasitical lichen or fungus, which seems to constitute the disease, injures the health of the wheat plant, and prevents it from perfecting its farinaceous seeds.

In 1808, 1809, and 1810, serious injury was suffered in many parts of Britain by disease, and consequent defalcation of the wheat crop, which consisted of a combination of the *blight* and *mildew* as here understood, and appeared to have

been occasioned by the circumstances of the weather mentioned above as productive of both. In the Appendix NO. III. to the Agricultural Report of Berwickshire, a series of questions regarding this subject are inserted, which were circulated in 1808 by Sir John Sinclair, with such answers by the reporter, as he was able to make at the time. Having seen no reason since to alter his opinions on that head, the following description of that complicated and destructive disease has been abstracted from his answers to these queries.

“ From the best information I can procure, the mildew began to make its appearance on the straw and ears of the growing wheats, immediately subsequent to a heavy fog or mist, rising as it were out of the ground, about the 4th to the 10th of July 1808, and which was followed for several weeks by much misty and rainy weather, attended by considerable heat and very little wind. The peculiar fog or mist above alluded to, is called *ground-rook* in some parts of Scotland, and strongly resembles a thick smoke which appears to rise from the surface of the earth. The disease upon the wheat-straw, here called mildew, and which occasioned so much injury, consisted of a species of lichen, of an oblong pointed form, like a wherry or canoe, having narrow white edges, and a black pulverulent disc; each individual spot or plant being about an eighth of an inch long, and about a sixteenth in breadth. I can only say from memory, that it exactly resembles the figures and description given by Sir Joseph Banks, as I had not then his excellent publication on the subject to compare them accurately. The species of lichen which constitutes the disease of mildew, when growing abundantly on the straw and ears of wheat, must necessarily be procured from its own peculiar seed, which seed accordingly is the immediate cause or origin of the disease. But why this lichen should so abound in some years and not in others, and why the particular weather which has been described as immediately preceding the appearance of the mil-

dew, should so singularly occasion and encourage the growth of these lichens, is perhaps beyond the power of man to investigate.

“ In its progress, the gradual increase and multiplication of the parasitical lichens on the straw, ears, and husks of the growing wheat, produced, in many instances, an universal blackness on whole fields, and the grains in the years were found more or less false, deaf, or unimpregnated, while much of the actually formed grains were small, shrivelled, and dark-coloured, having very little farinaceous matter in their substance. After this appearance of mildew, the wheat crop was much lodged by heavy rains about the beginning of August; and in several instances the straw had become so tender by the effects of the disease, that it burst open in bending under the weight of the rain. By this, entire fields were utterly destroyed, so as not to contain a single grain of wheat in the ears, and the straw became utterly unfit for fodder. In such cases, whole fields, that promised ample crops, were mown and led into the fold-yard as bottoming to the dunghills; while others were dried like hay, and built up in stacks, to bed the fold-yards, feeding-sheds, and stables, as wanted. In one instance in Northumberland, a removing tenant absolutely refused to reap and remove his last crop of wheat, which was utterly useless to him, but might serve his successor to convert into muck, and he was ultimately found not liable to the charge which would have been for the sole benefit of another person. In other cases, where the plants remained alive and unbroken, the injury was not so entire, yet sufficiently distressing, by the diminution of the quantity of produce, and the deterioration of the quality of the grain which remained. This varied in different proportions, according to circumstances. Crops that were estimated at the beginning of July to produce 40 bushels of good wheat from each acre, were valued at harvest to give 6, 10, 12, or up to 20 bushels of very inferior grain, some of which did not command the price of inferior

oats, and many farmers accordingly gave their bad wheat to their work-horses, and sold their oats.

“The whole of the injury was not attributable to mildew, but proceeded from the concurrence of two other causes: a *blight* in the ear, occasioned by heavy showers of rain, while the wheats were in full flower, by which the *pollen* was washed away, and prevented from fecundating the florets. This idea is strengthened by the circumstance of the upper florets of the ears, and very often the whole of one side of the head, being generally barren. In consequence of a great deal of the crop having been lodged by heavy rain at the beginning of August, the grain produce where impregnated, became *sloomy*, or small, shrivelled, and ill filled. Both of these causes are known to injure grain crops materially, in years when the mildew has not been noticed.

“Besides the mildew, blight, and lodging, which by their combination produced such extensive injury in 1808, several farmers observed great numbers of minute maggots among the ears of their wheat, every one of which appeared to lodge among the florets, and to devour the forming grains in the state of milk, or while soft. These were compared to the springing maggots often seen in rotten cheese, but vastly smaller. These must have been the larvæ of some small fly, scarabee, or moth, the multiplication of which had been peculiarly favoured by the circumstances of the weather, or which had been attracted particularly to the wheat, in consequence of its diseased state.

“No discrimination of soils could be pointed out, as more or less affected by the disease. It attacked the crops of wheat on strong as well as on free soils; and the only observable difference was, that high, open, free-aired situations, were comparatively less diseased, while low grounds, much sheltered by high hedges, hedge-row trees, and plantations, and situations near rivers, were obviously and considerably more materially injured. The near neighbourhood of the

sea seemed to have a beneficial influence in preventing or lessening the disease. Much of the wheat crop, in various soils and situations, was comparatively exempted, or so little injured as to give an abundant produce, and of good quality: But no circumstances occurred that could throw any light on the causes of these differences, at least in a practical view of the subject, so as to point out any means of preventing or even lessening the evil on any future opportunity*.

* As far as could be learnt in Berwickshire, where the reporter then resided, all kinds of wheat usually cultivated there, were equally affected by the disease, or nearly so; other circumstances being similar, the variety named *creeping* wheat excepted. In East Lothian, the *thin-chaffed* wheats suffered much less injury than the *thick-chaffed* varieties. Both autumn-sown and spring sown wheats were affected, but the autumn-sown obviously and materially more so than the spring-sown crops. This difference was perhaps owing to the spring-sown crops having flowered later than the autumn-sown, so as not to have had so much of its pollen washed away. Bearded wheat is not cultivated as a kind in Berwickshire; yet heads of that variety are often found in most fields, more or less numerous, as an accidental mixture. A field of wheat infected by the mildew, in which there was a considerable intermixture of bearded wheat, was carefully inspected in autumn 1808, but no difference could be perceived in the degree of disease between the bearded and the smooth eared kinds. This observation was particularly attended to, because in the before-mentioned queries, it was alleged that bearded wheats were not nearly so liable to the disease. Perhaps the bearded kinds there alluded to, belonged to the summer species, or *triticum aestivum*.

* Hedges and trees, by preventing a free circulation of air, would detain moisture longer on the grain, than in open situations. Near the sea, there is generally a circulation of air occasioned by the tides, perhaps even in the calmest weather.

“ Upon the whole, this complicated disease, by which such serious injury is caused to farmers and the public, appears to have been occasioned by the unfavourable state of the weather at the time of flowering, combined with a continuance of unfavourable weather during the after progress of the wheat in filling and ripening, and to be utterly unsusceptible of any preventive, precautionary, or curative attempts by any human efforts.”

Rust is another disorder incident to wheat crops, in which a brown or orange coloured dust gathers on the stalks and leaves, occasioning the plants to become weak and sickly from a deprivation of nourishment. Perhaps this rust may be a species of lichen or fungus, entirely different from that which constitutes the disease of mildew already described; but observations are still a-wanting to ascertain this fact. It is said to be occasioned by excessive heats and unusual drought; which of course, like the former diseases of mildew and blight, are beyond the power of man to prevent.

There are three other distempers to which wheat is liable, which are not much known in Scotland; 1. *Red gum*, which is a partial appearance of redness, or rather a sort of deep orange colour on the chaff of the ear; 2. *Cockle-eared*, or small ears like the root of the plant cockle; and 3. *Root-fallen*, when it is loosened at the roots. In some cases also, when the weather is cold and ungenial at the time when the ear bursts from the shoot-blade, the points of some ears are caught in the angle where the two edges of the leaf join, by which they are forced into a curve, and in such ears there certainly is a deficiency of grain, or partial blight. But this has not been seen so extensive on any particular crop as to merit the name of a disease.

Before quitting this subject, it may be proper to notice an opinion that has been propagated, and even on high authority, “ that blighted and mildewed wheats may be safely used

as seed ; because, on trying experiments on this subject, such were found to vegetate." Although there is no direct experience on this subject, the analogy of man and animals give strong grounds for believing that a compliance with this opinion in practice may be attended with imminent danger. Men and animals, though afflicted by many and heavy diseases, can propagate their kinds ; yet experience evinces, that a healthy and vigorous progeny is infinitely more to be expected from healthy and vigorous parents than from those which are diseased. This is not the place to discuss the subject of hereditary diseases ; but certainly no sensible person would expect handsome cattle, from a poor-shaped bull or cow, fine woolled sheep from those having coarse fleeces, or a racer from a cross-bred hackney. That light, defective, or diseased wheat will vegetate, there is no disputing ; yet it is much to be feared, that the defects of the seed may be communicated to the produce ; and these may even, as in some hereditary diseases of man and animals, pass over one generation, and break out with virulence on that which succeeds. An experienced agriculturist asserts with confidence, and we give him entire credit, " that he has seen fields partly sown with sound, and partly with mildewed wheat, and that the difference was discernible at one glance even in the winter months, during the first stage of their growth *."

As on all such subjects the result of comparative experiments carefully conducted are of infinitely more importance than the finest reasonings, the freedom is, therefore, used to borrow from the last quoted author a decisive experiment in favour of using perfectly ripened and well harvested seed-wheat in preference to that which is light or imperfect †.

" The late Benjamin Bell, Esq. in October 1783, sowed a field of twelve acres at Hunthill in Roxburghshire with 54

* Brown's Treatise on Rural Affairs.

† Ibid.

bushels of wheat, of which 12 bushels were the best that could be procured in the London market of crop 1783, 30 bushels were from East Lothian of crop 1783, 6 bushels the best wheat in the London market of crop 1782, and 6 bushels produced near Edinburgh in that year 1782. It must be remarked, that 1782 was a season generally unfavourable to raising wheat in perfection, but that in 1783 the grain was sound and of good quality. The field on which these parcels of wheat were sown had been well fallowed, was equally manured with dung, and the whole of these seeds were sown in the beginning of October, all of them having been washed in strong brine, and afterwards dried with powdered quicklime. The English seed of crop 1783 was sown on one side of the field; three bushels of the Mid-Lothian seed of crop 1782 were sown on the next three ridges; to this succeeded the English seed of crop 1782; then the East-Lothian wheat of crop 1783; and, lastly, the remaining three bushels of Mid-Lothian seed crop 1782.

“The field being all in good condition, the wheat appeared early above ground, and the shoots were every where strong, except on those ridges which were sown with the Mid-Lothian seed of crop 1782, on which the plants were weak and not very numerous; neither did these spread or *tiller* like the others; so that during the winter and spring months, the wheat on these ridges had a weak appearance; in harvest the straw was thin and short, and the ears were short and small, the grain likewise being not so large or heavy as on other parts of the field. On being threshed and measured, the produce of the 12 bushels of seed, crop 1782, both the London and the Mid-Lothian taken together, was only 66 bushels, or $5\frac{1}{2}$ after one. The produce of the rest of the field was fully 15 bushels for every bushel of seed. The difference in value was also considerable, as the produce of the seed from crop 1782 sold almost a shilling the bushel lower than the other.”

On the whole, it seems the safest plan, to use none but good seed, and to avoid as much as possible the seed of wheat that has been infected with any disorder.

§ 12. *Harvesting*.—When thoroughly dried in the straw, which is easily known by the corn knots or joints becoming brown and free from sap, and by the heart of the sheaves not giving a sensation of coldness or moisture to the hand when thrust in, the crop is led into the barn-yard, and built into cylindrical ricks with conical pointed tops, thatched with straw, and secured by straw ropes, in the way already described, Part I, Sect. 13. of this chapter.

§ 13. *Threshing*.—Having already detailed the steps of the threshing process for grain in general, in the *first* part of this chapter, nothing remains to be said on the subject in this place. *Dressing* for market, has been likewise sufficiently described in the section which immediately succeeds the account of the threshing process.

§ 14. *Produce*.—The quantity and value of produce from a crop of wheat, necessarily varies exceedingly on different soils, according to a variety of circumstances, in seasons, tilth, manure, and course of crops. Forty bushels *per* English acre is esteemed a large produce on good soils in high order, even in favourable years, though sometimes from 38 to 47, and even 55 bushels *per* English acre, have been obtained. From 24 to 30 bushels, may be stated as a fair average produce on middle-soiled farms under good management; 18 bushels is considered to be a very poor crop.—The produce, after deducting what may be necessary for seed and family use, is sold to corn-dealers, millers and bakers, or to other farmers for seed.—*Prices* necessarily vary from year to year, according to quantity and demand, and as near or distant from shipping, or extensive grain markets.

§ 15. *Gleaning*.—This is universally allowed on all farms after the crop is removed to the stack-yard; but of late, all careful managers, refuse to admit any gleaners into their fields, when reaping is going on. In former times, while

the crop was cutting down, it was often more troublesome to the steward, to keep the gleaners in order than to direct the reapers; and while the stooks were on the ground unguarded, which they must necessarily be after the crop is cut, it was impossible to prevent pilfering, which is injurious both to the interest of the farmer, and the morals of the gleaner. No person able to handle a sickle to any useful purpose, ought ever to be allowed on any pretence to glean, while any ripe corn remains unreaped in the neighbourhood.

Having in this section, and the corresponding subdivisions of the first part of the chapter on arable land, entered with sufficient detail into many particulars respecting the management of crops of grain, it will only be necessary to particularize such differences, as belong to the other grains, in the succeeding sections of this part of the chapter.

SECT. II.

OF RYE.

IN general but little rye is grown in the more improved districts of Scotland, and hardly any particulars respecting it are recorded in the reports of the best cultivated Scotch counties. Indeed, during eighteen years' residence in Berwickshire, and frequent visits to the neighbouring counties of Roxburgh and the Lothians, the reporter has not had occasion to see this crop growing, except in a few instances, and in very small patches.

In the Berwickshire fiars for 120 years, from 1689 to 1808 both inclusive, the price of rye is not once recorded. Formerly indeed, small quantities of rye used to be cultivated in that county, especially upon uninclosed lands near villages

and farm towns, on which an outside ridge was often sown with rye, along the road-sides, as a fence against poultry, as they will not feed on rye, and will hardly pass through it in search of other standing corn. Not being used for bread, either plain, or in mixture with wheat or any other grain, in the south-eastern districts, and being accordingly in no request with corn-dealers and millers, it is now hardly ever sown. Besides, as it requires to be sown early, and as it is most suited for soils that are adapted to the turnip husbandry, it could not be conveniently cultivated along with that great staple of improved agriculture. Rye is said to be employed in the manufacture of starch, and to be mixed among wheat in the flour that is used for making inferior gingerbread; probably in both cases, on account of its being sold cheap, in proportion to its produce of farinaceous matter. The only bread made of rye-flour in the south-eastern districts, so far as is known to the reporter, is in very small quantity under the name of *anchor-stocks*, baked principally at Mussleburgh, and sold by hucksters in Edinburgh. In the north of England, bread made of rye and wheat mixed, under the name of *masslem* or *masslejohn*, is much used, and is considered to be laxative and wholesome*. It has been found in the north of England, that wheat sown in this manner, is never affected by the mildew.

In Galloway, however, winter-sown rye is found to answer well on moor farms, and when properly managed, is said to be the most valuable crop that can be there produced. One farmer in the parish of Borgue has, for many years, raised excellent crops of rye, on a soil composed of a mixture of sand and sea-shells, with very little appearance of mould, where other crops used commonly to fail; and has had equal success on a drained flow-moss, top dressed with his sandy soil. His produce of rye is stated at from 55 to 60 bushels

* Berwickshire Report, p. 237. East Lothian Report, p. 134.

per Scotch acre, or an acre and a quarter English measure; and the other parts of that country are said to average 40 bushels to the same acre. These are certainly productive crops, if the grain were generally saleable*.

Rye has likewise been cultivated for ages in the Hebrides or Western Islands of Scotland, where it was probably introduced by the Norwegians, who anciently held the dominion of these islands. It is there sown in spring on sandy soils manured with sea-weed, and is reckoned more profitable than the miserable grey oats which are usually cultivated by these islanders. Of late years, some of the most intelligent cultivators there have discontinued the cultivation of rye, being persuaded that it is an impoverishing and unprofitable crop. Its straw is of little value as fodder, though excellent for thatch; and wherever it can be grown to any advantage, more beneficial crops of oats or barley might probably be raised †.

The only species of rye known to agriculturists is the *Secale cereale* of botanists, but of this species there may be many varieties. That which is grown in the Hebrides is an early or spring variety, and is only sown at that season. It is a weaker plant, having a smaller grain, and its produce is much inferior to that from the winter variety, which ought always to be sown in autumn, and to be chosen where it is proper to cultivate rye. Land at a moderate rent, having a light soil, clean, and in good tilth, but unable to carry wheat, may, it is said, be profitably occupied with rye, which, in some parts of Scotland, has been known to afford a crop worth eight or nine pounds the acre, where the value of a crop of oats would not have exceeded six pounds †.

Rye is grown on some light soils on the coast of Cantyre, and being well adapted to such soils, might there be no un-

* Galloway Report, p. 122.

† Walker's Hebrides, I. 218.

‡ Walker's Hebrides, p. 232.

profitable crop. It is not, however, in much estimation, and the quantity sown is so inconsiderable as hardly to merit notice*.

Rye, though not commonly cultivated in Roxburghshire, is sometimes sown there on light soils, when first broken up for improvement, and pays better than a crop of oats. Being a smaller grain than wheat, less seed is requisite to the acre, and the produce often exceeds 18 to 24 bushels. Yet the culture is not by any means general, though it is not uncommon to sow it on single ridges around corn fields near dwelling-houses, to defend other crops from poultry, and to furnish thatch for their houses and ricks, for which its straw is admirably adapted †.

Rye ought never to be sown in wet or strong soils, nor even on those of a sandy nature where the subsoil is retentive. Upon downs, *links* ‡, and all soft lands which have been recently manured, this grain thrives in perfection; and if once covered in, will withstand an afterdegree of drought, that would destroy any other of the *cereal gramineae* or culmiferous grains. The several steps of its cultivation may be considered as nearly the same with those of wheat, except pickling, which it does not require. Rye may be sown either in autumn, winter, or spring; but the earlier sown fields are generally most productive. It may succeed either summer fallow, clover, or turnips: even after oats, good crops have been raised §.

After these quotations respecting the excessively scanty cultivation of rye in a very few districts in Scotland, it would be improper to enter into any analytical view of the way in which it is managed in its different stages, as has been done in respect to wheat; both because that would require to be

* Argyleshire Report, p. 99.

† Roxburgh Report, p. 101.

‡ Very heavy crops of rye have been reaped in East Lothian, on *links* or grounds of blowing sand, on which no other grain crop would probably have grown.

§ Brown's Treatise on Rural Affairs,

extracted from English reports, which do not belong to the present object of inquiry, and because the object is of extremely little importance in giving a view of Scotch husbandry. Any one who has a soil adapted for the culture of rye, and wishes to make the experiment, may easily do so on the general principles of the alternate husbandry, already endeavoured to be elucidated, by merely substituting rye in place either of oats or barley in his rotation. On breaking up such soils from pasture, oats will probably pay better than rye, while the soil is bound together by the undissolved grass turf, especially if well rolled. Rye, therefore, will naturally follow turnips, consumed early on the ground by sheep, and sown on one furrow, well rolled, in January if possible. Clover and rye-grass may be sown in spring with this crop, to be pastured three or more years. From the east coast of Scotland, the proper markets for this grain are, Newcastle, Hull, and London; from the west coast it may be sent to Carlisle, Workington, Whitehaven, or Liverpool.

SECT. III.

OF BARLEY.

§ 1. *Soil and preparation.*—This grain is next to wheat in value, especially on light and sharp soils adapted to the turnip husbandry. It is perhaps less cultivated now than formerly, as the quantity used as bread-corn has been very much diminished, whilst the immense taxation which is laid upon it in malting, brewing, and distillation, has contributed to depress its market value. This grain follows variously in the general system of alternate husbandry already elucidated, according to circumstances, as after turnips, pulse, or fallow, though

seldom after the last, especially on good soils, except when unfavourable seasons have prevented the possibility of sowing wheat on lands that have been fallowed for that purpose. After turnips or pulse, it is sown with one ploughing only, and as quickly afterwards as possible, upon what is termed *hot-fur*, so as not to allow time for the newly turned up soil to lose its sap. When, however, these soils happen to turn up very coarse and cloddy, it is sometimes judged proper to harrow and roll the land, and to give a second or even a third ploughing, to reduce the soil to good tilth. This is often more especially necessary, on the land where the last of the turnip crop has been consumed, when a considerable drought has set in after the surface has been much trampled upon in consuming the turnips, by which the soil becomes so hardened and consolidated, as to require the industrious use of the plough, harrows, and roller, to render it proper for receiving the barley seed, which if possible ought always to be sown on a fine tilth *. After beans and peas, it is usual to give two ploughings for barley, one before winter as soon as the pulse crop is removed, and one in spring immediately before sowing the barley. So necessary and useful is it to sow barley immediately after ploughing, that it is usual every day to sow all the land which has been seed furrowed.

As clover and rye-grass generally accompany this crop, the fields sown with barley are often finished off with the heavy roller. So far as is known to the reporter, barley is never sown without ploughing; and the scarificator being an implement hitherto but little known to Scotch husbandmen, it is of course never employed in the culture of this grain.

* Some farmers are of opinion, that all turnips should be drawn and removed from the field, and the land ploughed up into ridges, to be moistened with rain, and mellowed with frost in due time; and that the turnips should be stacked, and consumed in the months of March, April, and May, on a pasture field, or in the feeding sheds, or straw-yard. Others never stack any turnips excepting *ruta-baga*, for consumption in May; and they prefer eating the turnips on the ground throughout the whole of April.

§ 2. *Manuring*.—Manure is never applied, in the well managed districts of Scotland, to the barley crop, except in so far as the land may be said to be manured, by consuming the preceding crop of turnips on the ground by means of sheep. In districts near the sea, where sea-weed is abundant, that valuable manure is sometimes applied to the barley crop after it is above ground, more especially where turnips have been drawn and consumed elsewhere; but no other top-dressing is customary in Scotland. In the higher parts of the country, lands that have undergone a summer fallow, are sometimes manured and sown with barley, or rather with big or bear; but commonly dung is given in the first place for rearing a crop of turnips, after which manure is not necessary.

According to the old husbandry of Scotland, when the best of the home lands or *infields*, were under a continual course of cropping, the whole farm manure was applied to one-third of the infield for a crop of barley. This break received three or more ploughings, or a kind of bastard spring fallow, still known in some parts of England by the corrupted term *pin-fallow*. The other two breaks of the infield were either under oats or peas. As in this antiquated system of husbandry, the outfield never had any manure, and its whole straw produce contributed towards the dunghill, it was easy to give an ample dressing yearly to a third of the infield. This practice has been entirely given up in the arable districts, and the distinction of outfield and infield is now abolished. In the highland districts and Scotch Isles, this system still prevails, though very judicious measures have been adopted for substituting the culture of turnips and clover in its place. For this most desirable purpose, the Highland Society of Scotland, a most valuable auxiliary to the Board of Agriculture, is in use to give yearly premiums, for the greatest extent of ground under drilled turnips and sown grasses in these districts.

§ 3. *Seed process*.—It was mentioned that barley is generally sown as quickly as possible after the land is ploughed,

or on what is called the *hot-fur*. It is also sown broadcast in ordinary cases, though sometimes drilled in the way already mentioned in respect to wheat, more especially on land that is much infested with annual weeds, or which, in other words, has been formerly cultivated in a slovenly manner. —The *quantity* of seed is regulated by the richness of the soil and judgment of the farmer, from two bushels and a half to four bushels the acre; though it may be always safer to give rather too much than too little seed.] According to the opinion of a judicious and experienced writer on husbandry, “thin sowing of barley must be attended with considerable disadvantage. If the early part of the season after sowing be dry, the plants must necessarily be stunted in their growth, and unable to send out off-sets to stock the soil. When rain afterwards falls, which will unavoidably take place in the course of the summer, the plants will necessarily then begin to stool or tiller at a late period. These young shoots cannot be expected to arrive at maturity; or if their ripening is waited for, there is a great risk of losing the first or earlier growth of the crop. Whether the second growth is waited for or not, the crop is uniformly small as to quantity, of an inferior quality, and presents a very unequal sample. In such cases, the crop from the first growth often sinks down by its weight when full, under the shade of the green after-growth, and is consequently deprived of the beneficial influences of the sun and air for perfect ripening; it becomes *sloomy*, shrivelled, small, and ill coloured; and when cut down is difficult to *win*, owing to its having so large a quantity of green unripe stalks among it. Upon the whole, therefore, it is surely preferable, not only with barley, but all spring-sown grain, to give a sufficient quantity of seed to ensure a full crop from the first growth, and not to depend upon tillering or planting out. With a full seed the crop grows and ripens equally, and the grain is uniformly good, unless in very unfavourable seasons*.

* Brown's Treatise on Rural Affairs.

The *time* of sowing follows that of oats. The most proper seed-time is the latter part of March or beginning of April, though good crops are often produced from a much later seed-time, even to the middle of May. Bear or big may be sown much later than barley, as it grows and ripens with greater rapidity. But it may be assumed as a general rule, that early sowing, when the land is in proper order, is always most desirable in every variety of the culmiferous grains that are sown in spring, as it ensures the chance of a proper season for ripening the crop, and for the operations of harvest. Under the old system of Scotch husbandry, when the infield was constantly cropped, and filled with seed-weeds, barley was seldom sown till after the middle or about the end of May; both for the purpose of destroying part of these weeds by the tillage of a spring fallow, and that the barley might have the advantage of an advanced and warmer season to outstrip the remaining weeds in rapidity of growth, it being then too often a contest between the cultivated grain and the host of weeds, which of them was to gain the mastery in the occupation of the soil.—Nothing can possibly be stated as to the *depth* at which barley is, or ought to be, deposited in the soil, farther than has been already mentioned in regard to wheat.—*Rolling* has been already mentioned, at the beginning of this section, as generally given to the barley crop, especially as the land is for the most part sown with clover and rye-grass along with it.

When drilled, the barley crop is usually *hand-hoed*, before or after the sowing of clover and rye-grass, in the same manner as has been already mentioned with respect to wheat. It is hardly ever weeded by hand, farther than cutting over thistles and other large weeds by means of the weed-hook; yet within these few years, some superior managers have begun to see the propriety of this useful operation, that their high priced lands, may be devoted entirely to the growth of profitable crops, instead of being ruinously usurped by a multiplicity of weeds. The reporter has lately seen with much plea-

sure, large gangs of young people employed, especially in the eastern part of East Lothian, in cleaning fields of barley and other grain from weeds; and thinks the practice will rapidly extend among judicious husbandmen. A few bushels of additional produce *per* acre, will amply repay the expence of weeding. In some cases, where a large crop of annual weeds, such as wild mustard and radish, provincially called *runches*, have sprung up early, these weeds will occupy the ground to the material injury of the crop. There is no operation in husbandry that will pay better than hand-weeding, if performed early. As soon as the annuals get two rough leaves, the operation ought to commence. The nearer that agriculture can be brought to resemble horticulture, more especially in the eradication of weeds, within due bounds of economy, so much the more profitable will it become to husbandmen and to the community.

§ 4. *Kinds*.—Of the kinds of barley known to husbandmen there are two principal species, distinguished by botanists by the names of *hordeum distichon*, or two-rowed barley, and *hordeum vulgare*, or *tetrastichon*, usually called *bear* or *big*, or four-rowed barley. These two species are commonly distinguished in Scotland by the names of *barley* and *bear*. A third species, *hordeum hexastichon*, or six-rowed barley, is often seen among crops of other kinds, but has not been brought into use for separate cultivation, so far as known to the Reporter. Two-rowed barley, the *hordeum distichon* of botanists, may be distinguished into two principal divisions, *early* and *late*, or *hot-seed* and *cold-seed*; the former ripening in a considerably shorter period, is called, in some parts of Scotland, *late seed*, as admitting of being sown late; and the latter, as requiring to be earlier sown to ensure ripening in a proper season, is sometimes contradistinguished by the name of *early seed*. Of the different varieties of these, and other kinds, some account, derived chiefly from the particular reports of the Scotch counties, shall be given.

Scotch barley.—This kind has been sown in Scotland from time immemorial, and is of the *hot-seed* or quick growing variety of the *hordeum distichon*. It admits of great latitude in the season of sowing, having in some cases been sown so late as the 12th of June, and produced a satisfactory crop. It is seldom sown, however, after the middle of May; because, when sown later, or even then, more especially if the summer be warm and moist, it is apt to grow up with so much rapidity that the straw is soft and weak, and in danger of lodging from a very slight cause, by which the crop is materially injured. When sown early in the season, the straw is much stronger and stands up as well as any of the other varieties. This variety is deservedly a favourite with judicious farmers, and is even preferred by brewers and distillers to the English varieties when sown in Scotland, especially when these have been more than once or twice sown. What is known by the name of *ware* barley in the south-eastern parts of Scotland, is merely this Scotch variety produced on land manured with sea-weed, provincially called *ware*. After the ordinary Scotch barley has been sown two or three times upon these *ward* lands, it is sought after for seed by farmers in the more inland and later parts of the country, where it is found to ripen earlier than barley which has grown on their own lands.

Rathripe or hotspur barley.—This variety is produced on the forward soils in the south of England, and affords the earliest barley crop wherever it is sown. It is well known in the neighbourhood of London, especially about Fulham and Putney. In a warm summer it ripens in ten weeks or seventy days, and is generally ripe two or three weeks sooner than any other variety. In Cornwall it has been known to ripen in eight weeks or fifty-six days. From having been immemorially cultivated on the most early soils, it has become a more early ripening grain than other varieties; and this early quality appears in whatever soil or situation it may be placed, providing the seed is renewed at short intervals from

its native districts. Its produce however is light, and this variety accordingly is not to be coveted; but on thin soils, and in late situations, the Rathripe barley must certainly be valuable*.

Thanet barley.—This so nearly resembles the Scotch variety, as to create a suspicion that it is originally the same, only a little altered by having been carried out of the country, and sown for a number of years in a warmer climate. When sown on rich lands early enough in the season, it grows strong, with a round and rather coarse grain, and gives a good produce as to quantity; but its colour being seldom bright, it does not bring the best price in the market. It is in chief demand for making pot-barley or meal, for which it is well adapted by its plumpness and thin skin; and although it makes excellent malt, it is not much relished by brewers and distillers, owing to its darker colour and coarser appearance †.

Lincoln barley.—This variety, which requires to be sown early, is by no means a favourite with maltsters, being a coarse and ill working grain. It was formerly sown upon land which had been summer fallowed; but since the culture of wheat became prevalent, that of Lincoln barley has been almost renounced. It requires to be sown early; and when the weather will admit, is generally sown in the end of March, and seldom after the first week of April. It is therefore a cold seed, or late ripening variety, and is only adapted for warm early soils and situations ‡.

Sprat barley.—This variety, which is likewise named *Battledore* barley, is occasionally grown in some parts of Scotland on rich soils after turnips, under an idea that it is stronger in the straw, and consequently less apt to lodge when the crop is luxuriant §. The grain is middle sized, or rather small, but plump and remarkably thin in the husk or skin,

* Walker's Hebrides, I. p. 250. — † East Lothian Report, p. 120.

‡ Ibid. § Berwickshire Report, p. 238.

which makes it heavy in proportion to the measure, and consequently productive both in meal and pot-barley.

Moldavian barley.—In the Inverness-shire report, it is stated that a gentleman in that county got some barley from Moldavia, and that the crop produced fourteen fold. This variety has also been cultivated in East Lothian, but the distillers are not fond of it, nor is it much esteemed even by those who have used it for other purposes.

Bear or big.—This is a distinct species of the barley genus, known to botanists by the name of *hordeum vulgare*, or *tetrastichon*, and may be named *quadrangular* barley, as its ear or spike has four rows of grains, while all the varieties hitherto mentioned have only two rows. Its ordinary Scotch name is rough-bear, or simply *bear*. This species, of which perhaps there may be several distinct varieties, is peculiarly calculated for elevated situations and late climates, as it will admit of late sowing and yet come early to perfection. It will grow upon a poorer soil than the two-rowed barley, and will stand rough weather with less damage. Yet, although one of its ears or spikes often contains a greater number of grains than two-rowed barley, the latter, on proper soils, affords a fuller-bodied grain and a larger produce *per* acre. In poor soils, however, its quadrangular ear is exceedingly short and almost globular, containing even fewer grains than the two-rowed barley. After all, it is a valuable grain in a late climate, and the only one at present cultivated in the Highlands that deserves to be retained. It is peculiarly calculated for affording a good crop on land which has been dug with the spade, and many farms in the Highlands and isles, owing to inequality of surface and intervening rocks, can only be cultivated in that manner*. It may be noticed in passing, though perhaps rather out of place, that all cultivable spots in the Highlands and Isles of Scotland ought to be devoted to turnips and sown grass, as winter provender for cattle, alternate-

* Inverness Rep. p. 158.

ly with bear and oats, according to the principles of modern husbandry.

It is alleged in the Report of Inverness, that when the best two-rowed barley which can be procured, is sown on some land of that county, the produce, after three or four years' sowing, degenerates entirely into big or four-rowed bear*. This information, if correct, would imply that big is not a distinct species from two-rowed barley, but only a degeneration or a variety accommodated by Nature to the soil and climate. The accuracy of the alleged fact may, however, be doubted; there being cause to presume, that owing to threshing in the same barn with big, it had become blended; and the big being more early ripe, and perhaps better adapted to the soil and climate, had gradually supplanted the barley.

Six-rowed barley.—This is quite a distinct species from the two-rowed and four-rowed, and is known to botanists under the name of *hordeum hexastichon*, or six-rowed barley. It forms a beautiful spike or ear, having six rows of seeds, and often contains as many as seventy-two grains in one ear; while two-rowed barley seldom exceeds from twenty-eight to thirty-two. Its reed or straw is considerably stronger and more abundant on the acre than that of four-rowed bear; and as it grows rapidly and ripens early, it is certainly well entitled to at least a fair trial in the Highlands and Islands of Scotland. It is the hardiest of all grains; and as it is remarkable for withstanding the inclemency of winter, it is sometimes called *horæum hybernum*, or winter barley. This is the prevailing barley of Ingria and other parts of Russia, as far north as any other grain is cultivated; and though little known in Britain, seems to deserve attention from some small trials that have been made of it †. For such, and other important investigations, it is desirable, that the Board of Agriculture had two or three small experimental farms under confidential managers, where the properties of different grains, those of

* Inverness Rep. p. 138. † Walk. Hebrid. I. p. 224.

farmers build their barley ricks with a hole or funnel in the centre from top to bottom, in the manner formerly described in the first part of this chapter. For this purpose, the open frames and central *bosses*, there described, are admirably adapted. Although perfectly well win in the field, yet when moistened by rain or mist, barley is more apt than wheat or oats to become musty in the rick, as its straw is a great deal more tender, and claps much closer in the stack.

It is *threshed* and dressed up for market exactly in the same manner as wheat or oats; yet most threshing-machines are defective in regard to separating the awns of barley from the grains, especially when it has been led home in a raw or soft state. Various devices are often had recourse to for obviating this defect. Some threshing-mills have an additional apparatus for this purpose, somewhat on the principle of a malt-mill, through which the grain has to go after it is separated from the ear. In others, by chain buckets formerly mentioned, all the ill-hummelled barley is repeatedly hoisted up to the threshing-stage, and passed frequently through the fluted rollers, skutchers, and winnowing-machines, till the awns are sufficiently removed. In other cases, where either of these devices are wanting, it has to be hummelled on the barn-floor, either by means of threshing with the old flails or swiples, or by stamping it with an implement resembling a pavioir's ram, the under end of which is armed with plate iron made like a honeycomb. On some occasions, barley has been known to be too much hummelled, at least for the use of maltsters; as, when the awn breaks off so close as to leave a small portion of the kernel naked, such grains do not malt kindly. This error, however, is not often committed; and is no loss to the miller, as his produce depends on the kernel alone. The lately invented hummelling-machine, however, is likely to answer better than any of these modes.

§ 6. *Produce and application.*—The *produce* of barley, like that of all other grains, varies according to soil and seasons, from *twelve* bushels, reckoned a very miserable crop, to forty-

eight or fifty, and sometimes even sixty, which is an abundant one. From thirty to forty-two may be reckoned fair average crops on good soils and in favourable years.—The *application* of the barley crop is partly to pay the gains or wages of the farm-servants, in those parts of Scotland where barley-bread is the customary household fare of the country people. The principal part of the produce is sold to brewers for malting, to millers for manufacturing into pot-barley or barley-meal, and to corn-dealers or distillers. The inferior grain, cleaned out from among the good, is given to the farm-horses, either broken by passing through the mill, or steeped in hot water; in which latter way, it is thought serviceable, by keeping their coats clean, and their bowels loose, when confined during winter to dry provender.

The straw is applied both as fodder to wintering cattle and horses, and as litter to the cattle and horses of the farm. The awns are given to the cattle in the straw-yard or to the cows; for which latter purpose, they are sometimes boiled along with chaff and other winter provender. The *price* varies according to quality and demand; though of late years this grain, so far as farmers are concerned, has never found its level in the market, owing to the incessant changes in the laws which regulate distillation. Many farmers have therefore been induced to substitute spring-sown wheat after turnips instead of barley; and on soils of decent fertility, spring-sown wheat will generally pay better for cultivation than barley, even although the quantity produced from the acre may be considerably inferior.

§ 7. *Manufacture into bread.*—In the ordinary household economy of the working people and farmers in several parts of Scotland, barley-bread is much used, in which a small admixture of meal from peas or beans, from a third to a fourth part or less, is commonly employed. This mixed meal, passed through a coarse sieve to separate the bran or fibrous part of the husk, is kneaded up with water and a little salt, without yeast or leaven, and is formed into round cakes about an inch

thick. These are fired or baked upon a girdle or flat plate of iron hung over a clear fire, on which they are frequently turned, and they are afterwards thoroughly dried or toasted before the fire. But this species of bread is very fast falling into disuse, and will soon be entirely abandoned in favour of wheaten bread. In some parts of Scotland, bread is made from barley flour, bolted or sifted through a fine sieve, and baked with yeast, exactly like bread from wheat-flour: and in other places what are called *supple* cakes are made from barley-flour, mixed up with boiling water or milk, and fired on the girdle. These are made very thin, and generally eaten warm with butter as a species of tea-bread.

SECT. IV.

OF OATS.

§ 1. *Soil and preparation.*—Oats are generally grown upon newly broken up ley or grass land, but sometimes after summer fallow, where the soil is not rich enough for wheat, or after pulse or turnips, according to circumstances in soil, season, or situation. In all cases, except after fallow, pulse, or turnips, one ploughing is only given, and the seed is almost universally sown in the *broadcast* way, and harrowed in the usual manner. Oats are hardly ever *drilled*, as the drill machine cannot work with any freedom on once ploughed ley; but they are sometimes drilled when sown after turnips, more especially when the soil is infested with annual weeds. *Dibbling* is hitherto hardly known in Scotland except by report; and perhaps the population is too scanty to encourage the attempt to introduce that practice into Scotch husbandry.

§ 2. *Seed process.*—The *time* of sowing is from the beginning or middle of March to the end of April, according to

seasons and other circumstances, the seed-time usually commencing when the sowing of spring wheat is finished. The quantity of seed is generally from four to five Winchester bushels to the English statute acre; but the Poland variety, not planting so well, requires more seed than others. Indeed it is always most advisable to give a full supply of seed, for the reason already mentioned in the former section respecting the quantity of seed barley.—The *depth* is altogether uncertain, much depending on the nature and size of the seed furrow; and all that can be said on this subject is, that the harrows are industriously used till the surface is reduced sufficiently, and the seed completely covered.

§ 3. *Kinds*.—Only one species of oat, botanically considered the *avena sativa*, is cultivated in Britain; but of this there are numerous varieties, occasioned by careful selection and judicious cultivation. It is exceedingly difficult to give any rational or intelligible account of these varieties, as in various districts they often receive different names, generally borrowed from the place or district whence the original seed was procured, or whence careful husbandmen continue to procure changes of seed to keep up the quality of the desired variety, as unless great attention is paid to selection, they are apt to degenerate when long cultivated on the same or similar soil and situation*. These varieties may be classed under two general descriptions, early and late ripeners, or hot-seed and cold-seed, or, as named in some places, *ear* seed and late seed. Those named hot-seed or late seed are early ripeners, and may therefore be sown later in spring; while the cold-seed, or *ear*-seed requiring a longer period to come to perfection, must be sown earlier to secure ripeness at harvest. Without

* By attention much may be effected. The Blainslie oat, for instance, has been cultivated there for at least fifty years, longer by far than on any other land in the country; yet far from degenerating there, this continues to be the place where it can still be had in the greatest purity and perfection.

pretending to classify the several varieties known in Scotland, a list of those best known is subjoined, with some observations on each.

White oat.—This variety contains many sub-varieties, and of these some are early ripeners and others late. Of the hot-seeds or early ripeners, the most approved of the white oat have names from the places whence they are procured, as Blainslie, Magbiehill, Bothrie, Halkerton, Kildrummie, &c. on which it is needless to enlarge. Of these the Blainslie variety was long in great repute, especially for high, and consequently late situations, but for some years past, other kinds of oats have been more run upon, in particular the red oat, to be afterwards mentioned. Of the later ripening varieties of common oat, one which got the name of Angus in the south-eastern districts of Scotland, was long in great repute, as yielding an abundant return, but has now given way in favour of the potatoe oat; yet in soils of rather inferior quality, the Angus oat is more certain of giving an adequate return; and, in the opinion of many, the meal produced from them, is considerably sweeter than what is procured from the new and fashionable potatoe oats, though not so abundant.

Common oat.—This variety is of great antiquity, and, when grown on good soils, yields a crop superior to most of the other kinds, having a prolific ear, and a strong straw, which affords a large quantity of fodder, and stands firm on the ground. It likewise grows well on the poorest soils. It is well calculated for late situations by its early ripening, but has for some time past been abandoned in favour of the Dutch and red varieties*.

Poland oat.—This is a large plump variety, ripening early, and producing an abundant crop of grain, if cultivated on rich soil; on which account, and because of its early ripening, and securing a high price in Marklane, it was long in

* East Lothian Report, p. 124.

great repute; but the quantity of fodder is considerably less than from other kinds, and it is susceptible of sustaining great injury from shaking, even before it has reached maturity*. In the richer low lands on both sides of the Tweed, a selected variety of this oat was long in great repute, as peculiarly plump, heavy, and productive. From the name of the farmer who brought this variety first into notice about the year 1786, it was called *Church's oat*; but, either from diminished care in continued selection, or owing to the higher reputation and price of potatoe oats, this variety is not so much cultivated as formerly †.

Dutch oat.—This variety, which came into notice a considerable time before Church's oat, is not so large in the grain, nor so thin in the husk, neither will it yield so much meal, nor does it ripen so early; yet it is better adapted for weaker soils, in low and sheltered situations, where the staple is not of sufficient strength to bear a full crop of the Church oat ‡.

Single oat.—All the varieties of oats cultivated in Scotland have two seeds on each pedicle of the ear or panicle, a larger and smaller, the latter of which is vulgarly called the *baby-oat*, or *bosom-pickle*. The reporter heard of a selected variety of oats said to be cultivated in Lincolnshire, in which there is only one large plump seed or grain on each pedicle, and no baby-oat. This kind requires very marked and constant attention in the selection of its seed, being apt to revert to the ordinary form of two seeds in each floret. The rule mentioned for this purpose in selection, was, to do so in the straw before threshing, and if the top floret of a head or panicle had only one grain, all the rest in that head was sure to be of the same description.

Red oat.—This is one of the earlier kinds, and is so called from the husks having a faint red colour. It originated in Peebles-shire, being either selected or first introduced into

* East Lothian Report, p. 125.

† Berwickshire Report, p. 243.

‡ Roxburghshire Report, p. 84.

that district by Sir William Montgomery of Magbiehill, hence it is also called the Magbiehill oat. Though small grained, the husks are thin, and of course it yields abundance of meal. It prospers well on high and cold situations, ripening early, and withstanding the force of the wind, better than any other kind*.

Early-brown oat.—This is an early and hardy kind, having a brown husk or skin, and has been lately cultivated in Fife with success on high and cold situations †.

Potatoe oat.—This new and valuable variety, introduced into Scotland about the commencement of the present century, has acquired great and well merited reputation, and has almost banished the other varieties from good and well managed soils. An account of its origin and name is given in a periodical publication, from information procured in the neighbourhood of the district in which it made its first appearance ‡. On all deep and tender loams, especially when taken up from grass, no kind of oat will make so abundant a return to the husbandman, whether the number of bolls *per* acre, or the quantity of meal from these bolls be considered: But it is not a favourite with some people on shallow soils; as it yields less straw or fodder than several other varieties §. In Marklane, 16th October 1811, the average prices of oats were, for the ordinary or common kinds 32s. Polands 40s. and potatoe oats 42s. the quarter, sufficiently indicating their superior estimation in the first grain market of Europe. Potatoe oats thrive better, and are better foragers, or tiller more abundantly than polands, and succeed well on soils in which the poland variety would hardly be worth cutting down. Indeed, so obviously superior are po-

* Roxburghshire Report, p. 85, and Peebles Report, p. 144.

† Fife Report, p. 162.

‡ See the Farmer's Magazine for May 1813, p. 167.

§ Brown's Treatise on Rural Affairs.

tatoe oats to all others, in the low country situations at least, both in produce by the acre, and in proportion of meal from the same measure, that many farmers now sow no other kind*.

It must not be concealed, however, that this valuable variety has in some measure degenerated from its original excellence, becoming longer and thinner bodied, growing out at the smaller end into a tail, even occasionally threatening to acquire awns, and getting a thicker skin. These untoward circumstances were perhaps more observable on its first introduction, when small quantities were sown on the same fields with other varieties, and when probably the influence of the pollen of other kinds occasioned a degree of mule breed. Still however, in the present time, when large fields are entirely occupied with this kind alone, a degree of degeneracy is perceptible. This must proceed from the natural propensity of every selected variety to return to its original state, and can only be counteracted by carefully adopting the principle of original selection. Were a small number of farmers in the different districts to devote a moderate attention, in selecting from their growing crops at harvest, a few of the strongest growing ears, which carried the purest and best formed grain, and from these carefully to propagate a fresh selection yearly, the breed or selected variety, might be preserved pure and uncontaminated.

Black oat.—This variety is little known in the best cultivated districts of Scotland, but is sown with much advantage in cold and exposed situations. It receives its name from the dark colour of its husk, which communicates a dismal hue to the field on which it grows; yet its meal is as white and good as that of any other kind. In the Hebrides it is cultivated with success on newly reclaimed lands, but ought only to be sown on the poorer soils, requiring pulverisation, and on low rented lands †.

* East Lothian Report, p. 127.

† Report of the Hebrides, p. 211.

Tartarian oat.—The variety which bears this name is known by its pendulous head or panicle hanging all to one side, by which its grains are always directed from the wind, therefore not easily shaken. But it is a late grain, and very coarse and thick-husked, producing consequently a small proportion of meal, and bears therefore a poor character in Scotland, where that criterion is of very material importance*.

Dun oat.—This variety is described as of a dirty grey colour, nearly resembling common white oats that have been heated in the stack. It produces only a small quantity of straw; but gives good crops of grain, with thin husks, which yield a large proportion of meal.

Naked oat.—This is a distinct species of oat, the *avena nuda* of botanists, and is introduced here on the authority of the late Dr Walker, professor of Natural History in the university of Edinburgh. In one instance, Professor Walker sowed some of this kind of oats on the 29th April, and the crop was ripe by the 15th September; from which circumstance it must be a very early kind. It has received its name from the circumstance of the seed not being enveloped firmly by its shell or chaffy husk, so that the grain falls naked from the head like wheat; yet, as the panicle leans all to one side like the Tartarian oat, it is by no means so easily shaken as might be expected. The meal of this oat is very different from that of other oats, and is accounted equal to that of wheat in those places where it is cultivated †.

The foregoing list of varieties of oats, might have been enlarged by the insertion of several others, but to very little purpose, as their distinctions and descriptions are by no means well defined in agricultural writings. From the list already given, and the observations made on each, agriculturists may easily select proper kinds for experiment, in the soils and situations which they respectively occupy; and, perhaps, there is no ordinary crop that requires more judgment in se-

* Report of the Hebrides, p. 222. † Walker's Hebrides, I. p. 230.

lection and changing of seed than oats, more especially because they are exceedingly liable to degenerate from their original state, which can only be guarded against by judicious selection of seed. This is to be accomplished in two ways; either by careful selection from the crops produced by good seed, or by carefully purchasing select kinds from neighbours, who have paid attention to that important business. In the hands of a careful and judicious person, the business of rearing select varieties for seed, might be profitable to the individual, and exceedingly useful to the neighbourhood. The farmer who first introduced potatoe oats, made a great deal of money by devoting his attention to the rearing and sale of that select variety. On his authority it is stated, that he uniformly riddled out the small or baby oats from his crop, which he reserved for home use, selling only the large grain as seed to others, for which he always got a high price.

§ 4. *Harvesting and threshing.*—The various steps of the harvest process, together with stacking, threshing, and dressing for market, do not in any respect differ from those already mentioned respecting barley. The oat is a hardy grain, and rarely gets much damage during harvest, except from high winds, or from shedding, either while cutting if too ripe, or when opened and tied up again after having been thoroughly wetted; yet in long continued moist weather, oats will sometimes chip or sprout in the ear, both when lodged and in the stooks. The early varieties being liable to shed when handled, require to be cut somewhat unripe; yet this circumstance must be ventured on with much precaution, as cutting too green, diminishes the produce in quantity and quality considerably.

One circumstance in harvest management, peculiar to the Western Islands, for securing barley and oats, particularly the former, may here be mentioned. In the course of each harvest day, all the sheaves are left standing on their butts, and in the evening all the reapers join together to unite these sheaves into threaves or double stooks; but if threatened with

rain or wind, they are built up in long narrow stacks, called *dashes*, ten or twelve feet long, the breadth of two sheaves laid horizontally, having their ear-ends inwards, and six feet high. The top is formed sloping both ways like the roof of a house, and is often secured by a covering of straw or coarse hay, to prevent rain from penetrating. After remaining in this state for two or three weeks, the crop is built in cylindrical ricks in the usual manner; sometimes temporarily in the field till the conclusion of harvest, and afterwards led home to the rick-yard*.

Having omitted to notice a mode of reaping practised in some parts of Scotland, in which the reapers are paid according to the work they perform, it shall now be mentioned. This mode is termed *threaving*, and consists in paying each reaper individually in proportion to his day's work, as ascertained by the number of threaves, of two stooks each, or twenty-four sheaves, which he or she has cut down, bound, and set up. Each sheaf, measured at its band, must fill a fork ten inches wide between the prongs, that is ten inches diameter, or thirty inches in circumference. The price varies in different places according to bargain, but may be stated at 4d. *per* threave, and these threavers have to provide their own victuals. A good hand will cut down, bind, and stook from nine to twelve threaves in one day, thus earning from three to four shillings; but many are employed who are not able to do a quarter of this work. The great advantage of this mode, besides saving much superintendance, is, that the threavers uniformly cut lower, and consequently cleaner, than reapers who are paid either by the day or the acre, as the lower they cut the sooner they fill their sheaves, and produce a greater number of threaves; thus, at the same time, adding to their own emolument, and increasing the store of their employer, by cutting and gathering the whole of his crop. There is some degree of awkwardness at first, especially among the female

* Report of the Hebrides, p. 203.

and young reapers, in binding and stooking, but they soon learn to be as expert as the men. The reporter of Kincardineshire, from whom this account has been extracted, says, that he has known women earn twenty shillings a week by this mode of reaping, but never knew a man earn more than eighteen*.

§ 5. *Produce and application.*—The produce of this crop must differ materially, like that of every other grain, according to circumstances of soil, season, and climate, or the particular variety cultivated, as adapted to the place of its growth. The quantity may vary from 70 bushels or somewhat more, down to 20 bushels or even less from the statute acre; and the bushel will differ in value, according to the proportion of meal which it yields when manufactured. The average is expected to produce what is called meal for oats, after payment of the mill-dues; that is, a *boll* or six Winchester bushels of grain will produce a boll of meal, or 140 pounds avoirdupois; though in some cases potatoe oats have yielded 165 lbs. meal from six bushels of grain. The mill dues or charges for kiln-drying, shealling, grinding, and sifting, where thirlage is not abolished, are arbitrary and uncertain; but, where that old species of bondage is done away, the customary charge is one shilling *per* boll of oats, or half a stone (8½ lbs.) of oatmeal.

It is alleged that oats are generally a more productive crop in Scotland than in England, and that the produce is of a superior quality. It is not known how far this opinion may be correct; but a late writer on husbandry states the following as the reasons why this may be the case: “In Scotland this grain gets an equal share of good soil with others; whereas in England, the worst or inferior soils are usually allotted for the growth of oats, and the best reserved for wheat and barley. The climate likewise of Scotland may be considered as more favourable to oats than that of England, being of a moister nature, and rarely so warm, consequently better cul-

* Kincardineshire Report, p. 263.

culated to bring this grain to perfection; as when a dry summer occurs in Scotland, oats, it is said, rarely yield well either in the barn or mill, being of a smaller size, thicker in the husk, and having longer tails than they usually have in moist seasons*." To these observations it may be added, that in all the best cultivated districts of Scotland, oats are always taken as the first crop after grass, in which case full crops are generally obtained.

The produce of the oat crop is applied in various ways; part to the consumption of the farmer's family, and part in lieu of wages to the married servants; the work-horses of the farm also use a considerable quantity, especially of the inferior qualities. After these demands have been supplied, and a sufficiency reserved for seed to the ensuing crop, the surplus is sold to corn-dealers, or to millers for making into oatmeal. In some districts of Scotland, the farmers are bound to manufacture all their surplus produce of oats at the mill belonging to their landlord, paying certain fixed dues or lordships, for the benefit of the proprietor or his mill tenant; which, though fixed by law or paction, are said to be very unsatisfactorily exacted, often in measures of no legal, or generally known standard.

The price of oats, like that of all other articles, varies according to produce and demand, so that nothing satisfactory can be stated on this subject. Within the last twenty years this grain has averaged as low as 2 s. and as high as 7 s. *per* Winchester bushel; perhaps in the present circumstances of the country, 4 s. 6 d. may be reckoned a fair average price for the best oats †.

The straw of oats is used both as fodder, and as litter for

* Brown's Treatise on Rural Affairs. Much must depend upon the climate. What might be considered rather a dry summer in the western parts of Scotland, might be accounted a wet one on the eastern; and a summer as dry as has been known in East Lothian, is hardly ever experienced in Clydesdale.

† In 1788, it is said that some oats were sold as low as 1 s. 6 d. *per* Winchester bushel, even in East Lothian.

farm-stock ; and even the working horses, in many parts of Scotland, are supported upon oat-straw from Martinmas till the middle of February, after which hay is for the most part substituted, when spring labour commences. This practice, however, is not to be commended, unless aided by a good supply of oats, yams, potatoes, turnips, ruta-baga, or carrots. Even wintering cattle, and young beasts, are now almost universally supplied with a moderate allowance of turnips, along with their straw, which both advances their growth and condition, and much ameliorates the quality, and increases the quantity of the farm-yard manure or muck. This is not the place appointed for discussing the nature and preparation of manures ; yet it may be mentioned in passing, that the less straw that is eaten by the farm-stock, so much the more abundant will be the muck, and the more valuable, if sufficiently trampled down, wetted with urine and mixed with dung ; and likewise, that the muck or manure procured from well-fed horses and cattle, is vastly preferable, to an equal quantity produced by stinted or half-starved animals.

The chaff of oats, when clean and dry, makes an excellent material for filling beds, not much inferior to ordinary feathers ; and being prodigiously cheaper, chaff-beds are almost universally used by the lower orders in Scotland.

§ 6. *Manufacture.* — For reasons already assigned, it is needless to enter into the minute particulars of manufacturing oats, as belonging to the trade or mystery of the miller, and not to husbandry ; yet some observations on the subject may be useful. It is understood, that in some parts very improper and illegal freedoms are taken in the manufacture of oatmeal, by mixing barley with the oats while grinding ; the reason of which is obvious. A boll or six bushels of oats of average quality will not often give more than 140 lbs. avoirdupois of oatmeal ; whereas, the same quantity of barley, even only of moderate quality, will produce above 280 lbs. Hence, in regard to the produce of meal, if a boll of oats in ordinary cases is worth 20s. to the miller, a boll of barley will be worth

40s. ; and the price never differs in any thing like such a proportion.

In ancient times a large quantity of oats used to be malted in Scotland, from which ale was brewed, though the practice is now entirely gone into disuse. But of late years considerable quantities have been used by distillers of whisky, broken down along with unmalted barley, and masked or brewed in conjunction with a certain proportion of malt. The oats are alleged to be useful in this process, keeping the grinded malt and barley so open or pervious, as to give out the whole soluble parts of the broken grain and malt to the hot water in the mash-tun.

In the mill process for converting oats into meal, after being previously dried on a kiln, they are, in the first place, made to pass through the mill-stones, regulated at such a distance as only to remove the external shell or husk, which is separated from the unbroken kernel by means of a winnowing-machine, attached to the mill gear. These separated shells, or *sheallings*, are only useful as fuel in the kiln for drying other parcels of oats, being so indestructible in their nature, as hardly to be susceptible of putrefaction, even when long mixed with rotting muck, and they are utterly unfit for food to any kind of farm-stock. Even in the kiln-fire, they consume very imperfectly into a kind of light charcoal, mixed with white ashes.

The kernels of the oats, after the shells are removed by this first operation, are named *grits* or *groats*, formerly much used in broths, which constitute a material portion of ordinary Scotch fare ; but pot-barley, which is of the same description, is now almost universally preferred. The *grits* are next grinded over again into a coarse rough meal, different in its fineness according to the taste or custom of different districts, much of the kernel being only broke down into rough fragments. This meal is afterwards sifted to remove the thin pellicle or inner skin of the husk, which adheres to the grits. From these skins, called provincially *seeds*, to which some of

the finer powder of the kernel adheres, a peculiar species of food is often prepared, by steeping in water, somewhat in the manner of manufacturing starch, which is called *sovens* in Scotland. It is a kind of jelly, which is prepared by boiling, and is eaten along with milk. Likewise in some steps of the mealing process, a light fibrous dark-brown dust separates from the oats, which is called *mill-dust*, and is given to the cows or pigs of the farm.

The principal produce from the mill is oatmeal, which is chiefly used for making *porridge*, or pottage, a kind of flummery or hasty-pudding. For this purpose the meal is gradually stirred into boiling water, till of a proper consistence, when it is seasoned with salt, and thoroughly boiled. It is afterwards eaten along with milk or beer, and forms a very general breakfast for the labouring people and young folks over all Scotland. Formerly the same dish was a very universal supper, but has now given way in winter to the use of potatoes, an equally wholesome food, and considerably cheaper than oatmeal. When travelling with droves of cattle to the different fairs, the Scotch Highlanders often content themselves with oatmeal stirred among cold water, as their chief or only food for many days, and a more hardy race is no where to be met with. In several of the northern counties of England, oatmeal stirred among boiling water, but not afterwards boiled, is a common breakfast, under the name of *crowdy*, sometimes seasoned with rinded fat, butter, or drippings. In Scotland, a common dish is made of toasted oatmeal stirred among the water in which salt meat has been boiled, and generally seasoned with the fat skimmed from the pot. This is named *brose*, and is a very substantial dish.

Oatmeal is likewise made into a kind of bread named *cakes*. The meal is kneaded up with cold water, or water which has been boiled, and seasoned with a little salt. This paste is spread out into thin cakes, which are fired on a *girdle* or plate of iron over the fire, and afterwards toasted before the fire, as already mentioned in regard to barley bread; but the

oaten cakes are seldom made thicker than the eighth part of an inch. Notwithstanding the illiberal definition of the celebrated lexicographer, that "oats are the food of horses in England, and of men in Scotland," oats constitute a material portion of the food of the people in several counties in England, and in most parts of Wales, perhaps extending to a population little short of a million of hardy and industrious peasants and manufacturers.

Before closing this subject, mention may be made of a wasteful and pernicious manner in which oats are sometimes manufactured in the Highlands and Western Islands of Scotland. The ears of the oats, with a small portion of the straw still attached, are thrown in small heaps on a clean swept hearth, where the straw and husks are burnt, and the grain parched or partially roasted. After being winnowed in the air or wind from the ashes of the straw and husks, the grain, now of a brown or half-burnt colour like roasted coffee, is immediately broken or grinded in a small stone hand-mill, called a *quern*, into a coarse sort of meal, which is afterwards baked into cakes, as already described. This is called in the Highlands *graddan* bread, which the natives allege to be particularly wholesome and palatable, but its burnt taste is unpleasant to strangers. Its only recommendation is simplicity and quickness of manufacture, as in the course of half an hour after plucking the ears from the standing corn, the bread may be ready for eating*. In this view, it may be useful for an army in an enemy's country, but can never be advisable when husbandry is the object of pursuit, being destructive of the means of after fertility.

* Report of Hebrides, p. 213.

SECT. V.

OF BEANS*.

§ 1. *Soil and preparation.*—In the well managed districts of Scotland, the cultivation of beans in drills has become a general practice, wherever soil and climate allow it to be followed. Beans have been long cultivated in rich clays and strong moist loams, which were formerly considered as the only soils in which they could be grown to advantage; but their cultivation has been extended of late to soils of a much lighter description, such as free loams and rich turnip soils, though on all dry friable soils, turnips are still considered a preferable crop by the best farmers. Formerly beans were all sown broadcast, in which mode of culture they were manifestly injurious, by the encouragement thus given to the growth of weeds, which often, in dry seasons, overtopped and ruined the crop by their luxuriance, as the openness of the bean crop, in the early stages of its growth, allowed them to grow without interruption. Of late years, in every well managed farm, beans are uniformly grown in drills, either alone or with a small mixture of peas; and when cultivated judiciously and industriously in this manner, they form an excellent auxiliary to summer fallow, which by their assistance requires less frequent recurrence, and is more easily executed. Though beans are a precarious crop, and rather troublesome to manage, yet they are extremely valuable in many respects, both in regard to the grain and the fodder which they produce, especially in favourable seasons. But

* As the substance of this section is almost exclusively extracted from Brown's Treatise on Rural Affairs, and the Berwickshire Report, chap. vii, sect. ix, p. 252, it were unnecessary to give minute references to these works.

an important advantage is, that they contribute greatly to the profitable management of heavy soils, enabling the farmer to postpone the recurrence of summer fallow with propriety, to periods of six or eight years, which, without their aid, would be necessary oftener.

In well conducted husbandry, soils adapted for beans are drilled with this grain after a culmiferous or white corn crop; and it is probably of little importance, which of these may precede, providing the soil is in a fit state of cleanness as to weeds, and has not been previously exhausted by over-cropping. In either of these cases, a fair crop of beans cannot reasonably be expected, and either naked fallow or turnip fallow, according to the nature of the soil, ought to be had recourse to. In preparing the ground for beans, it ought to be ploughed after harvest, or early in winter, and with as deep a furrow as it will admit, so that the soil may become mellowed by winter-frost, and the roots of the beans have depth sufficient for their growth and nourishment. Some husbandmen have been in use to give this winter ploughing across the lands or ridges, as they only give one endlong spring ploughing before sowing the crop. But as experience proves, that two ploughings in spring are highly advantageous for the crop, the winter ploughing may be given endlong, especially in strong clays, as being better adapted for laying the field in a proper situation for the escape of moisture during winter, in which way the land is sooner dry in spring for the after-steps of cultivation. Whichever of these modes is followed in the winter ploughing, every care must be taken to open up all inter-furrows and other exits of water, as formerly insisted upon, when treating of ploughing and fallow.

Under the idea that the land is to have three ploughings, and that the winter-furrow has been given endlong, the second ploughing is to be given across the ridges, as early in spring as the ground is sufficiently dry to admit of being ploughed. Immediately afterwards, all the inter-furrows, fur-

rows of the head-lands, gaw-furrows, and cross-cuts, are to be carefully opened up by the plough or shovel, that no water may have any chance of stagnating on the land. The third furrow, either forms the drills, or receives the seeds under furrow, and belongs to the seed process, therefore will be mentioned under that subdivision.

Dung is often given to the bean crop, more especially when it succeeds to wheat. By some, dung is spread on it upon the stubble previous to the winter ploughing. This, however, necessarily implies that the farmer must be provided with a sufficient stock to serve for that purpose, and for his fallow break. This mode of application, likewise, can seldom be effected in a satisfactory manner, on account of the state of the land in winter being unfavourable to carting on the manure, unless in frost, when it may lie long exposed to the weather, either in heaps, or spread, much to its disadvantage. Laying the manure into the drills is certainly the most effectual mode of application, and in spring, *immediately before* the beans are drilled on its surface.

§ 2. *Seed process.*—It is perhaps inconvenient to divide this from the preparation, as both are in a great measure conjoined, or a continuation of the same series of operations. There are, as already hinted, two several modes of drilling beans. In one of these, the lands or ridges are divided by the plough into hollow drills with intervening ridgelets, or one-bout stitches, at intervals of about twenty-seven inches. When this preferable mode is to be adopted, a previous spring-ploughing is given, as before mentioned, across the ridges of the winter-ploughing. If dung is to be given, the seed ought to be first sown, as it is found inconvenient to run the drill machine afterwards. Then the dung may be drawn out from the carts in small heaps in the hollow drills, one row of heaps serving for three or five drills, and is evenly spread and equably divided among these drills, as will be more minutely described when turnip culture is treated of.

The high drills or ridgelets are next split out or reversed, either by means of the common plough, or by one with two mould boards, which covers the seed in the most perfect manner.

In the other mode of drilling, the seed is sown at the same time with the spring-ploughing. If dung is given, it is previously spread over the surface of the winter furrow, and is ploughed in during this spring-ploughing. Three ploughs start in succession immediately after each other, and a drill barrow continually follows the third plough, by which a row or drill of beans is sown in each successive third furrow, at from twenty-four to twenty-seven inches asunder, according to the breadth of the furrow-slice. It is obvious, that this system may be so extended upon large farms, that each third plough, or any number divisible by three, shall have a drill barrow in its rear, or attached to the plough itself.

The most approved way of sowing beans, however, when dung is applied at seed-time, is to spread the dung and to plough it down with a strong furrow, after which light furrows are drawn, into which the seed is deposited by the drill machine. The dung used in this way ought always to be well prepared.

Whichever of these modes of drilling are followed, the whole field must be carefully and industriously water-furrowed in every necessary place, by means of the plough and shovel, as already several times insisted upon.

It has often been disputed among experienced husbandmen, whether broad or narrow intervals between the drills of beans, are most advantageous? In all the well managed districts of Scotland, broad intervals have been adopted; while in the bean districts of England, where drilling or dibbling prevail, narrow intervals are chiefly used. It cannot be denied that narrow intervals are by no means favourable to the horse-hoeing mode of cultivation, so that wherever they prevail, hand-hoeing is almost exclusively resorted to, which is by no means sufficiently efficacious on clay soils.

The *time* of sowing beans is as early as possible after the severity of winter is over: In February if possible; but not later than the end of March, as otherwise the ripening of the crop, and its safe harvesting, would be very precarious in this climate.

The large horse-bean is the *kind* almost universally cultivated, though occasionally the *tick* procured from London has been tried; but that variety has seldom produced good crops in Scotland.

The *quantity* of seed, in the practice of the most experienced cultivators of beans in Scotland, is four bushels to the statute English acre, when sown in drills. When sown broadcast, five bushels are thought necessary. A much smaller proportion of seed is allowed in England; but in the experience of observant husbandmen in Scotland, a thin crop of beans never turns out well, unless the soil is particularly rich. Unless the rows of beans close effectually over the land, weeds will unavoidably grow and flourish after the cleaning process is finished; the land will become foul, so as to defeat the very object of the drill husbandry, the crop will be proportionally injured by being robbed of its nourishment, and the land will be left in a bad condition.

Either in the broadcast or drill husbandry, it is very common to mix a small quantity of the *cold-seed* pea, to be afterwards mentioned, along with the beans; perhaps about half a bushel to each acre; or, in other words, one bushel or more of peas with every six bushels of beans. In the agricultural language of Scotland, this is called a crop of beans with a dropping pea; and it considerably improves both the quantity and quality of fodder, besides giving material assistance in harvest, as the peas generally serve to bind up the beans into sheaves.

When sown broadcast, as with all other grain, the depth at which beans are deposited in the soil, by the operation of harrowing, must be various and quite uncertain. When drill-

ed after the plough, or what may be called ploughed under, the seed is deposited from three to four inches below the surface, and continues in that situation. In the better and more accurate manner of sowing in hollow drills, covered over by splitting or reversing the ridgelets, the seed is covered deeper; but, by the subsequent operation of harrowing, that depth is reduced to four or five inches, in consequence of the ridgelets being harrowed down into the hollow interspaces.

§ 4. *Cultivation while growing.*—Harrowing is always given to the bean crop. When sown broadcast, the harrow of course is used to cover in the seed, and in so far belongs properly to the seed process; but it is likewise generally used afterwards, sometimes just before the seedling beans make their appearance, on purpose to destroy any annual weeds that may then have vegetated; but at other times just *after* the beans have got their first green leaves, and are fairly above ground. If applied sooner, the harrows break the necks of the beans, which, till exposed a few days to the weather, are quite brittle, though afterwards pliant, when instead of receiving injury, they are benefited by the operation; by means of which also, more annual weeds are destroyed among the beans in the rows, as more have had time to vegetate. When sown in drills, in either of the modes formerly mentioned, the harrows are applied ten or twelve days afterwards, or as soon after that as the weather will allow, and being driven across the drills, the soil is laid completely level for the after hoeing process. If the soil is any way apt to retain moisture, it is indispensably necessary to replace all the water-furrows with the utmost care; and indeed this must be carefully attended to during the after-processes of cleaning, as wherever water is allowed to stagnate upon a field, the crop is sure to suffer material injury, whilst the melioration of soil, produced by previous culture, is entirely frustrated.

After the beans have acquired some growth, sooner or later according as the soil may happen to be encumbered with,

or free from weeds, the intervals between the rows or drills are gone over with the *horse-hoe*, scraper, or Dutch hoe. The *hand-hoe* follows immediately after, to cut up such weeds as are beyond the reach of the horse-hoe; and for this purpose, besides the ordinary broad edged hacking hoe, some husbandmen have a narrow hoe on the back of the larger one, that the hoers may get between the stems of the beans. In the practice of good husbandmen, all the weeds which grow among the beans, beyond the reach of the hoe, are pulled up by hand. These operations of horse-hoeing, and hand-weeding are, or ought to be, repeated successively, as long as the growth of weeds call for them, and are generally finished off with the horse-hoe. A well managed field of beans, ought to be as clean as a garden bed, and always is so in the hands of an industrious husbandman. Nothing surely can be more preposterous, or more contradictory to every principle of good husbandry, than to see a crop of beans labouring hard for subsistence among a host of weeds, this being not only destructive to the immediate crop, but highly injurious to the succeeding crop of wheat. Unless a field be previously well cleaned from vivacious root-weeds, such as docks, couch, and bulbous rooted oat-grass, provincially knot-grass, by means of a thoroughly well wrought summer fallow, it is in vain to grow beans as a meliorating crop, and absurd to look afterwards for valuable crops of wheat or other grain. Farmers who cultivate in this slovenly manner, are a disgrace to their profession, and are actual nuisances.

Before the introduction of the horse-hoe, a common small plough drawn by one horse, was employed for working and cleaning the soil between the rows of drilled beans. In the first place, this plough went one bout, or up and down in each interval, gathering the soil from the beans into a ridgelet in the middle, after which hand-hoes were employed to cut the weeds close to the rows. A second hand-hoeing followed, to destroy any fresh growth of weeds: and, some time after-

wards, a small double mould-board plough, drawn likewise by one horse, split open the gathered soil between the rows, and earthed up the roots of the beans on each side. By some people the benefit of earthing up is disputed, alleging, that any benefit gained in this way, is more than counterbalanced by the extraordinary trouble which it occasions in harvest, when the crop is reaped. In cutting beans, it is often difficult to get the reapers to cut low enough; without which precaution, much of the straw is not only lost, but the lowest pods are frequently left on the stubble, to the manifest injury of the produce.

No *diseases* occur in beans, except what is usually called the *collier*, or a multiplicity of small dark-coloured insects, which in some years infect the tender tops of the stems, and produce injury by exhausting the juices of the plant. But as no remedy, either curative or preventive, has hitherto been proposed, it does not seem necessary to enlarge on the subject.

§ 4. *Harvest management*.—Generally speaking, it is proper that beans should be well ripened before they are cut; because when cut green their quality is considerably impaired, and a long time is required before the straw is sufficiently dry, or brought into a proper condition for being ricked with safety. It is not, however, either necessary or proper to wait till the outer skin of the bean has become dark-coloured or black, as in that case their quality, or market value, will be considerably impaired. Neither is it at all necessary to wait till the pod has grown black and dry. After the eye of the bean is thoroughly blackened, and the skin has acquired a yellowish and leather-like colour and appearance, the crop is in a fit situation for being cut down. In an early harvest, and when the straw is not immoderately rank, the bean crop becomes ripe in good time, and is easily *wined*, and prepared for the rick-yard. But in moist, warm seasons, when beans are apt to take on a second growth, the grain hardly ever ripens effectually, and it is exceedingly difficult to get the straw into a proper condition for the stack. In such cases of se-

cond growth, the following expedient has been successfully employed to force in some measure the more early ripening of the crop, by putting an effectual check to the new growth. A person walks up and down between the drills, having an old scythe-blade set in a wooden handle, like a cimeter, with which he switches off the succulent tops. If the crop be extensive it will require several persons armed in this manner to go over the whole. This plan was devised in imitation of gardeners, who very commonly nip off the summits of the flowering stems from their late beans, to make them ripen earlier. At first sight this may appear an expensive process; but as one man can easily top-dress two acres in a working day, the expence cannot much exceed one shilling *per* acre; and it is not improbable, that in moist seasons this operation would occasion the crop to be ready for the sickle a fortnight earlier, while perhaps an additional week may be gained in the *winning* process.

It seems unnecessary to allow beans to remain uncut after the first week of October; as any benefit after that period, will probably be more than counterbalanced by the loss from postponing the seed time of the subsequent crop of wheat. Under these circumstances the practice recommended by Mr Mitchel, of carrying the bean crop from the place of its growth, immediately after it is bound into sheaves, and setting it up to dry in another field, is admirably calculated for allowing the sowing of wheat in due season. On land which is of a proper quality, and in good condition for producing an abundant crop of wheat after beans, the difference in value, between a crop of wheat, and a crop of barley, will amply compensate for the additional trouble and expence of this removal. The difference in the value of these crops, can hardly be less than three guineas in favour of wheat, perhaps often five guineas *per* acre.

Beans in Scotland are almost universally cut by means of the sickle; generally by old ones that are not fit for reaping other grain; and it is of great moment that they be cut very

near the ground, both that as much of the straw as possible may be secured as fodder, and because the best pods are often placed on the stems near the roots. Beans are always tied up into sheaves, either by means of short straw-ropes made on purpose, or bands made of the peas which grow among them. In either case, the reaped beans are merely laid at first on the bands, and are left for several days in that loose state to wither, which is termed *broad-band*; sometimes they are laid down on the field in large rips or handfuls to wither, without bands, which are afterwards supplied. They are then bound at a convenient opportunity, and set upon their butts, in double rows or stooks, to dry or *win*, but without any head-sheaves.

When sufficiently dried, they are led home to the rick-yard, and are usually built up in round ricks, in the manner already described. Sometimes, however, they are built in oblong stacks, provincially called *sowes*, resembling a house; having interruptions, without any intermediate spaces, dividing them into portions of convenient size for being threshed at one time, which divisions are termed *leets*. The tops of these long stacks are drawn up to a ridge, like the roof of a house; and the whole is thatched with straw, which is secured by straw-ropes in the manner formerly described. When the round ricks are made of any considerable size, it is very useful to keep an opening in the centre drawn up from the bottom to the top, so as to allow a free circulation of air, by which the grain and straw are materially preserved from injury; as when stacked in a damp or raw state, both are apt to become mouldy or musty, which lessens their value considerably.

Beans may be *threshed* by the mill or machine, like any other grain, and are *dressed* by the fanners or winnowing-machine, as has been previously described. It is only necessary therefore to remark in this place, that while riddling, all the light beans and broken shells have to be carefully skimmed off by hand, which may be easily done, as these rise to the surface in consequence of their lightness.

§ 5. *Produce and application.*—No crops whatever are more uncertain in produce, or so dependant on seasons, as beans and peas. A good crop of beans, on a fit soil, well managed, and in favourable seasons, may sometimes exceed 42 bushels *per* statute acre; but from 24 to 32 bushels are reckoned a satisfactory produce. In unfavourable seasons, even on very good soils, the crop sometimes turns out almost an entire blank, so far as the grain produce is concerned, and not worth threshing, except to clean the straw from soil and mouldiness, before using it as fodder.

The *straw*, especially when mixed with peas haum, is of great value as fodder to the working horses; and when well harvested is reckoned very hearty feeding. But this food does not suit well for riding horses, as it is apt to hurt their wind. In some horses, both bean straw and peas haum is apt to occasion cholic pains, or the disease which is provincially called *batts*; for which the most effectual remedy is a dose of laudanum, about half an ounce, or the fill of a table spoon, given in a warm drench. Both of these evil effects from bean straw and peas haum are probably occasioned by flatulency.

The grain produce of the bean crop, is partly applied in payment of the *gains* of farm servants, in those districts where grain payments prevail, and where the ordinary household bread is made of barley mixed with peas or bean meal; partly in feeding farm-horses, mixed with oats, either whole or broken. Sometimes bean-meal has been employed in carrying on fattening cattle, between the close of turnips and the commencement of pasture, when markets were not favourable for the disposal of stock. On such occasions, great care ought to be taken, that each beast eats its own allotted portion, and no more; as a master ox will often devour a great proportion of the quantity intended for all his neighbours in the same yard, and may die of a surfeit. The surplus produce is sold to corn-dealers, or millers, or to other farmers, for payment of their servants, for horse-corn, or for seed. The *price* of beans

in the market is exceedingly fluctuating, insomuch that this crop is by no means so steadily in demand as other articles of farm produce, being sometimes hardly saleable, more especially when oats are cheap. On the other hand, when oats are dear, beans are sure to be in demand, and to bring a good price; in the former case being perhaps as low as 4s. the bushel, and in the latter as high as 8s. or more, independent of years of scarcity.

The stubbles are not applied to any particular use, except that the live-stock of the farm, cattle and horses, are allowed to pick up what they can get, which is very little indeed on land that has been properly cultivated; more especially as the gleaners gather up all dropt pods and even single beans, and that the land has generally to be ploughed for the succeeding wheat crop immediately on removing the beans. It is a melancholy truth, however, that bean stubbles are often apparently excellent pastures, in consequence of the most reprehensibly negligent cultivation of the land, by growing beans in a matted bed of couch and other disgraceful weeds. In some districts, premiums are given for instances of superior cultivation; yet perhaps the consequences of bad husbandry, by inferiority of produce, may be a sufficient punishment in itself, and on high rented land must inevitably tend to ruin those concerned, or at least to injure them in the most serious manner.

SECT. VI.

OF PEAS.

§ 1. *Soil and preparation.*—Peas follow variously in the system of rotation, as formerly mentioned, being chiefly adapted for protracted rotations on soils which are not of sufficient depth for beans, such as light turnip soil, or thin weak clays.

Their culture has however fallen rather into disrepute in all well managed districts, being found both unprofitable and injurious to the ground, in consequence of the quantity of annual and perennial weeds, which grow among the crop when cultivated according to the broadcast system. Even when sown in drills, as the plants fall over very early, the necessary hoeing can seldom be properly executed. Sown along with drilled beans, as already mentioned, peas are often cultivated to great advantage. On such soils as are not of sufficient depth for beans, and where from other circumstances the cultivation of peas, is advisable, a mixture of peas with a smaller proportion of beans, will prove advantageous, as the beans will serve as props to sustain the peas from falling down, in which way the sun and air has much more influence. In the case of a sufficient mixture of beans, which may be from a third to two-thirds of the seed, the preparation, cultivation, and other steps belonging to this crop, are precisely similar to those already detailed in the preceding section.

§ 2. *Kinds.*—There are two varieties of the gray or field pea cultivated in Scotland, which are usually distinguished like oats, by the names of hot-seed and cold-seed. The *hot-seed*, hastings, or early pea, admits of being sown at any time till the first week of May. The cold-seed, on the contrary, is a late ripener, and requires to be sown in February or March, to give a fair chance of ripening and harvesting in due time. The hot-seed pea, of which an approved sub-variety, called the Magbiehill pea, from the place of its original growth, is considerably speckled, seldom exceeds three or four feet in the length of its haum, and when it comes away kindly in a favourable season, generally produces a satisfactory crop of grain; but, as its haum is short, and consequently of small bulk on the ground, its produce of fodder is proportionally scanty. The cold-seed pea is larger in the grain, and of a more uniform unspotted colour, often growing to six feet long in the haum, and sometimes even to ten or twelve feet. It is therefore

more valuable in point of fodder, but is very uncertain in regard to its grain, often in wet seasons continuing to grow and bloom till late in autumn, which greatly injures the grain produce, and sometimes occasions in that respect an absolute blank.

A third variety of field or gray pea was cultivated in Berwickshire, on a limited scale, a few years ago, under the name of the *mottled pea*. The seed came from England, and was believed to be what is called the partridge-pea in the county of Norfolk. It was a very early ripener; and, in the experience of the reporter, was usually ready for the sickle before any other grain on the farm, although sown as late as the middle of May. But, though its grain produce was sufficiently satisfactory, its straw was short and scanty, and its quality as fodder was quite worthless, being tender, dry, and without substance, and much disrelished by horses. Its cultivation, therefore, was soon abandoned; the value of peas-traw, as winter provender for the work-horses of the farm, being one of the strongest inducements to the cultivation of peas.

§ 3. *Seed process*.—When peas are cultivated in drills along with beans, the seed process, and all the other steps of their treatment, are the same as those already detailed in regard to beans. Broadcast sowing is so diametrically adverse to clean husbandry, that it can in no case be recommended; although there is no question that on lands previously clean and in good order, and in favourable seasons, when the crop comes away early and soon covers and overshadows the ground, rich and valuable crops of peas may be sometimes grown in this slovenly manner. But from what has been so often seen in this mode of cultivation, where the fields devoted to crops of broadcast peas, were entirely filled by a host of weeds of every possible description, there can be no doubt of the vast superiority of the drill husbandry for the cultivation of this leguminous crop, where circumstances render it advisable.

From what has been premised, it is almost certain that in all cases where it is proper to admit peas alone into the rotation of a farm under good management, they ought invariably to be sown in drills, and industriously hand-hoed. In this way only can such a leguminous crop be made an useful auxiliary to the clean alternate husbandry, so frequently and so earnestly recommended. The reporter has not had any extensive experience in the cultivation of clean peas; but in two or three instances in his practice, he had most convincing evidence of the superiority of drilling over broadcast sowing in this crop. The fields were drilled, and carefully hand-hoed, and were as clean as garden beds at harvest, and the crops both of grain and haum were quite satisfactory; but the head lands had been sown broadcast, and their crop of peas, thinly scattered among a wilderness of annual weeds of various sorts, were absolutely not worth reaping.

When peas are sown alone in drills, the rows are made in general about twelve inches asunder, but this is too narrow for horse-hoeing; from two feet to two and a-half feet is not uncommon, or about the same width as for beans and turnips. They may either be sown by means of the compound drill-machine already mentioned for wheat and other culmiferous grain, which sows one ridge at one bout; or by a simpler but more tedious method, similar to what has been already mentioned for beans, only with much narrower intervals as already stated. After the land is brought into proper tilth, a small plough, drawn by one horse, having two mould-boards, is employed to form the soil into shallow drills, or ridgelets, with intermediate hollows, eleven or twelve inches asunder. A single drill-barrow on one wheel, pushed by a man like a common wheel-barrow, follows the drill-plough in the hollows, and sows each drill separately. The seed is partly covered by each successive drill formed by the drill-plough, and is effectually covered afterwards by harrowing, which lays all the drills level. A still better method, because more economical, is to have a small drill-machine attached to the plough

which forms the drills, by which means the drills are formed and sown at one operation. Others recommend Bailey's drill-machine, as the best calculated for that purpose.

It has been already mentioned, that the *time* of sowing varies according to the particular kind of pea which is cultivated. Cold-seed peas are sown at the same season with beans, and are often mixed with them, in February if possible, but not later than March, as otherwise their ripening and harvesting would be very precarious. Hot-seed is sown at the same season with oats, which is in March or April; the mottled variety, or partridge-pea, at the same season with barley, that is in April or May.

When sown broadcast, a full *quantity* of seed ought to be given, as the crop seldom grows with vigour till it covers the ground; four to five bushels *per* acre are necessary. When drilled, four bushels may be sufficient, or even a little less when the land is in very good order; but, generally speaking, seed ought not to be distributed with too rigid economy, as a full crop, of any kind of grain whatever, is cheaply purchased by giving a sufficiency of seed; while a scanty crop, besides being in itself unprofitable, is sure to poison the land, by facilitating the growth of weeds. In regard to the quantity of seed, much must depend upon the size of the pea, and other qualities of the pulse must be taken into account, as the luxuriance of growth, &c.

§ 4. *Cultivation while growing.*—To broadcast crops of any kind, no cultivation whatever is usually given in Scotland, except cutting over thistles by the weed-hook, or pulling them up by nippers. With drilled peas, horse-hoeing has seldom been attempted, as the intervals are too narrow for using the scraper or Dutch horse-hoe, and the compound hoeing implement has not been adopted in Scotland, so far as is known to the reporter. Drilled peas are however generally *hand-hoed*, and this operation ought always to be performed early, before the plants begin to fall over, and should be very diligently executed.

In favourable seasons, when peas have arrived at that stage of growth when they fall over, they entirely cover and overshadow the ground, so as completely to suffocate all weeds which attempt to grow after that period; except on such spots between the rows, as happen to be left bare, by two adjoining rows falling over in opposite directions. When that happens, every careful husbandman ought to have these bare spots again gone over with the hand-hoe, and diligently hand-weeded close to the rows.

§ 5. *Harvest management.*—The harvest work of peas differs materially from that of wheat, oats, and barley, or even beans. The bandsters wade in among the crop in advance of the reapers, and twist a number of bands or ropes from the rankest growing peas, which they throw upon the standing corn before the reapers. The reapers lay these bands behind them on the bare ground, and tear up the crop with the points of their reap-hooks, usually employing old ones which are kept on purpose from the preceding year. The reaped peas are laid in moderate sized bunches upon the bands, with their heads all one way; and are left unbound in that situation to wither for several days. After the sheaves are bound, they are commonly left on the ground to dry for a week or two, during which time they are repeatedly turned, mostly once a day. This operation is easily performed by a few people walking along the rows, and turning every sheaf completely over with the point of a hook. Sometimes they are put up in small cocks like hay, and never bound at all.

§ 6. *Produce and application.*—The produce of peas is exceedingly variable, and more dependent on seasons than that of any other grain. In some years, even on soils best adapted for their culture, the crop, so far as grain produce is concerned, may scarcely be worth threshing; while in favourable seasons, from thirty to thirty-two bushels may be reaped from an acre, more especially on good soil newly limed. Such productive crops are however uncommon, and perhaps twenty bushels may be considered as a fair average, even on good soils and in favourable seasons.

The straw or haum is used as fodder for work-horses, instead of hay, and, when well harvested, forms excellent provender, insomuch as to be almost of equal value with the grain crop even when that is abundant; and when the latter is unproductive, and the harvest season favourable for *winning* the haum, it may greatly exceed the value of the grain. Peas-straw is likewise an excellent food for sheep, who are particularly fond of it. As the haum is seldom if ever sold, there is no data on which its weight and consequent money value can be estimated; but a good crop, in favourable seasons, may perhaps weigh 150 Scotch hay stones, or a ton and a half; and may consequently be worth from L. 3 to L. 5 *per* statute acre. The same observation already made respecting the injurious effects of bean-straw on some horses, and its unfitness for riding horses, apply to pease haum.

The application of the grain produce is the same with that of beans. Porridge, or thick gruel made of peas or bean meal, and given along with skimmed-milk, is an excellent food for breeding calves after they have been fed a few weeks on new milk. By means of this substitute or addition, a farmer may breed up a great many more calves yearly, with the ordinary number of cows, than could possibly be done on milk alone. Oat-meal porridge, however, and perhaps barley-meal, answers equally well. But of late years, beans and peas have not been nearly so saleable as oats, and their price, even when in demand, has not been at all proportional to the quantity of meal which they produce, in relation to the meal produce of oats; and consequently peas and beans can be more economically applied to this purpose than oats, and likewise to the feeding of pigs and horses.

PART V.

OF ARTICLES PRINCIPALLY CULTIVATED FOR THEIR
LEAVES AND STEMS.

SECT. I.

OF RYE-GRASS AND CLOVERS, INCLUDING THE PRACTICE
OF SOILING.

§ 1. *Introductory observations on their cultivation.*—The cultivation of artificial or sown grasses for hay, soiling, and pasture, has been already considered as a prominent feature in the improved or alternate husbandry of Scotland, these being always sown by judicious husbandmen when the soil is in its highest state of tilth and fertility. In other words, rye-grass and clover, are uniformly sown with the first grain crop which succeeds a well wrought and manured fallow or turnip crop, or at least as near as may be, in the various rotations or courses of crops already pointed out in the *third* part of this chapter.

This essential character of the alternate or convertible husbandry, is diametrically opposite to the exploded old system, if such it may be called, in which crops of grain were persisted in so long as they continued to yield a little more than defrayed the expence of seed and labour. When the soil, by this injurious treatment, was exhausted almost to a *caput mortuum*, fouled by a legion of weeds, and incapable of producing any more grain, it was then allowed to rest, that it might *gather heart*, as it was called; during which period, it became fully stocked with weeds and natural grasses; in which

state it remained, till a series of years of miserable pasture, restored it to some degree of fertility, when it was again broken up to grow a few scanty crops of grain. Such was the wretched management of the *outfield* land in all the arable districts of Scotland; and on these only was there any herbage allowed to grow for pasture, except on uncultivated moors and commons; as the *infield* land, to which all the farm muck was exclusively devoted, was *every year's land*, and made to grow grain crops in perpetuity.

Under such wretched management, every species of improvement that could be devised, such as liming, marling, paring and burning, fallow, folding, draining, and so forth, were only stimulants of temporary fertility, which left the soil ultimately deteriorated. But the introduction of cultivated herbage, and the growing experience of its excellent and permanent effects, have taught all observant husbandmen, that the true *arcantum* of profitable husbandry is, to increase and to preserve the fertility of the soil by every possible means, and never to strain and exhaust its vigour and fertility by overcropping.

In treating of cultivated herbage, or mixed rye-grass and clovers, it is proposed to consider them under three several views, as adapted for hay, soiling, and pasture. But before adverting to these in a particular manner, some general observations may be premised, on the manner in which the seeds of cultivated herbage are deposited in the soil.

The stages of the several rotations in which rye-grass and clover are introduced, have been already pointed out; and as the preparation of the soil belongs entirely to the grain crops along with which they are usually sown, neither of these circumstances require to be repeated*. These seeds are sown indiscriminately with or among wheat, barley, and oats, but uniformly in the spring season. Hence, when with winter

* Grass seeds, however, are sometimes sown by themselves, and without any grain crop.

sown wheat, the seeds are always sown among the growing crop. When along with spring-sown wheat, oats, or barley, especially when these grains are sown broadcast, the grass seeds are sown immediately afterwards, and covered in by a double time of the harrows. The field is then water-furrowed, if that work is necessary; after which the water-furrows are cleared out by the spade and shovel.

The sorts of artificial grasses that are sown, depend partly on the nature of the soil, and partly upon the intention of the cultivator, in regard to whether he proposes the ley to be only temporary, or if he means to keep the field in a state of permanent pasture, or in pasture for several years.

When the field or break is only intended to remain for one or two years in grass, and then to be taken up for a course of tillage, the usual mixture of grass seeds for a statute acre of good soil, is about half or two-thirds of a bushel of clean and well dressed rye-grass seed, with ten or twelve pounds of red-clover seed. Sometimes two pounds of white clover, and a pound or two of yellow clover, are added to the mixture, in which case the quantity of red clover seed is proportionally diminished. When land is to remain two or more years in pasture, a great allowance of white clover ought to be given; and indeed the red and the white are often sown in equal quantities.

When the grass is meant to remain for a greater number of years than two, or for permanent pasture, white clover must predominate, because red clover generally dies out in the third year, and often even in the second. On this occasion, the mixture may be as follows, one bushel of clean perennial rye-grass seed, eight pounds of white clover, and six pounds of red clover, two pounds of trefoil, with a pound or two of narrow leaved plantain, provincially called rib-grass, is often added to the mixture. In one instance, in laying down a small field for permanent pasture, the reporter added two pounds of perennial red clover, vulgarly called cow-grass, to the mixture for each acre: but as the crop was closely pas-

tured, and never allowed to rise to the scythe, he can give no certain account of the success of the experiment.

On one occasion, which came within the reporter's knowledge, a respectable farmer, when laying down a considerable field for permanent pasture, added a proportion of the seed of chicory to the ordinary mixture of rye-grass and clover. His chief object was to secure a sufficient stock of artificial herbage for full pasture, till the field might stock out abundantly with natural grasses, which always sooner or later take possession of the soil, to the exclusion of a part or the whole of the cultivated herbage. In this solitary experiment, the chicory plants grew vigorously, and were liked by the live-stock, being equally eaten with the other plants in the field, and remained at least in the third year of the pasture. The farmer was disposed to have extended the practice over his farm, but was prevented in consequence of the seed having become scarce and enormously dear. Another objection to the culture of this plant, (which is certainly abundant in point of produce), is, that it is so difficult to eradicate.

Very marked attention is, or ought always to be given to the quality of grass seeds. Within the last twenty years a variety of rye-grass has been introduced into Scotland, which being an annual plant, grows only for one year. There being no external mark or criterion by which the seed of this variety can be distinguished from that which is permanent or perennial, it is highly incumbent on all farmers, to be exceedingly careful in purchasing rye-grass seed from persons of character, on whom they can depend, especially when the land is intended to remain in grass for more than one year. Annual rye-grass seed looks well, and even produces, for one year, a crop perhaps superior to the perennial; but it never springs again from the root. Its introduction has been the occasion of much serious loss and disappointment, more especially when fields were laid down with the view of continuing in grass for the remainder of a lease. On such occasions, the farmer ought to be particularly attentive to provide himself certainly with

the seed of permanent rye-grass. On the other hand, where the ley is only intended for one year, the annual rye-grass is preferable, both as giving an abundant produce for that year, perhaps considerably more than that of the perennial variety; and because it is less apt to remain in the ground, and act the part of a weed when the land is broken up for a grain crop.

Somewhat of a similar difference has been observed in regard to the seed of red clover, procured from England and Holland. The plants from the Dutch or rather the French seed, have been generally noticed to die out before or in the second season, while the English seed produces plants which stand over the second year, many of them even remaining in the third year. In choosing clover seeds, marked attention ought to be paid to their quality, and that they do not contain any admixture of other seeds, which may vegetate and become troublesome weeds. The like attention is necessary in the purchase of rye-grass, which is very often mixed with the seeds of what is called *goose-grass*, tall oat-grass, hair-grass, and couch, together with docks and other abominable weeds. Most of these may be distinguished by attentive examination; but the seeds of couch so strongly resemble those of rye-grass as not easily to be discriminated. The word and character of the disposer, therefore, are the only securities against this terrible pest being introduced on a farm, which may afterwards occasion excessive trouble, and considerable expence to eradicate, when the land comes again into tillage. The reporter had a very vexatious instance of this evil, on first commencing the business of farming. His predecessor had sown off a field in grass, with the sweepings of livery stable lofts in Berwick, in which neighbourhood a number of small foul meadows are occupied by the burgesses, who sell or use the crops as hay. When that field came afterwards to be worked as a turnip fallow, the heaps of gathered couch roots were not much less considerable than the cocks of a moderate crop of hay. Clean husbandry depends mainly on the industry with which fallow and turnip crops, and drill-

ed beans are cultivated ; though there can be no doubt but that much foulness is occasioned, by want of attention to the purity of grass seeds. As no good husbandman will use hay seeds for his own farm, if his crops are foul, by a parity of reasoning, every one ought to be equally cautious in regard to purchased seed.

Universally, the various seeds of the artificial grasses are carefully mixed on the barn or granary floor, by repeated and industrious turning, and in the proportions intended for use. They are sown by hand, from a sheet fixed across the shoulders, and usually by what are called *three casts* to each ordinary ridge of land of fifteen or eighteen feet in breadth. The equability with which grass seeds are distributed to the soil, is a strong test of a good sower ; as from bad or careless sowing, the soil is irregularly stocked in curved *wales*, too thick of plants with bare intervals ; but unfortunately the evils arising from bad sowing, are not discoverable, until too late for being remedied.

The *time* of sowing has been already adverted to, as regulated by the seed time of the grain crops along with which they are sown ; and may be any time in March, April, or May, according to these circumstances. When sown among drilled grain, which requires to be hand-hoed, the seed process must be postponed till after the grain crop is hand-hoed ; or immediately before the crop is hand-hoed, in which case that operation assists to cover in the grass seeds ; after which the land may be neatly harrowed. This harrowing may either be given by the common harrows, by a very light harrow with numerous small teeth, or by a bush harrow. Some husbandmen are afraid of the operation of the harrow on this occasion, lest the young plants of the grain crop may be torn up by the roots ; but it sufficiently appears from experience, that all the apparent injury from the harrow teeth is amply compensated by the subsequent growth of the corn, and the abundant tillering of the plants which afterwards takes place. Accordingly, it is no uncommon practice, to harrow a grain

crop in spring, after it is above ground, although no grass seeds may be sown among it.

No culture whatever can be given to grass land, except spreading mole-hills, cutting thistles or other weeds, and gathering surface stones, especially when the grass is intended to be mown. These operations must be given, of course, in the subsequent year or years after sowing, as all such operations, in the first year, belong to the grain crop. In all wet soils, or those having a retentive bottom, water-furrowing is necessary, and opening up gaw-furs and cross cuts must be carefully attended to, as nothing is more injurious to cultivated herbage than stagnant water.

With every possible attention, grasses are sometimes partially or totally suffocated by the luxuriance and lodgment of the grain crop among which they are sown; or may be thrown out, especially the clovers, by frosts in the ensuing spring. On these occasions, a careful husbandman will fill up the blanks by sowing and harrowing in fresh seed, or he will resow the whole field with tares or hot-seed peas. This evil is peculiarly distressing when, by the conditions of a strict lease, the field ought to remain in grass during the remainder of the lease, or when the farmer is liable to heavy penalties, if the stipulated quantity of grass land is deficient. No rules of husbandry whatever can be devised for overcoming this difficulty, which will be any way effectual or profitable. To implement the imperious conditions of his lease, the tenant may be under the necessity to sow the land over again with grass seeds without any grain crop, with the almost absolute certainty of incurring a heavy loss, by being obliged to keep his land under worthless grass, not in the least advantageous to the landlord, or rather obviously injurious. For such land will stock itself with weeds, and its quality or fertility will become deteriorated, instead of being improved, by remaining in pasture. If the field, however, be sown in spring with *ten* pound of white clover seed of *good quality*, and three pecks of rye-grass *per acre*, well harrowed in among the stubble, a flush of herbage will appear before mid-summer.

§ 2. *Of rye-grass and clover, for hay.*—When it is intended to save the rye-grass seed of a hay crop, the operation of mowing must necessarily be postponed until it is ripe *. In this case the crop is generally threshed on a moveable boarded floor in the field, having a number of barn-cloths spread out to receive the seed; and performed when the cocks are drawn together for the purpose of being formed into tramp-ricks. On this occasion, the hay is very slightly threshed by flails or swiples, so as not to break the hay, and only to beat out the best ripened seeds. At other times the seed is not threshed out till spring. † Some persons select such parts of their hay field in which there happens to be little clover, and tie up the crop in bunches or sheaves, which they set on their butts like corn stooks; and when these are *win* or dry, they either build them into a rick carefully thatched, to be threshed next spring, or thresh out the seed and mix the hay or rye-grass straw with the rest of the crop. In all cases of threshing at hay harvest, the raw seed is packed into sacks, and carried without delay to a granary floor, where it is spread out as thin as possible, with free access of air, and turned twice a-day for some time; after which it must be turned once a-day till thoroughly dried. Without this necessary precaution, the seeds would infallibly grow or *malten*, and become entirely useless, by losing their power of vegetation. When effectually dried, it may then be dressed, or may remain mixed with its chaff till next spring. It is dressed by means of the winnowing machine or fanners, exactly in the same manner as grain of any kind, using the fanners gently; or it may be sifted or riddled out of doors, in a gentle steady breeze, the heavy seeds falling nearly below the sieve or riddle, while the lighter chaff blows to some distance.

* It is common, in some places, to bind the grass in sheaves after the scythe, to set it in shooks to stand till it be pretty dry, and to beat off the best of the seed by striking the tops of the sheaves against a sharp-edged spar placed horizontally two feet above the ground. This is as expeditious as the flail, and there is much better seed.

The produce of seed *per* acre, depends on a variety of circumstances, such as the proportion of rye-grass plants in the crop, and the light handling of the hay in making; but hardly exceeds eighteen bushels of seed to the acre, even in favourable circumstances, which may be worth five shillings a bushel in years of ordinary abundance and moderate demand.

Where a farmer is possessed of rye-grass of good quality, which he wishes to propagate, for his own use, or for sale, perhaps it were better to cultivate this by itself on purpose, unmixed with clover. This is the true mode of cultivating rye-grass for seed, and double the quantity will be produced. In this case, the entire crop ought to be put up in sheaves and stooks, and built into a rick or ricks to preserve it over winter for threshing in spring, and the whole managed exactly as a crop of grain. Under these circumstances the remaining hay, or rather rye-grass straw, is very worthless as fodder; and the soil on which it grew, ought to be considered as having carried a grain crop, and managed accordingly in the subsequent course of cropping.

Owing to the lateness of the climate in Scotland, few attempts have been made, to save the seeds of any of the clovers; which therefore are annually imported from England or Holland. It consists, however, with the experience of the reporter, that the yellow species, or trefoil, usually called hop-clover, effectually ripens its seed every year, when allowed to stand long enough for that purpose. He has accordingly saved some occasionally for his own use; but was unacquainted with the manner of removing the shells or husks, so as to fit it for market. The seeds even of white clover, are often perfectly ripened in Scotland, but no instance has ever occurred of their being saved for sale.

The produce of cultivated grass varies, of course, according to soils and seasons. A poor crop of hay may consist of 100 stones of 22½ pounds avoirdupois, or 20 cwt. A good crop may extend to double that quantity, or 200 stones, and from that to 250, or even 300 stones, which latter is a very

superior crop indeed, and very seldom reaped. This weight is to be understood of new-made hay from the tramp-ricks; as clover and rye grass hay, loses considerably in weight, by the after operation of stacking, and by keeping through the winter, perhaps from a quarter to a third part, according to circumstances*.

The value of a hay crop must vary considerably, according to produce and demand. From 6d. to 8d. a stone, that is 50s. to 66s. *per* ton, in years of ordinary abundance, up to 15, 18, or even 24 pence, in years of extraordinary scarcity and demand, or 125, 150, and 200 s. *per* ton. Hence the value of an acre of hay may vary from L. 2, 10 s. to L. 30. It is to be observed, however, that it is only near towns of some considerable size, that hay is an article of farm produce in regular demand for sale. Besides, except near towns and villages, whence manure can be purchased, and to which the carriage of hay is convenient, the sale of hay from a farm ought not to be permitted, as it deprives the land of a proportional part of its means of fertility. The application therefore of the hay, growing upon farms at any considerable distance from towns, is chiefly to the farm-horses in spring, when white straw has become dry and little nutritious as fodder; to cows about to calf or newly calved; and to the breeding flock of ewes, generally along with a moderate allowance of turnips.

The latter-math or *foggage* of rye-grass and clover being hardly ever made into hay, is usually devoted to pasture, or cut as a continuation of the soiling process. In those parts of the country, where an abundance of sea-weed, enables husbandmen to keep their land in constant fertility, the first year of rye-grass and clover is frequently cut three times for soiling. In this case, the first cutting is generally early, when the land often gets an immediate top-dressing of sea-weed, which ensures an early and abundant second growth.

* The mode of making hay in Scotland, will be explained in the Chapter on Grass Lands. See Vol. II.

§ 3. *Of rye-grass and clover for soiling.*—This most profitable practice has not hitherto become universal in Scotch husbandry, even in the best managed districts, but is gradually extending, and needs only to be fully known, to be adopted wherever circumstances allow it to be carried on. It is only about sixty or seventy years ago since the seeds of rye-grass and clover were brought from England, and sown in this country, at first in a few places, and in small quantities. When the soil was good, and the preparation had been judicious, very large crops of grass were produced, much earlier in the season, and more palatable, than from any natural meadow. The quick reproduction of the clover also, after it had been cut, yielded after-crops far superior to what had been hitherto experienced. These advantages were too obvious to be overlooked; the practice of cultivating artificial grass gradually extended, and, by means of it, farmers being enabled, to fill the stomachs of their working-horses quickly at the stall, could make them do more work, and perform longer journeys without injury. It is thus that one improvement facilitates others. Working horses, instead of slowly gathering their food in the fields, and shunning the yoke when they were wanted, by being now fed in the stall, are always at command, and able to perform the important labours for which they are destined. They do not require more exercise in the open air, than they get in eight or ten hours of daily labour, and the remainder of their time is better devoted to rest and feeding. Nor has the culture of artificial grasses been less beneficial in the dairy. The quantity and quality of the milk, is in some proportion to the ease and quiet the cows enjoy, and the abundance of palatable food given them. Few animals are more impatient of the scorching heat of the sun, and the torment of galling insects, than the cow kind. However plentiful the pasture, when the sun scorches, and the gad-fly stings, cows forget that ease and plenty in which they delight, and dissipate their milk in madly ranging over the fields. By sheltering them under

the cool shade of the cow-house, before the violent heat commences, and indulging them in a feed of cut clover, this hazard is obviated, and the produce of the dairy augmented.— For these advantages, the country is indebted to the introduction of artificial grass.

But, in some instances, a more universal system of soiling has been established. When horses have been for some time accustomed to green food, they do not feed so freely on that which is dry, and tares and other green vegetables have been raised to fill up the vacancy between the first and second cutting of clover, and the soiling thus continued without intermission, as long as vegetation is alive. The same has been found successful in feeding both milch cows and those for fattening.

The advantages accruing from these practices, have been found very considerable. The same number of beasts are maintained on something less than half the land which would have been required, had they been allowed to tread over it while feeding, and gambol when filled. The farmer obtains a greater quantity of valuable dung, which he can apply in the most efficient manner. Cattle are in less danger of *hooving* by feeding on cut clover, than on that which is growing; and the depredations by breaking through fences, and destroying corn-fields, is totally avoided. The most remarkable circumstance, however, is, that the corn crop, the following year, is in general better, on the land from which the grass had been twice cut, than on that which had been depastured. But, though the smothering under a strong crop of clover, and the numerous leaves which the plant sheds on the ground, may have this effect for one year, the ground cannot be so rich afterwards, as if all the manure that the pasturing stock left, had remained upon it*.

* These observations on soiling, are extracted from a communication written by John Naismith, Esq.

One recorded instance, in the experience of the reporter, may be given as an elucidation of the economy and advantages of this practice*.

In summer 1806, he kept six work-horses and a riding poney in the fold-yard upon cut clover and tares for four months. Two acres of the first cutting of a good crop of clover and rye-grass were expended, along with half an acre of green tares, to carry them on till the clover would cut a second time. These, valued fully at seven guineas the acre, were worth L. 18 : 7 : 6. It required *twelve* acres of the second cutting of the clover crop, at 30s. or L. 18, to carry on the horses. Hence the whole expence of feeding *seven* horses for four months was L. 36 : 7 : 6. The expence of cutting and leading is not included, as these may be considered as fully compensated by the value of the disposable muck produced.

It would certainly have required *six* acres of the clover in pasture to have maintained the horses for four months. Estimating these at L. 8, 17s. an acre, or the same value as already stated for the two cuttings, the horses at pasture would have cost, for the same period, L. 61, 19s., leaving a fair profit of L. 25 : 11 : 6 in favour of soiling, or L. 2, 13s. for each horse.

The soiling of cattle, either tied up in sheds or allowed to run loose in the fold-yard, is more recent than with horses, and has not as yet become so general. From analogy, it may certainly be inferred, that since it answers satisfactorily for horses, it will do equally well for cattle. It is quite obvious, that any quantity of clover that is fit for cutting, may be consumed in this way to the great benefit of the tillage farmer, who generally stands in need of more dung, than can be accumulated in the ordinary manner, from the straw of his grain crops. It is likewise obvious, that a much larger quantity of dung may be collected by this practice, than in the ordinary way, while the quality is superior to every other kind, made on a farm or in the farm-yard, except that which is

* Berwickshire Report, p. 262.

produced from cattle fed upon turnips. Experience is in all cases the surest guide; and from trials made by Mr Brown of Markle in 1805, the results have proved so decisively in favour of soiling, in comparison with pasturing, that it has been regularly and extensively continued ever since*. It is, however, unnecessary to extend these observations, as the President of the Board, (Sir John Sinclair), in Part III. of his Remarks on the Practical Details of the Scotch System of Husbandry, has collected so much information on the subject, of which the following are the results:

1. Cattle feed as well on cut meat as on pasture, if regularly and fully supplied.—2. The saving of grass is considerable; though the experiment alluded to was not so conducted as to ascertain its extent with precision, Mr Brown is of opinion, that it is equal to more than 50 per cent., in other words, that a field of clover and rye-grass will fully feed one-half more beasts, when cut by the scythe, than when it is depastured.—3. In carrying on the soiling process to advantage, it is necessary that the fold-yard or hammels should be conveniently fitted up with shelter sheds and open yards well littered.—4. The cattle should always have abundance of good water at their command.—5. A careful servant ought to be entrusted with the management, and to supply fresh food regularly at least five times a-day.—6. Tares sown at different times, to cut in succession when the clover becomes hard and unpalatable, and to supply the soiling cattle till the clover is ready for a second cutting, are indispensable for the advantageous management of this excellent system, as the cattle will make no progress in feeding on clover that is fit for being made into hay.—7. Cattle intended for feeding by the soiling process ought to be in good condition, otherwise the best part of the season, or the month of June, when the grass is richest, will be over, before much alteration can be discovered.

* Brown's Treatise on Rural Affairs.

But the system of soiling can only be pursued in fertile and well-cultivated districts, where the crops of grass are luxuriant. Where the grass is thin and weak, the trouble of going over much ground, to collect a small quantity of food, would lower the superiority of house-feeding; nor would it be perhaps so suitable to all kinds of live-stock. Young animals in a growing state, will probably thrive best, when at liberty to take their natural exercise in the open air, in quest of their food. Milch cows, though they ought to be soiled in the middle of the day, may, at other times, be advantageously pastured. The same remark is applicable to fattening stock.

It has been observed, that the partiality of the Scotch farmers for artificial grasses, has not yet been sufficiently justified by experience; that clovers have not hitherto failed so much as probably they will do from repetition; and that the constant cutting of the crop for hay or soiling, will make the artificial grasses fall off sooner than if they had been occasionally pastured. It is to be remarked, however, in answer to these observations, that the system adopted in Scotland of *deep ploughing*, so seldom carried to the same extent in England, in a great measure obviates these objections; that the new soil, thus occasionally brought up, promotes the production of clover; and that, whilst that system is adhered to, no repetition of clover is likely to be unproductive. This will particularly be the case when the land is kept occasionally in pasture, which, by the most intelligent managers in Scotland, is considered indispensably necessary even on the most fertile soils. This is a subject that will be more fully treated of in the following chapter.

§ 4. *Of rye-grass and clover for pasture.*—Although the reporter is decidedly of opinion, that the soiling system is preferable to pasturage, on all lands fitted by soil, situation, and climate for that purpose; yet he is satisfied, that there are many descriptions of soil, which cannot yield sufficiently good crops of rye-grass and clover to admit of being profitably de-

voted to soiling. Even on tillage farms, there are many soils which require to be recruited by pasturage, for two, three, or four years, before they can be again broken up to tillage with profit. With these lands, wherever they are situated, and in all upland districts occasionally under tillage, pasturage, either permanent, or limited to a certain number of years, must necessarily be had recourse to. Tillage may be often employed to improve upland soils, so that they may be laid down to permanent pasture, after undergoing such a course of improvement, as may be required to put them in a productive state. The proper mode, however, of pasturing land in that state, will be treated of in the subsequent chapter on grass lands.

SECT. II.

OF TARES.

§ 1. *For soiling.*—When tares are intended to be cut green for soiling, the seed ought to be sown moderately thick, or about three bushels and a half to the acre; and it is customary in Scotland to mix a small quantity of oats with the seed tares, to the extent of a sixth or eighth part, by which the tares are supported while growing, and stand better to the scythe, whilst the fodder is considerably increased. When fit for cutting, this mixed food becomes amazingly substantial, in consequence of the nearly ripe oats and tares, along with the strong and still succulent straw and haum, enabling the farm horses to go through the heavy and protracted work with alacrity and vigour. Tares ought to be put into the ground at several intervals, from the end of March to the end of May, so as to furnish successive cuttings, to supply the soiling stock in the interval between the first and second cut-

tings of the clover crop. After the seed is sown and carefully harrowed in, the surface ought to be smoothed by the roller, to allow the free use of the scythe; and the field should be guarded for some days from the depredations of pigeons, who are exceedingly fond of tares, and will often do great injury, it is said, by picking up the seed, unless carefully watched. Others contend that this injury is ideal, as pigeons pick up only what they discover on the surface, and the seed which is not covered does not grow.

Both horses and fattening cattle thrive well on cut tares, and even feed faster on them, than on cut clover, or any other green or succulent food whatever. When tares are wet, foul, or too green and succulent, especially after their pods are formed, the stock which is fed upon them, are sometimes liable to dangerous cholics, or to the disease of hoving, being apt to devour amazing quantities of this grateful food. Perhaps some dry food might be given alternately with the frequent supplies which ought always to be furnished to soiling cattle.

§ 2. *For seed.*—When cultivated for seed, the management of tares is so extremely similar in all respects to that of peas, as not to require any particular detail. Early sowing ought however to be studied, and the seed ought to be committed to the ground in March, or not later than the first of April, if a good crop is expected. The *quantity* of seed for this purpose, must be smaller than when intended for soiling, otherwise the thickness of the crop may prevent the plants from blossoming and ripening the pods sufficiently. In this case, three bushels to the acre are quite sufficient. It may likewise be mentioned, that a small quantity of beans, or about a bushel to the acre, is sometimes mixed with the seed-tares with advantage, as they serve admirably to carry the tares from the ground, like sticks to garden-peas, by which the air is effectually admitted to the crop, and its blossoming, podding, and ripening materially assisted. The produce of the beans is easily separable in the barn, by the employment of proper riddles, which allow the tares to pass through, and

retain the beans. In this mixed mode of culture especially, drilling the crop is much to be preferred; and, on account of the beans, the intervals between the drills ought not to be less than 27 inches. When the tares are drilled alone, twelve inch intervals are quite sufficient; and as the plants soon fall over, hand-hoeing must be given early.

Although there is no direct record of the fact, yet analogy gives good ground to conclude, that the tare crop, especially for seed, will succeed best on land that has been recently limed; but it is known from experience, that on soft moist land, or in loamy soil that is full of manure, or in a fertile state, that the tare crop is very liable to take on a second growth, and to continue growing and successively blossoming to a late period, to the material injury of the crop. Dry land, therefore, and land that has already carried a crop of any of the culmiferous grains, is best adapted for procuring a satisfactory crop of seed-tares. It is of high importance, however, that the soil be clean, and in a good state of tilth, as the tare is a small and tender trailing plant, and ill calculated to contend against weeds. It may be added, that thin clays, if in high condition, are generally considered as best adapted to the growth of tares, when grain is the intended object.

§ 3. *Winter tares.*—Hitherto, so far as known, winter tares have not been grown to any extent in Scotland; and experience will not warrant any particular recommendation in their favour. Yet in two instances in the year 1811, excellent winter tares, sown after harvest 1810, were grown in Berwickshire, which were fit for the scythe some time earlier than the clover crop, and were admirably calculated for an early commencement of the soiling process. In these instances the crop was mixed with rye, which both held up the tares from the ground, and added materially to the bulk of green food; and the crops growing on soft moist loamy soils, were cut in sufficient time for working the land on which they grew for turnips. Where the soiling system is carried on effectually, the culti-

vation of a proportion of winter tares, on that part of the farm which is destined for turnip fallow, seems worthy of attention; selecting for that purpose some part or parts of the stubble land intended for turnips, that is well sheltered. Perhaps a light dunging on the stubble might secure a more ample crop.

According to the opinion of an experienced botanist, "the summer and winter vetch or tare are the same plant, and are distinguished by these names, from the seasons in which they are sown, and the purposes for which they are designed *."

"There is a plant of this kind, were it sufficiently known, that would repay the attention of British agriculturists; the Narbonne vetch, or *vicia Narbonensis* of Linnæus. This is a plant of a much more vigorous and rampant growth than the common vetch, as when both were sown in a garden in Scotland, and on a poor soil, it afforded more than double the crop †." We have often much admired a plant of this family in gardens, usually called French honey-suckle, which deserves the attention of agriculturists, and which is here only mentioned as a hint ‡."

* Walker's Hebrides, I. p. 228.

† Ibid. I. p. 289.

‡ Several patches of the *vicia sepium* and yellow vetchling mixed, stood in East Lothian forty years ago, and were cut every year, and afforded a luxuriant crop of herbage. One, on the Gosford estate, on the farm of Spittal, was broke up about twenty years ago only, and taken into rotation with the rest of the field. It consisted of several acres. It must have been very valuable before the introduction of red clover.

The *erium hirsutum*, or small hairy tare, grows very luxuriantly among all grain crops, in Ross-shire. It affords most delicate herbage, and the seeds can be collected in any quantity. It is an annual plant, a hardy native, and, by culture, might increase in size and succulency, and form a valuable addition to the stock of soiling herbage cultivated in this country.

PART VI.

OF ARTICLES PRINCIPALLY CULTIVATED FOR
THEIR ROOTS.

SECT. I.

OF TURNIPS.

§ 1. *Introductory observations.*—“The introduction of turnips into the husbandry of Britain,” says an experienced agricultural writer who has been frequently quoted*, “occasioned one of those revolutions in the rural art which are constantly occurring among husbandmen. Before the introduction of this root, it was impossible to cultivate light soils successfully, or to devise suitable rotations for cropping them with advantage. It was likewise a difficult task to support live-stock through the winter and spring months; and the practice of feeding cattle and sheep for market, during these inclement seasons, was hardly ever thought of or attempted, unless in a few instances, where a full stock of hay was provided. The benefits, therefore, which are derived from turnip husbandry, are manifold and of great magnitude. Light soils are now cultivated with facility and profit, by which abundance of food is provided for man and beast; the earth is turned to the uses for which it is physically calculated; and, by being suitably cleaned and fertilized by this preparatory crop, a bed is provided for grass-seeds, in which they prosper

* Brown's Treatise on Rural Affairs.

with greater vigour, than after any other mode of preparation."

As turnip husbandry is the sheet-anchor, or *sine qua non* of the modern alternate and convertible husbandry, in all dry-soiled districts, the Reporter is induced to enter into a considerable detail in this section; more especially as the turnip husbandry, as practised in the best managed districts of Scotland, admits effectual culture, and is incomparably superior to any other mode hitherto devised. Being however unwilling to enter upon any controversial discussion of the merits of the drilled turnip husbandry, so universally adopted in all the well managed districts of Scotland, or to contrast it with the broadcast manner of sowing, the reporter considers, that he cannot better fulfil the intentions of the Board of Agriculture on the present occasion, than by giving an abstract of the detail formerly communicated in the Berwickshire Survey, concerning the most appropriate way of cultivating turnips, according to the drill system. The remainder, therefore, of this section, chiefly consists of a transcript from the Berwickshire Report, chap. vii, sect. xiii. p. 266—283.

In the addenda to the original Report of Northumberland, the introduction of *drilled* turnips is referred to the celebrated Tull, who appears to have chiefly used intervals of three feet; it farther appears, that Tull gave all, or most of his favourite horse-hoeing husbandry to his turnips, *after* they were sown; whereas, in modern husbandry, the soil is invariably reduced to a fine friable tilth, *before* the seed is sown, and the horse-hoeing continued during the period of their growth.

The Northumberland Reporter considers Mr Craik of Arbigland, in Dumfriesshire, as having been the first cultivator of drilled turnips on the borders, about the year 1745. He farther supposes this practice to have reached Cumberland about ten years afterwards; when Philip Howard, Esq. of Corby, first cultivated turnips, at intervals of four feet, which he afterwards reduced to two feet.

Nearly at the same time with Mr Howard, or about the year 1755, Mr Pringle, near Coldstream in Berwickshire, cultivated turnips in drills, at three feet and a half distance, and likewise drilled his grain crops; following, in both cases, the general principles of Tull's publication.

At this time William Dawson, Esq. of Graden, an intelligent and successful farmer in Roxburghshire, after some residence in the county of Norfolk, where he had attentively studied the system of alternate husbandry, adopted the practice of Mr Pringle, in regard to the cultivation of turnips, in preference to the mode which he had seen practised in that celebrated county. Mr Dawson began the drilled turnip husbandry in 1764, on an extensive scale, growing nearly 100 acres yearly. He ultimately fixed upon thirty inches, as the best interval for the purpose, after repeated trials both of broader and narrower; and his practice has been universally followed in all the border counties.

§ 2. *Scotch system of turnip culture.*—Turnips are grown upon all comparatively dry soils, from the poorest sand and gravel, up to the richest free loam; but are exceedingly apt to fail, on soils that have a tendency towards clay, or where the subsoil is at all retentive of moisture, more especially in dry seasons: Yet they are every year sown, in greater or less breadths, upon soils not physically adapted for their growth; so great is the anxiety displayed to have a supply of that valuable succulent winter food for farm-stock.

2. The land intended for turnips, is ploughed after harvest, as soon as convenient; and is carefully water-furrowed, to lay it completely dry, if it has the smallest tendency to retain wetness. When spring seed work is over, the whole strength and energy of the farm is exerted to the utmost, to reduce the turnip break into fine tilth, by repeated ploughings, harrowings, and rollings; and the roots of vivacious weeds, more especially of couch grass, are carefully gathered into heaps, and carted off for making composts.

3. Upon rich soil, which has only grown one crop of grain, after being taken up from old pasture ley, turnips are frequently sown without any manure; but generally the turnip-break is manured with farm-yard dung. Some farmers dung the whole, or a part of the land intended for turnips, immediately after harvest, before giving it the first ploughing*. This, it is said, saves a great deal of time and labour, in the excessive hurry of the turnip season; and answers tolerably well upon good land that is entirely free from root weeds. But the most generally approved method of applying dung, is to lay it in the drills, immediately before sowing, as shall be explained in the fifth subdivision of this section.

4. The time of sowing must be regulated by circumstances; but the beginning of June is considered as the most favourable season for ensuring a full crop. When sown earlier, they are apt to run up their flowering stems before winter, to the great injury of the feeding quality of the root. When later, they have scarcely time enough remaining before winter sets in, to form their roots to a full crop. The first week of June is the usual time of beginning to sow; and every exertion is made to have the whole finished before the end of the month.

5. Drilling of turnips is so general over Scotland, that hardly any is to be seen broadcast; and the drills or rows are universally at from 27 to 30 inches distant.

When the soil is clean from root weeds, and finely reduced, it is formed into straight lined ridgelets of the proper

* It is difficult to imagine, how these farmers got manure enough to lay on this season, unless they had begun originally to manure in this way, and lost the use of their dung for one season altogether. At any rate, their dung must be by far too much digested and rotten, except that portion made by summer soiling. The practice is not to be recommended; for a part of the valuable matter of the manure, must be diluted and washed away by the winter rains, and more must evaporate in a gaseous form, when the land is wrought and prepared for receiving the seed in the spring and summer following.

breadth, either by a double-mould-board plough, or by the common swing-plough. The dung is then carted on, and drawn out in small heaps, in every third furrow or hollow drill, the cart wheels going in the two hollow drills on each side. It is then regularly spread out in these three hollow drills, though in some instances five drills are taken at one time, though this is generally considered too many, as it loses time in spreading the dung by moving off sidewise. The quantity of dung varies, according to the powers of the farm, and the means of procuring adventitious manure from towns, or from the sea-shore, but in general is from 12 to 20 loads of a two-horse cart. It is always carefully rotted before using, by turning over in the fold-yards, some time previous to use, or by carting out during winter into heaps, near the place where it is to be applied*.

In districts where sea-weed is procured in abundance, this valuable manure is always applied to the land in a perfectly fresh state, immediately as it comes from the shore, and is never rotted, at least by itself. As the time of procuring sea-weed is extremely uncertain, all that is procured in winter and early spring, and intended for the turnip break, is immediately spread upon the surface, and should be ploughed in as soon afterwards as possible. Any that is procured at the time of forming the hollow drills, is carted upon them, and managed exactly in the same manner as dung.

* Some intelligent farmers are of opinion, that this turning over and carting out, are both destructive of the quality of the manure, allowing the finest parts to evaporate, and promoting fermentation too much. They contend, that by a regular, careful admixture of the cow and horse dung and urine in the yard, as taken out of the stables, &c. and a due supply of turnip, or some other succulent food to the stock of fold-yard cattle, to moisten the straw laid down to them, by their urine, there will be no occasion for either turning or carting out in winter; and the manure, when it is applied to the soil in June, will be found both greater in quantity, and superior in quality, than if it had been moved away or exposed to the weather by carting and turning it in winter. But the general opinion of turnip-land farmers is in favour of rotten dung, for a turnip crop.

Immediately after dung has been spread out in the hollow drills, the ridgelets are split open to cover it; and the seed is instantly sown, to preserve the natural moisture of the soil as much as possible, that the seed may spring quickly and equally. In districts where considerable quantities of turnips are cultivated, a compound drill-machine is used, which sows two drills at once, and is connected with a light roller for flattening the tops of the drills to exclude drought. Single row drill-barrows are still to be seen in many places.

As the land for the grain crop which follows turnips, whether barley, oats, or wheat, seldom gets more than one ploughing, it is customary to lay off the turnip drills, in a direction somewhat different from that in which the ridges are to be afterwards drawn for the grain crop. By this a more equable distribution of the manure is made through the soil for nourishing the ensuing crops of grain and grass.

6. The sorts generally cultivated are the white-topped Norfolk and the Globe. Sometimes the seed procured from England has a mixture of green or red topped among the white. Several persons, in different districts, are at great pains to raise seed of selected varieties, mostly, however, white globe, for sale; to which some men have chosen to give peculiar names of their own contrivance. The tankard variety is sometimes cultivated for early use, but it is believed not to bear the vicissitudes of winter equal to the others already mentioned. A new variety, called the yellow field turnip, has of late been recommended in some districts, as peculiarly well calculated to stand the winter, and to serve for late spring feed, when the white kind is over. "This variety is quite different from the yellow garden turnip, being larger, containing more juice or nutritive substance, more easily cultivated, and preserving its feeding powers till the middle of May, when the grass season may be expected to commence. Upon ordinary soils, it is superior to ruta-baga, because it will grow to a considerable weight where the other would be stunted or starved, and it stands the frost equally well. The mode of

culture required for this sort, is in every respect similar to what has been already stated for common turnip; only it requires to be sown a fortnight or three weeks earlier, and the plants need not be set out so wide in the drills, as they do not swell to so great a size*."

7. With regard to the quantity of seed which should be sown, from a pound and a half to two pounds and a half to the acre, is reckoned quite sufficient to ensure a full stock of plants. The want of a sufficient quantity of seed might occasion unprofitable blanks; while too great abundance occasions the plants to be weakly, and difficult to single out in the hoeing process.

8. Rolling is applied at the moment of sowing; in consequence of the construction of the drill-machine formerly mentioned.

9. In the early stages of growth, turnips often suffer materially, by the ravages of a peculiar species of fly, or rather beetle; but, during fifteen years' experience in Berwickshire, the reporter has neither seen nor heard of this misfortune, except in a few instances. Upon a most industrious inquiry among a number of experienced farmers, no certain account can be procured of the causes of this comparative exemption from the ravages of the fly. One idea has been suggested, that thick sowing is a sure prevention of injury from the turnip fly, giving a sufficient number of plants to serve the voracious appetites of these insects, and to leave abundance of plants for a crop†. This

* Brown's Treatise on Rural Affairs.

† The great object is, to have the land well manured and prepared so as to bring the turnip sooner into the rough leaf, by which means it escapes the beetle. The soil on the tops of the drills is so finely reduced by the two rollers, that the little vermin have few or no hiding places, except in the hollows between the drills among the small clods there; these little insects are very shy, and skip off and conceal themselves under the small clods, as soon as you come near them, by which means they are also protected from small birds. They feed in sunshine, and when feeding, will be picked up by small birds, in skipping from the tops to the intervals of the drills, to conceal themselves.

was the opinion of a Norfolk ploughman employed by Dr Hutton, and afterwards by Mr Fordyce, so long ago as from 1763 to 1772. It may be noticed to the credit of English husbandry, that to the example of this ploughman, the modern Berwickshire husbandry, particularly as relative to clean turnip fallows, neat ploughing, and the introduction of cultivated grasses, greatly owes its origin.

In summer 1804, a great alarm prevailed for some weeks, on both sides of the Tweed, from the appearance of immense numbers of small black, or very dark green caterpillars, upon detached small patches of the turnip fields. Their ravages were rapid beyond conception; but they fortunately did not spread, and suddenly disappeared, after doing moderate mischief. A few of the same kind has appeared in different parts of the country, every year since, but have never produced any serious injury. The fly is said to attack turnips while in the seed leaf only; whereas the caterpillar feeds voraciously on the broad rough leaf, even after the plants were singled out. In some instances, the hearts or crowns of the plants escape, and have afterwards vegetated, but the roots of these plants never became large. For the caterpillar, a number of ducks will be found the best remedy, as they devour that species of vermin with great avidity.

The principal danger to which turnips are exposed, is from the slug and fly. In a fortnight after the young plants begin to appear, it often happens, especially in dry weather, that either the whole is totally consumed, or so many destroyed as to leave a very scanty and irregular crop. Various methods have been devised to prevent this calamity. Some roll the turnips in the night time, when the slugs, concealed in the ground through the day, are supposed to come out to feed on the young plants, and are crushed and destroyed by the roller. To save the crop from the ravages of the fly, it has been recommended to sow a mixture of seed, of three different and successive years' growth. As the latest or freshest will always spring first, and the different portions of the mixture will rise

at different times ; the fly will naturally fasten on that which first appears ; but, when the second growth comes up, it will quit the first and attack the second ; the same preference will be given to the third when it appears, the youngest being always the sweetest and most palatable. Before this last is finished, what remained of the two former growths will be so far advanced, and will have acquired so harsh and bitter a taste, that the fly will not return to them again. Thus a sufficient quantity of plants may escape for a full crop. As this is a very easy method, it is surely worth the trial. Perhaps the whole secret lies in sowing thick, that the fly may have abundance of food, and leave a sufficient number of plants.

10. As soon as the plants have acquired sufficient strength to admit of being singled out, the intervals are horse-hoed. The hand-hoers then fall to work and set out the plants singly in the rows, at distances of eight to ten inches, destroying all weeds and unnecessary turnip plants. When a fresh growth of annuals has sprung up, the horse-hoe clears the intervals, and a second hand-hoeing immediately follows. This generally suffices, as the broad leaves of the turnip now overshadow the soil, and effectually prevent all vegetation except their own.

In case of blanks occurring among the drills, an excellent expedient is, to have a seed bed of ruta-baga, sown on purpose, which bear transplanting, and may be used to fill up the vacancy.

11. In consuming a turnip crop, part is taken up during winter, or drawn, for feeding cattle in the house or under shelter shades, and for giving a moderate allowance to young cattle and cows. The remainder, and usually the larger proportion, is applied to feed sheep, either where they grow, or led off into grass fields. It is very common to lead off one half of the turnips, in regular breadths of five or six drills, for the several purposes already mentioned, leaving the other half to be consumed by sheep where they grow.

When fed by sheep, in the place of their growth, the turnips are lotted off by means of flakes or hurdles, or by sheep-nets fastened to stakes, that they may be regularly consumed. When the first allowance is nearly eaten up, the bottoms or shells are picked out of the ground, by means of a two pronged blunt hook adapted for the purpose, that no part may be lost. An additional portion of the field is then given, by shifting the hurdles or nets, and the whole field is thus regularly gone over; always leaving the cleared part of the field open, as a dry bed for the sheep.

In the expenditure of turnips to young cattle, especially calves, and to hogs or young sheep in the first year of their age, towards spring, when the loosening and coming out of their teeth render them unable to bite the hard roots, it is customary to cut or slice the turnips, either by means of a spade or chopping knife, or by an implement constructed for the purpose, called a turnip-cutter; or they are sometimes bruised by means of a heavy wooden mallet.

During severe frosts, turnips become so hard, that no animal is able to bite them. The best remedy in this case, is to lay the turnips for some time in running water, which effectually thaws them; or, in close feeding houses, the turnips intended for next day's use may be stored up over night, in one end of the building, and the warmth from the animals will thaw them sufficiently before morning. It is advisable indeed to lay up a sufficient quantity before Christmas, to serve during any severe frost that may reasonably be expected to happen before March sets in. Without this precaution, feeding cannot be relied on, unless potatoes are stored.

It is difficult to estimate the expence of hurdling; because every farmer who has occasion for that accommodation, has a complete set of hurdles, or nets, or both to serve his purpose; and these, with proper care, will last a long time. Two hundred sheep flakes or hurdles, made somewhat like gates, of foreign fir, having four rails each, with pins, stobs and rances, for securing them, may cost about sixty pounds, and will last

from ten to twelve years, with proper care, and moderate repairs. A set of sheep-nets, which answers admirably for the large quiet Leicester sheep, sufficient for the use of a moderate farm, may be had for a third part of that price; but they will hardly last beyond four or five years. They are, however, much more readily transported; and sheep breeders and feeders have often to take turnips at many miles distant from the places of their abode.

The effect of eating turnips on the place of their growth by sheep, in manuring the ground, and enabling it to grow weighty crops of grain, is material, and obvious to the daily experience of every farmer; but no direct experiments have been instituted with a view to ascertain the comparative value of the grain and grass crops which succeed turnips eaten upon the ground, and turnips that have been drawn and eaten elsewhere. The difference may be thus estimated, that in the former case, the land will carry a moderately good crop of spring wheat, while in the latter, the farmer must be contented with a crop of barley or of oats. If, however, the turnip crop is to be carried entirely away from the farm, the difference is of great importance, as, carrying away a complete dressing of dung, is equal to not less than five pounds an acre; which sum, therefore, may be assumed as the value of the amelioration produced by eating the turnips where they grow. That sum, at the same time, is by no means lost to the farm, though abstracted from that particular field, when the turnips are eaten in the fold-yard, feeding-houses, or upon other fields of the farm.

12. It is difficult to estimate the produce of a turnip crop, as it is hardly ever weighed. Near large towns, where turnips have been occasionally sold by weight to the inhabitants, for feeding cows, about 40 tons *per* English acre have been raised, but that is accounted an immense crop*.

* Recently, in Ayrshire, there have been instances of above 60 tons raised on the English acre, the leaves not included. Thirty tons, however, may be a high enough average even for good crops, in the course of a regular rotation.

The value or price by the acre, is so various, from differences in soil and seasons, and fluctuates so much according to abundance and demand, that nothing decisive can be asserted on this subject. It likewise varies according to the modes of application, as above mentioned. A farmer who has turnips to sell, will demand more money *per* acre, if they are to be drawn and consumed by the taker in the fold-yard, or on the pastures of the farm, than if eaten by sheep where they grow; and will require a much higher price if they are to be led away from the farm. Indeed, hardly any price will compensate for such abstraction of manure, and consequent loss of future fertility, unless where manure can be readily purchased to supply the defalcation; and that can only be done by those who are situated near towns and large villages, where a few turnips may be sold in that way, for the cows of the inhabitants. Eight guineas an acre is considered as a good price, in seasons of uncommon demand, for a good crop; five guineas, in ordinary years, and down to thirty and forty shillings for inferior crops. Upon an average of years, five guineas may be reckoned a fair price for a good crop, eaten by sheep where they grow. Near large towns, where turnips are in demand by cow-feeders, they will sell in ordinary years for double, and when in extraordinary demand, for three or even four times these prices; but in these cases they are always removed from the farm, and consequently their manure or amelioration is lost to the soil.

From what has been said, it will appear obvious, that the turnip crop, considered singly, is by no means a source of direct profit to the grower; when rent, manure, and extraordinarily expensive labour, are all taken into consideration, double the price already mentioned as a fair average would not compensate the outlay, and leave a fair profit to the farmer. But, when the beneficial consequences of this crop are taken into view; as standing in place of a naked unproductive fallow; as producing an abundant supply of excellent succulent food, for winter and spring use, to sheep and cattle; as securing subsequent fertility, and augmenting the means

of producing heavy crops of grain and hay, and excellent pasture; the turnip culture must be considered as the mainstay of all good husbandry, on soils to which it is adapted.

It is not uncommon to let turnips at an agreed price, or board, for each sheep or beast weekly. This varies, according to age and size and demand, from fourpence or less, to eightpence, or more, for each sheep weekly; and from two shillings to five for each beast. An acre of good turnips, say 30 tons, with straw, will fatten an ox of 60 stone, or ten Leicester sheep. Supposing the turnips worth six guineas, this would bring the weekly keep of the ox to six shillings and threepence halfpenny, and of the sheep to about sevenpence halfpenny a-week. In this way of letting, however, disputes may arise, as the taker may not be careful to have them eatet up clean.

The person who lets the turnips has to maintain a herd for the taker; and when let for cattle, and, consequently, to be led off, the taker finds a man and horse, and the letter maintains both. The taker has to provide hurdles or nets for fencing the allotments; but the letter must fence his own hedges, if necessary. The period at which the taker is to consume the whole, is usually fixed in the agreement, that the letter may be enabled to plough and sow his land in proper season.

13. Turnips are very seldom secured, though sometimes a portion is drawn and formed into heaps, like potatoe camps, to be described afterwards, and lightly covered with straw; or preserved for some time under a roof or shed. On these occasions, the shaws or leaves, and the tap-roots, must be cut off and removed, before storing up, to prevent heating and rotting.

It has been asserted, that turnips ought on no account to be preserved in heaps on the ground, in the manner of keeping potatoes, to be afterwards explained; but that they should always be stacked, like corn, on stands, or staddles, and covered with straw; in which way they will keep for several months. It is, however, a common practice in many parts,

to keep them in small heaps on the ground, first depriving them of their shaws, or leaves, and roots, and then lightly covering them over with straw, or old thatch. These store heaps ought to be laid down in a dry and well aired situation, in the neighbourhood of where they are to be consumed, as in the barn-yard of the farm; and when large quantities are to be secured in this manner, they ought not to exceed three feet in depth, disposed in the form of a narrow tapering ridge, and never closely covered up with earth.

14. When turnips are cultivated for seed, it is usual to transplant a part of the crop, some time in the month of February; as experience shows, that when allowed to run up to seed, without transplantation, they are very apt to degenerate. Those who make this a business by itself, or connected with the profession of a public gardener and seedsman, select a quantity of the best formed roots yearly, which they transplant into a piece of well manured soil, in fine tilth. They are placed in regular rows, by hand, in hollow drills, previously made by the plough, in the manner already described, and the intermediate ridgelets are split open to cover the roots, leaving the crowns bare. No particular culture is given afterwards, except keeping the ground free from weeds, by means of the hoe. When the pods fill, and the seed begins to harden, the crop must be carefully watched, to prevent the depredations of small birds; and the stalks ought to be cut before the seed is completely ripe, as in that state the pods are extremely apt to split open in handling, and to spill the seed. When the stems are sufficiently dried, the crop may be secured in ordinary ricks, carefully thatched like corn stacks, and threshed out in spring.

The produce of this transplanted crop is sown in the next succeeding year, and is not transplanted. The seed of this second crop is saved for sale, and is then sold under the name of transplanted turnip-seed. Thus, having two breaks of seed turnips, the cultivator may always keep up a stock of excellent seed; and every farmer may, if he chooses to take

the trouble to perform this operation for himself. But the seed *per acre* is so cheap, as hardly to be worth the necessary pains and attention, except to those who do it for sale to some extent; or as a decent source of profit to villagers, or professed seedsmen. One acre of ground may produce to the value of fifty pounds; but any considerable extension of the culture would soon greatly overstock the market. Farmers, however, who raise their own seed, besides saving the price, have this additional advantage, that they are always sure to obtain good sorts.

EXPLANATION OF THE PLATE.

Fig. 1. Is a section of the drills, as first formed, and having the dung spread out in the hollow drills.

Fig. 2. Represents these drills, as split open, to cover the dung; what was formerly the hollow drills being converted, by this operation, into the ridgelets, and *vice versa*.

Fig. 3. Gives an idea of the figure of the drills, or ridgelets, after having been seeded by the drill-machine.

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 is now in a horse-hoed state.

Fig. 5. Shews the situation of the drills, on finishing off the field in the older method, by splitting open the gathered ridgelets of Fig. 4.; but which practice is not now generally followed, for reasons already assigned in the body of this section.

Fig. 6. Gives an idea of the situation of a field of drilled turnips when finished off; the furrows or hollow drills not being opened out, for the reasons already assigned; and the turnips are represented as having their *shaws* or tops removed, for the use of young stock, previously to the feeding stock of sheep being laid on.

Fig. 7. Contains a plan, upon a smaller scale than the preceding sections, of a turnip field in regular drills, in which these are laid off obliquely to the usual direction of the ridges, to facilitate the more equable distribution of the dung covered up in the drills, when the field is afterwards ploughed for a crop of grain.

SECT. II.**OF RUTA-BAGA, OR SWEDISH TURNIP.**

THIS valuable plant has been introduced into the agricultural system of Scotland only of late years. It is an article of farm produce of great importance, as it supplies succulent food of the very best quality, which is highly relished by every kind of stock. It is therefore of extraordinary advantage to all farmers carrying on the alternate husbandry, as it enables them with certainty to unite the winter and summer seasons of feeding, a circumstance which had long remained a desideratum in husbandry. By means of this excellent article, especially when conjoined with yellow field-turnips already mentioned, farmers are not now obliged to force off their feeding stock to market when the turnip crop fails, often to great disadvantage; or to carry them on at a vast expence by means of oil-cake, hay, bean-meal, or other dear articles of food; but may continue the system of feeding very advantageously throughout the whole year, selling off gradually as their stock becomes fit for market, and buying in additional stock, as their means of feeding may require*.

In the opinion of the late Rev. Dr Walker, who was an experienced botanist, this plant is the *brassica napobrassica* of Linnæus, or turnip-rooted cabbage †. He alleges that it was

* Ruta-baga can certainly be cultivated to advantage on strong soils; and a farmer near Edinburgh, Mr Gray of Gorgiemuir, has contrived a mode of taking them off without injuring the land. 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; they are then carried home, and stored up, in any dry frosty morning, without injury to the land.

† Others contend that the turnip-rooted cabbage is quite a different plant.

first introduced from Germany into England, about the middle of last century, under the name of turnip-rooted cabbage, and was brought from England to Scotland in 1766; that about the same period it was transported from England to Sweden; and that the seeds having been sent back to this country of late years, as of a new and useful plant, it has been since cultivated under the Swedish name of *ruta-baga* *. However this may have been, *ruta-baga*, or Swedish turnips, is a most useful article of farm culture, and almost of indispensable use on every farm in which tillage and feeding of live-stock are combined. It is cultivated and applied so exactly in the same manner as turnips, that to detail the various steps or subdivisions in this section, would necessarily become a mere repetition, in a great degree, of what has been already detailed in that immediately preceding. Only such circumstances, therefore, as are different, in the culture and application of *ruta-baga*, from those already mentioned in regard to turnips, shall be here noticed.

The yellow fleshed species, or variety, of *ruta-baga*, is alone worth cultivation. At its first appearance, several farmers got the seed of the white fleshed variety, by which, for a time, the reputation of this plant was considerably injured. *Ruta-baga* requires to be sown a full fortnight earlier than turnips, to secure a full crop. Its seed time, therefore, ought to be in the second week of May, and not later than the fourth week if possible. This is a fortunate circumstance, as not interfering with the seed-time of turnips, and as distributing the pressure of seed time, in a turnip farm, more equally, and consequently much more conveniently, for the farmer.

At its first introduction into Scotland, *ruta-baga* was sown in seed-beds, often in gardens, and transplanted into the field, previously prepared in regular manured drills, exactly as if for turnips. But the season of transplanting was often thrown excessively late, for want of rain to enable the young plants

* Walker's Hebrides, I. 285.

to strike root; and, now that seed is to be had in abundance, it is sown in drills exactly in the way already described for turnips, and cultivated by the horse and hand hoe precisely in the same manner.

Generally speaking, the crop of ruta-baga is a good deal lighter on the ground than a crop of turnips; but not quite so much so as it seems, for its root is considerably more under cover. But its substance is much firmer and heavier in the same bulk*; and being more abundant in saccharine matter, it is greatly more nutritious in the same weight. No strict experiments have been reported; but the repeated experience of many judicious feeders has completely established, that a given quantity of ruta-baga always kept a larger stock in full feed, for a longer time than was foreseen, forming a previous judgment upon the experience of the duration and feeding of an equal appearance of turnips.

Ruta-baga, in its first growth, is less prompt and rapid than turnips, and requires a soil of more fertility and consistency, thriving best upon soils of some depth, inclining towards loam. It likewise requires more dung to produce a full crop. Upon dry and rather hungry gravel, which often gives a good crop of turnips, ruta-baga is apt to be poor and weakly, and seldom produces roots of any size. But it bears the vicissitudes of the weather with great hardiness; and a rotten root is hardly to be seen in any season †. Even when bitten by sheep or cattle, or broken by their feet, which accidents are sure to destroy turnips, the wound or break in ruta-baga skins over and heals, and the root continues sound. It likewise lasts much longer in spring, without running up to flower; and even when that stage of growth takes place, its nutritive qualities are much less injured than those

* If a ruta-baga and a white globe turnip occupy the same space in water, the ruta-baga will be from 20 to 25 per cent. heavier than the turnip.

† It is said that in the high country between Glasgow and Edinburgh, a crop of ruta-baga was destroyed by frost, in the winter 1808 and 1809.

of turnips in the same situation. Even after ripening its seed, in the subsequent July or August, the roots still retain a very considerable portion of their saccharine nutritious pulp. Besides, it may be drawn, and secured under a light covering of straw, after cutting off the tops and tails, in the manner already mentioned for common turnips, and will keep for any length of time that may be required, or they will keep well in water.

From the experience of its valuable qualities, ruta-baga is now universally cultivated upon every turnip farm in all the well managed districts of Scotland, for carrying on the feeding stock till pastures or clovers are ready for use. It is likewise an excellent food for horses, which are remarkably fond of it, and it keeps them cool and open in winter when on dry food.

Cubes of two inches of the white field turnip, the yellow garden turnip and ruta-baga being weighed, yellow turnip was found one-eighth part, ruta-baga one-fifth part heavier than the white. This renders ruta-baga, bulk for bulk, of much more avail in feeding than the field turnip; and its compactness and solidity enables it to resist degrees of frost which destroy the common turnip*.

It is cultivated for seed exactly in the manner already described for ordinary turnips; only that it requires extreme care to keep it at a distance from any of the cruciform plants of the same natural order, as it is exceedingly apt to degenerate by the influence of their pollen or fecundating dust, so as to form worthless hybrid or mule varieties of various descriptions. Perhaps it is more liable to this degeneracy from being itself an hybrid plant or accidental variety. It is likewise of great importance, when raising the seed of this valuable root, to extirpate or reject from the seed-bed, all plants that have white-fleshed roots. This may easily be done by cutting out a small piece from each root, as the ruta-baga has the remarkable property of healing over a wound, without

* Walker's Hebrides, I. 284.

putrefying like a wounded common turnip. The colour of the roots may likewise be determined, with tolerable certainty, by that of the flowers; as the white-fleshed ruta-baga produces a bright golden yellow flower, while that of the true orange-fleshed ruta-baga, is of a paler lemon yellow. On one occasion the reporter sold some ruta-baga seed of his own sowing, at the rate of L. 256 the statute acre, or 4s. the pound; being at the rate of 1280 pounds weight from an acre of land. In this instance the roots were transplanted, and placed very thick in the seed-bed, and seed was that season (spring 1809) very scarce and dear. This season (spring 1812) he has about 3300 pounds weight, the produce of $2\frac{1}{2}$ acres, and was unable to find a market, so easily is the country overstocked by a seed of which so little is required to the acre.

SECT. III.

OF POTATOES.

§ 1. *General account of their culture.*—As an article of human food, potatoes are certainly of great importance; and it seems wonderful, to those who contemplate their extreme usefulness, how the population of this country could have subsisted before their introduction into general use, which was within the memory of many people yet alive. From no other crop that can be cultivated in our climate can so much human food be derived, on the same extent of ground*. “And it admits of demonstration, that an acre of potatoes will feed double the number of people that can be fed from an acre of

* It is calculated that the produce of an acre of oats, converted into meal, and used as porridge, will equal half the weight of an acre of potatoes, and the former is certainly the most nutritive.

wheat *." Yet potatoes cannot be considered as a farm crop, strictly so called; as, although they are cultivated on every farm, for the use of the farmer's family and his cottagers, it is only in limited quantities †. Potatoes require a great deal of manure to secure an adequate crop, and generally return very little to the soil; indeed none at all when sold from the farm. They are a bulky article, troublesome and tedious to take up, remove, and secure, and interfere considerably with the seed time of wheat, one of the most important concerns of the farmer. They are not at all calculated for a regular shift, or for occupying a division in the course of crops, unless in the immediate neighbourhood of towns and large villages, as they are utterly unsaleable beyond the quantity required by the population almost immediately dependent upon the farm, whilst their bulk and weight, in proportion to price, render it impossible to transport them to any distance by land carriage, unless with loss instead of profit.

In the neighbourhood of small towns and villages, a large breadth of potatoes may be profitably grown, for the supply of the inhabitants. In this case, the farmer gives all the horse culture; the sub-takers supply their own seed, and give all the hand labour; and are generally bound to give all the dung produced at their cottages during that season, in addition to the rent of the land, or at a price agreed on. The rent of these small patches is generally high; varying, according to the quality of the soil, distance from towns and villages, and the proportional demand for ground, from four to twelve pounds the acre; and not unfrequently the villagers expend

* Brown's Treatise on Rural Affairs.

† In the moderate sized farms in the west of Scotland, potatoes may well be called a farm crop. Not only man, but horses, milch cows, calves, &c. are fed upon them. As soon as the corn harvest is over, the potatoes are stored up, and the land is sown with wheat, and a much better crop generally succeeds than after turnips. At all times the land is found in better condition for after crops, where potatoes have been planted, than after turnips consumed off the ground, though the manure for both have been equal. Hence turnips are less cultivated, and potatoes more. Remarks by John Naismith, Esq.

as much, in rent, seed, and labour, as the full market value of the produce. But, as potatoes are an indispensable necessary of life, and not to be got for money in many country places, the people are under the necessity of cultivating them, and to make the best bargains they can with neighbouring farmers for the ground on which they are planted.

From what has been premised, it seems needless to enter upon a detailed account of the mode of cultivating potatoes, as no valuable information can be derived from what only forms a mere incident to the system of Scotch husbandry.

1. The quantity of land intended for potatoes is selected, according to conveniency, from any part of the tillage land of the farm, avoiding wet places, or such as are of excessively dry, gravelly, or sandy soil. Loamy and sandy soils are always preferred where potatoes are much cultivated.

2. The universal mode of growing potatoes in the best managed districts, is in drills, as described below.

3. The land gets one ploughing after harvest, with the view of making it mellow, by the influence of the atmosphere during winter. It is cross ploughed in spring; and gets, or ought to get, as many ploughings and harrowings as are necessary to reduce it into fine tilth, and to remove couch and other vivacious roots.

4. After the land has been effectually cleaned and reduced, it is formed into hollow drills and ridgelets, and the dung is laid on and spread, in the same manner as already described for turnips. The sets are laid, by hand, upon the dung, in the bottom of the hollow drills, at various intervals, from four to eight inches; the ridgelets are then split open by the plough, to cover in the seed.

5. The sets are commonly cut, seldom whole; though some prefer the latter, as giving in their opinion a greater produce: In this latter case, the intervals between the sets are larger, and the quantity of seed more considerable.

6. The sorts or varieties mostly cultivated, are the round white; the long kidney shaped white, with a dash of red at one end, called red-nebs, or red-nosed kidneys; and a round

purple coated, or excessively dark-blue skinned potatoe, provincially named *black-a-moors*. The last is considered as giving heavy crops, and, with proper care, they keep extremely well till past mid-summer. The quantity of seed, when cut of a proper size, may be from eight to ten hundred weight to the statute acre, or from 18 to 22½ Winchester bushels.

7. The time of setting, or planting, is usually from the end of April to the middle of May, according as the other work of the farm admits, being generally intermediate between the close of spring seed and the commencement of the turnip work.

8. Some time after setting, and before the plants begin to push up, the land is harrowed down flat. After the plants are fully up in the rows or drills, the intervals are horse-hoed, and the rows hoed by hand. These operations are repeated at intervals, and, when the plants have acquired some strength, the intervals are split open by the double-mould-board plough earthing up the plants. The cleaning process, however, ought not to continue long, else the crop will be injured by disturbing the radicles when in search of food. And if the soil be kept *too loose* the whole summer, the plants will not bulb well.

9. They are taken up after harvest, in October or November, usually by the plough, laying open the drills, when they are gathered; or they are carefully dug up, root by root, with flat grained three pronged forks, each digger having one or two children to gather them*.

10. Potatoes are stored up for winter in dry cool out-houses or cellars, covered up with straw, and secured from all access of frost; or in what are called pits, pies, or camps.

* Sometimes the drills are rather laid over than opened. The gatherers are stationed at different parts on the length of the drill, and after they have got all that appear above ground, a harrow goes over every two or three drills, which are then gathered a second time. By the plough, an acre of potatoes can be taken up for twelve or fifteen shillings. By digging, the expence will be more than double, besides the loss of time at so late a period of the season, when it is often meant to sow wheat after them. - None are left, if the ploughing, harrowing, and gathering are properly conducted.

A pit or pie, is a conical heap of potatoes, about four feet diameter at bottom, built up to a point, as high as they will admit of, and resting upon the dry bare ground. The heap is carefully covered by a layer of straw: a trench is then dug all round, and the earth thrown over the straw, and well beaten down by the spade. The apex, or summit of the heap, is generally secured from rain by a broad grassy sod. A camp is a long ridge of potatoes, four or five feet wide at the bottom, and of any length required, built up to a sharp edge, as high as the potatoes will lie, covered by straw, and coated over with earth dug from a trench on each side. If any part of the contents is removed during winter, the open end is carefully closed up with straw and earth, to keep out wet or frost.

11. The produce varies according to season, soil, and manure, from three to nine tons *per* acre; and the ordinary boll is about nine bushels by measure; weighing about four hundred weight avoirdupois. Almost every county, however, has a different potatoe measure.

12. The price, in years of abundance, seldom exceeds seven or eight shillings *per* boll, at which price no farmer can afford to grow them for sale, unless his market be within three or four miles of his farm; and even then, he would be much better paid by a good crop of turnips, which add manure to the land, while potatoes carry every thing away.

13. Having already observed, that the culture of potatoes is in general extremely limited, and chiefly confined to necessary family use, no direct experience can be furnished as to the exhaustion or fertilization of soil, in consequence of potatoe husbandry. The general opinion, however, is, that to retain land in a state of fertility, which is regularly under a crop of potatoes, a considerable supply of manure is required. This, of course, can only be procured in the near neighbourhood of towns and villages; and there only, likewise, is the culture of potatoes, in any quantity, at all eligible, for other reasons already advanced.

14. Potatoes were first brought from Ireland to the

county of Lanark, by Major Hamilton of Raplock, towards the end of the seventeenth century, but were very sparingly cultivated for more than sixty years. It is asserted in the Statistical Account of Scotland, vol. xviii. p. 282. that Mr Robert Graham of Tamrawer, in the parish of Kilsyth, and county of Stirling, was the first person in Scotland who cultivated potatoes in the open field, by dibbling and hand-hoeing. His first essay, in this husbandry, was in the year 1739, when he planted potatoes by means of the dibble, on about half an acre of croft, or old infield land, at Neilston in that parish; and he continued to carry on the potatoe husbandry, with increasing ardour and uniform success, for many years, in that neighbourhood, and diffused their cultivation by his example in other districts, on lands which he rented in the vicinity of Renfrew, Perth, Dundee, Glasgow, Leith, and Edinburgh. One instance of his success is recorded on sufficient evidence, that in 1762, he planted one peck of potatoes with the dibble, and in the October of that year, dug up an increase of 264 pecks.

As the neighbourhood of Kilsyth seems to have persevered with great industry and attention, in following the example of Mr Graham, it may not be unimportant to transcribe, what may be termed the Kilsyth aphorisms respecting potatoe culture, from the account of that parish, which furnishes a good pattern of statistical information.

1. The kidney potatoe is there reckoned the most productive and best tasted variety.
2. Ground that has never been broken up before, or, at least, which has never produced potatoes, although not better manured than other land, is by much the most productive.
3. Potatoe sets ought to be planted at the distance of eighteen inches from each other, even when not drilled.
4. When not drilled, the plants ought to be carefully earthed up by the hoe; when in drills, by the double-mould-board plough.
5. When ley or grass ground is employed, the dung ought

to be spread in the preceding autumn, or very early in spring, that it may incorporate with the soil, before it is ploughed in ; and even on stubble land this practice is deemed advantageous.

6. Lime is considered as unfavourable to the cultivation of potatoes ; and it is alleged that its bad effects continue fourteen or even twenty years. One of these injurious effects, and the only one mentioned by the reverend author, is, that potatoes, on recently limed land, are almost always scabbed, though the produce may be large.

7. The sets for seed ought to be pretty large, and should be kept a week or two, after they are cut, before planting. This is peculiarly advantageous in wet grounds. The cut surface becomes dry and shrivelled, and as if covered by a tough skin, which prevents the sets from rotting, and tends to make them vegetate quickly.

8. When frequently repeated, or oftener than once in seven years, on the same ground, potatoes are found to be a very scourging crop. If once every two years, they soon reduce the soil to a *caput mortuum*.

9. A very productive crop of early potatoes may be raised and dug up before the middle of July. And turnips, or greens, may be sown as a second crop in the same season, after having realized a clear profit of ten or twelve pounds an acre from the potatoe crop. This system is common about Aberdeen.

10. In gardens, the stocks or stems and roots of greens and cabbages, laid regularly in the bottoms of the drills, are one of the best manures for potatoes ; both enriching the ground, and keeping the soil open, by which the shoots or running roots of the potatoes have room to spread.

§ 2. *Of raising potatoes from seed.*—The following circumstances respecting the mode of raising potatoes from seed, have been thought worthy of being inserted, as extracted from the Statistical Account of the parish of Kinloch in Perthshire*.

* Statistical Account of Scotland, vol. xvii, p. 743.

“ From repeated experiments, it has been found, that the most effectual means of preventing potatoes from degenerating, and rendering them more prolific, is to raise them, occasionally, from their true seed, in the apples or fruit. For this purpose, choose a few large ripe apples, from a perfectly healthy plant, of an approved kind, or variety, and preserve them carefully through the winter, in some dry sand, so as to keep all the apples apart from each other. In the beginning of April, pick out the seed from these apples, and sow it in narrow drills, or rows, in a prepared bed of rich garden ground. Or, which is much easier, mash the apples and sand together, and sow this in the drills without taking the trouble of separation.”

“ When the seedling plants are about an inch high, raise them carefully, with as much earth as possible about their roots, and plant them out in another prepared bed of rich earth, in rows, or drills, about fourteen inches wide, having intervals of ten inches between each plant. Take them up when ripe, and secure them over winter in a well guarded pie.”

“ Next season, plant these seedlings in a good ground, with abundance of room ; and this second crop will arrive at the full size of potatoes planted in the ordinary manner. Besides which, potatoes raised according to this plan, from the seed, will continue, for several years, to give a considerably more abundant produce, than those which have been long cultivated from sets in the ordinary way ; and they will be much less liable to the disease usually called the curl.” This last position, however, is disputed.*

* It is proper to observe, that no reliance can be placed on obtaining the same potatoe from the seed, as that from which the apple or berry was taken. The varieties from seed will be numerous, and most of them good for nothing. A valuable new variety is sometimes obtained from the seed, but never the identical same variety from which the seed was produced. A son may resemble his father, but still he is a different individual. There is only *one* individual of each sort of potatoe, and the cuts or sets, and the produce of these *ad infinitum*, are merely continuations of that single individual. As to the produce of the new sorts, being greater than the sorts long cultivated, this depends on the

The potatoe plant possesses two modes of securing its reproduction, the one by means of its tuberous roots, the other by the general mode of flowers and seed vessels. It has been ascertained by the ingenious President of the Horticultural Society of London, (Mr Andrew Knight), that the plant employs the same fluid in both these operations; and by preventing the consumption of it in either one of these, it will be made to act more strongly in the other. Upon this principle, if a potatoe plant is carefully deprived of its tubers as soon as they are formed, it will be made infinitely more productive of blossoms and seeds. On the other hand, if its blossoms are constantly picked off, and it is prevented from forming any seed at all, the fluid which would have been employed in that operation, will be exerted in forming an increased crop of tubers. It is true, that men who have to attend to the management of a number of acres, will hardly condescend to think of potatoe blossoms: but there are thousands of cottagers, whose scanty pittance may be increased by the simple expedient of employing their children in preventing a potatoe crop from ever forming a seed vessel. The point, however, is still disputed. It is contended, at the same time, that if the crop is not increased by plucking the blossoms, it is sooner ripened, which is a material advantage, if it is uniformly the case.

SECT. IV.

OF CARROTS.

CARROTS have not hitherto been much considered as an article of culture in the system of Scotch husbandry. They require, it is said, too early sowing, that is, in the beginning of

dispositions of the sorts, or varieties to carry many or few, large or small, bulbs, and the state of health of the sort longest cultivated. The tendency to curl will always be greatest in the oldest sort, circumstances in other respects being similar.

April, to admit of the land being thoroughly cleaned; they need a soil of unusual depth, turned up and reduced to fine tilth, freed entirely from stones, and almost without any admixture of clay. It is usual to raise them on rich soils, or on land that has been highly manured with dung in the preceding year, or if the manure be applied the year the crop is produced, it must be placed at a considerable depth, (from 16 to 17 inches). The seed cannot always be procured of a good quality, and the sowing of it is attended with difficulty. As carrots require so much attention and superintendance for their production, they are not likely to become an object with actual farmers, unless in very favourable circumstances.

From several sources of information, carrots are understood to thrive well in drained peat soil, which of course must be of considerable depth. Lord Balmuto, in particular, a Judge in the Court of Session, has raised excellent carrots in peat soil on his estate in Fife. The following account is given by Mr Butterworth, in the neighbourhood of Edinburgh, of his success in carrot husbandry*. —He ploughed the ground in October, probably from stubble, as he gives no account of his course of crops. He ploughed it a second time in March; and after a good harrowing, sowed about 5½ pounds of seed to the statute acre, in rows twelve inches distant, after which the ground was gone over by a heavy roller. When the plants appeared in the rows, the Dutch hoe was used in the intervals, and the rows were hand-hoed, leaving the plants four inches asunder. The crop was again weeded about three weeks afterwards, and was kept very clean. In October, part of the crop then intended to be consumed, had the tops cut over with a scythe, and the carrots were taken up by means of the plough, in a similar manner with potatoes. In dry ground, the roots not wanted for immediate use, were left in the ground with their tops on, in which state they kept excellently till spring; though they must be raised in March, as they generally, at

* Husbandry of Scotland, by Sir John Sinclair, Part I. p. 277.

that time, begin to put on a fresh growth. They must not be left in wet ground during winter, as frost destroys them. He sowed his carrots without dung.

The preceding facts are certainly very encouraging towards the culture of carrots, where soil and circumstances are favourable. They are excellent food for work-horses, milch cows, and fattening stock; but they can only be sold with profit in the neighbourhood of large towns; and even there, the demand would be glutted by the crops of a very small extent of ground. Carrots, indeed, requiring a much more than ordinary attentive and minute culture, do not seem calculated for entering into the regular system of farm management, and would be much better delegated to jobbers, who might hire small pieces of suitable land from actual farmers, or from landholders, for this express purpose, as is already done in many places with regard to potatoes, near towns and populous villages.

Thus it appears, that drilling is the general practice in Scotland, in regard to turnips, and potatoes, and carrots, where they are cultivated. As to culmiferous crops, that practice is but rarely adopted, and there are two circumstances which will probably prevent it from ever entirely superseding broadcast sowing. The first is, the additional labour, which requires to be performed with great accuracy. The second is, that by the rotations of convertible husbandry, white crops, are, for the most part, either sown upon ley, which does not admit of being drilled, or after fallow or turnips, when the land is so clean, as not to require hoeing. In the latter case, too, grass seeds are almost always sown with the grain crop, and are probably more equally planted, when covered by harrowing, than by hoeing. This is always the case in a four years' rotation; 1. Grass; 2. Oats; 3. Turnips or fallow; and, 4. Wheat; and the grass which follows the wheat, is often several years old, before the rotation begins again.

Great doubts indeed are entertained, of the alleged superiority of drilled crops upon clean land. It is certainly useful, where annual weeds prevail, but that is not the case upon either well wrought fallows, seeded in autumn with wheat; nor upon well-managed turnip fields, succeeded by a spring crop of either wheat, barley, or oats, if the greater part of the crop has been eaten on the ground by sheep.

PART VII.

OF MISCELLANEOUS ARTICLES CULTIVATED ON ARABLE LAND.

SECT. I.

OF FLAX.

§ 1. *Introductory remarks.*—This is not a crop of much importance in the best managed districts in Scotland; yet being extensively cultivated in some districts, and a necessary article in Scotch manufacture, it requires to be attended to in a General Report of Scotch Husbandry. It has been grown from time immemorial; and though not a scourging crop when pulled green, in which state it always produces dressed flax of the best quality, yet a sufficient quantity has not been hitherto cultivated to supply the wants of the country. Even in the present time, when the difficulty of procuring foreign supplies is so great, and when consequently imported flax has risen far beyond its former medium price, its culture in Scotland has not increased, notwithstanding all the

advantages that are offered for its cultivation by premiums of considerable value, both on the quantity of flax, and the production of its seed. Yet a great extent of the soil of Scotland, is well adapted for raising this crop to full perfection; and the circumstance of this article, not being grown in quantity sufficient to supply a half of the demand, must either be owing to the price not being adequate to the expence, or the difficulties in the way of its cultivation, serving as a discouragement to the husbandmen.

The mere cultivation of flax and hemp is attended with no extraordinary difficulty or trouble; but the attention required in the numerous minute steps of their after preparation for use, in watering, grassing, drying, breaking, switching, and preparing for market, are utterly incompatible with the more important avocations of the real farmer. Should ever the culture of flax and hemp become an object of importance on well managed land, the actual farmer must call to his assistance, a different description of people, who shall purchase the growing crops on the ground, and assume the direction and superintendance of the troublesome and minute steps of their preparation for market.

In the compilation of this article, the reporter has carefully consulted Brown's Treatise on Rural Affairs, and the following Reports of Scotch counties, Fifeshire, p. 199; Perthshire, 165; Argyle, 100; Kincardine, 285; Galloway, 148; and the Hebrides, 291. It does not therefore seem necessary, to quote minutely on all occasions, from which of these publications, the following circumstances, respecting the cultivation of flax, have been derived.

§ 2. *Soils, and their preparation.*—The soils most proper for flax are deep friable loams, and such as contain a large proportion of decayed vegetable matter in their composition. Strong clays do not answer, nor those of a dry gravelly, and sandy nature. But wherever it is cultivated, the soil ought neither to be in too poor nor too rich a condition, as when too poor, the crop will be weak, and the produce scanty; and when too rich, the crop will grow too luxuriantly, and the

produce be coarse*. In districts where wheat is cultivated extensively, flax is not approved of, because both crops are considered as exhausting the ground, and both cannot therefore be introduced into a close rotation with safety and propriety†. Pasture ground, that has been laid down clean and in good order, when newly taken up, will seldom fail to carry a good crop of flax, after a crop of oats, if the soil be suitable.

Whatever may happen to be the succession in which it is intended to grow flax, the land ought to be broken up or ploughed as early as possible, that it may be mellowed by the frost, and that it may be in good order for the harrowing process at the ensuing seed time. No other previous culture is generally given for this crop.

§ 3. *Seed process.*—The *time* of sowing is in the month of April, usually from about the middle to the end. The *quantity* of seed varies according to the end in view. If it is proposed to save the crop for seed, thin sowing is preferable, that the plants may have room to expand, and have free access of air to forward their blossoming, filling, and ripening. In this case, about two bushels to the statute acre is quite sufficient, and even less may do, if the soil is rich and in good order.—When the crop is intended for articles of manufacture, thin sowing is extremely injudicious, as the crop becomes coarse and unproductive; and by throwing out branches, occasions the fibres to break short in dressing, running much to the refuse or inferior sorts of dressed flax. According to the quality and state of the soil, from three bushels to nearly four may be given to the statute acre. The seed is universally sown broadcast, after the land has been extremely well harrowed, and the seed is covered in by a close double time of the harrows. The land is then water-furrowed, and any stones or roots that may have come up to the surface are removed.

* Brown's Treatise on Rural Affairs.

† Perthshire Report, p. 166.

§ 4. *Culture while growing.*—If the crop requires weeding, this ought to be done early, when the plants are about four inches high. Before this period, the weeds have not advanced sufficiently to be accurately pulled, and many would consequently escape notice, leaving the ground foul. If delayed too long, the flax plants would be in danger of being broken down, and not able to recover their upright posture. The weeding process is usually performed by women and young people, in a lying or sitting posture, picking up every weed that can be seen. The natural grass is not considered as a weed to be pulled, as it is not believed to do much harm to the growing crop; whereas, if pulled, especially couch grass, the roots of which spread far and wide in the soil, it would bring up a good many of the flax plants along with it. When thoroughly weeded, in proper time, there is little chance of a second growth of weeds rising up to injure the crop, unless when the flax crop is very thin, and the land very foul*.

§ 5. *Pulling.*—The harvesting process, or pulling the flax, must be regulated by the intention of the crop, as meant principally for seed or for dressed flax. When intended for seed, either for sowing again, or for using at oil mills, the crop must remain till the *bolts* or seed pods are hardened, and the seed ripened; in which case, the leaves of the plant are mostly fallen off, and the stems become yellow. If dressed flax of good quality is wanted, the crop ought to be pulled considerably earlier, while the plants are in a green state. Different people have discordant opinions on this subject; but perhaps the plants may be considered as having come to their most perfect state of maturity, when the flower begins to fall off, which takes place about a fortnight or three weeks before the seed is thoroughly ripe. The plants are pulled up by the roots, and laid in handfuls across each other, in which state they are allowed to remain for two or three days to wither. They are then made up into sheaves, which are bound with

* Fife Report, p. 202.

some of the stalks in the same manner as corn, and are usually made of such a size as may be grasped with both hands.

If the crop has so ripened that the seed is worth preserving, that ought to be first removed, by *rippling*, which is done by pulling the heads through an implement like a comb with iron teeth. When seed is a principal object, the bound flax is set up in stooks like grain, with the *bolts* or seed pods upon it; and after being thoroughly *winn* or dried, is stacked up through the winter, threshed or rippled in spring, and afterwards watered when the season allows. Even when the bolls and seeds are formed, though not ripened so as to be worth preserving for sale to oil mills, they ought to be removed from the plants before watering, by the rippling process; both because they are apt to produce vermin while in the water, by which the flax is in danger of being injured, and because the bolls are said to be an excellent food for cows and horses*.

§ 6. *Watering*.—The purpose of this operation is, to dissolve the natural mucilage of the stems and bark of the flax plants; that, when afterwards thoroughly dried, these parts may become brittle, and easily separable from the fibres of the bark, which are the sole object of cultivation, as the material of the linen manufacture. This process of steeping or watering, may either be carried on immediately after the pulled flax is withered and tied up, or in the ensuing spring, as suits the convenience of the grower.

For the purpose of watering or steeping, the flax tied up in *beets* or small sheaves, as already described, is put into ponds, pools, or canals, which either contain water, or into which water can be conveniently conveyed. On all occasions soft water ought to be used. The best plan for watering is, to have a pond or canal into which water can be conveyed, and drawn off at pleasure, both for the more convenient disposition of the flax, and for its more easy removal after it has

* Fife Report, p. 204.

been sufficiently steeped. The beets or sheaves are for the most part thrown in without any particular order, in a confused horizontal position, and held down below the surface of the water by means of stones, or sods with the grassy side down, to keep the flax clean. But the best plan is, to place the sheaves in rows, in a reclining posture, nearly upright, with the top ends upwards, as that portion of the flax plant is most difficult to water, and ought therefore to be nearer the surface, where the water is warmest. In this case, likewise, the flax must be lightly held down by a sufficient weight to prevent it from floating, but not so heavy as to compress it upon the bottom of the pool.

The time necessary for steeping flax effectually, varies according to the state of the weather, being less as it happens to be warmer, or the contrary. In warm weather, eight or ten days may suffice, and in cold weather twelve days are generally sufficient. It is of infinite importance that the steeping shall not be so long continued, as to induce even an incipient rottenness or putrefaction, which would necessarily and greatly injure or destroy the texture, strength, and quality of the flax fibres. To guard against this, the pods ought to be carefully examined every day from the seventh forwards, taking out a few stalks from the middle of several sheaves, in different parts of the heap. These are dried and rubbed by hand, to see if they part freely with the dried woody parts of the stem; in which case the flax may be considered as sufficiently watered. At all events, it is preferable to give rather too little than too much steeping; as in the former case, only a little more care and labour is necessary in separating the fibres from the refuse, and in the latter, the quality of the fibres is essentially injured. Besides, any imperfection of the watering process may be remedied, by a judicious protraction of the grassing one.

Of late years, boiling the recently pulled flax has been recommended, as entirely obviating all danger of injuring the quality by oversteeping. But as this new practice does not appear to have been adopted in Scotland, it is only inciden-

tally mentioned in this place. Perhaps the employment of steam might be very usefully and conveniently adopted for this purpose.

§ 7. *Grassing.*—When the flax has been sufficiently watered, the covering is carefully removed from the heap, and the flax taken out of the water, sheaf by sheaf, any of the sheaves that may have been dirtied being carefully washed. It is laid in a heap on the ground near the watering-place, till thoroughly drained, and is then removed in carts to a clean airy grass field. The beets or sheaves are here opened out, and the flax spread thin and evenly on the ground, in regular rows, working backwards, the top ends of each subsequent row always covering the root ends of the former row. In this state it remains for a longer or shorter period, according to the judgment of the grower, till the woody or refuse part of the stems have become sufficiently tender to part easily from the fibres. This part of the process is generally continued too long in Scotland, the flax being often injured, under the idea of partly bleaching it.

When the flax is sufficiently grassed, it is taken up from the ground, and collected into sheaves, which are now made considerably larger than for the watering process; and, after these are effectually dried or win, like corn, the crop is either carried to the flax-mill to be dressed, or stacked at home till that operation can be conveniently attended to*.

§ 9. *Produce.*—This must necessarily depend on the quality of the soil, and on the perfection of the various steps of

* Mr Lee of Enfield Wash has lately made an important discovery in the preparation of flax and hemp, by which the process of steeping is avoided, and the fibre is preserved entire. His plan has not been yet divulged, and his right to the invention is secured by an act of Parliament. The finest quality of flax he produces is similar in strength and appearance to silk, and, it is supposed, may be applied to every purpose for which silk is adapted. This discovery may be the means of reviving the linen manufacture of Scotland, or, at any rate, it will afford facilities for the introduction of new branches, and may ultimately be of the greatest national importance.

preparing the soil, weeding, watering, and dressing the crop. On rich land, and under good management, from 500 to 600 avoirdupois pounds of rough flax have been procured from the statute acre; but the average produce seldom exceeds 400 pounds weight. At the estimated value of 18s. *per stone* of 22 pounds, these crops may be worth respectively L. 15, L. 19, 10 s. and L. 24 *per Scotch acre* for the rough dressed flax; prices certainly not sufficiently encouraging, to induce real husbandmen, to encounter the minute and troublesome attentions which such a crop requires.

Although there is reason, from the foregoing estimate, to consider flax as by no means a desirable article for cultivation, in situations, adapted by soil and climate, for successful tillage husbandry, there certainly are many elevated districts, of cold and wet bottomed land, where flax will thrive extremely well, and be of an excellent quality. On these, doubtless, flax may be raised to great advantage, and may even be more profitable than any grain crop. Yet even in such situations, farmers who have any important concerns to look after, had better let their land to middle-men, or professional flax growers, who take the entire charge of the crop after the seed is put into the ground, than undertake the culture of this crop themselves*.

* Every crop must be scourging that returns no manure to the soil. Were a sufficient quantity of flax raised in Scotland, to supply the internal consumption, the produce of grain, roots, and cultivated herbage would be much reduced; and the fact, that even high premiums are inadequate to encourage or increase its culture, seems quite sufficient to demonstrate, that flax is found, by intelligent agriculturists, to be an unprofitable crop in Scotland, except in particular situations and circumstances. The truth is, flax can only be cultivated to advantage, on new rich lands, as those on the banks of the rivers in Russia, and North America, or perhaps in some parts of Ireland, or in the richest parts of the fens in England; or on warp lands, which can be renewed by fresh alluvial depositions. In any country, the climate of which suits the nature of the plant, when flax is allowed to ripen its seed, it is one of the severest crops that can be raised on land.

SECT. II.**OF HEMP.**

§ 1. *Preliminary observations.*—This crop, like flax, appears to have been much cultivated in Scotland in old times, though now almost given up every where. It is mentioned in Henry's History of Britain, that at a very early period in the fourteenth or fifteenth century, when a papal legate was travelling through Scotland, he observed, in every rural habitation, the people employed in separating the hemp from its stalks. The same circumstance is still related by old husbandmen in the south-east district of Scotland, that in their youth, a small quantity of hemp was grown on every farm, usually in the rick-yard; and the servants and families of the farmers, employed their winter evenings round the fire in peeling it. In those days, the farmers had all their rude implements of husbandry made at home, where likewise they manufactured their whole *graith* or harness, giving no employment whatever to the saddler or collar-maker. All those things belonging to working cattle, which are now made of leather, were then made of plaited hemp, such as breechings, back-bands, belly-bands, and the like. Even the traces for ploughs and carts, now universally of iron chains, were then made of hempen ropes. The collars were composed of straw-ropes. Instead of bridles, hempen *tethers*, often with wooden cheeks, served the farmers even for riding to church and market; and instead of saddles, they were contented with a kind of hempen bags, stuffed with straw called *sodds*; while a different shape of the same materials called *sunks*, served to preserve the horses' backs in carrying loads. Even the ridge chain, which supports the weight of a cart over the back of the shaft horse

in a cart, was then termed a *rig-woody*, being composed of a *withy*, or twisted branch of a tree. In modern times all these things are completely changed; insomuch, that in a nineteen years' agricultural residence in Berwickshire, during which the reporter has repeatedly had occasion to see the whole agricultural district of the eastern borders, Berwickshire, Roxburgh, and the Lothians, he has never had occasion to see hemp growing, except once about a quarter of an acre or so at Berwick.

“It is astonishing,” says the author of the Agricultural Survey of the Hebrides, “that so little attention has been paid to the cultivation of hemp in our British islands, considering the immense demand for the articles of which it forms the material, and the absolute necessity of our being always supplied with them in abundance. On this supply, our power as a nation, our honour, our independence, and even our very existence depend. The precariousness of our intercourse with the countries in which this plant is extensively raised, is such, of late years, as to rouse patriotic persons in the kingdom at length to commence hemp cultivation. Among these, Mr Campbell of Shawfield, ever attentive to what promises advantage to his tenants and his country, sets a salutary example, on his lands in the island of Islay. It is trusted that others will follow; and that the country shall not be under the necessity of purchasing from jealous or hostile powers, at the price which they may choose to impose, the means of our security, and the sinews of our strength. Then the nation, may not only save a large sum annually, but the influence of rivals and enemies be reduced in proportion as our own is augmented.

“The climate and soil in the Hebrides, are well calculated for the cultivation of hemp. The manures, whether enriching, (as sea-weed), or calcareous, in which they abound, are the best possible for this crop; and as little or no weeding is necessary, the summer season will not be broken upon by these operations, which can consequently be devoted to green

crops and other necessary purposes. From sowing the seed early in May, till the latter end of August, the farmer need not look at his hemp field, and even afterwards, so that his task will not be very arduous *."

§ 2. *Soil and preparation.*—Hemp delights in a deep free soil; and whether sandy, clayey, gravelly, or mossy, is of little or no consequence; but it requires to be deeply ploughed, reduced into fine tilth, well manured, and free from root weeds. The same field may continue to grow successive and luxuriant crops of hemp, providing it be manured to every second crop. When it is to succeed a grain crop, the land will generally require three ploughings, one of which ought to be given before winter to mellow the soil.

§ 3. *Seed process.*—It is of much importance that the seed be new and of good quality. That from Riga and Narva has long been held in high reputation as the best. From two to three bushels of seed are generally given to the acre; but as the crops are apt to be injured by the plants being too numerous and close, from two bushels to two and a half are recommended as quite sufficient for the acre. This, however, may vary, according to the quality wanted in the hemp, as in the culture of flax. If for the purpose of being manufactured into ropes, for which a strong coarse quality may suffice, thin sowing may be advisable; but when meant to be manufactured into finer linen, thicker sowing may produce a finer

* Survey of the Hebrides, p. 278. Others however, contend, that the soil of the Hebrides, excepting perhaps in a few places, is not favourable to the growth of hemp, nor is the climate propitious to it. The reasons for cultivating hemp at every homestead, have been long ago superseded by commerce, the improved state of civilization, and the division of labour in Great Britain. The same reasons operate against the culture of hemp, as a rotation crop, as against flax.—As long as Great Britain maintains her naval superiority, the difficulty of procuring hemp is a mere bugbear. Our colonies of Canada, and New South Wales, will alone yield a sufficiency, if ever a defect of supply from the Baltic should take place. It would certainly be desirable, however, to a certain extent, to be independent of foreign supply.

fibre. Hemp is most commonly sown broadcast ; but the crop seen by Mr Macdonald, on Mr Campbell's fine farm in Islay, which that ingenious reporter considered as equal to any he had seen in Russia or Courland, was sown in drills, at intervals of about 32 inches. The time of sowing may be any time in April or the beginning of May.

§ 4. *Culture while growing.*—As this plant is of quick and tall growth, with thick foliage, it soon covers the surface, and prevents weeds from rising; little or no attention is required by a hemp crop after seed time, especially when sown broadcast ; yet it is recommended that the crop should be gone over attentively with the weed-hooks or nippers formerly mentioned, to cut or pull up thistles, docks, or other strong weeds that may rise among the hemp.

§ 5. *Pulling.*—The ripeness of the crop is known by the stems acquiring a whitish yellow colour, and some of the leaves beginning to drop off. As the male plants ripen five or six weeks before the female plants, this crop has two harvests, or must be pulled at two distinct periods. These two kinds of plants are easily distinguished from each other, as the male plant produces a flower but no seed, and is besides so much earlier in assuming the colour indicative of ripeness. The stalks thus selected are to be carefully pulled up by hand, shaking off the soil from the roots before the handfuls are laid down. The pulled crop is then tied up into sheaves or *beets*, of ten or twelve handfuls each, with bands or ropes of straw or dried rushes, three bands, or at least two, being given to each sheaf or bundle, one near each end, and one in the middle. The sheaves are then to be set up to dry or win, either in stooks or leaning against a wall. If the seed is meant to be preserved, the second or female crop of plants must of course be allowed to remain unpulled till the seed is ripe, which may be easily known by inspection.

§ 6. *Watering.*—When the bundles are dried, they may either be immediately watered, or secured in ricks till next season. Before watering, the leaves, seeds, and branches of

the plants must be removed by means of a ripple, formerly mentioned when treating of flax, after which the bundles are tied up as before, and consigned to the steeping pool, where they are managed very much in the manner already mentioned in regard to flax. Care must be taken, in the conduct of this operation, that the sheaves be not pressed down against the bottom of the pool, and that no part of them float above the water.

Hemp is known to be sufficiently steeped or watered, by drawing out a few stalks in different parts of the pool and drying them. When the fibrous rind separates easily from the heart-stalk, or *boon*, the watering has been sufficient; but it is better to give rather too little steeping than too much, as the latter is apt materially to injure the texture and strength of the hemp fibres, by incipient rottenness. From six or seven, to ten or twelve days in the water usually suffices, according to the temperature of the season, and the quality of the water.

§ 7. When sufficiently watered, the hemp is spread out on a clean short sward of grass, sheltered from strong winds, and that is not liable to be flooded. The crop continues on the grass till by frequent trials the fibrous part becomes easily separable. For such hemp as is meant for ropes and other coarse articles of manufacture, the grassing process is seldom used in Russia or Poland. Immediately after watering, it is dried, and then laid up to *sweat* for five or seven weeks, which causes it to work the more easily in the after parts of its preparation. After being sufficiently grassed, the hemp is tied up again into sheaves or bundles as before, and again dried. It requires from a fortnight to five weeks grassing, in proportion to the degree in which it has been watered.

§ 8. *Breaking*.—This process is so similar to that in the management of flax, as not to require being specified. It is necessary, however, to be careful in this process not to cut or tear the hemp by the brake-machine, which is to be avoid-

ed by frequently turning and shifting the handfuls under the brake.

§ 9. *Produce and price.*—The produce of an acre of hemp when it grows well, is stated to be about 40 stones*. But the reporter does not discriminate either the acre or the stone to which he alludes. Supposing the Scotch acre, and the tron-stone of five to the hundred weight to be implied, and that the reporter means hemp so far dressed as to be fit for market, this will give a produce of about *five* cwt. to the statute acre. Assuming L. 120 the ton as the present war-price of clean undressed hemp, that is merely broken, switched, and bunched, the value of the produce of an acre of hemp will amount to L. 30. The expence of cultivating an acre of hemp, and preparing it for market, is stated at L. 16, 13 s. leaving a clear produce, to meet rent, taxes, and profit to the grower, of L. 13, 7s. an acre.

§ 10. *Concluding observations.*—As it is well ascertained, that in Ireland, Russia, Poland, Canada, and the north of France, hemp has been commonly grown for twelve or twenty years successively on the same spot, without any perceptible degeneracy, it is perfectly obvious, that this plant can in no degree be reckoned a scourger of the soil. Yet, it is obvious, as hemp requires to have the soil manured every second year, that this article can never become extensively cultivated, unless in the neighbourhood of large towns, where muck can be purchased, or in situations where abundance of sea-weed can be procured. These observations apply to the cultivation of hemp even under the present enormous prices of imported hemp; but were hemp to revert to the peace-price of L. 28 *per* ton, it is easy to perceive that the expences attending its cultivation would much exceed the value of its produce. Even at L. 68 *per* ton, it would merely cover expences, leaving nothing whatever to indemnify the grower for his risk and trouble, or to pay rent.

* Argyle Report, p. 116.

§ 7. *Buck-wheat*.—This plant has been cultivated in a few rare instances. As a green food for cows, it is said to have produced an extraordinary quantity of rich milk, uncommonly good for making butter and cheese *. And in one instance is said to have yielded a crop equal to fourteen times the seed, even on unsuitable soil †; but the quantity of seed is not mentioned. In two small experiments on good lands in Berwickshire, one broadcast and the other drilled, the want of success was so complete as not to encourage a repetition ‡. There are two species of buck-wheat, natives of Britain, the *polygonum fagopyrum*, or true buck-wheat, and *polygonum convolvulus*, or black bindweed. The former is very impatient of cold, and dies at the first attack of frost. The latter bears cold better, and produces a greater quantity of seeds, which are quite as good as those of the former §.

§ 8. *Madder*.—“ From the premiums offered by the Highland Society for the cultivation of madder in the Highlands of Scotland, it is probable that its culture may be soon attended to. Madder, or rather a substitute of much greater value, called by the same name, is a native of Britain, and has lately come into great estimation since the art of dyeing cotton a *Turkey-red* has been discovered. The root gives a colour nearly as bright as cochineal, and the top answers all the purposes of weld in dyeing yellow. It delights in a deep dry soil well pulverized; and perhaps peat well drained and reduced might answer as well. One acre may produce three or four tons, and one ounce of seed will produce plants enough for an acre. From the great quantity produced, the cultivation must always be very confined.

§ 9. *Woad*.—This plant is assuredly either of British growth, or well adapted for cultivation in our climate, having been used by the barbarous indigenous inhabitants to stain their bodies, so early as the time of Julius Cæsar. The only in-

* Perth Report, p. 190. † Roxburgh Report, p. 105.
 ‡ Berwickshire Rep. p. 264. § Walker's Hebrides.

stance of its cultivation in Scotland is contained in the Report of East Lothian, and is as follows: "The dyers at Haddington have sometimes raised pretty good crops of woad on fields which they rented for the purpose; but have seldom grown it to greater extent than was necessary for their own consumption. The management appears to have been well understood. It requires land of the first quality; must have diligent attention paid to keep it clean; and must be cut at the proper season*."

These two valuable articles in manufacture, madder and woad, have been mentioned, in the hope of inducing some public spirited individuals to attempt their cultivation on an extensive scale. They are both probably well adapted to our climate; and the circumstances connected with property and cultivation in Scotland, having no drawbacks inimical to the interest of the cultivators, give room to hope that these articles may become highly profitable to individuals, and advantageous to the country. It has been frequently asserted, that the operation of tithes had banished or greatly checked the cultivation of madder from England; but as that system does not affect Scotland, it may be fairly concluded that the growth of such high priced articles is well worth attention and experiment.

§ 10. *Hops*.—There is no instance known of hops having been cultivated as a crop in Scotland, except perhaps a few in gardens. The late Lord Kames recommends, that in our northern climate, they should be trained low, upon espaliers, or poles of nine or ten feet long, set up in a line from east to west, at intervals of three feet between each pole. He does not direct any particular distance between the rows; but perhaps six or seven feet may serve for this purpose. Beginning at the west end of each row, a hop-vine is to be planted at the foot of each pole, the last six or seven excepted. Instead

* East Lothian Report, 149.

of allowing the growing plants to ascend the poles in the ordinary manner, he recommends them to be trained diagonally from pole to pole, in an angle of nine or ten degrees with the horizon, binding them to the poles, and directing or leading the shoots by means of small twigs between the poles.

§ 11. *Tobacco*.—During the American war, this article of very generally diffused luxury became so dear, that several successful attempts were made in Scotland for its cultivation. The chief seat of that new culture was in the neighbourhood of Kelso, where it was introduced by Dr Jackson, of Nicolatown-field, who had long resided in America. It succeeded so well, that $16\frac{1}{2}$ statute acres at Crailing brought L. 104, or L. 6:7:4 *per* acre, being purchased by government under the authority of an act of Parliament, at 4d. *per* pound. It would easily have sold at three times that price, if this financial regulation had not been interposed, to preserve the revenue arising from imported tobacco *. From this fact it appears, that the Crailing crop averaged 382 pounds of saleable tobacco from the statute acre. It was tried with tolerable success in other parts of Scotland, particularly in Perthshire, where the reporter of that county raised tobacco eighteen inches long in the leaf, and twelve inches wide †.

§ 12. *Rhubarb*.—This plant grows luxuriantly in the climate of Perthshire, and is found even in Shetland. Owing to the great profit which it is calculated to bring, it is surprising that its culture has not claimed more attention, and been adopted on a more extensive scale. Gardeners and others raise it to great perfection; and there is a constant demand for it as a medicine. The Duke of Atholl, some years ago, cultivated the greatest quantity ever known in this country; but such a rage for every thing foreign prevails, that rhubarb

* Roxburghshire Report, 105.

† Perthshire Report, 189.

of Scotch growth is generally rejected in the shops, if known to be such; which may have prevented its cultivation*.

The reporter raised a few plants of rhubarb, upon a piece of barren worthless deep sand, and produced rhubarb of excellent quality. The plants were at intervals of six feet from each other; and he is satisfied that his small crop, to which no very particular culture was given, would have averaged considerably beyond four pounds of dry rhubarb to each root. At the assigned intervals, a statute acre of rhubarb will contain 1200 roots; which, at four pounds weight *per* root, and one shilling *per* pound, would amount to L. 240 *per* acre. But, as rhubarb has to stand a good many years before it is fit for being taken up, say seven years, the annual produce of such a crop can only be valued at L. 34 : 5 : 8 *per* acre, at the low price above mentioned.

§ 13. *Canadian marsh corn*.—Here may be mentioned the *Zizania aquatica* of botanists, an exceedingly prolific cereal gramen, or at least nearly allied to that most useful of all the vegetable tribes, which grows in great luxuriance, and produces great abundance of bland farinaceous seeds, in all the shallow streams of the dreary wilderness in north-west America, between the Canadian lakes, and the hilly range which divides Canada from the country on the northern Pacific ocean. So far as it is known, this plant was first noticed by the celebrated and adventurous traveller, Mackenzie, who explored his dreary way across these barren deserts to the shores of the Arctic sea, and of the northern Pacific. “The seeds of this plant, contribute essentially to the support of the wandering tribes of Indians, and feed immense flocks of wild swans, geese, and other water-fowl, which resort to that almost solitary wilderness for the purpose of breeding. Productive as is this excellent plant, and habituated to an ungenial climate, and to situations which refuse all culture, it is surprising that the

* Perthshire Report, 18.

European settlers in the more northern parts of America, have as yet taken no pains to cultivate and improve a vegetable production, which seems intended by nature, to become, at some future period, the bread-corn of the north*."

CONCLUSION.

GENERAL REMARKS ON THE SCOTCH SYSTEMS OF HUSBANDRY.

HAVING thus endeavoured to give a general account of the most important particulars regarding the tillage husbandry of Scotland, as followed in its best managed districts; it is now proper to conclude, with a short statement of those particulars in which its excellence consists, and to suggest a few hints for its further improvement.

The peculiar and distinguishing feature in the system of arable husbandry followed in Scotland, appears to consist in the judicious alternation of white and green crops, and the conversion of arable land, at convenient and proper intervals, from tillage to pasture, and from pasture to tillage. When that system is efficiently executed in all its parts, there is every reason to believe, that a much larger quantity of the food of man, and of domesticated animals for his use, will be profitably obtained from the same extent of land, than by tillage husbandry and pasturage, separately conducted on distinct portions of land, which forms the grand feature of distinction between English and Scotch husbandry. This leading circumstance of alternation and conversion, forms the essential character of the system of husbandry, now adopted in all the best

* Pinkerton's Modern Geography, III. 380. It is said that a plant which only grows in water, can hardly have such extended culture and growth, as to become a principal source of subsistence to man: but rice, which feeds such an immense population, is of the same description.

managed districts of Scotland. Its peculiar excellence consists in the accuracy with which the steps of the fallow process is conducted, whether the land is cleaned by a naked summer fallow or by turnip culture; in the industry with which the drilled pulse crops, as subsidiary to fallow, are effectually cleaned by horse and hand hoeing; in the judicious introduction of grain crops at proper intervals, as suitable to the soil, climate, and situation; and the alternation of cultivated herbage, or ley, for soiling, hay, and pasturage;—the whole being admirably calculated for the amelioration of the soil, the production of muck for its enrichment, and the profitable production of beef, mutton, and wool. A farther excellence of Scotch husbandry consists in the economical, yet effective energy, with which all its operations are carried on; in the first place, in consequence of the simplicity, efficaciousness, and easy draught of its implements of tillage; secondly, by means of the more frugal, yet sufficiently substantial and healthy fare of the servants employed in all the operations connected with Scotch husbandry; and, thirdly, by the superior steadiness, sobriety, and regularity of married servants, so general on Scotch farms in the more improved districts, whose families likewise furnish such essential assistance to the operations of the farmer.

There are no material obstacles to the improvement of husbandry in Scotland, excepting such as depend upon want of capital and information among the inhabitants of some of its remoter districts. In all the well managed districts, numbers of the farmers are men of education, experience and observation. Many of their sons are bred to the same profession, and have often to look out for farms in those other parts of the country where improvements have not been so generally adopted. By these means the knowledge of improved husbandry is spreading and disseminating as rapidly almost as could be wished, or at least as quickly as the nature of the subject admits, in consequence of the gradual accumulation of agricultural capital. In the unimproved parts of the coun-

try, where deficiency of knowledge, and want of the necessary funds, in a great measure, constrain the possessors of small farms to persist in imperfect management, there does not appear to exist, any effectual means for introducing the improved husbandry, at least on an extensive scale, except by the gradual extension of what may be called agricultural colonization, as just mentioned, by the sons of farmers, from the districts already improved and fully occupied, being under the necessity of seeking for farms in these other districts.

As these young men generally possess considerable farming capitals, comparatively at least with the farmers of the unimproved districts, their establishment almost always occasions the consolidation of several small farms, into one of a considerably larger size, by which, of course, several of the old farmers must necessarily be displaced, and have to seek out for new situations or new employments. At first sight this may appear injurious to the population of those districts, which are or may be improved by means of the consolidation of small farms; yet it has been uniformly found, that even the agricultural population of every district has increased, along with the improvements of husbandry. Additional production, and more correct cultivation, both supply increased means of subsistence, and require additional hands; both directly in the operations of husbandry, and indirectly in the more numerous wants of the more opulent husbandmen, and of their continually employed and well paid servants and labourers. Building, repairing, fencing, draining, hoeing; every thing, in short, which is connected with the improvements of husbandry, requires additional hands, and furnishes them with constant occupation and support. Even the small market towns in improved agricultural districts, rise into affluence in consequence of these improvements, by the greatly increased expenditure of the rural inhabitants of all classes.

This opinion of improved agriculture being favourable to population, is strongly corroborated by attending to the progress of population in Berwickshire, which is exclusively an

agricultural district. In 1755, before the commencement of improved husbandry, the entire population of that county did not exceed 25,000; but in 1801, when its agriculture had become highly improved, and the number of farms greatly reduced, the number of inhabitants had increased to 30,000. It is quite obvious, that this increase was entirely and exclusively owing to circumstances connected with the improvement of its agriculture, because no manufactures, which could in any degree affect its population, are carried on within the county. In small country towns, the opulence of shop-keepers and tradesmen, who are more or less connected with the agricultural population, has risen greatly, but in a degree which cannot be distinctly appreciated, as no record can be expected of these circumstances. And this has happened in the above-mentioned county, notwithstanding that the town of Berwick, not now in the county, enjoys by far the greatest share of these advantages, in consequence of being the almost weekly resort of the greater number of its affluent farmers. It is certain that the seryants and other persons employed by the farmers of Berwickshire, now spend more money yearly in the shops of Berwick, and the small towns scattered over the county, than the landed proprietors, farmers, and cottagers, in short the whole population of the county, expended in that way, in 1755, before the introduction of improved husbandry. At that more remote period, almost every family manufactured the coarse homespun articles of clothing which they required. Almost every person is now more profitably employed in labouring for the farmers, either directly or indirectly; and now purchase, from the excrescence of their farming wages and other gains, what they were formerly obliged to make for themselves, or were unable to obtain. In every town and village, saddlers, carpenters, plough and cart wrights, mill-wrights, (for threshing-machines and fanners), masons, bakers, and butchers, now abound, where such trades hardly before existed. Even mantua-makers and milliners are to be found in most of the towns and larger vil-

lages, where such occupations were formerly unknown. Perhaps the only trade which has fallen off is that of the weaver, by the discontinuance of the homespun manufacture, and the non-establishment of any substitute.

Among the legislative provisions required for facilitating the improvement of Scotch husbandry, the extension of roads and bridges, in those parts of the country still in want of these necessary accommodations, is perhaps the most important; and by the wise and liberal policy of parliament, such useful accommodations are in a fair way of being most extensively provided. Perhaps, likewise, the following particulars might be placed on a better footing, by the intervention of the legislature: 1. The right of using conterminous streams, for the erection of water threshing machines, mills for grinding farm produce, or for manufacture, or for the purpose of irrigation. 2. Power to carry main drains through the lands of others, on payment of damages. 3. The obtainment of passages or *way-leaves* through the lands of others where necessary. 4. The right of access to drinking-pools for live-stock, at rivers, brooks, ponds, or springs, on the lands of neighbours, where requisite. All of these might easily be regulated on the principles now followed in turnpike acts and canal bills; and by these means, on certain occasions, contentious neighbours would be deprived of the bad power of preventing others from improving their estates.

As tending to the improvement of Scotch husbandry, it might be advisable to establish a few small experimental farms, in different situations as to climate and elevation, and on different soils; in which comparative trials might be made of various proposed modes or articles of cultivation, and the results of these accurately communicated to the public, under the auspices of the Board of Agriculture. Not many years ago, a public spirited individual, the late Sir William Pulteney Johnston, instituted a professorship of agriculture in the University of Edinburgh, which has been attended by very

beneficial consequences. Perhaps this benefit might be advantageously extended, by the establishment of agricultural chairs in the other universities of Scotland. In this case, it might be worthy of consideration, how far it were proper, to put an experimental farm under the charge of each professor, where the experiments he wished for might be tried.

It does not appear necessary that an experimental farm should be large. About eighty or an hundred English acres, divided into a moderate number of inclosures, would be quite sufficient for every purpose, so far as related to the convertible and alternate system of tillage husbandry. On a farm of that extent, especially if containing clay land and turnip soil, every operation and course of crops might be easily and accurately executed, and comparisons instituted respecting the advantages and disadvantages of fallow, green crops, soiling, pasturage, and the like. The establishment of such a farm, if already provided with a commodious house and offices, or to be so provided by the landlord, would hardly exceed a thousand pounds; and the ordinary produce sold by the manager, under strict responsibility, ought to pay the rent, seed and labour. As selected varieties of all the best farm productions for seed, would of course be raised, some profit might even be derived from such an establishment, provided it was properly conducted. The manager would require a salary, perhaps of two hundred a year, with a garden, the keep of a horse and two cows, and potatoes for his family. These, with the permission of having pupils under his superintendance, especially if connected with an agricultural professorship, might make such a situation sufficiently comfortable to be worth the acceptance of a person properly qualified.

One other institution might materially contribute to the advancement and improvement of Scotch husbandry, the appointment of agricultural surveyors, to examine from time to time the practices of particular districts, and to report the results to the Board of Agriculture for publication. Three or four such employed in England, and one or two in Scotland,

and two or three in Ireland, might, in the course of a short period of years, collect and diffuse a valuable mass of well digested agricultural information; and, in the course of their surveys, might communicate the knowledge of many interesting and useful practices, among the rural districts through which they had to travel. It is believed that agriculture has been greatly benefited by the publication of farming tours; and there can be no question, with regard to the vast national utility, of the numerous County Reports which have been drawn up and published under the auspices of the Board of Agriculture. The institution now proposed, seems calculated to continue and extend that most excellent source of information and improvement, and at no great expence.

Such are the results of this most important inquiry into the management of arable land in Scotland. It is a subject confessedly of infinite importance, since the strength and resources of every country, and consequently of its government, must necessarily be commensurate to the numbers, comfort, and productive industry of its inhabitants; and for their multiplication, support, and beneficial employment, it is highly essential, that a constant and ample supply of food, and of the raw materials of manufacture, should be provided. What then can be more desirable, than to ascertain the best systems for managing the territory of a country, according to the circumstances connected with its situation, soil, and climate; and to disseminate a knowledge of those systems, among the numerous body of individuals, who are employed in carrying them into effect?

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