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CORN, ROOTS, AND OTHER CROPS OF THE FARM.

A PRACTICAL GUIDE TO THE SUCCESSFUL AND REMUNERATIVE CULTIVATION OF

Wheat, Maize, Peas, Turnips,
Oats, Flax, Beans, Carrots,
Barley, Hemp, Tares, Parsnips,
Rye, Rape, Potatoes, &c. &c.

With Illustrations.

LONDON:
WARD, LOCK AND CO.,
Warwick House, Salisbury Square, E.C.
PUBLISHERS' PREFACE.

The aim of the following handbook is to deal in a thoroughly practical manner with some of the most important branches of agricultural industry. The author has taken up, one after another, the various Crops of the Farm, and has given such information regarding these as will certainly, if attended to, secure their successful cultivation. As a farmer possessing an extensive knowledge of the various departments of practical agriculture, his observations are well worthy the attention of all interested in rural affairs, and we believe that this little volume will prove not unworthy of a place in our Country Life Series, the gratifying reception of the previous volumes of which is the best proof of their meeting a real want in a satisfactory way.

The illustrations have been selected with a view to usefulness, and we hope they will be found to add greatly to the clearness of the text. For some of them we are indebted to Messrs. Sutton and Sons, Reading.
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THE CROPS OF THE FARM.

CHAPTER I.

WHEAT.

Its Natural History—Biblical Account—Columella on Wheat—Varieties—
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1. WHEAT: ITS NATURAL HISTORY.—The attention of
naturalists has, at various times, been directed to the nature and
origin of wheat; while some have conjectured to be improved
glass of the Triticum order, a genus in which the spikelets are
sessile on the axis of a single spike, containing each two or more
florets, which are either all fertile, or having the terminal one rudimentary,
or barren, having two glumes to the spikelet, and two
pales to each floret.

The Triticum genus comprehends a great variety of species, in-
cluding a number of grasses which are named wheat, and this
variety of species, it is surmised, has been created chiefly through
the modifying influences of soil and climate, as well as of at-
mospheric phenomena, the Triticum vulgare, or common wheat,
being defined as a botanical species having the spikelets usually
imbribated in a close ear, each with two or more perfect flowers
and a terminal barren one; the glumes and outer pales broadly
ovate, with a blunt angle or notch on the top on each side of the
point or awn, the grain separating when ripe more or less readily
from the pales or chaff.

During an extended period of cultivation, so many distinct races have become
permanently established ones, that it is difficult to trace them to their original
botanical species, and various interesting experiments have been recorded as having been made with the seeds of this type, which had not yet been developed into the mature stage which would allow of its being termed "wheat"; amongst others, one by Sir Joseph Banks the naturalist, who received from a lady in 1803 a packet of grass-seeds which she presented him with, that was labelled "hill-wheat," but Sir Joseph was unable to learn precisely where they came from, except that they came from the East. The seeds were about the same size as ordinary wild grass-seeds, but being examined under a microscope they displayed all the outward characteristics of wheat, and it was conjectured they came from either the high ground at the back of the plains of Bengal, or from some other mountainous region of the Indian Peninsula, or from the mountains of Boutan, an island in the Indian Ocean, and perhaps they might have been the primitive type of the *solanum*. However, the seeds were sown in the naturalist's garden, and to his great astonishment the produce of the first year was perfect wheat, resembling in size of the grain, and in every other respect, the ordinary spring wheat that is commonly grown in this country.

It is not, of course, to be supposed that the original types have become extinct, but that they have undergone certain transformations during the lapse of time, and it is now usual to include the whole of the cultivated wheats, except the smaller spelts, in one botanical species under the name of *Triticum vulgare*, the name of "spelt" being generally given to all wheats in those cases where the grain adheres to the chaff, though our common species of wheat varies considerably in the degree of readiness with which it sheds its seed.

The wheats mostly cultivated in Europe consist of the following leading varieties:—

*T. vulgare muticum*, common beardless wheat, *T. hybernum* of Linnaeus; its distinguishing features being a smooth, or nearly smooth, compact ear, without awns, and hollow straw.

*T. vulgare turgidum*, grey wheat, pollard, duckbill, *T. turgidum* of Linnaeus. The ears of this description are more or less hairy; palecs generally with long awns, and with coarse, thick grains. The straw is full and hard, especially towards the top, the celebrated mummy wheat, *T. compositum* of Linnaeus, being a sub-variety with irregularly branching ears.

*T. vulgare polonicum*, polonian wheat, *T. polonicum* of Linnaeus. In this instance the ear is very long, and nearly smooth, with very long awns, and remarkably long, leafy chaff, sometimes above half an inch in length, the grains being few in number, long, and narrow.

*T. vulgare durum*, or hard African wheat, *T. durum* of Desfontaines. The ear of this variety is not large, being more or less hairy, palecs with long awns, the grain long and narrow.

*T. vulgare dicoccum*, the larger spelt, or *T. spelta* of some classifiers. The ears of this variety resemble those of the common bearded
wheat, but are not so compact, the spikelets being often at some distance from one another, while the grain does not separate so readily from the chaff.

We may mention that the wild forms of the *T. vulgare* include the *Ægyptos ovata, triuncialis, triaristata, negleota* and *triticoides* of botanists.

It has, however, been argued, on the other hand, that wheat, in its present form of development, has always existed from the earliest times; and while doubtless, from repeated and continual cultivation, the seeds of the grasses could be eventually made much larger in size and heavier in bulk, it remains to be proved that, in those instances where the wild species, upon being properly cultivated, turned out to be sound, good wheat of the ordinary description, they were not specimens themselves of degenerated types of wheat, reduced to their inferior condition by inadaptation of soil and climate, history furnishing many proofs that wheat, in its present form, constituted the principal item of the food of man from the very earliest times.

Triptolemus, the son of Celeus and Ncera, cultivated and sowed grain at Eleusis fourteen hundred years before the Christian era; the inscription on the Arundel Marbles recording that Ceres left Sicily, her native country, and went to Athens in the year 1409 before the Christian era, and there taught the Greeks to cultivate the earth and sow seeds, who therefore venerated her as a goddess in their mythology.

2. BIBLICAL ACCOUNT.—In the Biblical account furnished in Genesis, special allusion is made to “seed-time and harvest,” and Joseph’s dream of the sheaves doubtless represented wheat-sheaves, for the “seven ears on one stalk, which the earth brought forth by bandfuls,” corresponds with the *Triticum compositum* at present grown in Egypt, which is styled *clog wheat*, still bearing seven ears on one stalk, the produce being used by London bakers, when made into coarse flour, for dusting their kneading-boards.

The wheat, also, which has been found in the mummy-cases enclosed in the cerecloths, having been planted, has produced a new variety of wheat, which now goes by the name of “mummy wheat,” and this, although it retained its vital principle, it is supposed had been entombed for three or four thousand years. This *Fingered Egyptian*, or *Mummy wheat*, is not grown to any very considerable extent, because of its inferior quality, but it is remarkable for its very large produce, and on this account is often culti-
The Crops of the Farm.

vated by cottagers on small patches of land, where quantity rather than quality is desired, some of the ears having as many as eleven offshoots, and having been found to contain so great a number as 150 grains in one ear, and as many as 60 ears having been known to be produced from a single grain.

3. COLUMELLA ON WHEAT.—Of the Roman writers on wheat, Columella says: "The most profitable grains for man are common wheat and bearded wheat. We have known several kinds of wheat, but of these we may chiefly sow what is called the red wheat, because it excels both in weight and brightness. The white wheat may be placed in the second rank, of which the best sort in bread is deficient in weight. "The Trimestrian should be the third, which husbandmen are mighty glad to make use of; for when, by reason of great rains, or any other cause, the early sowing has been omitted, they have recourse to this for their relief." (Our spring wheat, which is sown to supply the omission of sowing, or the failure of winter wheat, is thus used for the same purpose as that called by Columella Tri-mestrian.) "It is a kind of white wheat. Pliny says that this is the most delicious and daintiest of any sort of wheat, and exceedingly white, but without substance or strength; only proper for moist tracts of lands, such as those of Italy and some parts of Gaul; that it ripens equally, and that there is no sort of corn that can bear less delay, because it is so tender that such ears of it as are ripe presently shed their grains; but in the stalk it is in less danger than any other kind of corn, for it holds its ear always upright, and does not retain the dews, which occasion blasting and mildew. "The other sorts of wheat are altogether superfluous, unless a man has a mind to indulge in a manifold variety—and a vain-glorious fancy.

"But of bearded wheat we have commonly seen four sorts in use; namely, that which is called Clusian, of a fine white bright colour; a bearded wheat which is called Venuculum—one sort of it is of a fiery red colour, and another sort of it is white, but they are both heavier than the Clusian; the Trimestrian; and that of three months' growth, which is called Kalicastrium, and this is the chief, both for weight and goodness. But these sorts, both of ordinary common wheat and of bearded wheat, may for these reasons be kept by the husbandman, because it rarely happens that any land is so situated that we can content ourselves with one sort of seed; one part of it
happening, contrary to our expectation, to be wet or dry. But common wheat thrives best in a dry soil, and bearded wheat is less affected by moisture."

The testimony of the Latin writers as to certain facts and circumstances is extremely interesting in connection with husbandry, but their technical information is but of very small value. The best-known amongst them is Virgil, who, although the prince

of the Latin poets, was but a very bad husbandman, though his "Georgics" have given great pleasure to thousands of readers.

4. VARIETIES.—The varieties of wheat are much more numerous than those of any other description of grain, which may be attributed to the different effects caused by soil, climate and cultivation. Many attentive observers and cultivators of wheat having been struck, when passing through the wheat-fields, with the difference in the appearance of the hues presented by the flowers when in full bloom, or by any remarkable peculiarity of excellence, or fecundity, have gathered them when ripe, and have kept them separately, and have planted the grains and their produce in consecutive years; and by this means various distinct varieties have
been produced, that often go by the names of the individuals who first brought them into notice, or by the name of the farm upon which they were grown.

Many of the accounts that have been furnished of new varieties produced in this way are extremely interesting. Brodie's white wheat dates its origin from a single ear picked by a Mr. Brodie of Ormiston, in 1821, and propagated by that gentleman.

From thirty-two grains originally sown in 1821, the produce had multiplied to 156 bushels in 1826. When its cultivation had become widely extended, and its characteristics became established, it was generally found to produce tall straw, and a fine early sample. A similar wheat exists that is named Oxford Prize, and this is supposed by some to be the same variety, or to have sprung from it originally; the supposition being warranted by the fact that Mr. Brodie was in the habit of sending wheat into Oxfordshire.

The origin of Fenton wheat has been described to be due to the following circumstance. In the summer of 1835 the late Mr. Hope of Fenton Barns, East Lothian, noticed three ears of wheat growing from one root, in the centre of a quarry on his farm. This quarry is composed of columnar basalt, and at the time the three ears of wheat were discovered, there was a large quantity of débris in the centre, from which these had sprung.

Mr. George Hope was with his father when the plant of wheat was first noticed, and he remarked that the short straw was in all probability not a peculiarity of the wheat itself, but arose from the circumstance that, in the place where it was growing, it could not very well have long straw, and in all probability was only Hunter's wheat (which they were growing), that had been accidentally taken there. Under this impression, at his father's request he rather reluctantly pulled the three ears of wheat when ripe, and dibbled out the produce year after year.

When enough had been collected to sow it in quantities, and to compare it with Hunter's wheat, it was found to be unmistakably different from it, and also from any other kind of wheat with which he was acquainted. The description he gave of it was, that it was remarkably short and stiff in the straw, and from its unequal length a sheaf is generally a mass of ears from the band upwards.

Although to outward appearance there is but little straw, yet when weighed there is less difference betwixt it and longer-strawed varieties than might be supposed, in consequence of its extreme density; and in comparative trials with Hunter's wheat, Mr. Hope always found the new variety to yield as much weight of straw, though greatly less in bulk. For some years at first the quality was inferior to Hunter's, but latterly it has become superior to it; and frequently it has been said the best samples seen in Haddington market are of Fenton wheat.
One peculiarity in connection with this variety is said to be that it is apt to become mildewed on low-lying soft soils; but, while this is true to a certain extent, it is an objection to which the long-strawed varieties are still more open.

Of the variety known as Dantzic white wheat, Colonel Le Couteur's Jersey was originally obtained by Colonel Le Couteur from a cargo of wheat imported from Dantzic. Its characteristics are: tall, slender straw; ears moderately dense, drooping to one side when ripe; thin, smooth and white chaff; oblong grains, and of a transparent light colour. The young plants are hardy, and bloom early. Experiments made with this variety by Colonel Le Couteur in 1836 gave 52 bushels per acre, of 63 lbs. per bushel, and 18 lbs. of flour yielded 34 lbs. of bread of superior quality.

The varieties of wheat included under the specific term *Triticum sativum*, or cultivated wheat, have been classed alphabetically by Lawson as follows:

### Whitish Beardless Varieties.

| Cape. | Red-chaffed. |
| Chevalier. | Mungoswells. |
| Chiddam, or Cheltham. | Naples. |
| Chinese. | Odessa. |
| Cluster, Tall. | Oxford Prize. |
| Dantzic, Le Couteur's Jersey. | Painted Stalked. |
| ″ Common White. | Pearl, Common White. |
| Eclipse. | Salmon. |
| Essex. | Saumur. |
| Fenton. | Talavera. |
| Flanders. | Uxbridge. |
| Hopetoun. | Velvet, or Woolly-eared Common. |
| Hungarian. | ″ Dantzic. |
| Hunter's. | Vilmorin's. |
| Indian. | Whittington's. |
| Le Couteur's Compact. | Whitworth Prolific. |
| ″ Small Round. |

### Reddish Beardless Varieties.

| Blood Red. | Lammas, or English. |
| Birshall Compact. | Marianopoli. |
| Caucasian Red. | Middlesex. |
| Clover's Red. | Pomeranian. |
| Common, or Old. | Piper's Thickset. |
| Creeping. | Sack, Yellow. |
| Dantzic. | Spalding's Prolific. |
| Golden Drop. | Velvet, or Woolly-eared of Crete. |
| Golden or Red Essex. | ″ Common. |
| Flanders, or Short-eared. | Waterloo. |
| Hickling's Prolific. | ″ |
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Whitish Bearded Varieties.

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<td>Caucasian.</td>
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<td>Light Yellow Spring.</td>
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Reddish Bearded Varieties.

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<td>Louisiana.</td>
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5. Temperature Best Suited to the Cultivation of Wheat.—Although a native of temperate climates, wheat has a wider range of habitat than any of the other cereals, being a remarkably hardy plant, living through the severest winters of Poland and Russia, as also in the opposite direction, succeeding well under the blazing sun of the torrid zone, as if intended by the infinite wisdom of Providence to form the principal staple of the food of man.

Yet the plant is essentially a native of the temperate zones, lying between the parallels of 25 and 60 degrees of latitude, occupying a large tract of country in all the divisions of the globe, the best wheat-growing districts in Europe being Turkey, Hungary, Italy, France, Spain, Southern Poland, Prussia, Austria and England.

In Asia, the best wheat-producing countries are those lying between the Black Sea on the north, and the heads of the Persian Gulf and the Red Sea on the south, including Armenia and Palestine; while the wheat-growing districts of Africa include Egypt and the countries bordering upon the Mediterranean.

In America, the wheat districts are almost boundless; while in Australia the climate is everything that can be desired for its growth.

6. Characteristics of Wheats.—There are certain salient features possessed by different kinds of wheat that demand a little notice. As a rule, it is found the best to grow red wheats on poorish soils, situated in early climates; but wherever the soil is a good clay, or firm loam in rich condition, the white varieties are to be preferred, as upon good land they are equally prolific, and command higher prices in the market.
The red varieties are generally hardier, and are more easily grown than the white sorts; and although of not so much value commercially, they are fully as profitable to the grower in consequence of the greater yield. Red wheat, again, has another advantage in its comparative freedom from the attacks of mildew and fly.

It has been recommended as a good plan, while not actually growing too many sorts of wheat upon one farm, to have two or three varieties in order to guard against failure of any one kind; as the abundant yielding of any particular variety varies in the different years, according to the seasons that prevail during the active period of the plant’s growth. In very dry years it will thus be found that the long-strawed varieties are the most prolific, but in wet seasons the shorter sorts do the best.

If the same kind of wheat is cultivated year after year upon the same soil, it will become degenerated, and if any particular variety is desired to be perpetuated fresh seed should be obtained from a distance, grown upon a different soil; or in case the seed procured in this way should not be considered reliable, a few bushels should be sent away to be grown elsewhere, after being well picked and dressed; but a great deal might be done in keeping up the vigour and high standard of the variety by pursuing the plan of separate garden-culture and propagation, in the way that has been described, until enough seed-wheat has been obtained that may be required to plant.

Unless in the very best soil and finest climate, the same kind of wheat can never be grown continuously without degenerating, which will be shown in functional derangement and imperfect development in bad seasons.

7. Most Suitable Soils.—Certain varieties of wheat are better adapted to some soils than others. Those which are naturally good, and of a firm texture, carry to the best advantage. Fenton, Morton’s, red-chaffed white, red-strawed white, and Chiddam and Pearl for white wheats; and of the red sort, Lammas, Spalding’s prolific, and Clover’s red.

Hunter’s, Hopetoun, Mungoswells are suitable varieties for winter sowing on medium soils in fair condition, and Talavera for spring sowing. On the poorer class of soils, “White Irish” and common red for winter; and fern, or April wheat for spring sowing have been recommended.

Good wheat land ought always to possess a certain amount of consistence, and consequently the larger proportion of clay and the less sand it contains the better, wheat having always been cultivated the most successfully upon land containing a large
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amount of argillaceous or clayey matter that has been thoroughly well drained.

Thus, when wheat soil is spoken of, it is meant that the land is of a somewhat firm and hard texture. Still, in some seasons, wheat has been grown quite as successfully upon light soils as upon heavy ones; but taking the average of years, the firm, deep soil obtains the preference. It was at one time supposed that light land was incapable of bearing corn crops, but very poor, thin lands have been much improved by a liberal application of clay, chalk, or marl.

Nearly every kind of land, whether composed of clay, loam, chalk, gravel or sand, will produce remunerative crops of wheat if it is properly cleaned, drained, and brought up to the adequate pitch of fertility by proper management, which, in brief, means thoroughly draining it, cleaning it of all weeds, and putting plenty of manure into it.

8. INGREDIENTS TAKEN BY WHEAT FROM THE SOIL.—Analysis has demonstrated that wheat removes a much smaller amount of mineral matter from the soil than even oats or barley, which is plainly shown by the fact that, when the soil has refused to grow wheat any longer from want of manure, it can still be made to yield tolerable crops of oats and barley.

Silica plays a very important part in giving stability to the straw, and its presence is very necessary in sufficient quantity for the purpose of sustaining a crop of wheat in health. Where any of the constituents necessary for the full development and growth of the plant are wanting, they must be supplied artificially, and how to do this we are informed by its chemical composition, to build up which the ingredients must perform be taken from the soil.

9. CHEMICAL COMPOSITION.—According to Boussingault, wheat and wheat-straw are composed of the following constituents:

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Wheat-Straw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>46.1</td>
<td>48.4</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>5.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Oxygen</td>
<td>43.4</td>
<td>38.9</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Ashes</td>
<td>2.4</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

These several parts elaborated in the grain, produce the following substances:

Gluten.
Starch.
Saccharine.

Gum.
Water.
Brau.
The ashes of wheat-straw have been thus divided by chemical analysis:

<table>
<thead>
<tr>
<th></th>
<th>Wheat,</th>
<th>Wheat-Straw.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric Acid</td>
<td>47°0</td>
<td>3°1</td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td>1°0</td>
<td>1°0</td>
</tr>
<tr>
<td>Chlorine</td>
<td>traces</td>
<td>0°6</td>
</tr>
<tr>
<td>Magnesia</td>
<td>15°9</td>
<td>5°0</td>
</tr>
<tr>
<td>Lime</td>
<td>2°9</td>
<td>8°5</td>
</tr>
<tr>
<td>Potash</td>
<td>2°9</td>
<td>9°2</td>
</tr>
<tr>
<td>Soda</td>
<td>traces</td>
<td>0°3</td>
</tr>
<tr>
<td>Silica</td>
<td>1°3</td>
<td>67°6</td>
</tr>
<tr>
<td>Alumina</td>
<td>0°0</td>
<td>1°0</td>
</tr>
<tr>
<td>Moisture and loss</td>
<td>2°4</td>
<td>3°7</td>
</tr>
</tbody>
</table>

Exact weight of each of the above constituents, taken from the soil by a crop of wheat per acre, according to Boussingault:

<table>
<thead>
<tr>
<th></th>
<th>As Stored.</th>
<th>Dried.</th>
<th>Reduced to Ashes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>1,500 lbs.</td>
<td>1,285 lbs.</td>
<td>33 lbs.</td>
</tr>
<tr>
<td>Straw</td>
<td>3,400 lbs.</td>
<td>2,550 lbs.</td>
<td>178 lbs.</td>
</tr>
</tbody>
</table>

The analysis of the ashes showed the following:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric acid</td>
<td>15°51 lbs.</td>
<td>5°52 lbs</td>
</tr>
<tr>
<td>Sulphuric acid</td>
<td>0°33</td>
<td>1°88</td>
</tr>
<tr>
<td>Chlorine</td>
<td>0°95</td>
<td>1°87</td>
</tr>
<tr>
<td>Magnesia</td>
<td>5°25</td>
<td>8°90</td>
</tr>
<tr>
<td>Lime</td>
<td>0°73</td>
<td>2°37</td>
</tr>
<tr>
<td>Potash</td>
<td>0°53</td>
<td>0°53</td>
</tr>
<tr>
<td>Soda</td>
<td>5°44</td>
<td>12°33</td>
</tr>
<tr>
<td>Silica</td>
<td>0°79</td>
<td>1°78</td>
</tr>
<tr>
<td>Alumina</td>
<td>traces</td>
<td>6°59</td>
</tr>
<tr>
<td>Moisture and loss</td>
<td>33°0 lbs.</td>
<td>178°0 lbs.</td>
</tr>
</tbody>
</table>

The proportions of the constituents of wheat derived from the atmosphere Boussingault also gives. To obtain them, he raised two successive crops on a soil destitute of nitrogen, but manured to the extent of 20,000 kilogrammes per hectare, the produce being 3,318 kilogrammes of wheat, and 7,500 kilogrammes of straw; in round numbers about 6 quarters, 2 bushels per acre.

The following table shows the composition when dry:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2,566</td>
<td>1037°4</td>
<td>164°5</td>
<td>123°0°8</td>
<td>65°2</td>
<td>68°1</td>
</tr>
<tr>
<td>Straw</td>
<td>5,550</td>
<td>2586°2</td>
<td>294°2</td>
<td>215°9°0</td>
<td>22°2</td>
<td>38°8°5</td>
</tr>
<tr>
<td>Total</td>
<td>8,116</td>
<td>3723°6</td>
<td>458°7</td>
<td>338°9°8</td>
<td>87°4</td>
<td>456°6</td>
</tr>
<tr>
<td>Manure</td>
<td>4,140</td>
<td>1482°1</td>
<td>173°9</td>
<td>106°8°1</td>
<td>82°8</td>
<td>133°1°1</td>
</tr>
<tr>
<td>Difference</td>
<td>3,976</td>
<td>2241°5</td>
<td>284°8</td>
<td>2321°7</td>
<td>4°6</td>
<td>874°5</td>
</tr>
</tbody>
</table>
The Crops of the Farm.

It will be seen by looking at the first and the last table, that carbon and oxygen form nearly nine-tenths of the entire weight of the wheat crop, the greater portion of these being obtained from the atmosphere in the shape of either air or water.

Nitrogen performs the most important part in the composition of wheat, being the foundation of animal muscle, and of the gluten found in such considerable proportions in wheat, as it is in all seeds, to a greater or lesser degree, upon which animals subsist. Nitrogen is to some extent obtained from the atmosphere by certain plants in the form of ammonia, some being much greater absorbents than others, but the largest supply is obtained from decomposition of organic matter in the soil.

In the instance of wheat, as may be seen from the figures of the last table, little or no nitrogen is obtained from the atmosphere, but its supplies are obtained principally from the manure and the soil, or the organic principles contained in it, while the excess of other constituents from the atmosphere is in each case nearly double the weight of the manure.

Liebig says, "the employment of animal matter in the cultivation of grain, and the vegetables which serve for fodder to the cattle, is the most convincing proof that the nitrogen of vegetables is derived from ammonia."

The quantity of gluten in wheat, rye, and barley is very variable; these kinds of grain also, even when ripe, contain this compound in very different proportions. Piroust found French wheat to contain 12.5 per cent. of gluten; Vogel found that the Bavarian contained 24 per cent.; Davy obtained 19 per cent. from winter, and 24 from summer wheat, from Sicilian 21, and from Barbary wheat 19 per cent. The flour of Alsace wheat contains, according to Boussingault, 17.3 per cent. of gluten; and that of winter wheat, 33.3 per cent. Such great differences must be owing to some cause, and this we find in the different methods of cultivation. An increase in animal manure gives rise not only to an increase in the number of seeds, but also to a most remarkable difference in the proportion of the substances containing nitrogen, such as the gluten.—(Chemistry in its applications to Agriculture and Physiology, pp. 48-9.)

Liebig gives illustrations of crops obtained without the assistance of manure, as under:

"For, small as is the quantity of alkali essential to plants, it is nevertheless quite indispensable for their perfect develop-
ment. But when one or more years have elapsed without the removal of any alkalies from the soil, a new harvest may be expected.

"The first colonists of Virginia found a soil similar to that mentioned above (a soil exposed for centuries to all the influences which affect the disintegration of rocks, but from which the alkalies, thus rendered soluble, have not been removed); harvests of wheat and tobacco were obtained for a century, from one and the same field, without the aid of manure; but now whole districts are abandoned, and converted into unfruitful pasture-land, which, without manure, produces neither wheat nor tobacco. From every acre of this land there were removed, in the space of 100 years, 12,000 lbs. of alkalies in leaves, grain and straw; it became unfruitful, therefore, because it was deprived of every particle of alkali fit for assimilation, and because that which was rendered soluble again in the space of one year was not sufficient to satisfy the demands of the plants. Almost all the cultivated land in Europe is in this condition; fallow is the term applied to land left at rest for further disintegration. It is the greatest possible mistake to suppose that the temporary diminution of fertility in a soil is owing to the loss of humus; it is the mere consequence of the exhaustion of alkalies, and of other essential ingredients.

"Let us consider the condition of the country round Naples, which is famed for its fruitful corn-land; the farms and villages are situated from eighteen to twenty-four miles distant from one another; and between them there are no roads, and consequently no transportation of manure. Now corn has been cultivated on this land for thousands of years, without any part of that which is annually removed from the soil being restored to it. How can any influence be ascribed to humus under such circumstances, when it is not even known whether humus was contained in the soil?" (Ibid, p. 118.)

Gluten forms an essential part of good wheat, and contains about 14 per cent. of nitrogen, being analogous to animal tendon. Nitrogen, being the basis of gluten, is therefore necessary for its production, and wherever nitrogen is found in abundance in a soil, the gluten found in the wheat grown upon it always abounds in it in commensurate proportion.

10. MANURES FOR WHEAT.—An experiment which shows the comparative efficacy of different manures for the production of
The Crops of the Farm.

Gluten in wheat is recorded by Boussingault, applied to the same soil, and the same seeds:

<table>
<thead>
<tr>
<th></th>
<th>Gluten</th>
<th>Starch</th>
<th>Bran and soluble matter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Human urine</td>
<td>35.1</td>
<td>39.3</td>
<td>25.6</td>
<td>100</td>
</tr>
<tr>
<td>2. Bullocks' blood</td>
<td>34.2</td>
<td>40.3</td>
<td>25.5</td>
<td>100</td>
</tr>
<tr>
<td>3. Night soil</td>
<td>33.1</td>
<td>41.4</td>
<td>25.5</td>
<td>100</td>
</tr>
<tr>
<td>4. Sheeps' dung</td>
<td>32.9</td>
<td>42.8</td>
<td>24.3</td>
<td>100</td>
</tr>
<tr>
<td>5. Goats' do</td>
<td>32.9</td>
<td>42.4</td>
<td>24.7</td>
<td>100</td>
</tr>
<tr>
<td>6. Horse do</td>
<td>13.7</td>
<td>61.6</td>
<td>24.7</td>
<td>100</td>
</tr>
<tr>
<td>7. Pigeons' do</td>
<td>12.2</td>
<td>63.2</td>
<td>24.6</td>
<td>100</td>
</tr>
<tr>
<td>8. Cows' do</td>
<td>12.0</td>
<td>62.3</td>
<td>25.7</td>
<td>100</td>
</tr>
<tr>
<td>9. No manure</td>
<td>9.2</td>
<td>66.7</td>
<td>24.1</td>
<td>100</td>
</tr>
</tbody>
</table>

It will be seen from the above that the first five manures contained the greatest quantity of nitrogen, which is the basis of gluten, and the experiments show that those substances that abound most in gluten are necessarily favourable to the growth of wheat, while the application of lime, which we shall speak of again, improves the quality of the wheat, and corrects the adhesiveness of the strong clay upon which wheat is mostly grown.

The introduction of what is termed the "turnip system of husbandry," and the growth of trifoliated plants and artificial grasses, has, however, to a certain extent revolutionised the system of procedure as respects the growth of wheat, after the production of which it was formerly usual to let the ground lie idle, in fallow. These plants, by their powers of attraction and absorption, derive from the atmosphere a large amount of nourishment which they procure for the land in a gaseous or aqueous form, by the inhalation of the foliage or herbage.

The necessity of a period of fallow arises from the soil requiring to be enriched by the action of the weather, in certain soluble ingredients in the shape of silicates and alkalies that are an essential condition to the existence of cereals. But the cultivation of turnips and potatoes during the interval does not impair the fertility of the field during the intervening time of their growth—supposing the supply of alkalies to be sufficient for both—as these plants do not require any of the silica that is necessary for cereals. A green crop, therefore, if manured, is considered equal to a fallow as a preparation for wheat, on account of its only exhausting the soil of those elements of fertility which would sometimes endanger the wheat-crop, and make it too florid, leaving untouched those that are peculiarly essential to its well-being, and without which the straw would predominate over the grain.

Too liberal a use of farm-yard dung to wheat, is apt to encourage
Wheat.

a free vegetation of the plant at the expense of the development of the grain; whilst condensed artificial phosphoric manure tends to increase the grain, while at the same time sustaining the plants in health and vigour, without stimulating too abundant a growth of straw, and securing a less liability for the crop to be laid.

An average crop of wheat is considered to consume per acre, 48 lbs. of alkaline salts, 32 lbs. of salts of lime and magnesia, and 104 lbs. of silica—mineral elements which must be furnished by the soil, and are not to be derived from the atmosphere.

If these constituents have not been replaced in the form of manure, it necessarily follows that the land contains so much less of these elements, which have been taken away by the outgoing crop. A portion will return in the straw, hay, and crops consumed by the cattle on the farm; but the animals themselves, after having assimilated a considerable portion, being sold and taken away, as well as all the wheat, there will be a considerable deficiency of the elements we have named, which need to be freshly supplied.

This theory will easily explain to the uninitiated the reason why corn-crops are exhausting to the soil, and the value of guano to corn-crops, one ton of which has been estimated by Mr. Nesbitt to be equal in its effects to 33½ tons of farm-yard dung; its relative proportion to that and other manures having been considered by that gentleman to be as under:—

Relative value of Guano:—

1 Ton of Peruvian Guano is equal to 33½ tons of farm-yard dung.

" " " 21 tons of horse-dung.

" " " 38½ tons of cow-dung.

" " " 22½ tons of pig-dung.

" " " 14½ tons of mixed human excreta.

Too free use of farm-yard dung to a wheat crop is not only calculated to produce straw rather than grain, but it is apt to make it get both lodged and mildewed; but a liberal use of salt will correct the tendency towards too free a growth.

Farm-yard manure promotes a rapid growth of turnips and green crops, which contain but little nitrogen; and to prevent the ammonia from evaporating from off dung-heaps, salt is recommended for fixing it, for corn-crops naturally benefit from the manures that have not entirely exhausted their fertilising properties which remain in the ground, and in this aspect of the case common salt is not only useful as a manure in itself, but exerts a most useful influence in thus fixing ammonia.

The effects of this may be readily seen, for if a dish of salt is placed in a stable that is shut up at night, the ammonia arising
from the urine and dung of the horses will be attracted by it, and become converted into sal-ammoniac.

Sea-sand has also been used to advantage in many districts to corn-crops, containing a large admixture of shells, conjointly yielding carbonate of lime and some phosphate of lime and magnesia.

Mild lime, or lime in an effete state, may be used with safety in the formation of composts for wheat-crops, and while it binds sands and gravels, it opens clays.

On bare fallows, clover-stubbles, and bean lands a liberal application of farm-yard manure prevents the subsequent wheat-crop from becoming weak-strawed, badly-coloured, and root-fallen, for by strengthening the straw (if not made too luxuriant) the quality of the grain is improved, and when the land has been heavily dressed in this way with farm-yard manure in a previous bean-crop, a second application for the succeeding wheat-crop is not positively indispensable, but it is considered advisable to give a half-dunging.

A common practice is to sow wheat after potatoes without dung, and to apply light manures in the spring, the whole of the farm-yard manure being disposed of on the green crops, while others have adopted exactly the reverse system of management, excepting in the case of potatoes, and raise their turnip-crop solely with light manures, and lay on the farm-yard manure which is saved for wheat; which is found to answer very well in a six years' rotation in deep land, whether hard or soft: first, clover; second, oats; third, potatoes, or beans dunged; fourth, wheat dunged; fifth, turnips with artificial manure, and partly fed off by sheep; and sixth and lastly, barley with seeds.

On light, dry, but fertile land, it is considered the best plan to dung for potatoes, as before, and use artificials for the wheat; and for the following crop of turnips both farm-yard and light manure, the objection to using farm-yard manure for growing wheat on light soils being that the plants are liable to become winter-proud, thin out in summer, and be but a poor crop at harvest; it being considered that, by avoiding forcing measures in winter, and applying artificials as soon as the spring growth has fairly commenced, a healthier summer growth is obtained, and a better crop secured at a less expense than would have accrued by the employment of farm-yard manure. But the same reasoning does not apply on deep soils, because, however free the growth of the wheat-plants may be in winter and spring, the risk of injury from drought and premature ripening is not so great as upon hotter soils.

II. PLoughING, AND PREPARATION OF THE LAND FOR WHEAT.—In the eastern counties of England the land is ploughed in September, rather shallow, with a skim-coultier plough, which cuts off the grass edge of the furrow-slice, laying the land as flat
as possible, and afterwards rolling it with a heavy roller, so as to close the furrows and give it the necessary degree of consolidation.

It is considered by many, however, best to plough the land as above, but not with so flat a furrow, and to use a press, or drill-roller, to consolidate the furrow-seams, while burying all particles of sod that may have escaped the skim-coulters. So treated, the furrows being raised by these means furnish a capital area of fine mould to the harrows when they are drawn across the ridges, and give a clean surface for drilling the seed, the soil at the same time being firm below, and yet soft and workable on the immediate surface.

The advantage of using the presses is, that the land may be ploughed as early as wished for, and the furrows can be allowed to remain unharrowed for a long time without any risk of grass springing up between them; when, if ploughed flat, and rolled with a common roller early in autumn, the grass and weeds are likely to grow between the furrows, and thus the surface is likely to become too hard to be harrowed into a proper tith.

The practice pursued differs considerably in various parts of the country. In the south of England wheat is sown after grass, green crops and bare fallows, but in the north, and Scotland, very seldom after grass, the variation of the practice as respects grass being due to climatic influences; for while in a dry climate the decaying roots of the previous clover, or grass-crop, afford a good supply of carbonaceous food, which the wheat-plant eliminates into so much healthy nourishment, the effects are not the same in a more humid climate on account of the cellular tissues being gorged with constituents which, for want of sunshine, cannot be elaborated into proper aliment; the result being that in Scotland, and especially Ireland, when wheat is sown after grass it becomes coarse and wheat-strawed, and is seldom so profitable as a crop of oats, although the land may have been liberally treated as regards manure.

When the soil is of a light and friable nature, in many parts of England wheat is very often taken after two-year-old leas which have been closely eaten down by sheep.

There are several ways of preparing the land for the reception of seed. The old plan, that is still followed in many places, was to plough the land early in July, and allow it to remain until September, and then sow broadcast, and cover the seed with heavy harrows. It is considered a better plan to rafter or rib the land across in July, harrow it down in September, then plough it into ridges with a close neat furrow, and press it; then harrow the surface, and drill the seed across the furrows. Sometimes the seed is sown by a machine attached to the presser, and harrowed lightly afterwards.

In order to cause land to be fit for the reception of the seed upon
clover-stubbles, or leas, where it is intended to plant wheat that is infested with couch-grass, it is best to give them as thorough a fallowing as the season will allow of. With this object in view, as soon as the hay is taken off, or the grass depastured, it should be ploughed clean, and torn to pieces with heavy harrows and rollers, and picked free from the couch-grass, followed up by grubbing, harrowing, and picking as often as may be required, and then allowed to remain untouched until after harvest, when the dung in a made state should be put on the land, and ploughed in under a pressed furrow, when the field will be ready for sowing.

When preparing clay soils for the reception of wheat after beans, a thoroughly good cross furrow needs first to be given. The harrows and grubber will then work freely. But if it is attempted to break up the land with the grubber first, it distresses the horses without properly cleaning and pulverising the soil. After potatoes, but little preparation is required beyond the ordinary ones of ploughing and harrowing.

12. SOWING THE SEED.—There are three ways of sowing seed, each of which possesses relative merits—by broadcast sowing, drilling, and dibbling. When the soil is clean, firm, and of good quality, the quickest, and perhaps the cheapest method of sowing wheat on a large scale is by the broadcast system; for although a larger quantity of seed is required than when drilled, or dibbled, the expense is less, while, taking the average, the difference in the amount of crop is too small to enter into any calculation.

When this is done, however, the common fault of too thick sowing must be avoided, the results of which may be seen in small ears, spindle stalks, and premature ripening; but on all soft soils where weeds grow thickly in winter and spring, drilling will be found the best method, the broadcast system in such a case being very precarious.

The advantage of drilling is that it affords the opportunity of using the horse-hoe, or of hand-hoeing in spring, for it may be seen that weeds grow faster in the vacant spaces between the rows, than when the seed has been sown broadcast, and the wheat-plants stand somewhat unequally upon the surface. When the land is steep and stony, the horse-hoe cannot be used effectively, so that if the seed is drilled in, hand-hoeing must follow. The drill system is best adapted to level or gently rising ground that is tolerably free from surface stones, where the horse-hoe can work with ease and accuracy. On very steep land it is extremely difficult either to sow or drill with machines. It is therefore con-
sidered the best practice upon hilly land to keep the soil in good heart by a
course of green-crop husbandry, and have it perfectly clean, and to sow broad-
cast not earlier than Martinmas. When this is done, a good dressing of guano,
or nitrate of soda, should be given in spring, to start the plants before the weeds.

13. BROADCAST, DRILLING, AND DIBBLING.—The advan-
tages of broadcast sowing may be seen in the foregoing, which will
apply to analogous circumstances and conditions, but by far the
most perfect system of sowing grain is by the method of dibbling it
in. The difficulty of carrying the plan out on a large scale, and on all
kinds of soil, is the reason why it is not more universal. Some horse
dibbling machines are not well adapted to heavy soils, by reason
of their great weight and the liability in wet weather to deposit
seeds in a kind of muddy hole created by the process. On hilly
land the difficulty of draught stands in the way, while in the oppo-
site direction some dibbles are too light to be effectually used on
heavy land. Dibbling by hand is extremely efficient and all that
can be desired, but then it is out of the question in most districts,
owing to the want of hands to perform the task, so that as far as
the large farmer is concerned he has no choice between the drill
system and broadcast sowing.

Which of these two methods is the most suitable, each agriculturist must
determine for himself, and be guided by their applicability to his own soil and
circumstances. Modern practice has shown that, as a rule, the best results are
to be obtained by systematically following out the drill system of husbandry,
both as regards grain-crops and green-crops, from the opportunities offered of
thoroughly extirpating the weeds. The difference in the expense of the two
systems is too trifling to weigh in the favour of one or the other plan.

On heavy clays the most convenient way of drilling wheat is to
form the ridges of such a breadth as one bout of the drilling-
machine will cover. An eighteen-furrow ridge, which will be 13\frac{1}{2}
feet wide, can thus be sown with great accuracy in a lineal direc-
tion by one turn of a nine-coulted machine, both the crown of the
ridge and the open furrow affording two parallel lines to guide the
man who steers, for even if the machine has no steering apparatus,
the sowing can be done very well by the exercise of a little care on
the part of the driver, and with steady-going horses.

On clays that have been well-drained, and are not retentive, and
on any soil where rain-water and melting snow sink quickly, it is
best to have the surface as flat as possible, without open furrows,
and to drill across the seed-furrow, whether that has been press-
rolled or not.

14. HARROWING.—In every case where the seed-furrow has
turned up whole or moderately firm, a double stroke of the harrows
is required to bring the surface to a proper tilth for the free and accurate working of the drill-sowing machine. Should, however, the land be soft, and the furrow be much broken in ploughing, no harrowing previous to sowing is required, if the machine be made to cross the furrows.

The less harrowing any kind of land gets for wheat the better, as a fine tilth, so desirable in the case of spring-sown corn, is actually injurious to wheat during winter and spring. The seed should not be too deeply sown, as the plant thrives better, and is less likely to be thrown out, when the seed is placed from an inch-and-a-half to two inches below the surface, than if it is deposited at a depth of four or five inches. The reason of this is, that the roots go downwards when the seed is tolerably near the surface, but when far from it, a weakly stem struggles upwards towards the light through several inches of soil, and it will be seen, if examined some time afterwards, that new roots have been thrown out from it about an inch below the surface, and very often all the root below this point dies off; which shows plainly enough that all the growth that has taken place previously is merely the result of the efforts made by the young plant to get into a favourable position for throwing out healthy roots, which having accomplished, the part below, being no longer required, is dispensed with altogether; thus proving that a certain amount of vital force has been wasted.

15. SEASONS FOR SOWING.—Upon the state of the land as well as the season must the time depend for sowing winter wheat, it not being always in the farmer’s power to choose his own time for the operation; but it is generally considered advisable to put the seed in the ground as early as may be convenient in autumn, in strong soils it being not unfrequently sown in the latter end of September, though more frequently in the month of October or beginning of November.

The operation must naturally be determined by the nature of the soil, for wheat planted early on friable loams is apt to exhaust its vegetative powers so much as to grow weakly and languid at that time when vigour is most needed; and on poor soils, the plants being so rapidly deprived of their vegetative properties, become foxy.

The 10th of October is generally considered about the most appropriate time, but even then, if the land should be in such a moist condition as to impede the working of the cattle, or so dry as to risk the proper vegetation of the seed, the operation is delayed until November or December. As a rule, it may be assumed that strong lands should be sown from the middle of September to the
latter end of October, and those which are thin and shallow, generally speaking, from the latter part of October till the beginning of November.

On most soils early sowing is found to be decidedly advantageous, late-sown wheats being more likely to become mildewed. Even if they escape mildew, should the season turn out unpropitious, the crop will not ripen so soon by some days as the corn which is sown earlier.

16. QUANTITY OF SEED PER ACRE.—The quantity of seed per acre to be used necessarily depends very much upon the method employed in sowing, whether broadcast, drilled, or dibbled. Two-and-a-half, three, and sometimes as much as three-and-a-half bushels is sometimes used, but, as before stated, thick sowing is objectionable, except in a few exceptional instances; while in the methods of dibbling and drilling, the quantity is ruled by the distance at which the rows and holes are placed from one another; but experience mostly proves, in the majority of cases, that a distance of 7 to 8 inches is the best for drilling, and in dibbling about 8 inches by 3. Sometimes 2 to 2½ bushels are thus sown in drills, though 6 or 8 pecks are generally thought sufficient; and in dibbling from 5 to 8 pecks is generally thought sufficient.

17. WEEDING.—Weeding is often too much neglected, it being generally considered sufficient to rely upon the operations of harrowing and hoeing, which have been allowed to supersede hand-weeding. The saving effected in this way is not a judicious one, for there is no other way of getting the weeds out from spots where they are close to the wheat-plants than by plucking them out by hand, for they do the most damage when growing amongst the crop. This ought never to be neglected, for however clear the land may have been made, it can never be so effectually rid of weeds that they will not be found growing in the spring.

18. AFTER-HARROWING.—After a wet winter, on strong adhesive clay-lands the soil frequently becomes hide-bound, and the practice of harrowing is had recourse to in spring in order to loosen the surface. It is also resorted to when the crop is thin, with a view to encourage the plants to shoot out and fill up the vacancies; although, according to some, it is the means of occasioning mildew, while others fear the effects of the roots of the plants becoming torn. It can be done with the least risk of injury when the wheat has been sown broadcast, the benefit derived from the operation being that, when the crust formed upon the surface of the soil is broken, the ground is rendered more pervious to the covered root
of the plants, which, in a week or ten days after it is done, litter and spread out with great strength.

When this plan is pursued, harrows must be used of a weight proportionate to the tenacity of the land, and not heavy enough to tear up many of the roots, though only a small quantity may be considered immaterial. The proper time for doing this is when the crop begins to revegetate, which necessarily depends upon the climate and the state of the season, some time in February being generally the most appropriate upon good soils, and rather later in poorer ones. This is a point of some little nicety, for if it be done when the plants are in an inactive state, they may be rotted, and if delayed till they are too forward, it will check their growth. Nor should the practice be ever resorted to when the crop is root-fallen, for in that case the roller would be more appropriate than the harrow.

To harrow light soils that have been drilled for wheat, would be in-judicious, as the implement would strip the land too much in some places, while in others it would leave the plants untouched. In addition, these kinds of soils are not subject to become hide-bound, and the object in land of that description is to have it firm and binding about the roots of the plants, while this operation has the effect of weakening their hold upon the ground.

19. **Spring Wheat.**—It sometimes happens that owing to the rigour of the winter the young wheat appears in such a sickly condition as to present no prospect of a crop being obtained, particularly on poor soils lying in a low situation which have not been sufficiently drained, so that it is felt necessary to again break up the land, and re-sow it with spring corn.
This conclusion ought not to be arrived at too hastily, however, for after a few days of bright, warm weather, the plants may often be noticed to shoot forth and tiller out abundantly; and a very unpromising looking field, that at one time appeared to be worthless, has at harvest-time produced a good crop of corn.

When, however, there is occasion for spring-wheat to be sown, although too tender to bear the frost of a severe winter, it is as quick in its progress to maturity as any species of what is called Lent corn; but it is more exhausting than winter wheat, and while it can be grown on all wheat lands, it does not require so strong a soil as the winter kind, and the land should be equally rich, but not too dry.

20. TIME FOR SOWING SPRING WHEAT.—Spring wheat is usually sown from the latter end of March until the middle of May, but about the middle of April is to be preferred; a period more likely to escape the danger of white frosts, and yet standing a good chance of obtaining the benefit of those gentle showers in early spring which are so favourable for promoting vegetation.

The quantity of seed sown needs to be larger than is generally used in autumn, and if sown broadcast, from three to three-and-a-half bushels per acre are usually employed when put in alone, but if sown along with clover-seed, then two-and-a-half bushels, or nine pecks, are considered sufficient.

21. YIELD OF SPRING WHEAT.—Spring wheat comes to perfection about a fortnight earlier than the common species (Talavera wheat being the kind most commonly used in England perhaps) in warm summers, but it is inferior in productiveness. The difficulty of getting winter crops off the ground frequently compels the farmer to have recourse to spring wheat, rather than clear his ground prematurely; and whenever the land is in a wet state, it will be found a better plan to sow it when it has become mellowed by the frost, rather than sow autumn wheat in December.

22. STEEPING, OR PREPARATION OF SEED-WHEAT.—Wheat requires more care and management in the preparation of the seed than any other kind of grain, and after being thoroughly screened and sifted, it should be afterwards steeped to destroy the larvae of insects, and the germs of diseases to which it is subject.

Stale urine, or brine made of salt and water of a consistence to float an egg, as well as caustic lime, used to be prescribed for effecting this object, but although the practice may have been attended with a certain amount of benefit, it was certainly not effectual.

It is now usual to employ sulphate of copper (blue vitriol) for the purpose, which is made into a pickle, the quantity generally used being a pound-and-a-half, dissolved in two gallons of hot water, to one quarter of wheat; the liquid being allowed to cool before it is thrown over the wheat; all that is necessary being to dissolve the vitriol in hot water, as before stated, having the wheat
spread out on a stone floor at the depth of about six inches, sprinkling the liquid equally over it, and then mixing it thoroughly up with malt-shovels until the wheat has acquired an uniform degree of dampness. Although it will be ready for sowing in the course of two or three hours, it is better to allow a clear day to intervene before using it.

Some farmers keep their seed-wheat for months dressed in this way before sowing, the vitriol appearing to have the power of protecting it against atmospheric influences. It is not considered safe to keep this pickled wheat for a longer period than four months without sowing, although there is little risk of injuring the wheat by an over-dose of vitriol.

Arsenic has frequently been employed for this purpose with great advantage, but its virulently poisonous nature causes it to be a very dangerous agent to employ, and frequent accidents have happened to those who have had recourse to it, while blue vitriol is equally powerful, and not dangerous to use.

23. Top-dressing Wheat.—Opinion appears to be divided as to the special effects resulting from top-dressing wheat with guano, and nitrate of soda; which doubtless is occasioned mainly by differences in soil, climate, and the time of their application, which ought all to be taken into account when comparative experiments are made and comparisons instituted.

In the case of a clay soil, if separate dressings of guano and of nitrate of soda are applied in early spring, the guano, in consequence of its less soluble and less active nature, and thus lasting longer, will be considered the better of the two; but, if put on the land later in the spring, the effects of the nitrate will be considered most favourable on account of the latter pushing the young plants forward. But these being exceedingly tender, are often much injured by the frosts which sometimes have a very prejudicial effect in early spring; while, when applied later, these casualties do not take place and the full beneficial effects of the nitrate are obtained without the drawback specified. When the weather is dry, late applications of nitrate of soda will therefore be found to answer better than guano as a top-dressing for wheat.

Some farmers prefer a mixture of both guano and nitrate of soda; and on land having a clayey texture, or a subsoil that is damp, a dressing of rape-cake and guano mixed will be found to be very advantageous at the time of sowing the seed, whether it be done at autumn or in winter.

On light land, an application of this sort is not seen so plainly in its spring effect; and often there is scarcely any difference to be noticed between the
dressed and the undressed portions. Where the soil is weak, it is found of great advantage to give the wheat-plant a stimulant to push it along during the winter, and for this purpose it has been found very efficacious to drill in with the seed a hundredweight-and-a-half of the best Peruvian guano, mixed up with it; and to follow it up by a top-dressing of one hundredweight of nitrate of soda rather late in the spring.

When using nitrate of soda as a top-dressing for wheat, an improvement will be found to result in the strength and brightness of the straw by mixing common salt with it: this is also said to prevent lodging and mildew, which is thought to be caused by the absorption by the plant of a larger quantity of soluble silica for use in the formation of the stem than it would otherwise obtain; but salt should only be used in inland situations.

When a mixture of guano and nitrate of soda is used, there is an advantage arising from their being incorporated a week or two before being applied, as the lighter and more minute particles of the guano are absorbed, and the mass made more soft and moist, which will admit of its being sown broadcast without the guano-dust blowing about in every direction; besides causing the nitrate of soda to be more intimately blended with the guano, and thus allow of being more evenly laid over the surface than when used alone.

24. DISEASES OF WHEAT.—All plants are liable to some kind of disease or other, but wheat appears to be subject to more than any other species of grain, as well as the attacks of numerous tribes of insects; variations of the atmosphere; and influences of the soil.

Some of the Infusoria, as that of vibrio, after having been dried for six years have been reanimated by water. The minute eggs of vibrio tritica are introduced with the sap from the infected grain, and hatch in the germen. The cavities of the grain, when filled with these, form balls of white silky fibre, which, when dissolved in water, liberate hundreds of worms; the principal diseases to which wheat is subject being bunt, smut, rust, chlorosis, ergot and mildew, several of them being vulgarly comprehended under the generic term of “blight.”

25. MILDEW.—Mildew is a disease which affects the ear, though it is also injurious to the straw, and has been sometimes called the “spotted distemper.” Its presence is due to the attack of a parasitic fungus, which is produced beneath the surface from a branched mycelium, and proceeds through the cuticle in the form of either a little brown or black sore, composed of clavate threads
The Crops of the Farm.

divided above into two cavities, filled with a grumous mass, and a
large oil globule. In an early stage of its appearance the swollen
heads of the filaments are undivided, and it is then distinguished
by botanists by the name of *Uredo linearis*, and is, in reality, a kind
of fungus.

It seldom makes its appearance until about the period of ripen-
ing, but when it has fairly taken possession of a crop it prevents
both straw and ear from making any further progress, and is due
to climatic causes, heavy crops being more subject to its ravages
than light ones, on account perhaps of the greater stagnation of the air.

There seems to be no method of avoidance, and it is generally considered that mildew must
be looked upon as one of those unavoidable dis-
asters which no prudence can guard against, the
best-cultivated farms often suffering the most
from it. Peach and grape mildew have been suc-
cessfully treated with sulphur.

**36. RUST.**—Called as well Red-gum,
Red-rag, and Red-robin, is produced by
a species of fungus known to botanists
by the name of *Uredo rubigo*, consisting of
fine myceloid threads running amongst
the tissues, and giving rise to ovate,
slightly echinulate spores, seizing on the
leaves and straw and withholding the
current of the sap until the plant is in
a great measure exhausted, which causes
the grain to be imperfectly filled and the
weight of the crop lessened.

Like the mildew, there is no remedy known
that can be applied to guard against rust, but it
is thought that rank manures tend to aggravate
the disease.

**27. BUNT.**—(Smut-ball, Pepper-brand, and Brand-bladders.)
Also in some districts termed Collibrand and Dustbrand. Bunt is
a fungus generated in the ovarium of wheat, and used to be one of
the most formidable scourges to which wheat is subject, but it sel-
dom does much injury at the present day, unless the seed-wheat
has been neglected to be steeped, and by careless cultivation. In
some cases the husk bursts, and the black powder is dispersed by
the wind and rain, and in others it remains entire, and is cut,
carried, and threshed with the bulk of the crop.
Its infectious nature may be judged from the fact that bunt may be produced at pleasure by merely rubbing the grain with spores. Careful washing and the choice of good seed go far to prevent mischief, but this is not enough, it being necessary to use some chemical agent. Salt is used by some farmers, while others apply a dressing of quick-lime, mixed with boiling water poured hot upon the seed-corn; but sulphate of copper (blue vitriol) is undoubtedly the best ingredient to use for dressing the seed. Two ounces or more to the bushel is recommended to be used.

Arthur Young has mentioned that, in one year when bunt was extremely prevalent, certain crops that had been grown from seed saved from a wreck, too much damaged by sea-water to be used for food, were entirely free. Nothing, however, will be found so effectual for destroying the vegetative powers of the bunt spores as the blue vitriol.

28. SMUT.—Smut is often confounded with bunt not alone by many agriculturists but by many writers as well, who describe it as a stinking powder which, in the form of a disease, is almost peculiar to wheat. But the dust of smut is free from that nauseous smell that characterises bunt, and barley, oats, millet, and several kinds of grasses are subject to this disease, which often locally goes by the terms that are assigned as above to bunt, and the same remedies that are effectual against the latter (steeping the seed) are said to be so to a less degree with smut.

There are certain conditions of the weather in sudden changes, when "blight" is said to be produced, and it affects corn when the sun shines hotly in a still air, and the atmosphere becomes suddenly overcharged with fog, or mist; or when, after a hot day and night, the vapours, in consequence of the great amount of exhalations from the summer vegetation, appear to hang over the surface of the earth in a cloud; and these are the times when "blight" is supposed to make its appearance; but there are attacks to be feared both from vegetable fungi as well as from insect enemies.

29. INSECTS DESTRUCTIVE TO GRAIN CROPS.—In every stage of the growth of wheat the crop suffers from the attacks of insects. In the spring the wire-worms commence their ravages, the true wire-worm being produced by the click-beetles, which lay their eggs in the field, where they become larvae or wire-worms, and afterwards turn into the perfect click-beetle. Partridges, wagtails, robins, blackbirds, and thrushes keep these down, and there are numerous remedies for destroying them. The larvae of crane flies are also injurious, and the young blade is subject to the attack of three kinds of slugs (Limax agrestis, ater, and maximus.)
The crops of the Farm.

The maggots of little flies (Chlorops lineata, teniopus, and oscinis vastator) eat into the central stem and destroy the ear, whilst the larvae of beetles turn their attention to the stem. The maggots of the wheat-midge injure the forming grain, as well as corn-bugs, while the ripening grain is preyed upon by the caterpillars of the wheat-moths, and the larvae of a ground-beetle (Zabrus gibbus) is very destructive to young wheat, both in winter and spring; while the ear-cockle, as before described, is due to the presence of the small worms called Vibris tritici.

By liberal dustings of unslaked lime, the slugs may be got rid of; as well as by resorting to the other methods usually pursued to destroy them. To reduce the wheat-midge, the seed-grain should be sifted, and the refuse burnt, in which the larvae and pupæ are to be found; yet many of these pests are too minute and numerous to be dealt with, but they have, fortunately, natural enemies of their own order, amongst which is the small four-winged fly (Proctotrupes), whose larvae live in the wire-worms. Platygaster, tipulae, and insecans, as well as other minute flies, accompany the wheat-midge and feed upon its larvae and pupæ, as well as others, who in their turn fall a prey to their own peculiar enemies. By painstaking cultivation and dressing the seed-wheat, as well as being very careful in the management and choice of it—which would always pay well to grow separately—immunity from a great many scourges may, if not altogether obtained, be partially secured, and to the practice of these we would commend our readers.
CHAPTER II.

WHEAT.—(Continued.)


30. TIME OF HARVESTING.—The time of harvesting necessarily depends upon the state of the weather, and varies considerably in different seasons; but it is generally from the middle of July till the end of August.

Wheat should be cut as soon as the grain has passed from the milky to the doughy state; for, if deferred later, the grain is thick-skinned and lighter in weight per bushel, and is likely to become discoloured by rain, either before being cut, or in the stook, and is more likely to sprout.

A good deal of loss is doubtless annually incurred in this country by allowing wheat to get dead ripe before it is cut. No matter if the straw be green for some distance downwards from the ear; if, when selecting some of the greenest heads, the kernels can be separated from the chaff when rubbed through the hands, it is a sure sign that the grain may be reaped with safety.

31. REAPING.—At one time the sickle was the only implement employed for reaping wheat, the scythe only being used upon oats; but not only has the scythe been very largely resorted to of late years, but wheat is now very generally cut by machinery, which commences upon the outside of the field and passes all around it till the whole is cut down; and, as we have before described, there are some machines which bind at the same time.

With respect to a comparison between the two older methods of reaping corn, it is cut down closer to the ground by the scythe than the sickle, and less waste is caused when the grain is over-ripe, besides which the straw is not crushed so much by the hand as in reaping with the sickle; and, being less compressed, the
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grain is more open to the action of the air, and consequently dries more readily, and becomes sooner fit for the stack.

32. STACKING.—At one time grain used to be commonly stored in barns; but when put up in a well-built circular stack, with a properly-tapered, well-thatched roof that will keep out any amount of rain, wheat will both keep better and dry sooner than when stowed away in the barn.

In building a round stack, a sheaf is first placed upright on its butt-end, as nearly as possible in the centre of a circle, around which other sheaves are placed in a circular fashion, also upright, with their tops inclining inwards, until the bottom or site of the rick is nearly filled. The stacker then places an outside layer of sheaves on their sides, with the ear-end inwards, but leaning obliquely against the upright sheaves, and, pressing them together with considerable force, he continues to lay on rows, with their butts outwards, till he has raised the outside of the rick to nearly the height of the standing sheaves. He then fills up the whole of the stack in nearly the same manner, with the corn-ends of the sheaves inwards, with a regular slope downwards and outwards to their butts; the centre of the rick being always kept somewhat higher and less compressed than the outer layers.

Attention to the proper sloping of the sheaves is very necessary from the beginning, but particularly so at the inner layer, that part requiring to be left more open. Completed so far, an outside circular row of sheaves is then put on, with the butt-ends projecting a few inches beyond the body of the rick, so as to form its eaves; and after those are laid, every successive row of outside sheaves is placed gradually more inwards until the roof is drawn to a narrow circle, when two or three sheaves are placed upright in the centre, which they fill up completely. The topmost sheaves are then firmly bound by two or three turns of the middle of a straw-rope, the two ends being fastened securely on the opposite sides, so as to secure the crown from the effects of the wind.

33. COST OF CROPS FROM SEED-TIME TO HARVEST.—The cost of raising a crop of wheat varies, as may naturally be supposed, according to the system and methods pursued in cultivation. One farmer, by liberally manuring and sparing no expense in cleaning his land and getting it into first-rate condition, will expend much more money upon it than one who pursues a more niggardly system; and again, forming as it does part of the course of a rotation, it is difficult to fairly estimate the exact cost of any particular crop; for, as
Wheat.

before described, when the land is rich and in high condition, nearly all the manures may have been applied to the green crops, and very little to the wheat; while others, on account of the nature of their land, have to use a good deal of manure, and give top-dressings to their wheat as well.

Mr. Mechi estimated his wheat-crop per acre some years ago to cost as under—but then farm-labour was considerably cheaper than it is now; whereas, on the other hand, labour-saving contrivances in the shape of steam and other machinery in use upon the farm should tend to keep down what otherwise would be much higher estimates.

The following are the particulars furnished by Mr. Mechi:

<table>
<thead>
<tr>
<th>Description</th>
<th>£  s.  d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One ploughing</td>
<td>7 0</td>
</tr>
<tr>
<td>Two harrowings and one rolling</td>
<td>2 6</td>
</tr>
<tr>
<td>13 bushels of seed</td>
<td>7 0</td>
</tr>
<tr>
<td>Two horse-hoeings</td>
<td>2 0</td>
</tr>
<tr>
<td>One hand-hoeing</td>
<td>3 6</td>
</tr>
<tr>
<td>Weeding</td>
<td>2 0</td>
</tr>
<tr>
<td>Cutting (with bagging-hooks)</td>
<td>9 0</td>
</tr>
<tr>
<td>Carting and stacking</td>
<td>3 6</td>
</tr>
<tr>
<td>Thatching</td>
<td>1 6</td>
</tr>
<tr>
<td>Taking in, threshing, and dressing five quarters</td>
<td>10 0</td>
</tr>
<tr>
<td>Carting to market</td>
<td>3 4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£2 12 4</strong></td>
</tr>
</tbody>
</table>

To this should be added an expense of 3d. for pickling the seed-wheat with blue vitriol, and the cost of drilling the seed, which may be set down at 1s. 6d. per acre. To this the rent of the land, rates, &c., and interest of money must be added. Five quarters also is a greater yield than is usually obtained.

34. COST OF LABOUR PER ACRE.—The cost of labour per acre varies a good deal in different districts, but the old scale of cost per acre for labour upon the broadcast system used to be fixed somewhat as under:

<table>
<thead>
<tr>
<th>Description</th>
<th>s.  d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One ploughing</td>
<td>7 6</td>
</tr>
<tr>
<td>Sowing</td>
<td>0 3</td>
</tr>
<tr>
<td>Harrowing (three single strokes)</td>
<td>1 6</td>
</tr>
<tr>
<td>Clearing out water-furrows</td>
<td>0 2</td>
</tr>
<tr>
<td>Harrowing with light harrows in spring</td>
<td>0 3</td>
</tr>
<tr>
<td>Rolling</td>
<td>0 6</td>
</tr>
<tr>
<td>Weeding</td>
<td>0 9</td>
</tr>
<tr>
<td>Reaping</td>
<td>7 6</td>
</tr>
<tr>
<td>Carting and stacking</td>
<td>3 6</td>
</tr>
<tr>
<td>Thatching</td>
<td>1 6</td>
</tr>
<tr>
<td>Threshing and dressing four quarters</td>
<td>5 0</td>
</tr>
<tr>
<td>Marketing</td>
<td>4 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£1 12 5</strong></td>
</tr>
</tbody>
</table>
3.2

The Crops of the Farm.

These kinds of figures and calculations can, however, only be made approximately, for they must ever be extremely various.

Much higher rates than these, however, used to be estimated—the expense of reaping, threshing and marketing being considered to amount to £1 18s., made up upon the following calculation, where it will be seen the threshing is put down at 12s. per acre, which would thus be done by the flail, and reaping at 12s. per acre, —which are very high estimates:

<table>
<thead>
<tr>
<th>Item</th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaping</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Carting and stacking</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Thatching</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Threshing (three quarters per acre)</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Winnowing</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Binding straw for market</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>£1</td>
<td>18</td>
<td>0</td>
</tr>
</tbody>
</table>

The last item is also a somewhat heavy one.

35. PREPARATION FOR MARKET.—When grain is measured for market, there is some degree of knack in doing it properly, for it is known by experience that when a bushel measure is filled by degrees in small quantities, it takes a larger quantity than when the measure is filled up at once. The grain should not be poured forcibly into the measure, nor filled up high above the rim.

All grain shrinks when held for any length of time in a storehouse, and although weighing more per bushel when this is the case, yet the additional value gained in the weight will by no means make up for the loss in the measure.

36. THRESHING.—The old-fashioned flail was the occasion of a great waste of power, and now all wheat is threshed out by the threshing-machine (of which there are various celebrated makers), which performs the operation expeditiously and in the most effective manner.

Those farmers who do not possess a threshing-machine of their own may easily hire one, and machines are now commonly used that cut up the straw into chaff, at the same time that the grain is being separated from the ear; doing both threshing and winnowing at the same time. The corn is thus taken from the stack by one method, and the sheaves are untied and placed in the cradles of a sheaf-elevator. The corn is then carried up to the feeding-board of the threshing-machine, when a man delivers it with its ears inwards to the drum, which strips the grain from the straw, and then pushes the straw on to the shaker, so that all the loose grain is shaken from amongst it.
The greatest part of the corn passes through the open spaces of the concave, and falls, together with that from the shaker, into the hopper of the winnower. This winnower takes out the roughest portion of the chaff, and then delivers the partially-cleaned grain to an elevator, by which it is carried up to the hopper of a dressing-machine. From a spout on one side of the winnower, the pugs, loose ears, &c., are taken up by an elevator, and delivered again to the drum, so that at the finish of the work nothing is left uncleaned. All remaining light chaff and dirt is removed by the dressing-machine, to which a hummeller is attached for rubbing the awns off barley, and the grain then falls into a screen, that removes any stones that may be amongst it, and subdivides it into such samples as may be required, and drops it into the sacks. While all this is being performed with the grain, the straw is not left uncared for, but is thrown from the shaker on to a travelling-band and conveyed to a machine, where it is at once cut up for litter or feeding purposes; and thus the whole work of threshing and preparing the grain for market is done at one and the same time.

37. WHEAT-STRAW.—Of the value of straw in making manure it is unnecessary to speak here, but as food for stock, straw has lately received a much larger amount of attention; and although the straw of oats is usually preferred, as being softer and more palatable to cattle, it is supposed by many that the straw of wheat is the most nutritive, and it is considered the best for steaming or cutting into chaff. It is coarser, but appears to contain more saccharine matter, and, when used with turnips, cattle are found to thrive upon it. The dry fibre of straw tends very materially to correct the watery nature of turnips, and it is now largely used by many stock-keepers to great advantage.

The composition of wheat-straw is as follows:—

| Nitrogenised substances which produce muscle | 185 |
| Heat and fat producing matters, free from nitrogen | 26-34 |
| Mineral substances, as silica | 4-59 |
| Water | 26-00 |
| **Total** | **100-00** |

38. WINNOWING-MACHINE.—The first winnowing-machine was brought from Holland, in 1710, by Fletcher of Saltoun; and a forcible illustration of the amount of prejudice that had to be combated against the introduction of machinery in farm-operations, is shown by the fact that its use was publicly denounced from the pulpit as impious.
Sir Walter Scott, in "Old Mortality," has humorously made use of the innovation upon old-established usages by the institution of labour-saving contrivances, in a sentence which would appear faithfully to represent the spirit of the times:

"Your leddyship and the steward hae been pleased to propose, that my son Cuddie suld work in the barn wi' a new-fangled machine for dighting the corn frae the chaff; thus impiously thwarting the will of divine Providence, by raising wind for your leddyship's ain particular use by human airt, instead of soliciting it by prayer, or waiting patiently for whatever dispensation of wind Providence was pleased to send upon the shealing hill."

There are now very perfect and complete winnowing machines, both separate from, and attached to threshing machines; but the common winnowing machine consists of a number of sieves, on which a current plays from a revolving fan, above which is the hopper containing the mixed seed and chaff that are to be separated.

The contents of the hopper are made to fall upon the sieve, and during the fall, and while acted upon in the riddles, the lighter portion is carried away by the wind, and the heavier portion that passes through the meshes of the sieve is the result of the process, which thus separates both bulky and light matter from the grain. The size of the mesh and the force of the wind are the agents which bring about this result; and there are ingenious arrangements devised for effecting this object, in the shape of a separator, consisting of an open cylindrical framework, covered by wire-work of different sized meshes; and by an arrangement of slides, the grain, as it falls, is separated the heavy from the light; it also separates the falling grain from straw and chaff, directing each to its own place.

**39. GRINDING.**—The grinding of wheat more properly belongs to the business of the miller than the farmer, but there are three methods of applying motive power for this purpose besides that of horses, viz.: by means of the water-wheel, the wind-mill, and steam. Water is cheaply made use of for grinding purposes, where it is found convenient, and thought necessary to employ it; but the wind-mill has almost passed out of the list of agricultural appliances in common use, having given place to steam, and where that is resorted to upon a farm, all that is required is to attach a driving-band to the engine, which will work any mill or grinding apparatus that may be required to be set in motion, and in one form or another can be made to do most of the work of men's hands.

**40. HOW TO JUDGE OF WHEAT.**—It requires a certain amount of experience to judge weight correctly, and accuracy of judgment can only be attained by long experience. Yet this can be definitely ascertained by those accustomed to handle samples, who can guess within a pound or two to the bushel of its actual weight.
The method of forming a correct estimate as to the quality of wheat, is by retaining the sample for a minute or two in the closed hand, and then to pass it gently through it, with a view of ascertaining whether the grain feels plump, dry, hard, and smooth, with a kind of mellow fullness to the touch. If it does not slip readily through the fingers, but handles rough, and sticks as it were to the hand, it will be found thick-skinned, damp, and will not turn out profitably to the miller.

The smell should also be particularly noticed, for if there is the least taint with it, it is a sure sign of its having been either damp or heated. It should also be narrowly inspected, to see that the grains are of a nearly equal size, and of a bright healthy appearance, unmixed with seeds of weeds, or smutty or sprouted corn.

41. ANALYSIS OF FLOUR.—The constituents of wheaten flour vary a good deal, but their average may be taken somewhat as under:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gluten</td>
<td>12.8</td>
</tr>
<tr>
<td>Albumen</td>
<td>1.8</td>
</tr>
<tr>
<td>Starch</td>
<td>59.7</td>
</tr>
<tr>
<td>Gum and sugar</td>
<td>7.2</td>
</tr>
<tr>
<td>Oil</td>
<td>1.2</td>
</tr>
<tr>
<td>Cellular fibre</td>
<td>1.7</td>
</tr>
<tr>
<td>Mineral matters</td>
<td>1.6</td>
</tr>
<tr>
<td>Total</td>
<td>14.0</td>
</tr>
</tbody>
</table>

42. NUTRITIVE PROPERTIES OF FLOUR.—The principal nutritive value of flour depends upon the amount of gluten it contains, which tends to form muscle, and in different samples of wheat the amount of gluten varies considerably. Foreign flour mostly contains more gluten than English; Polish and Egyptian generally ranking the highest. The chief constituents of its average composition may be summed up thus:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flesh-forming, or nitrogenised substances</td>
<td>14.6</td>
</tr>
<tr>
<td>Those fitted to sustain animal heat, and the formation of fat, consisting of non-nitrogenised substances</td>
<td>69.8</td>
</tr>
<tr>
<td>Inorganic matters</td>
<td>1.6</td>
</tr>
<tr>
<td>Water</td>
<td>14.0</td>
</tr>
</tbody>
</table>

43. ADULTERATION OF FLOUR.—Flour has at times been adulterated with plaster of Paris, and similar substances, but these barefaced impositions are seldom practised, the adulteration consisting for the most part of mixing good with inferior kinds, and in-
ferior meal. Bakers like to mix foreign with English flour, and, to
some extent, the necessity of mixing wheat for grinding purposes is
dependent upon mechanical considerations.

In the country, wheat when ground is usually separated into fine flour boxings,
sharps or pollard, and bran. In London, where a great deal of wheat is ground
into flour by steam-mills, the millers divide it into a greater number of qualities,
the value of the wheat to them chiefly depending upon the quantity of fine flour
it will yield. Thus we have fine flour, seconds, fine middlings, coarse middlings,
pollard, twenty-penny, and bran; and as some descriptions of wheat furnish a
larger proportion of fine flour than others, they fetch a correspondingly higher
price in the market.

The flour made from wheat that is cut before it is quite ripe is
whiter than that from fully matured grain, and consequently bears
also a higher price; so that, if intended for the miller, wheat should
be reaped before it has attained its perfect growth, but that inten
tended for seed should stand until the last moment it can safely be
defferred to.

In ordinary practice, the divisions of ground wheat into their
various degrees of fineness may be summed up as under, reckoning
the bushel to weigh 60 lbs.:—

<table>
<thead>
<tr>
<th>Fine flour</th>
<th>Household flour</th>
<th>Pollard</th>
<th>Bran</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

or 48 lbs. of flour of two qualities.

44. USES OF FLOUR.—Flour is chiefly used for making bread,
but a large quantity is also disposed of for manufacturing purposes,
in dressing goods, and for making size; buntty or smutty wheat
finds a market with the gingerbread makers, to whom colour is not
a main object, and low price a temptation.

45. VARIETIES OF BREAD.—Bread made of the flour of
spring wheat is more nutritious than that from winter wheat, on
account of its containing a larger quantity of gluten. The finest
flour makes what is termed the best white bread; the second quality
the household, or inferior, and the brown bread is made by includ
ing the coarser particles as well in the loaf. The husk of wheat
contains about 6 per cent. of oil, but in fine flour there will not be
found more than 1 per cent.; it also contains a larger amount of
protean compounds. In consequence, bread made of fine flour
is not so nutritious as that made from the whole grain.

46. MARKETS FOR WHEAT.—The markets for wheat are very
numerous all over the country, each county and division of county
furnishing one or more; the prices at which wheat is sold being
regularly reported every week in the *Times* and other newspapers, while large quantities of foreign grain are imported into London, and the chief seaport-towns.

47. **IMPORTATIONS.**—These importations of wheat are now made upon a very large scale to England from all the wheat-growing countries; even those kingdoms like France, which, in certain years, do not grow much more than is required for their own consumption, sending their surplus over here in bountiful years; while in America vast quantities are regularly grown with a view to its shipment to England, as well as the countries of Northern Europe, and some parts of Asia.

48. **CULTIVATION OF WHEAT ABROAD.**—Agriculture, taken altogether, is in a much lower state as regards corn growing in France and Prussia, than in England; and with every advantage both of soil and climate, the produce of cereal food per acre is perhaps not much more than half that of Great Britain; and although we have such large supplies sent us from Northern Russia, agriculture is still in the lowest condition in Russia.

The Don and the Volga, which traverse the vast steppes of south-eastern Russia for 2,400 miles, carry to the ports of the Black Sea and the Sea of Azoff large quantities of wheat; while from the extreme north the rivers Dwina, Onega and Mezene bring corn to Archangel. But in Russia the produce per acre is but very meagre in consequence of the slovenly method that is followed in preparing the land, the same grain being sown year after year without manure; for in the plains of south-eastern Russia wheat seems to be almost an indigenous plant.

In some parts of the interior of Russia the land is sown with the seed shelled at harvest, and very little trouble is bestowed upon it, beyond merely covering it over with the plough.

Wheat is largely cultivated in the Dominion of Canada; Canada-West sending large supplies, via Chicago, by the Erie Canal and Hudson River to New York, from whence it is shipped to Europe; while, as the railroad traverses some of the States of the Union, a passenger may sometimes see growing a continuous area of wheat in an unbroken length for a hundred miles.
CHAPTER III.

OATS.


49. **NATURAL HISTORY.**—The oat-plant belongs to the order *Avena*, a genus of grasses appertaining to the division with two-flowered spikelets, whose glumes are as long as their florets, or nearly so, and whose pales—usually surrounded by stiff hairs—are furnished with an awn, both twisted and knedd.

There are fifty or sixty species enumerated by botanists, but there may be considered to be only five important ones, so far as its cultivation in the form of grain is concerned. These are *A. sativa*, or Common oat; *A. strigosa*, or Bristle-pointed oat; *A. nuda*, the Naked oat (Pilcarn or Peclcarn); *A. orientalis*, Tartarian oat; and *A. brevis*, or Short oat. To these cultivated kinds must be added a troublesome wild species in addition, that is often found infesting corn-fields, known as the Haver, or Wild oat, that is familiar to most agriculturists, being apt to get mixed with barley; flowering in June and ripening in July before the corn amongst which it is growing is ready to cut, and this should be picked out by hand.

The native country of the oat-plant appears to be unknown, but it is supposed that the five sorts named, which include all the cultivated ones, have had a common origin, and most likely originated in Mesopotamia, or Persia; for though from its hardiness the supposition might be entertained that it had a more northern origin, no trace of it in a wild state has been discovered in any cold climate, while a species has been found on the banks of the Euphrates growing naturally.
Oats

30. VARIETIES.—There is a list of fifty different varieties of oats, which have been arranged in the following order by botanists.

*Avena sativa*, Cultivated oats:—

**WHITE SPECIES.**

<table>
<thead>
<tr>
<th>Potato Oat.</th>
<th>Drummond Oat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy Oat.</td>
<td>Cupar Grange, or Grange of Bothrie.</td>
</tr>
<tr>
<td>Hopetoun Oat.</td>
<td>Blainslie Oat.</td>
</tr>
<tr>
<td>Early Angus Oat.</td>
<td>Georgian Oat.</td>
</tr>
<tr>
<td>Shirreff Oat.</td>
<td>Early Kent Oat.</td>
</tr>
<tr>
<td>English Berlie Oat.</td>
<td>New Early Essex Oat.</td>
</tr>
<tr>
<td>Scotch Berlie Oat.</td>
<td>Blue Major Oat.</td>
</tr>
<tr>
<td>Barbacklaw Oat.</td>
<td>Malbichill Oat.</td>
</tr>
<tr>
<td>Cumberland Early Oat.</td>
<td>Loudon Dun Oat.</td>
</tr>
<tr>
<td>Friesland, or Dutch Oat.</td>
<td>Danish Oat.</td>
</tr>
<tr>
<td>Old Poland, or Tam Finlay Oat.</td>
<td>Three-grained Oat.</td>
</tr>
<tr>
<td>Dyock, or Davidson's Oat.</td>
<td>Argyleshire Oat.</td>
</tr>
<tr>
<td>Flemish Oat.</td>
<td>Cleland Oat.</td>
</tr>
<tr>
<td>Kildrummy, or Halkerton Oat.</td>
<td>Lancashire Witches Oat.</td>
</tr>
<tr>
<td>Siberian, or Early White Oat.</td>
<td>Tuscan Early Oat.</td>
</tr>
<tr>
<td>Strathallan, Irish or Earish Oat.</td>
<td>Church's, or Churrick's Oat.</td>
</tr>
<tr>
<td>Late Angus Oat.</td>
<td>Hanging-side Oat.</td>
</tr>
<tr>
<td>Grey Angus Oat.</td>
<td></td>
</tr>
</tbody>
</table>

Black Dun, or Red-coloured, and Parti-coloured species:—

| Common, or Old Black Oat. | Brown, or Archangel Oat. |
| Common Dun Oat. | Red Essex Oat. |
| Winter Dun Oat. | Orleans, Early Brown Oat. |

*Avena orientalis*, White species:—

| Common White Tartarian Oat. | Early White Tartarian Oat. |

*Avena orientalis*, Black species:—

Early Black Tartarian Oat.

*Avena fatua*, or Wild oat, sometimes sown for making oat-hay:—

| Common Wild Oat. | Markel Bearded Oat. |
| *Avena brevis*, Short oat:— | |
| *Avena nuda*, or Naked oat (not cultivated):— | |

Common Naked Oat. | Small Naked Oat.

*Danthonia strigosa*, Bristle-pointed oat.—The smallness of the grain in this instance renders it unfit for cultivation, except on poor mountainous land where nothing better can be grown. It is capable, however, of much improvement. Lastly, *Avena sterilis*, Animal or Fly-oat, which is only grown as a curiosity in occasional instances.

Many of the above-mentioned varieties have sprung from the same stock, their difference arising from various circumstances caused by the influences of soil, and different methods of cultivation; as the *Hopetown* Oat, a variety of the Potato species which was brought forward in East Lothian by Mr. Shirreff, to
whom the silver medal of the Highland Society was awarded, which, although derived immediately from the Potato stock, now claims a separate title.

51. TEMPERATURE BEST SUITED FOR THE CULTIVATION OF OATS.—Oats grow freely in all temperate climates, but are especially adapted to those having a somewhat humid atmosphere, and a low and equal range of summer temperature.

Ireland, Scotland, and the north and west of England, are the best districts for growing oats in the United Kingdom; in the drier divisions of the east and south-east oat-growing having always been subordinate to that of wheat and barley; though in any damp soil oats do well. Scotch oats generally rank the highest in the market, both the soil and climate of Scotland being favourable for the growth of oats.

Although they suffer like all other grain from bad weather, yet they recover more readily when it changes, and consequently in moist climates they are a more certain, as well as a more profitable crop than wheat.

52. MOST SUITABLE SOILS.—Oats are generally found a capital crop to follow clover that has stood for two years, and they are sometimes sown with the clover; but they are more apt to shade the ground than barley, and are, in consequence, more likely to smother the young grass-seeds.

The county of East Lothian appears to be peculiarly well adapted for the growth of oats, larger crops of the grain being produced there than in any other part of the United Kingdom, although the soil varies considerably in its physical character.

All soils that are of a deep and alluvial nature, provided they are not too stiff, or adhesive, are favourable for the production of oats. For good land, the early and superior varieties of oats are best adapted, such as Yootah, Poland, Shirreff, Bertie, Early Angus, and some few others. The deeper and blacker the soil, the better for these varieties.

The Tartarian, the Black and the Red oat, are best adapted to
mountainous districts and situations, where the climate is late; and however poor a soil may be, the seed should always be procured from a poorer one still wherever it is practicable. The poor soils are included amongst light gravelly land, situated in the neighbourhood of mosses, sandy land, chalk-oolite soils, and poor cold clays.

The best soils are those consisting of rich, reddish-coloured clay loams; deep black alluvial land; well-drained fen land; and hazel-coloured loams, which are often of a great depth. Upon these soils heavy crops of oats can be grown; ten quarters per acre being sometimes raised, weighing 48 lbs. to the bushel.

Nothing perhaps varies more in both quality and quantity than oats, which depend very much upon the nature of the soil, and the mode of management, as well as the varieties of the species cultivated; and thus, in some situations, a crop of not more than 28 bushels per acre is expected, while others yield five quarters, and some again from six to eight.

The medium-class soils are, however, those most commonly at the command of cultivators, consisting of clay land that has been thoroughly drained, light loamy land, medium trap soils, and reclaimed peat soils, and the most suitable soils for oat cultivation appear to be those where vegetable matter has a tendency to accumulate when laid in grass; and where the climate is cool and moist. Under such conditions the oat crop is usually abundant, and a profitable one to grow, and no grain succeeds on peaty or high-lying soils except oats, that can be at all profitably grown.

53. LEADING CHARACTERISTICS OF DIFFERENT VARIETIES.—The Blainslie oat is the most common variety sown in the south of Scotland, being earlier than the common varieties of oats, while the Drummond oat is the one perhaps most in favour in the central parts, comprising the counties of Fife, Kinross, Stirling, Dumbarton and Bute, being a variety well adapted for heavy clay lands in high condition. It is shorter-strawed than the Late Angus, and ripens about a week earlier.

The Late Angus is commonly grown in the north of Scotland, and is well adapted for growing upon all kinds of clay land situated in an early climate, the straw being tall, strong, and not easily lodged, and does not shed its seeds in high winds that would do much damage to some other crops. It is a kind, however, seldom met with in England.

There are two varieties of the Berlie oat—English and Scotch; the English standing well and being more prolific than most early sorts, and is a good variety for all descriptions of rich soils.
The Scotch Berlie is later in ripening, is not easily shaken, and is better adapted for light soils, the straw being of excellent quality, making good fodder.

The Potato oat for a long time was a favourite variety, and owes its name to having been originally found growing in a potato field in Cumberland; but newer varieties have usurped the place it once used to occupy in many districts.

It has a fine compact ear, round, short, and very fine seeds, with thin husks, and straw inclined to be rather short. It grows very fast when free from tulip-root, to which it has a tendency, and tillers freely, which causes it to need to be sown thinly. It sheds its seeds easily, and there is often a loss incurred in reaping, and on this account it should be cut a little green, as it will ripen in the sheaf without injury to the quality of the grain.

Like several other varieties of grain that have owed their origin to individual notice and attention, the Sandy, or Sandie oat, was first discovered by a herd boy named Alexander (or Sandie) Thompson, who found it growing upon a bank of recently turned-up earth. His master, whose name was Pirie, propagated the seed from year to year, until at length it came to be extensively cultivated in almost every part of Scotland. It is tall and stiff in the straw, grows freely, does not shed its seeds so easily as the Potato oat, and is not easily lodged.

The grain is smaller than the former, and not quite so rich in meal, yet it is liked by millers, and weighs well in the bushel; though not a good sort of feed for horses, when given whole, as they are likely to be swallowed entire; this objection vanishes, however, when the grain is bruised.

For inferior, and late soils, Kildrummy, Tam Finlay, and Barbauchlaw are well adapted; for clay soils, Sandy and Flemish; and the Potato, English Berlie, Early Angus, Shirriff and Hopetoun, for easy-working alluvial loams in good condition.

Objections to growing Black Oats.—Black oats are often a useful crop to grow, but they are frequently objected to on account of the inferiority of the straw for fodder, and in consequence of the difficulty in entirely separating the husk from the meal in the grinding, which is injured in its marketable value by reason of the black specks in it which spoil its appearance. Many prefer the meal of the Black Tartarian oat to that of the white varieties, to whom the black specks are no objection, being acquainted with the reason of their presence, while horses prefer them; and, as a set-off to the objection, some extraordinary heavy crops are at times grown, as much as 100 bushels per acre having been harvested, on hard black land that has been found peculiarly well suited to their growth; and in fen districts, and upon peaty and marshy soils, they may be grown generally to great advantage.
54. INGREDIENTS TAKEN FROM THE SOIL BY OATS.—It has been calculated that a fair average crop of oats will remove from the soil the following quantities of mineral matters the calculation being based upon 48 bushels, weighing 42 lbs. to the bushel. These will weigh 2,016 lbs., and contain 60-5 lbs. of ash. The straw and chaff will contain 138-4 lbs. of ash, the mineral matters removed per acre standing as under:

<table>
<thead>
<tr>
<th></th>
<th>In the grain</th>
<th>In the straw and chaff</th>
<th>In the whole crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>27'2</td>
<td>69'6</td>
<td>96'8</td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>15'2</td>
<td>7'1</td>
<td>22'3</td>
</tr>
<tr>
<td>Sulphuric acid</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>1'1</td>
<td>4'7</td>
<td>5'8</td>
</tr>
<tr>
<td>Lime</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>2'2</td>
<td>9'8</td>
<td>12'0</td>
</tr>
<tr>
<td>Magnesia</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>3'8</td>
<td>5'3</td>
<td>9'1</td>
</tr>
<tr>
<td>Peroxide of iron</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>0'6</td>
<td>2'1</td>
<td>2'7</td>
</tr>
<tr>
<td>Potash</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>9'2</td>
<td>27'3</td>
<td>36'5</td>
</tr>
<tr>
<td>Soda</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>0'9</td>
<td>2'7</td>
<td>3'6</td>
</tr>
<tr>
<td>Chloride of potassium</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>...</td>
<td>3'8</td>
<td>3'8</td>
</tr>
<tr>
<td>Chloride of sodium</td>
<td>lbs.</td>
<td>lbs.</td>
<td>lbs.</td>
</tr>
<tr>
<td></td>
<td>6'3</td>
<td>6'0</td>
<td>6'3</td>
</tr>
<tr>
<td></td>
<td>60'5</td>
<td>138'4</td>
<td>198'9</td>
</tr>
</tbody>
</table>

55. MANURING, PLOUGHING, AND CULTIVATION.—The method of growing oats in Scotland, which is considered to furnish the best example, is for the oat-crop to follow after grass which has been pastured one or more years with cattle or sheep, or after clover, or rye-grass, which have been mown for hay, or used for stall-feeding.

If the land is of a first-rate quality, and has borne a good crop of grass that has been eaten down by sheep, under ordinary conditions, it will be sufficiently manured by their droppings to produce a good crop of oats. But if depastured for two years by sheep, the crop will likely be too bulky in straw, and stand a chance of getting lodged, when the ultimate yield would be affected.

One year's feeding by sheep is commonly thought to be as good as two years' pasturing by cattle, the droppings of sheep being more equally distributed over the land than those of cattle. Where, however, the land is of a second-rate quality, it is customary to feed sheep for one year, or two years by cattle, before being broken up for oats, and if cut the first year, the aftermath depastured, and the whole field allowed to remain another year in pasture to make up for the removal of the hay crop.
In those cases where both the first and second crops of clover and rye-grass are cut and removed, as the succeeding crop would be worth but little after twice mowing, it is thought good practice to cart turnips to the field in winter, and feed them off by sheep, first spreading them evenly over the surface, this making up for the two mowings of grass.

When a field has remained in grass for four years, after being broken up it is found necessary to take two crops in succession off it, in order to allow the sods time to get sufficiently decomposed, and the land in proper condition for a green crop.

The practice is contrary to this in England with oats. In clayey districts, they generally follow a summer fallow, sometimes following turnips in sandy and light soils; but very rarely being sown after grass; and in Norfolk, good crops of oats are got after turnips.

In some parts of Ireland, for a good many years together, oats and potatoes have been planted alternately, till the soil has been pretty well used up; but in the districts where a better system of husbandry is followed, the Scotch plan is resorted to of sowing oats after grass in the ordinary rotation either four, five, or six-course.

The ploughing of lea ground in Scotland is mostly done in February, when oats are to be put in, but the older and tough leas are taken before this, when the weather permits, so as to allow as much time as possible for the action of the weather to decompose the sods before seed-time, the clover-stubbles being left last, as they are looser and require less time in crumbling down. The land is ploughed in ridges, or stitches, either six or twelve yards wide; the former in clay land or low-lying damp soils, but in well-drained ordinary soils, the latter.

It is considered that lea land should never be ploughed when the furrows are so wet as to become glazed by the action of the mould-board, unless in those situations where frost may generally be reckoned upon to follow, and crumble it down; and in addition, it is found advisable to use the press, or drill-roller, especially on light or soft soils.

56. SEED AND ITS COST.—From three-and-a-half to five-and-a-half bushels per acre are commonly sown, but more seed is often used than is necessary, the early and small-seeded varieties taking about a bushel-and-a-half less to the acre than the coarser-grained sorts, such as the Late Angus. But thickness or thinness of sowing in their results will depend a good deal upon the climate and season; where the climate is moist, thick sowing is not so injurious as
in a drier one, for the thicker a crop is sown the more it suffers from drought.

The cost of the seed will thus necessarily depend upon the quantity used, which may be estimated at the market-price per bushel, but three bushels per acre of the early and small-seeded oats are sufficient, and four bushels of the coarser-grained sorts.

57. SEASON FOR SOWING.—The usual time for sowing oats is in the months of March and April; from the beginning to the middle of March being generally considered the most favourable time, the yield being found deficient if the sowing is postponed until April.

But in those situations where still earlier sowing can be managed, if the seed can be got into the ground about the end of February, it will be found to answer better. Early-sown oats produce the larger quantity of grain; late-sown, of straw. But the practicability of this being done must be determined by the climate, for on the western coast of England and Scotland, and in Ireland, March is generally such a wet month that the land is not in a fit condition for sowing, and it frequently has to remain until May before the seed can be put in the ground. The object of early sowing is in order to allow the grain to form before the parching droughts of summer set in, from which oats suffer more than any other kind of corn, requiring a good deal of moisture.

Oats have been occasionally sown in the autumn, in the sandy loams of some counties in Ireland, when they ripen three weeks before those sown in the spring, but in ordinary practice this method would be attended with inconvenience and disadvantage.

58. SOWING AND HARROWING.—Oats are generally sown broadcast in Scotland on the winter furrow, the seed being covered in by two, three, and sometimes four harrows coupled together, drawn by the same number of horses, but this practice has to depend upon the nature of the soil; on dry land farms, three or four harrows being used; but on clay farms, where the ridges are narrow, only two harrows drawn by two horses are employed.

In England, it is commonly the practice to drill oats, especially after fallows, the land being ploughed in winter, and having been well pulverised by frost, it works into a fine tilth, which enables the seed to be drilled with great accuracy.

On poor land, and where weeds abound, the broadcast plan does not answer, as there is frequently a struggle for supremacy between the oats and the weeds, the latter, in some cases, proving victorious.
By the aid of the horse-hoe and the hand-hoe, when oats are sown in drills, the weeds may be kept down.

59. **WEEDING.**—The main advantage of the drill system of husbandry upon poor lands consists in the facility with which weeds may be kept down, and on all soft soils, however diversified, even after a long course of turnip husbandry, there is always more or less a proneness to throw up a heavy crop of weeds amongst corn, especially when any change of weather arrests the progress of the young plants, which stand a chance of being smothered thereby, unless the weeding is carefully seen to.

On many soils corn-crops are infested with charlock, or wild mustard, and nothing seems to be able to extirpate it except hand-pulling. The cost of doing this is a very heavy item at first; but some farmers who have diligently pursued this method, have finally got rid of it altogether, the expense gradually decreasing year after year.

60. **DISEASES.**—Oats are less subject to disease than any other kind of corn, smut occasionally making its appearance, but never to any very serious extent, and its leaves, like other cereals, are liable to be infested by *Uredo rubigo vera*, as before described with wheat, but it passes comparatively unscathed, and the attacks by mildew are very rare.

61. **INSECT ENEMIES.**—It is, however, more likely to suffer from the attacks of wire-worm than any other cereal, on account of the crop being often taken after old pastures that have been broken up; in which case shallow ploughings, by killing the roots of the grass, deprive the wire-worm of its natural food, which can be effected by the breast-plough taking off about two inches of the root.

The larvae of the beetle *Crioceris melanocephala* feed upon the leaves of the oat, as well as the caterpillars of the moth *Leucania obsoleta*; but neither of them appear to do any great amount of damage.

62. **TIME OF HARVESTING.**—The time of harvesting the oat-crop must necessarily depend very much upon the season; but all the earlier varieties of oats should be cut when "raw," as it is termed, for if allowed to ripen completely, they shed their seeds to a considerable extent.

The late, or common oats, are less liable to shake when ripe; but it is always best to err on the safe side with regard to cutting, for the straw of early-cut oats is very superior for foraging purposes, and perhaps no species of oats ought to stand till the straw gets entirely yellow, if we except perhaps the "Sandie" oat.


When the green and yellow colour of the straw is about equally mixed, may be considered about the right time in which to put in the sickle, and in no case should the cutting of oats be delayed till they are dead ripe, for which there is not the slightest occasion, as the ripening process will go on very well in the sheaf.

63. REAPING.—Oats, although it is advisable to cut them early, should never be carried in so damp a condition as to run the risk of heating, which not only injures the colour of the grain, but renders the straw worthless as fodder; and good oat-straw on a farm where a number of beasts are kept, is a very important item.

When oats are mown with a scythe, they should be cut upwards towards the standing corn, by which the stems are less jerked, and there is less danger in shaking out the grain, than when the action of cutting is made away from the standing crop.

Where large crops are grown in humid climates, they are often so twisted together and laid, that the scythe is found to be only an imperfect instrument; and the hook is found a much better one under these circumstances. When reaped with a hook, oats are generally set up in shocks of twelve sheaves each; and in late districts, two sheaves are put butt to butt on the top of each shock, which serves as a kind of thatch. But although they keep out the rain by these means, they also keep out the wind, and thus prevent the other sheaves from drying as quickly as they otherwise would do; but where there is labour at command, it answers well to follow this plan and remove two top sheaves in the day-time, and replace them at night, or, upon the likely approach of rain, allowing them to stand together by themselves to dry as well, when not acting as “hood-sheaves”; but generally the exigencies of harvest-time will not allow of the extra labour to be given.

64. STACKING.—Where oats are grown upon a large scale, the stacks are made to contain a number of shocks according to the size of the farm, varying from 120 to 400; stacks of 200 or 300 shocks being common. As before noticed, they must not be carried too green, the crop taking from a fortnight to three weeks to get thoroughly dry, according to the weather.

Round stacks are the most convenient to build, and they also get better ventilation, and to promote a thorough circulation of air through them, it is a usual practice to form a triangular vent inside the stack. They are thatched with wheat or barley-straw, the thatch being secured and tied down with ropes made of tough oat-straw, there being a very cheap machine in use for the purpose of making these straw ropes, which no farmer should be without.

65. COST OF CROP FROM SEED-TIME TO HARVEST.—
As oatmeal forms a large item of the food of the rural population in Scotland, as well as being largely consumed in the towns, oats are
The Crops of the Farm.

grown to a very considerable extent, and generally average from a fourth to a third in amount of all the other grain-crops, and the cost of a crop of oats from seed-time to harvest has always been reckoned upon the somewhat stereotyped scale as under for clay-land:—

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<tr>
<td>Ploughing lea, one furrow 9 to 10 inches broad</td>
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<td>Sowing broadcast, one man 2s., and one woman 8d. per day (assuming 20 acres for the day’s work)</td>
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<td>Seed, 4 bushels at 2s. 6d.</td>
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<td>Reaping, binding, setting-up, and superintendence</td>
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<td>Carrying and stacking</td>
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<td>Thatching and dressing 48 to 60 bushels by steam</td>
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<td>Marketing and delivery</td>
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<td>Seed, 4 bushels at 2s. 6d.</td>
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<td>Harrowing 3 double strokes</td>
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<td>Hand-weeding twice</td>
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<td>Reaping, binding, setting-up, and superintendence</td>
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<td>Thatching and dressing 48 to 60 bushels by steam</td>
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<tr>
<td>Marketing and delivery</td>
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66. COST OF LABOUR PER ACRE. — The above is an old calculation, made when labour was somewhat cheaper than it now is, but it will serve approximately to show the relative cost of each item.

In Scotland, the labour of women is made use of to a much greater extent than in England, and this assistance is the means of bringing down the cost of labour considerably. The wages of the men in the above calculation are set down at 12s. per week—perhaps 14s. may now be said to be the more common average, though a considerable higher rate of wages is paid in the neighbourhood of the large manufacturing towns in the north of England.

67. DIFFERENCE BETWEEN SCOTCH AND ENGLISH METHODS OF CULTIVATION.—We have given the cost of the cultivation of an acre of oats as it is reckoned up in Scotland, but the array of figures will be considerably greater in England.

In Scotland when oats follow lea, the cost is comparatively small, but on the clay soils of England where oats follow a bare fallow, and a heavy dressing of farm-yard manure is given, the cost is considerably greater, and has been estimated at from £7 10s. to £10 10s. per acre; but what the English farmer saves on his wheat-crop he expends on his oats, the practice being the reverse with the Scotch farmer, who saves on his oats what he has previously laid out on his wheat-crop. In this way, in estimating the cost of a crop, it must be taken into account whether other crops are benefited, or a present crop benefited by others, and it becomes necessary to include in the consideration the whole outlay and income of
an entire course of rotation; and thus, in Scotland, oats are found to do best after lea, and wheat after fallow.

68. PREPARATION FOR MARKET, GRINDING, &c.—The usual methods of preparation for market are pursued with oats as other grain, in getting it clean and in proper condition, but in the mealing process, the oats having been previously dried in a kiln, are made to pass through the mill-stones, in order to rid them of their coarser husks, or "shealings" as they are termed, before being ground. After this process the kernels are then called "grits," or "groats," and are then ground over again into a coarse, rough meal, varying in its fineness according to the different districts which affect meal of various degrees of fineness; and hence, in London, the very coarse Scotch meal is held most in favour by families who occasionally give their children oatmeal porridge; but in Scotland and Ireland and the north of England, it is made into cakes and used in lieu of bread.

69. OAT-STRAW.—Continental chemists rank oat-straw amongst the least nutritious of the different kinds, and this may probably be correct when applied to oat-straw grown on the Continent, but it is not the case with the oat-straw grown in Great Britain, which is superior to any other kind of straw, and is on this account much preferred for foddering purposes.

But both the quantity and quality of oat-straw differ very materially per acre, according to the nature of the soil upon which the crop is grown, as well as the different sorts varying very much, and thus the Tartarian or Siberian, though yielding grain plentifully, produce straw of such a coarse nature as only to be fit for litter. The Late Angus gives a more abundant supply of straw, as well as of superior quality. Polands yield but a small quantity of straw, and the straw of Hopetoun, Red, and Potato oats is reedy, and inferior in quality.

Again, when the early part of the summer turns out wet and is succeeded by drought, the short-strawed species yield a better quality of straw than the other kinds, as they reach maturity before the dry weather sets in. In opposition to this, when the early part of the summer is at first dry, and is then succeeded by a rainy period, the long-strawed varieties are much benefited by it. In following out these various changes, it may be as well to remark that, when a season is throughout wet, the smaller varieties frequently excel the others, by reason of the straw of the larger oats becoming too luxuriant. Oats like a moist climate, and when there is a larger share than ordinary of wet, their growth gets unnaturally stimulated.

The straw of oats is invariably preferred to that of wheat for
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fodder (barley-straw ranking the lowest), and it is only reasonable to surmise that this would be the case on account of the greener condition in which oats are invariably cut, when a considerable portion of the sap of the plant still remains in the stem; and oat-straw is always considered richer in protein compounds, which is easily explained by the fact that these steadily decrease with the maturity of the seed.

70. THRESHING.—Another reason may be found for the more nutritive qualities of oat-straw in the fact that there is sometimes a difficulty in cleanly threshing the grain, in consequence of the irregularity with which the crop ripens. So far as the yield is concerned there is a little difficulty often experienced in the threshing of oats from this cause, but what is thus lost in grain is gained by the cattle which consume the straw.

71. ANALYSIS OF OATS.—The relative proportions which the straw, chaff, and grain of oats bear to one another are considered to be as follows:—

Straw, 9; chaff, 1; grain, 6. Total, 16.

But the proportion of husk varies very much in different samples of oats, the quality of meal produced by each being often very various. The composition of the French oat, as given by Boussingault, as relates to the proportion of gluten and albumen contained, is lower than the analyses made by Professor Norton of samples of Scotch oats.

The result of four specimens of Scotch oats that were analysed by Professor Norton and Mr. Fromberg, after having been dried at 212° have been given as under:—

Proximate Composition: calculate dry.

<table>
<thead>
<tr>
<th></th>
<th>Hopetoun Oats, Northumberland</th>
<th>Hopetoun Oats, Ayrshire</th>
<th>Hopetoun Oats, Ayrshire</th>
<th>Potato Oats, Northumberland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>65'24</td>
<td>64'80</td>
<td>64'79</td>
<td>65'60</td>
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<tr>
<td>Sugar</td>
<td>4'91</td>
<td>1'58</td>
<td>2'09</td>
<td>0'80</td>
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<tr>
<td>Gum</td>
<td>2'10</td>
<td>2'41</td>
<td>2'12</td>
<td>2'28</td>
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<tr>
<td>Oil</td>
<td>5'44</td>
<td>6'97</td>
<td>6'41</td>
<td>7'38</td>
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<tr>
<td>Caseine (avenine)</td>
<td>15'76</td>
<td>16'26</td>
<td>17'72</td>
<td>16'29</td>
</tr>
<tr>
<td>Albumen</td>
<td>0'46</td>
<td>1'29</td>
<td>1'76</td>
<td>2'17</td>
</tr>
<tr>
<td>Gluten</td>
<td>2'47</td>
<td>1'46</td>
<td>1'33</td>
<td>1'45</td>
</tr>
<tr>
<td>Epidermis</td>
<td>1'18</td>
<td>2'39</td>
<td>2'84</td>
<td>2'28</td>
</tr>
<tr>
<td>Alkaline salts and loss</td>
<td>2'84</td>
<td>1'84</td>
<td>0'94</td>
<td>1'75</td>
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</tbody>
</table>

100'00 N. 100'00 F. 100'00 F. 100'00 N.
72. NUTRITIVE VALUE OF OATMEAL.—The best Scotch oatmeal, so far as the nutritive value is concerned that depends upon flesh-forming constituents, is usually considered to contain a larger percentage of these than the best English wheaten flour; and is, on this account, considered more nourishing to the human system. The fattening qualities of oats are very great, none of the other starchy feeding materials containing so much fat.

It has been frequently a matter of observation that, where people live almost entirely on oatmeal, as is the case in some parts of Scotland, their strong, muscular frames give undeniable evidence of the superior qualities of oatmeal for the formation of muscle.

73. OATMEAL AS FOOD.—Oatmeal ground with various degrees of fineness, according to the custom of different districts, is mixed into a paste, and baked upon heated irons made for the purpose, into thin cakes, when it becomes oaten bread; there being several methods of making it, according to the means and tastes of the persons using it. Or the meal is made up with water, usually boiled into a thick consistence, and is mostly eaten with milk, or skimmed milk, or, if this is not procurable, with butter, treacle, &c.

In some of the eastern counties of Scotland, the unmarried ploughmen live entirely upon oatmeal and milk, except in the winter time, when they get potatoes in addition. As an article of food, oatmeal is well adapted to a northern climate, but in a warm one it is neither an agreeable, nor is it considered a healthful article of diet, as it heats the blood and produces eruptions upon the skin; its warmth-giving properties, that are so valuable to the labourer in a bracing atmosphere, being somewhat a disadvantage in a warm one.

74. USES.—The consumption of oats for feeding horses is very great throughout the United Kingdom. When railroads were first instituted, at a time when an enormous number of relays of horses were kept on all the main roads for horsing coaches, it was feared their introduction would throw horses out of work, and so diminish the demand for oats for feeding purposes, but the opposite has been the result, more horses than ever being employed in connection with work upon the railroads, through the great impetus given to travelling, and the extra employment of horses for flys, omnibuses, and other vehicles, continually plying to and from the various railroad-stations throughout the kingdom; and the main ingredient of the horse's food must consist of oats, to keep him in good health and working condition.
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When there are, unfortunately, wet harvests, and the crop of oats becomes discoloured, or sprouted, a good deal of it is cut or bruised for feeding cattle with by some farmers; as upon these occasions it is found they may be fed as cheaply as by buying oil-cake for the stock. When given to cattle they should always be bruised, and in ordinary times it will often be found useful to give a mixture of oats to cattle fed upon oil-cake, as they contain starch and sugar, in which the cake is deficient.

It is an absolute necessity when feeding sheep with oats, that they be thoroughly well bruised, for if given whole they are apt to swell in the stomach, and may produce inflammation, which occasionally ends fatally.

Husks, or oatmeal seeds as they are called, are found very useful to mix with the spent brewers' or distillers' grains, and form a capital mixture for fattening sheep or cattle.

Sir Humphry Davy gives the analysis of a bushel of Scotch oats, reckoning the nutritive matter contained in 1,000 parts—the weight of the bushel being, perhaps, 42 lbs.—as containing 641 parts of mucilage, 15 of saccharine matter, and 87 of gluten: making 743 parts in all.

75. MARKETS.—Corn-markets have been established through necessity in every town of importance throughout the United Kingdom, that are either held weekly or bi-weekly according to the extent of business transacted.

At most markets grain was sold by the imperial quarter; but, up to quite recently in some of the country markets, it was sold by the boll, which in one locality meant 4 bushels, and in another 6; but, by the Weights and Measures Act, which came into operation on the 1st of January, 1879, one uniform scale of measurement is enjoined under a penalty.

76. IMPORTATION OF OATS.—London is a very important market for oats, in consequence of the large importations which often arrive in the port of London, a good many cargoes of oats being sent to us from Northern Europe and other parts abroad. Damaged foreign grain may often be bought cheaply, which is well worthy the attention of stock-keepers and others, who make purchases upon a large scale.
CHAPTER IV.

BARLEY.


77. NATURAL HISTORY.—The original or native country of barley (hordeum) appears to be involved in as much obscurity as wheat; but the Egyptians have a tradition that it was the first of the cereals made use of by man, and the geographical range of barley is wider than even that of either wheat or oats; being grown in Africa, Central Asia, and Europe and America; ripening alike under the intense and steady heat of the south, and the short summers of the north; its rapid and vigorous growth perfecting the development and maturity of the seed under the most opposite conditions. And thus Linnaeus relates, in his tour in Lulean Lapland, that on the 28th of July he observed the commencement of the barley-harvest, and, although the seed was sown only a few days before midsummer, that the grain was perfectly ripe, the whole process certainly not having occupied more than six weeks.

Barley differs from wheat in containing more farina, or starch; less gluten, and about 7 per cent. of uncombined saccharine matter, which latter, wheat does not possess previous to germination. The use of barley in the preparation of fermented liquor and spirits is carried on to a great extent in this country, the invention of this preparation being ascribed by Greek writers to the Egyptians. Herodotus says that the people of Egypt, being without vines, made their wine from barley; Dioscorides attributing the first cultivation of barley to the Egyptians under the guidance of Osiris.

Pliny gives the name of "Zythum," in his Natural History, to the
The crops of the farm.

liquor made by the Egyptians, which may perhaps have resembled the intoxicating liquor still made from barley, both in Egypt and Nubia, which is known by the name of *bouzah*. Tacitus mentions that the German people, in his day, were acquainted with the method of preparing beer from malted grain; while Pliny describes a similar “brewing” under the name of *Cerevisia*.

The purposes to which barley are applied in the United Kingdom are chiefly those of brewing and distilling, a small portion undergoing decocation, or removal of the bark, for the purpose of being converted into what is known as “pearl-barley”; while, ground into meal, it is extensively used for fattening pigs and feeding poultry.

The different species of barley have been classed or divided by botanists into “two-rowed,” “four-rowed,” and “six-rowed” barley; though, properly speaking, according to Low, the term “four-rowed” is a misnomer; for this writer says:—“Barley is termed ‘two-rowed,’ or ‘six-rowed,’ according to the number of its fertile florets. In ‘two-rowed’ barley, one row of florets on each of the two sides of the spike is fertile, and consequently one row of seeds on each side is perfected. In ‘six-rowed’ barley, three rows on each side of the spike are fertile, and consequently, three rows on each side are perfected. In this sense only it is termed ‘six-rowed’ barley; but there is no species known to us in which only two rows on each side of the spike are fertile. Slightly examined, indeed, ‘six-rowed’ barleys frequently present the appearance of four rows; but this is in appearance only, for such barleys have always the three rows on each side perfect. In poor soils and unfavourable situations, two of the rows run much into each other, and this has, perhaps, given rise to the mistake; but the two rows which thus run into each other in appearance, are on the opposite sides of the rachis.”

78. Varieties.—There are two distinct kinds of barley—the one that is usually sown in spring, and a winter species, which is termed Bere, or Bigg, rarely cultivated in the southern parts of England, but very generally sown in the north, and Scotland; being of a much hardier nature than spring barley, the many
varieties which exist being termed by farmers “sprat, or battledore barley,” “rath-ripe, or hotspur, and naked barley.” Chevalier, Annat, Thanet, Egyptian, Moldavian, &c., are well-known kinds, besides a number of modern varieties which take their name from the place where they were first grown—the Annat barley, for example, which is one of the best known, owing its name to the fact that a few ears were first casually picked from a field in the Carse of Gowrie during the harvest of 1830.

The common, or two-rowed barley, is the one most frequently cultivated, and it maintains its place in general estimation as one of the best kinds to grow, being especially in favour on light lands in moderately late districts. It reaches maturity early, ripening in thirteen to sixteen weeks after sowing; and it adapts itself to a greater variety of soils than any other species that is cultivated. Its yield per bushel, in weight, upon average soils, varies from fifty to fifty-four pounds, according as the season is wet or dry, just before the ripening of the grain, dry weather increasing its specific gravity—from thirty-two to thirty-six bushels per acre being generally expected. The straw is mostly about three feet in height.

Chevalier barley is generally about a fortnight longer in ripening than the Common, or Early English, if sowed at the same time; but if sown earlier, can be made to come round much about the same time. The straw of this variety being thicker and stronger, is less liable to be lodged, which is a recommendation when dealing with soft, forcing soils. It bears a good reputation with the maltsters, the malt made from it being of a superior quality. Black and rich sandy loams are the best adapted for its growth.
The Annat barley is similar in many respects to the Chevalier, the average length of the straw being three feet, two or three inches; its roots being stronger, and striking deeper into the soil than the Early English variety.

Italian barley bears the reputation of standing well upon soft soils, the length of the straw being about three feet, seven inches; but it degenerates rapidly when grown for more than two or three years upon the same farm. The ears are short and broad, the grains being very plump and round.

Dunlop barley, grown rather extensively in Perthshire, somewhat resembles Early English barley; but is taller in the straw, ripens earlier by nearly a week, and has shorter and more compact ears. It is, however, more delicate than common barley, and is apt to ripen, or rather whiten prematurely, especially when visited by high winds or rough weather just before harvest.

Although farmers distinguish two sorts, the Common, and Raisd-ribe barley, they are in reality the same plant; the latter being a variety occasioned by long cultivation upon warm, gravelly soils.

79. WINTER, OR SQUARE BARLEY, BERE, OR BIGG. (Hordeum hexastichon)—This variety is more commonly cultivated in Scotland than in England, and is a much more hardy plant than spring barley; the grains being large and plump, and the spike thicker and shorter than the common English variety. In opposition to Low, Lawson denominates it, and the other varieties akin to it, four and six-rowed barley. The average number of grains in the ear is forty-seven—that of the spring barley being only twenty-six, and sometimes less. The average length of the straw is three feet, three inches, and the ear two-and-a-half inches.

80. SPRAT, OR BATTLEDORE BARLEY. (Hordeum zecriton)—This variety has shorter and broader ears than either of the other sorts mentioned, its awns or beards being longer; and it does not usually grow so tall as the other species, the straw being also coarser, and not of much value as fodder.

81. SIX-ROWED, NAKED BARLEY.—The ears of this variety separate naturally from the husk, and being without the beard with which the common kind is furnished, wear a bare appearance, from which its name is derived. It is very productive, and on the Continent it is termed blé de Jérusalem, from the supposition of its first having been obtained from the Holy Land; and on account of its fruitfulness, is also styled orge céleste. It is of hardy growth, being strong in the stem, and tillering out with great vigour, producing
heavy crops of grain of superior quality. The quality of the straw is better than any other kind, but it only does well in rich, well-cultivated soil, and requires to be sown earlier than any other sort.

82. TEMPERATURE BEST SUITED FOR THE CULTIVATION OF BARLEY.—As previously stated, barley succeeds well in very different climates, and ranges of temperature; but some sorts succeed better than others in different localities.

The *rath-ripe* is delicate, and is sometimes destroyed by a slight frost, but ripens early in warm summers, being usually ready to cut within nine or ten weeks of the time of sowing, and is therefore well suited to the forward soils of the southern counties of England.

Winter barley, or bere, is the hardiest of all grain, and is remarkable for standing the inclemency of winter, and on this account is largely grown in some of the exposed districts of Scotland, being cultivated in the Highlands as a spring crop, while in Ireland it is grown as a winter one. When bere is cultivated on good land in an early climate, the produce is often greater than that yielded by two-row barley, but it is on high-lying, late districts that the cultivation of bere is most profitable.

83. MOST SUITABLE SOILS.—Barley succeeds best on those soils which are naturally dry, and can be easily reduced into fine working order; but since the practice of thorough drainage has become more general, barley is now grown upon soils that would formerly have been considered entirely unsuitable, the silicious districts in the county of Norfolk, and the downs upon chalk sub-soils being the best natural barley soils.
The Crops of the Farm.

Clay soils cannot grow barley so profitably as wheat, besides the crop unfitness it for the growth of a wheat-crop until five years after one of barley has been taken, according to the opinion of some of the best farmers; a circumstance due to the effect that barley has in softening the surface of the land, and so loosening it as to render it unsuitable for the reception of a plant requiring a surface of sufficient firmness to resist the disintegrating influences of alternate frosts and thaws.

Clay, however, that is tempered with an admixture of chalk mixed with sand, will be found a favourable soil for barley, but poor, tenacious, and cold land is quite unfitted for its growth; while a rich, friable, mellow soil, which retains a moderate quantity of moisture, but not in the least approaching what could be termed a wet soil, will be of a favourable description.

84. INGREDIENTS TAKEN FROM THE SOIL BY BARLEY.—From the mineral constituents of barley, there does not appear to be any very marked or distinctive peculiarity that would point to its absorption of any particular mineral ingredients, except magnesia; which, although it is found in all cereals, appears to be most abundant in barley; and this fact would suggest the necessity of supplying this element when the soil is deficient in the constituent. That barley assimilates magnesia readily, appears from the fact that crops grown on the magnesia limestones always do remarkably well, except when there are counteracting circumstances which interfere with its growth.

85. MANURES.—The proper place for the barley-crop in the course of rotation is after turnips, as it flourishes best upon land that has been well tilled, and previously heavily manured. The turnips should, however, be fed off the land by sheep, and in Norfolk a great point is made of securing what is termed the *teathe*, which consists not only of the excrement of the sheep, but also the contact of their bodies with the surface of the soil, before it is washed by the rain, which is "sealed" in, by ploughing closely to the flocks as they eat down the turnips, so as to prevent as much as possible its being dissipated by evaporation, volatilised by decomposition, or washed away by rains.

86. PLOUGHING.—In ploughing land that has been thus folded, it is considered the best practice to have the furrows shallower than in ordinary cases, so as to keep the teathe as nearly as possible to the surface, yet being sufficiently covered; barley drawing its nourishment more immediately from the top soil than any other cereal. In Scotland, the general practice is to sow barley broadcast upon the stale winter furrow, which is not considered so good...
Barley.

59

a method as the system pursued in England, though the plan succeeds well enough when the frosts have been sufficient to make the soil mellow, the system of drilling corn not being so prevalent in Scotland as in England.

87. HARROWING.—But whether the seed is sown broadcast or drilled, the land requires to be well harrowed and rolled afterwards. When barley has been sown broadcast, the usual method is to harrow the land after sowing twice lengthways, then across, or obliquely; after which it is rolled, and the grass-seeds sown, and finally light harrows passed over to cover all up.

88. DIFFERENT MODES OF CULTIVATION.—There are, however, different methods of cultivation followed. If sown, as it frequently is, upon wheat stubble, the land should have at least three ploughings, but if after spring-crops, which have been drilled, and the ground well worked by the horse-hoe, and made thoroughly clean in the course of cultivation, one ploughing is sufficient.

Upon clay soils the practice is to plough, and to allow the land to lie all the winter exposed to the action of the elements, after which it is brought into a friable condition by the scarifier, when it is either ploughed and sown broadcast, or the seed drilled, without any further ploughing, if the land is sufficiently fine and loose. But when the barley is sown very early, sometimes the sowing of the grass-seeds is delayed till the barley is above ground, as sometimes late frosts do them injury. They are then sown broadcast and harrowed in with a lever harrow, and afterwards rolled.

89. SEED.—When seed is drilled in, 2½ to 4 bushels per acre are generally employed, and the land is afterwards lightly harrowed and rolled; less seed is, however, required of the ordinary species of two-rowed barley, as if sown too thickly the plants become weak. The quantity of seed needed will also very much depend upon the quality of the soil. If the land is rich, ten pecks may be considered enough; if adhesive in its nature, twelve will most likely be wanted; and if very light land, from fourteen to sixteen pecks are thought necessary if sown broadcast.

If sown at a late period, steeping the seed for twenty-four hours in soft water has been recommended, with a view of both cleaning the seed, and causing it to germinate at the same time.

Clover and grass-seeds, though sometimes sown simultaneously with that of the barley, is not considered so good a method as that of allowing the barley-plants to get above ground first, and then harrowing the clover in with light wooden harrows.

90. SEASON FOR SOWING.—Barley, perhaps, on the whole, is most commonly sown in the month of April, though the operation is deferred sometimes until the middle of May, and good crops
have been often reaped that were not sowed until June; but a degree of judgment needs to be exercised with respect to the season of sowing, not only with regard to the nature of the soil upon which it has to grow, but also in reference to the species of the grain. If the soil is warm and rich, the sowing may be deferred till a later period than in those instances where the land is cold and poor; and in all cases, due consideration must be given to the characteristics of each species, to which we have before referred, taken in conjunction with the temperature of the season.

Cold springy soils that have only been imperfectly drained, should not be planted too early, for a wet spring would starve the crop, and while light and dry soils in the southern counties may, with advantage, be sown in the latter end of March, stony lands that have been got into fine, workable order, will suit the period about the first or second week in April, and the soils first named later still.

Early sowing is generally recommended, if it can be done safely; and produces better crops than if barley be sown late. If not sown sufficiently early upon stony land, it is apt to run too much to straw, while if deferred till too late upon light lands there will be but little straw, and even less corn. But on the other hand, in opposition to early sowing, there is the consideration to be entertained of late frosts, which when severe will cause the crop to be but a poor one.

91. **MODE OF SOWING.**—As before described, the mode of sowing is made to vary considerably, and is done both broadcast and by drilling; but the former mode is decidedly preferable upon light land upon which barley is mostly grown, as it ensures not only a more equal spreading of the seed, but affords a clearer field for distributing the grass-seeds that may afterwards be put in.
The distance at which the drills are placed from each other, is usually at eight inches in light soils, and nine for stronger ones, two pecks of seed less being needed per acre than when sown broadcast.

92. WEEDS.—Barley is sometimes sown after a clover-lea, but this is generally looked upon as being rather a risky practice, both with regard to the crop itself, as well as it affects the other grain-crops which succeed; and a plan may be sometimes seen followed which is universally condemned, of sowing barley after wheat, without a green crop being taken between; which not only is putting too great a strain upon the land, but enormously increases the difficulty of keeping the land clean.

In some parts barley is made to follow beans or peas, the land being ploughed in autumn immediately after the bean-crop has been removed, cleaned and allowed to remain till spring, when it is ploughed up and sown with barley. The objection to this practice is the difficulty of keeping the land sufficiently clean, for if on account of the unfavourable state of the weather, the land has not been sufficiently cleaned after the bean-crop has been removed, or during its growth, both the barley and grass-seeds which follow run a good deal of risk of injury from weeds, as well as both plants requiring a good deal of sulphate of lime to promote their growth, the drain upon the supply of this particular substance may be too great; the better plan in the course of rotation being to sow beans and peas after oats, and let potatoes or mangold-wurzel follow after wheat and before barley, particularly as it is not now the custom to dung for barley. At one time farmyard manure was held in high estimation as being peculiarly suitable for barley, but since the introduction of artificial manures, and the practice of sheep-folding, all the manure is now reserved for the root-crops.

93. ARTIFICIAL MANURES.—Sometimes guano has been applied with advantage to the barley crop, but its action is generally found too forcing, increasing the bulk of the straw to such an extent as to endanger the quality of the grain, encouraging premature growth on weak soils which ceases when the ear is about half-filled, so that whitening takes place before ripening, the straw being soft and weak, and the grain shrivelled and husky.

But while on all soft soils the use of guano should be avoided, on good hard land it may often be used to great advantage. A good compound of artificials may be made thus:

<table>
<thead>
<tr>
<th>Compound</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peruvian Guano</td>
<td>1 cwt</td>
</tr>
<tr>
<td>Nitrate of Soda</td>
<td>1 cwt</td>
</tr>
<tr>
<td>Sulphate of Magnesia</td>
<td>1 cwt</td>
</tr>
<tr>
<td>(Epsom Salts)</td>
<td></td>
</tr>
<tr>
<td>Common Salt</td>
<td>2 cwt</td>
</tr>
</tbody>
</table>
The guano may be harrowed in with the seed without injury, and the other substances applied with great effect when the barley-plants have made some little progress.

Upon those occasions when farm-yard manure needs to be applied, as when barley is made to follow wheat (a bad practice), the best way is to plough the manure in rather roughly before winter, and allow the land to remain in this rough state till seed-time, when it should be cross-ploughed to mix the manure well with the soil, harrowed, and then ploughed into ridges; but if the land is sufficiently soft the seed may be drilled in without further ploughing.

94. DISEASES. — Smut sometimes attacks barley, but never to any great extent in this country, though in exceptional years crops have occasionally suffered somewhat, and the same may be said of mildew, which has now and then affected late-sown crops. Sometimes the grains of barley are ergoted like those of other cereals, but never to such a degree as to attract much notice. Barley may be said not to be subject to any formidable disease.

95. INSECT ENEMIES. — Wire-worms sometimes infest the roots of barley, and the young plants are often a good deal injured by the maggots of a midge, which are of a minute size (Cecidomyia cerealis); while the maggots of three other flies are also destructive — Chlorops Herpini, Oscinis vastator, and Musca frit. The caterpillars of a moth also prey upon it — Pyralis frumentalis, while the maggots of the corn saw-fly take up their residence in the straw (Cephus pygmaeus), and a bug establishes itself in the ears (Miris dolobratus). Burning the stubble after harvest is the best way of
getting rid of the saw-fly, while by pulling up infected, drooping stems, the ravages of the *Chloropsis* are often stayed. Wire-worms must be dealt with after the various ways that are prescribed for their extirpation, which is often a very difficult matter.

96. **TIME OF HARVESTING.**—There is a certain advantage attending the early cutting of all grain crops, but in the case of barley it is necessary that the crop should be of uniform ripeness before it is cut; an even ripeness being necessary to cause it to be in fit condition for malting purposes, whatever that stage of ripeness may be. Perfect ripeness is indicated by the hanging down of the ear, and by the dryness of the grain when squeezed, and although it is commonly looked upon as an evil to allow the crop to ripen to such a full extent—save in those circumstances which are exceptionally favourable to an even growth—this full ripeness appears to be a necessary evil, in connection with its commercial value.

97. **REAPING.**—Barley is generally mown with a short-handled scythe in England, and sometimes reaped by the sickle or scythe-hook, the latter being the most common way in Scotland. It is more expensive, but the work is done in a cleaner manner, there being a much smaller quantity of clover, or artificial grasses bound up with the barley than is the case when the scythe is employed, and the young grasses are forward, which is a great advantage.

When, however, the scythe is resorted to for cutting barley, amongst which there may be a good deal of clover or other grass, it will be found a good plan to allow it to remain in the swath for a few days before it is bound up, in order to allow the air to act upon it. When, however, the scythe-hook is used it is customary to bind up the crop into small sheaves at once, and place them in shocks of a convenient size.

98. **STACKING.**—In good and favourable weather for harvest operations, barley requires from ten days to a fortnight after being cut to be brought into proper condition for being stacked; but if the weather is hazy, or damp, considerably more time must be allowed.

As barley is very liable to heat, on account of its often having a good deal of grass amongst it, it is usually built up into smaller-sized stacks than either wheat or oats. Where barley is grown as a principal crop, and a good deal of attention is paid to the stacking, the stacks are usually built with a triangular vent inside, to ensure a thorough draught, the vent reaching nearly as high as the eaves, a hole being kept open at bottom for the passage of air.

99. **PREPARATION FOR MARKET.**—The crop of two acres
is generally thought sufficient to form a stack of barley, and the stacks are not generally allowed to stand long, for it is seldom profitable to hold barley longer than the advent of spring, as it loses in quantity without a corresponding increase of quality, estimated by its weight per bushel.

On this account the barley crop is often the first which the farmer sends to market, and which first has to undergo the processes of threshing and hummelling.

100. THRESHING.—Barley is now almost universally threshed by machinery, though the flail long remained in use for barley, under a mistaken impression that its grains malted better when threshed out by the flail; and after being separated from the straw, it is denuded of adhering awns by hummelling; the labour of threshing and cleaning the grain of bere being harder than that of common barley.

101. HUMMELLING.—When threshing-machines are employed, the services of a hummeller are sometimes dispensed with, the process of hummelling being entrusted to the threshing-machine, by passing the barley through the machine again, after it has been separated from the straw, trusting to the manipulation of the beaters to separate the awns from the grain.

The better and more efficient plan is however to make use of a hummeller, of which there are different kinds and forms; but they all act upon the principle of passing blunt knives rapidly through the grain, either when loosely passing along a cylinder, or when under a process which acts by the force derived from considerable pressure of a weight of grain above it. In the common forms of hummelling machines, the grain is spread on the floor of a barn, and operated upon by a stamping implement, or by one that rolls upon it, and the whole is then put through the winnowing-machine, and the dust of the broken awns blown from the grain.

102. GRINDING.—Large quantities of barley are ground into meal every year, it being a very profitable branch of business with some country millers who do an extensive trade in barley-meal, which is largely employed in fattening pigs, and forms as well a portion of the food of other animals. To obtain its maximum effect it should be given in conjunction with linseed, or beans. Unfortunately, farmers do not commonly grind their own grain, but those who do, find it a great advantage and assistance to grind their corn for feeding purposes.

Mills may be purchased at a reasonable price fitted with all the necessary adjusting, and feed-regulating contrivances; with mill-hoop, hopper, and driving pulleys, and the whole resting on a strong, portable iron base-plate complete. About £40 or so, would be the cost of such a mill that would grind six or seven bushels an hour of barley for feeding purposes, or from 3 to 3½ bushels of wheat.
Barley.

for making flour. When a large number of stock is kept upon a farm, such a mill is almost invaluable, and makes the farmer entirely independent of the miller.

103. BARLEY-STRAW.—Barley-straw is lighter than that of wheat, for although the awns are good food for cattle, the straw itself, or stem, is deficient in nutriment, and is seldom given as fodder, but mostly used for litter. The crop of barley standing generally till it is quite ripe, the straw is brittle and contains but little sap, though it has been said, when compared at an earlier stage of its growth, to possess more nutriment than wheat.

104. ANALYSIS OF BARLEY.—Various samples of barley differ somewhat in their constituent parts, but the average composition of the grain, as deduced from different analyses, is about as under:—

<table>
<thead>
<tr>
<th></th>
<th>Air-dried.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gluten</td>
<td>12.88</td>
</tr>
<tr>
<td>Albumen</td>
<td>0.30</td>
</tr>
<tr>
<td>Starch</td>
<td>48.06</td>
</tr>
<tr>
<td>Gum</td>
<td>3.87</td>
</tr>
<tr>
<td>Sugar</td>
<td>3.75</td>
</tr>
<tr>
<td>Oil</td>
<td>0.34</td>
</tr>
<tr>
<td>Wood-fibre</td>
<td>13.34</td>
</tr>
<tr>
<td>Ashes</td>
<td>3.56</td>
</tr>
<tr>
<td>Water</td>
<td>13.90</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>

105. NUTRITIVE VALUE OF BARLEY.—As an article of food for man, or animals, barley occupies a lower position than either wheat or oats, its composition in 100 parts being made up as follows:—

Air-dried Barley.

| Matters containing nitrogen, of flesh-forming capabilities | 13 parts. |
| Matters not containing nitrogen, but which furnish animal heat, and tend to the formation of fat | 69½ parts |
| Ashes | 3½ |
| Water | 14 |
| Total | 100 |

The nutritive properties of good specimens of two-rowed barley, according to the analysis made by Sir Humphry Davy, as contained in 100 parts, are:—

| Muclilage, or Starch | 79 |
| Saccharine matter | 7 |
| Gluten, or Albumen | 6 |

But the grain which formed the subject of this analysis was taken
from a fine specimen grown in Norfolk, a county celebrated for the production of the finest quality of barley.

106. USES.—Besides being largely used in fattening animals on the farm, the grain of barley, boiled, has been found to form a capital mash for horses after a hard day’s work. It acts well as a gentle aperient and sudorific, opening the system and softening the skin.

Barley-meal is also considered a capital adjunct to the food of stall-fed or box-fed animals, being soothing in its effects, and tending to prevent cutaneous irritation.

The great consumption of barley is, however, in the enormous amount that is converted into alcoholic drinks in the form of beer and spirits, which brings in a large amount of revenue to the Government, as well as forming a large branch of national industry. The abuse of the use of intoxicating drinks, which prevails to such a great extent in the United Kingdom, and is such a frightful source of misery among the lower classes, is both a national reproach and a source of deep regret to every patriotic Englishman.

107. FOOD.—As a bread-stuff barley is not only inferior to wheat flour, but is secondary also to oatmeal, even in the estimation of the rural working-classes of Scotland.

It is seldom used as an article of food in England; but it may often be seen on the tables of the working-classes in North Britain. The barley is ground into meal, made into cakes, and baked on a griddle, either by itself—forming what is termed barley-cakes—or mixed with oatmeal.

In the South of Scotland these mixed cakes, or “bannocks,” as they are termed, are very commonly made and eaten. The bread, made with an admixture of barley-meal in it, bears the character in the north of being more substantial and satisfying than that made from the flour of wheat; and the meal, when mixed with oatmeal, is considered more beneficial to the human system as tending to keep the blood in better order than when oatmeal is used alone.

108. MALT.—Malt can be made either from wheat, oats, rye, or barley; but the latter grain is the one almost exclusively used in this country for the purpose of malting.

The process of making malt consists in changing a portion of the starch of the grain into sugar and dextrin, a kind of gum, produced by artificially excited germination, which is suddenly checked by the application of heat; the chief aim of the malting process being to produce diastase, which may be termed a kind of grape-sugar, the value of the malt being dependent upon the proportion of diastase it contains.

The grain is first thoroughly soaked in cold water, in a large cistern, or tank, until it has absorbed about half its own weight of the water, which causes it to swell considerably. The wetted grain is then thrown upon the “malt-floor” where it remains for some time in a heap, technically called the “couch,” in a
layer from twelve to sixteen inches in depth. The germinative process now sets in, in the course of which a great amount of heat is developed, and in order to prevent its getting too heated, the germinating grain is spread out on the floor in thinner layers, the temperature being properly regulated by repeatedly turning over the grain with wooden shovels, specially made for this purpose, the heap thus regulated maintaining a heat varying from $55^\circ$ to $62^\circ$.

When the young shoot thus artificially stimulated in its growth has attained about the length of the barley grain, and the acrospire, or rudiment of the future stem, makes its appearance, the process of germination is stopped, and the malt is carried to the kiln. Here it is dried on frames of wire gauze, at first at a temperature not exceeding $90^\circ$, but afterwards gradually raised to about $140^\circ$.

Brewers generally make use of three different kinds of malt: pale, or amber malt, which is the principal ingredient used in the manufacture of beer and ale; brown malt, which is employed to impart flavour; and roasted, or black malt, which is used in colouring porter—the varieties being produced by a higher or lower temperature in drying the malt.

109. MARKETS.—Barley is commonly bought and sold in most of the established corn-markets throughout the kingdom; but the maltsters in particular are large buyers of barley, certain districts throughout the country being celebrated for the production of malt over others, the maltsters being willing to pay full prices for the best kinds of barley that are especially well fitted for their own particular purpose and business.
CHAPTER V.

RYE, MAIZE.


110. NATURAL HISTORY.—Rye (secale cereale), in its grain, bears an appearance somewhat between wheat and barley, the ear being bearded and the stem tall and slender. Four species of the plant are enumerated by botanists, secale villosum, orientale, creticum, and cereale, the last-named being the only kind cultivated in Great Britain.

Secale cereale is said to be a native of Canada, there being two varieties of the species which are termed respectively winter and spring rye, but probably this difference may have resulted more from different methods of cultivation, than from any inherent variation of the plant.

Rye is used for making bread in all the sandy districts to the south of the Baltic and the Gulf of Finland, and is not only the chief item of human consumption, but enough is raised upon these otherwise unproductive districts to export as well to some of the Prussian ports.

The Swedish peasantry to a great extent subsist upon rye-cakes, which they bake only twice in the year; and consequently they are often considerably harder than the stalest sea-biscuit, during most part of the time when it is eaten.

Rye is subject to a disease called by English farmers horned rye, but which is of rare occurrence in Britain; by the French termed ergot, from the fancied resemblance the excrescence bears to a cock’s spur, the disease usually having been noticed as occurring after a wet spring that has been succeeded by an unusually hot summer.

When bread has been made from this diseased rye, its use has been followed by spasmodic symptoms, and gangrenous disorders. It is related that, in 1596, an epidemic raged in Hesse that was entirely attributed to the use of horned rye, a number of persons being seized with epilepsy, which for the most part ended
fatally; while others became insane, and never afterwards recovered. Not only human beings, but quadrupeds and insects, have been fatally affected by it; its effects being well known to medical practitioners, ergot of rye having found a place in the English pharmacopoeia.

Rye, when parched and ground, has been sometimes used as a substitute for coffee, and in Holland it is the chief grain from which is made the spirit called hollands, or geneva, the Dutch name for juniper, with which it is flavoured, and hence the English name of gin.

111. VARIETIES.—The varieties of rye comprise the common or winter rye, and the spring rye, which latter has shorter and more slender straw. It is earlier than the winter variety by ten or twelve days, and as it does not tiller so freely, is consequently less productive than that sown in the autumn, which, taking longer to vegetate, but tillering more abundantly, yields larger crops.

112. MOST SUITABLE SOILS.—The soils most suitable for the growth of rye are those which contain the largest proportion of sand, and it is the only description of corn that will grow upon land where there is a mixture of more than 85 per cent. of sand with other earths.

Although rye will grow upon land of the poorest quality, yet the produce will not be so abundant as when grown upon a more fertile soil, so that it be not of a clayey nature. Rye may be grown to advantage upon poor heath-land, upon which no other kind of corn would grow, and which ordinarily produces herbage only of the scantiest description.

113. MANURES AND CULTIVATION.—Upon sandy soils it is considered the best plan to commence with one good ploughing
and harrowing, and then to spread a coat of farm-yard manure upon the surface of the land, and plough in the dung. Although rye is generally sown upon the poorest land, with few of the best appliances of tillage, or manures, as cultivated in England, it is a very impoverishing crop.

It used to be the fashion with some old-fashioned farmers to plant about one-thirtieth of rye to each bushel of wheat, from the idea that the rye afforded shade and shelter to the wheat, especially upon poor soils, improving the quality of the wheat. The deterioration to the sample of corn by the admixture would be more than recompensed, it was thought, by increased yield.

The ordinary cultivation of rye is much the same as wheat, only requiring less tillage. It pays for being well hoed, and also for harrowing in the spring, provided the roots be found to have a firm hold of the ground; and it is necessary to use light harrows.

The cultivation of rye as a corn-crop has been steadily decreasing of late years in this country, owing to the improvement of the land that at one time was only thought good enough for the production of rye; but as a forage-crop for early spring feeding it is very extensively cultivated.

In bleak situations unfit for the production of wheat, freshly broken-up ground has been profitably sown with rye, fresh wastes of some elevation bringing heavy crops, as well as lowland gravelly loams.

114. SOWING.—Rye is generally sown a month earlier than wheat, sometimes the seed being put into the ground at the latter end of July, but the usual time of sowing is some time in August, and seldom later than the beginning of September, the yield of the crop suffering from late sowing; when the quantity of seed must be increased, 2½ bushels being enough for an early sowing, but 3 bushels will be required for a late one.

The seed must be more lightly covered than that of wheat, for if sown too deeply in a tenacious soil, it may be prevented from germinating.

115. RYE AS A GREEN CROP.—It is, however, as a green crop that rye is the most valuable to the farmer for stock-feeding purposes, being peculiarly well suited for animals giving milk, as ewes and milking cows, being given to the latter mostly in conjunction with good chaff; as a soilling-crop its great advantage is its earliness, coming in handy after the turnip-crop has been consumed.

When used as a green-crop, it is considered that rye cannot well be sown too thickly, a few tares or rapeseed being sometimes
sown as well, to thicken the bottom of the feed, and improve its quality.
The time that rye is fed off has to depend upon the weather, and if allowed to get too far forward sheep will not readily eat it; from the middle to the latter end of April being the most usual period. When in a forward state it is mown for horses, which relish it exceedingly, but it should be given in a quantity not exceeding one-third of the whole amount of fodder, that is to say, one-third of green rye cut into chaff, to two-thirds of green provender, increasing the quantity as the season advances, and thus preparing gradually for the green summer food, which, when given all at once, from its laxative nature, is accompanied by mischievous results to both horses and cattle.

116. RYE - STRAW.—Rye-straw is tough and pithy, and not much liked by cattle, growing to a greater height than that of wheat; sometimes yielding nearly two tons per acre. It is of a very nutritious quality, and can be given to cattle profitably on this account, and can be made to be eaten by them if steamed, and the chaff mixed with more palatable food.

It is in good request by brickmakers for making bricks, who are willing to pay a long price for it, while its great length makes it useful to the harness-maker, for stuffing collars, as well as being the best kind of straw for thatching. Straw hat and bonnet-makers purchase it for making plait; and it is, on account of its usefulness for various purposes, considered more valuable than any other kind of straw.

117. HARVESTING.—Rye ripens earlier than wheat, and must not be allowed to stand till it gets dead ripe before it is cut, for sometimes even a shower of rain which may fall upon it in this condition will occasion it to sprout.

Its ripening is denoted by the straw losing somewhat of its bright yellow colour, and becoming paler in hue, while the knots in the stem no longer continue green, but assume one uniform shade of yellow with the rest of the stalk. The corn also sheds easily from the ear, and when these signs exhibit themselves the crop should be reaped and carried without delay; the harvesting operations being conducted on the same principle as the other grain crops.

118. COST OF CROPS.—A crop of rye costs less in its course of cultivation than wheat, and has been called the wheat of our light soils, requiring a smaller amount of tillage and less manure—and it might, doubtless, be cultivated more extensively than it is in
England upon poor, light soils where other kinds of grain cannot be grown.

The cost of its growth has seldom been minutely calculated, being only an occasional crop, grown upon freshly broken-up land of poor quality, being very impoverishing to grow regularly, its long and stiff straw being probably the greatest occasion of this; its product of grain being nearly the same as that of a moderate crop of wheat, something like three quarters per acre being about the average, and thus considerably below what may be termed a good wheat-crop, the weight of a bushel of rye generally ranging from 50 lbs. to 56 lbs.

119. USES. — Rye is made into bread in those districts where it is most commonly grown, as a breadstuff being considered slower of digestion than wheat, and therefore better adapted for the use of those who have to exert muscular strength, but it has never been taken to thoroughly by the English peasantry. It is darker in colour than wheaten flour, and keeps much longer moist than bread made of wheaten flour; but rye for this purpose has been practically thrown aside in England, where it is of more importance as a green crop than in the shape of corn.

120. CULTIVATION OF RYE ABROAD.—Rye is held in much estimation abroad, and is used extensively, and grown for the purpose of a breadstuff in the north of Germany, in Norway, Sweden, and some parts of Russia, and very generally throughout the north of Europe. While rye also can be grown in latitudes that are too cold for the cultivation of wheat, it delights in the sandy flats of Flanders, where the grain is grown to perfection.

Linnaeus relates that he observed the practice in Lapland of mixing one part of rye and two parts of barley together, and sowing the grain as early as possible in the spring. In that climate the barley shoots up vigorously, and ripens its ears which are reaped; while the rye merely gets into leaf, without shooting up any stem, its growth being kept back by the barley, which to an extent
smothers it. But after the barley is reaped, the rye grows rapidly, and without any further care yields an abundant crop in the following year.

137. MAIZE, OR INDIAN CORN (*Tea* *mayz*), is of too little consequence to be of any agricultural importance to farmers in this country, so far as its cultivation is concerned, though it may be often employed economically as a feeding-stuff.

Should its cultivation be attempted, it is necessary to make choice of a warm spot, which is perfectly open to the influence of the sun's rays, and not at all shaded. In order to admit the sun as much as possible to the plants, it is usual to remove the blades as well as the top and tassel, as soon as the office of dropping the fecundating farina upon the ears has been duly accomplished.

The largest known variety of maize is American Indian corn, which in favourable situations has a very considerable growth, rising to a height varying from seven to ten feet; in some instances having been known to have reached the extraordinary height of fourteen feet, without the productive power of the plant being impaired. This variety will rarely arrive at maturity in a northern climate, and can never be relied upon for a crop in any part of Europe.

It is found growing wild in some of the West Indian Islands and in some parts of Central America, in the best situations adapted for its growth, producing from three to four hundred-fold increase upon the amount of seed sown, which is often gathered; an increase of eight hundred to one at times having been known—a rate that has occasionally provoked the incredulity of Europeans who have been informed of the circumstance, which they have set down as a traveller's tale.

A smaller variety of maize is cultivated in Spain, Portugal, and Lombardy, which has white grains, the French, among whom the grain is partially cultivated, giving to it the name of *Blé de Turquie*; but it will not succeed in England, except in unusually favourable seasons.

A yet smaller kind still has both yellow and white seeds, seldom rising to a height above four feet, and the ears not exceeding four or five inches in length; and this kind will ripen its grains in England, but it has constantly failed in this country as an article of permanent cultivation.

The ears, or corn-cobs as they are called, are eaten green in the United States, forming a delicious vegetable, that is relished in much the same degree as early green peas in this country; and William Cobbett, who resided for a considerable time in America, and others, have made repeated efforts to estab-
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lish its regular growth in this country. Partial success has attended these efforts in favourable years, when unusually long and warm summers have prevailed, but even in the best seasons it cannot be profitably grown.

When its cultivation is attempted, the seed is sown three or five grains together at regular intervals of three feet, in rows sufficiently wide to admit the passage of a small plough or horse-hoe, to keep the ground clean and free from weeds, and for the purpose of loosening the soil around the roots; and to stimulate the growth, when the weather is hot and dry, a shallow basin round the stem of each plant is sometimes formed, in which a little guano is sprinkled, but so as not to touch the stem, and the ground flooded about it with pond water; or a little guano is dissolved in water and poured at once on the soil.

When the stems are a foot high, more earth should be added to enable them to better stand the force of the wind. In all moist seasons fully-formed cobs may be produced for the table by the garden system of culture, and many sufficiently so for the poultry-yard, and which turkeys especially will be found to relish very much.
CHAPTER VI.

FLAX, HEMP, AND RAPE.


122. NATURAL HISTORY OF FLAX. — Common flax, Linum usitatissimum, is an annual plant indigenous to this climate, which grows with slender, upright stems, from eighteen inches to two feet high, which bear clusters of small, blue, shining flowers. The fruit is a globular, cartilaginous capsule, splitting when ripe into ten boat-shaped valves, each containing a single seed, called in common parlance lin-seed. These are oval, brown, flat and shining, possessing a very mucilaginous quality when acted upon by hot water, and, when pressed, giving out an abundance of linseed oil; the residuum forming the unctuous substance known as oilcake, now so largely used in fattening cattle. A good deal of this oil is sent to France, where it is refined, and afterwards sold again in this country.

Flax has been cultivated from time immemorial for the sake of its textile fibre, though the flax culture in England has decreased very much of late years, more attention being bestowed upon its growth as an agricultural crop in Ireland. The Dutch settlers commenced to cultivate flax on the flat lands in the neighbourhood of Selby and Hull, where it continues to be produced of good quality, but is only grown to a very small extent; it being a very laborious crop, better suited to small farmers than large ones, unless the latter are prepared to bestow the minute attention upon it which its successful cultivation demands. This is eminently bestowed upon it in Flanders, from whence we obtain flax of the finest quality.

123. VARIETIES. — There are several kinds of blue-flowered flax
known to botanists, but the *Linum usitatissimum* alone is cultivated, of which there are two different kinds.

*Linum humile*, or *crepitans*, the spring flax, is sown in April, and is more dwarf and inclined to branch than the winter flax sown in October, the true *Linum usitatissimum*, which has smaller capsules than the former, not bursting with the elasticity which distinguishes the other, and having seeds of a much darker brown colour.

**CULTIVATION.**

—A rich alluvial sandy loam, or a loose marl, neither too wet nor too dry, is the most appropriate for the growth of flax. Upon poor clays, or dry gravelly soils, it will not thrive. If the land is at all of an inferior quality, it should be heavily manured for the preceding crop, to bring it into a productive condition fit for the reception of flax-seed — otherwise the manure will have but comparatively little effect — and should be brought into much the same condition as good wheat-land. If the soil is made too rich the crop will be coarse, and become liable to be lodged.

There is no crop for which the land requires to be better worked; and if the stems are pulled up for the sole purpose of the textile fibre from which yarn is produced, without allowing the seed to ripen, it does not exhaust the soil.

The seed is always sown broadcast, the object being to produce a thick crop of plants, which, like trees when standing closely together, will bring up straight stems, better adapted for the growth of yarn-fibre than if they were allowed to branch out. The quantity of seed sown is therefore somewhat large, as much as three bushels
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per acre being sometimes used, which is a very large quantity for so small a seed—though many growers use only two bushels.

The flax-crop in Ireland is generally thought to be sown too thin, which is the chief cause of the inferiority of the produce compared with that sent from Flanders, as the stems branch out too much, and although it will thus bear a great deal more seed, they produce it at the expense of the length of the fibre, which is the chief object when grown for manufacturing purposes.

Seed should be frequently changed, for if plants are continuously raised from the same species, the plants every year become shorter; and the imported seed from Holland, or the Baltic, should always be used, as it is an incontestable fact that seed produced in those districts is superior to that grown in Great Britain. Even in Holland and Germany, growers are in the habit of importing their seed from Russia, which is grown in the provinces of Livonia, Courland, and Lithuania, being known here under the description of “Riga-kind.”

125. COST OF CROPS.—When carefully cultivated, flax is a most profitable crop to grow, the whole expense not amounting to more than £10 an acre, while a profit of £20 per acre has been frequently realised; a result of course dependent upon the market-price of the article.

126. TREATMENT OF THE CROP, AND PREPARATION FOR MARKET.—The crop must be supposed to have been carefully weeded in the first place, which is done by hand, to avoid pulling up or injuring the young plants of flax. The plant blossoms in July, and if the object is merely the flax, it is then pulled, but if grown for the sake of the seed it is allowed to stand till it gets perfectly ripe, which will mostly be towards the latter part of August.

When pulled, the plants require to be sorted, and the long and coarse ones kept by themselves, as they each require different modes of dressing, according to the uses for which they are intended to be applied, and are then bound in sheaves about the thickness of a man’s thigh, and are either “dew-retted,” “dyked,” or “water-retted,” with the object of loosening the rind from the stalk.

The process of “water-retting” is the one most usually adopted, the sheaves being immersed for several days in standing water in a pit, the sheaves being placed in direct, and across, and trodden down as they are laid in. After it is heaped up with sheaves to within six inches of the surface, it is covered over with rushes or straw, and loaded with stones or any other heavy weight to keep them pressed down.

There is a good deal of nicety to be observed as to the length of time the flax remains in the water, which is understood by practised hands, it sometimes being found sufficiently steeped in five days, while in other instances it has remained ten days or longer without
injury; but when it is left too long in the water the threads become soft and weak, and are comparatively useless to the manufacturer. The water of the dyke should be clean but stagnant, and when removed from it, the flax is spread upon grass-land where the grass is short, to dry.

"Dew-rettng" consists in spreading the plants immediately they are pulled upon a grass sward for five or six weeks, and occasionally turning them till they are sufficiently brittle for the separation of the fibre from the bark. But the success of this operation depends very much upon the weather, and therefore cannot be relied upon definitely, and it is not very often adopted unless when the crop is left to stand for seed.

The preparation of the flax consists in breaking or bruising the stem, so as to separate the fibre from the bark, and afterwards "scutching" it, or cleaning it, from refuse; it is then "heckled" as the final preparation for market. There are machines used for these operations which it is not necessary to give a description of, beyond stating the fact that the heckler uses numerous iron teeth fixed upon a board, through which the flax is drawn repeatedly, and by employing different sets of teeth he is enabled to sort the flax into various lengths, the refuse being tow.

When flax is grown for the production of seed, the plants are not pulled till quite ripe and the pods have become yellow, and the leaves withered and drooping, and the plants are best dried like standing corn. The seeds are separated from the stems by a process called "ripping," the stems being drawn through a set of teeth till they are completely cleared of the grain.

127. NATURAL HISTORY OF HEMP.—Hemp (Cannabis sativa), although applied to nearly the same purposes as flax, is altogether a different plant in appearance, its fibre being of still greater strength than flax, being mostly employed in the manufacture of sailcloth, canvas, cordage, &c.

It is a native of the warmer regions of Asia—the locality of the plant in its wild state extending from Syria to the mountains of India, though it is extensively cultivated in most of the milder portions of Europe—being an annual belonging to the order of nettleworts, many of which are furnished with a tough fibre useful for textile purposes; the most notable of this description of plant, which has lately had a good deal of attention bestowed upon it, being the Rhea nettle.

Hemp attains a height of five or six feet, and has been known to reach twelve feet under favourable circumstances. The surface has hairs sparingly scattered over it, which in hot climates dis-
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charge a resinous secretion which has an unpleasant odour, and is
of a narcotic principle, though this quality is developed in only a
slight degree in cold climates; but it has an unhealthy influence
in places where it is steeped, poisons the fish. The leaves are
separated into five narrow, taper-pointed, rough, serrated fingers,
or lobes; some of the plants being male and others female, the
flower and fruit growing on separate stems, the female hemp
bearing the seed, and the male plant containing merely the pollen
by which it is impregnated, the plants being often confounded.
Though they are both produced from the same seed, the male
plant ripens five or six weeks earlier than the female, the difference
only being known at the time of blossoming.

The narcotic, stimulating, and intoxicating properties which mark the plant
when grown in India or Syria, but of which it is destitute when grown in England,
do not arise from a difference in variety, but are due to the influence of soil and
climate. From the rough, hairy green back, containing numerous woody fibres,
the hemp is obtained which is sometimes called the “reed” or “boon;” the
male species being mostly smaller, and more delicate than the female. The stem
dividing itself at the extremities into several branches, which terminate in slender
spikes, ending in a point; the flowers when expanded hanging in clusters of a
purplish colour pendant from the leaves: whilst that of the female terminates
in tufts, and leaves of considerable size, amongst which is the seed, which is borne
along the stem.

A great difference of opinion is entertained as to the effects of a
crop of hemp upon the soil—some considering it very exhaustive,
while, in some of the old leases to be found in Cambridgeshire, there
are stipulations that the land shall be sown with hemp in the last
two years of the term; while in others there are absolute prohibi-
tions to its growth. But it is generally admitted to be an effective
cleanser of the soil, growing so quickly and with such strength as
to destroy all the weeds which spring up under it.

The hemp-plant is said to attain a height of from 15 to 20 feet
in oriental climates, and on the low lands near the mouth of the
Danube, and also in Italy.

The seed is soft and oily, large quantities of oil being obtained
from it in the crushing-mills, the refuse forming oilcake; the Riga
seed being considered the best.

128. SOIL.—A strong rich loam is the soil best suited for hemp;
in this country, the moist, rich fens of Lincolnshire and the Isle
of Ely and similar land being particularly appropriate for its cul-
tivation; the strength of its fibre being always in proportion to
the richness of the ground upon which it has been grown. Grown
upon ordinary soils, the yield is smaller, but the quality is somewhat
finer.
CULTIVATION.—The land is dressed in much the same way as for flax, but the time for sowing is deferred to a later period, as the young plants are more susceptible of injury from frost. Sowing should therefore not be done till the middle or end of April in the southern districts of the kingdom, and not till the middle of May in the northern ones, when no frosts of consequence are to be apprehended. The earlier it can be sown with safety the better will be the quality of the hemp.

The quantity of seed sometimes varies from two and two-and-a-half bushels per acre, to three bushels. If the fibre is wanted fine, the larger quantity is used, and can be most profitably applied to soils of second-rate quality; but poor land must never be selected for hemp, as the crop will turn out to be small, and its produce be only of inferior quality.

The seed is commonly sown broadcast, for though drilling in rows at an interval of 30 inches has been recommended, so as to allow of the soil being well hoed, and to admit the air, the hemp by this means is made coarse, and, with regard to the weeds, the rapid growth of the plants smothers them effectually.

There are two objects to be arrived at in growing a crop of hemp—the production of seed, and that of fibre. If the seed is not taken, the crop will be ready to harvest in about thirteen or fourteen weeks after sowing the seed, and the stalks which bear the flower containing the pollen ripen three weeks earlier than those which bear the seed, ripeness being indicated by their turning yellow at the top, and white at the root; while the flowers fall, and the leaves begin to wither.

These should, therefore, be pulled separately, and in a somewhat green condition, as the fibres will then be more easily separated than if allowed to stand longer, and be better fitted for the manufacture of cloth. The two species, male and female, are called respectively "femble" and "seed-hemp;" and their separation should be carefully attended to, though, in some districts, it is very much neglected, which is occasioned sometimes by the pressing occupations of harvest-time, and is in others deterred from a fear of the awkwardness and inattention of the pullers injuring the rest of the crop.

The ripeness of the seed-bearing plants is indicated by similar signs to those which mark the "femble," as also by the seeds turning brown and the pods bursting open; and when allowed to stand for seed, the harvest is necessarily later, the crop seldom coming off the ground until the end of September or the middle of October, when it is put up into shocks in the same manner as corn to dry, and is threshed out upon cloths in the field, the sheaves being
afterwards stacked till the spring, when the "retting" takes place in the same way as flax.

When the crop thus stands for seed, the quantity of the hemp is diminished, and the quality is also inferior, the "maiden-hemp," as that is termed which is pulled green, generally producing about one-fourth more than the seeded hemp.

130. COST OF CROP.—The cost of the cultivation of a crop of hemp has been estimated to be about £18 per acre, including pulling, steeping, spreading, threshing, scutching, cleaning seed, and taking to market; and the price of 20 loads of manure at 5s. per load. The latter represents an item of £5, not reckoned in the estimate of flax given before, which has been supposed to follow a richly-manured crop; and in giving these kind of estimates it is difficult to make anything like a correct statement of expenses, as those of one crop ought to be relatively considered in its connection with other crops in a course of rotation. Thus hemp, after beans, has been known to produce a crop weighing 30 stones more than is to be obtained by any other manner of culture, as bean-stalks on strong land form one of the best manures, on account of keeping the land open. Hemp, on the other hand, leaves nothing behind that can be applied as manure; but its growth has been found an admirable preparation for a wheat-crop, and, when heavily manured, alternate crops of wheat and hemp have been very successfully grown upon the same land for several years.

Uses:—It is not, however, regarded as being such a good paying crop as flax, its application not being for similar uses and purposes; but for coarser fabrics, such as sacking, cordage, and what are known as inferior hempen textile fabrics.

The husk is only fit for fuel, but the chaff is said to be equal to the tail of common oats, and horses eat it with great avidity. As before stated, a large quantity of oil is obtained from hempseed, and the residue forms oilcake.

131. BIRDS, &c.—Birds are very destructive to hemp, at several stages of its growth. When it first comes up, small birds make great havoc amongst the young plants; and at this period the growing crop requires well watching, the birds being scared away.

Again, when the seed-hemp is set up to dry in sheaves, the birds are greatly attracted to it, being a seed of which they are uncommonly fond; and, to keep them off, the undergrowth should be raked up, and spread evenly over the tops of the shocks, and the heads should be bound round with a band of the same, to prevent the wind disturbing it.

During the process of watering, or "retting," in order to obtain the fibre, it is customary, after this course has been completed, to
spread the hemp on summer-cut grass land, to set the fibre free, and to bleach. The meadow should be allowed sufficient time to allow the grass again to grow—a period of three weeks or so—for when the grass is very short, and the land bare, worms are apt to draw a considerable quantity of flax or hemp fibre into their holes. A good growth of new grass will prevent this injury if the turning-over is properly attended to.

132. RAPE.—Rape is described as a biennial plant of the same natural botanical order as the turnip, and some writers speak of it as coleseed; but although the terms rape and cole are often used synonymously, they are two very distinct plants, and while equal in value for the production of seed, rape only ought to be cultivated as food for sheep, its habit being to form a strong upright stem in the first place; whilst cole spreads into leaf in the autumn, and only shoots into stem during the following spring, breaking out into flower even while the stems are forming.

133. RAPE AS A GREEN-CROP.—Rape is an excellent crop to grow upon soils which are too adhesive for turnips, as food for sheep, provided the soil is of good enough quality to allow the plant to grow with luxuriance, and they fatten upon it with great rapidity. Upon the chalk and oolite formations, it is often grown mixed with vetches or turnips.

The crop seldom fails, and is less affected by the variations of the weather than most other plants, though it is not of equal value to a crop of turnips, for which it is sometimes substituted; a great deal of the nutriment being contained in the pith with which the stalk abounds, the sheep preferring the stem to the leaves.

On peaty land, turnips are seldom of good quality, when rape will be found an excellent substitute for them.

134. CULTIVATION.—The methods of cultivation are somewhat different in various counties, but the tillage is usually much the same as practised with turnips, the land being prepared in a similar manner as for a root-crop.

It is often sown broadcast, but the better plan is to drill in about four or five pounds of seed per acre at suitable intervals, in accordance with the quality of the land, varying from one to two feet. To stimulate the early and abundant growth of the plant, a light dressing of superphosphate of lime, or bone-dust, mixed with ashes, and applied when the seed is drilled in, is given.

The time of sowing for the first feeding off in August and September, is in April or early in May, but it is sometimes sown in June, the most common time being about the latter end of July upon rich alluvial loams.
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The young plants of rape when they have attained the proper size, are harrowed, and horse or hand-hoed, and the plants singled out in a similar manner to turnips, though in some districts this is not done. The crop is not so commonly grown for the sake of its seed in this country as it is abroad, but when this is done, rape is often made to follow peas, or winter beans. The crop is ready for cutting about the end of June, or beginning of July, but it ripens very unequally, the upper pods getting ripe before the lower ones; the best time for cutting being when the upper pods are perfectly ripe, and of a red-brown colour.

The sickle, or hook, needs to be very carefully used, on account of the seed being easily shaken, as it is generally too ripe to be tied in sheaves. It must lie in handfuls some time to dry and ripen, which needs to be carefully done, for if not well got the seed is of inferior quality, and but only of small value. A little rain often damages the crop, and it requires to be got out of hand quickly, the bean-drum of a common threshing-machine answering for the purpose of threshing very well when the crop is large; but when only a small quantity is grown, it can be threshed with a flail upon a large cloth that is kept for the purpose where rape is grown as a regular crop.

Uses:—As rape grows very rapidly, and continues to grow late in the autumn, it is considered a good crop for ploughing in as a green manure, and is sometimes cultivated for this sole object.

The seed is bought by seed-merchants, and seed-crushers, for the sake of the oil which can be expressed from it; the residue forming rape-cake, which is an excellent manure for top-dressing. Rape-oils belong to the non-drying oils, possessing a disagreeable smell and taste, and are generally used for illuminating purposes. A quantity of this oil is sent from England to France, from whence a portion is returned to us under the name of colza oil, though colza is a different seed, rape producing a smaller crop.

The haulm of rape is too frequently burned, but it makes a valuable litter, either for the farm-yard or for stack-staddles.

135. COST OF CROP.—No certain estimate can be offered as to the cost of a crop of rape, as the expenses vary according to the different modes of cultivation practised, and the object of the crop, whether to be used as manure and ploughed in; as a green crop for feeding stock; or if grown for seed. In the latter case, in addition to the usual cost of ploughings, harrowings, and hoeing, together with the manure used, the cutting, turning the crop, and bird-keeping must be added—the latter rather an expensive item; but the estimate of cost of any particular system, when these are duly taken into account, can readily be arrived at.
136. INSECT ENEMIES.—Rape, and all the cabbage tribe of plants, are liable to the ravages of a great number of insect enemies; in spring, the leaves being eaten by the little skipping beetles (*Altica consobrina*), while from June to the end of November, the leaves are at times infested by the caterpillars of the white-cabbage butterflies (*Pontia brassica*). Again, the cabbage-moth attacks the hearts (*Noctua*, or *Mamestra brassica*), as also does the larvæ of smaller moths; while the cabbage-plant lice (*Aphis brassica*), in the autumnal months smother the under side of the leaves. These should be carefully taken off, and the leaves put in baskets to be carried off and burned, while the smaller patches may be crushed by the hand.

There are other insects which prey upon these in turn; the caterpillars, especially, having a host of enemies, which check their excessive multiplication, which otherwise would be beyond the power of the agriculturist to keep down.
CHAPTER VII.

PEAS.

Natural History—Varieties—Soil best suited for Peas—Ingredients taken by Peas from the Soil—Seasons for Sowing—Sowing—Weeding—Diseases, Insect Enemies, &c.—Harvesting—Yield per Acre—Stacking—Cost of Crop from Seed-time to Harvest—How to Judge of Peas—Analysis of Peas—Nutritive Value of Peas—Peas as Food for Cattle—As Human Food—Pea Haulm.

137. NATURAL HISTORY.—The common pea (Pisana sativum) is found growing wild in Greece and other parts of the Levant, and is known in India, China, and Cochin China, though, when it was introduced into Britain, or from whence, is entirely unknown.

It is considered probable, however, that it originally came to us from the warmer parts of Europe, from whence it may have been derived from Egypt and Syria. The narrative of historical events furnishes proof that it was cultivated in this country at a very early period, it being related that, when the English army was besieging a stronghold in Lothian, A.D. 1299, running short of provisions, the troops maintained themselves upon the peas and beans that were growing in the surrounding fields.

From an old song called "London Lackpenny," made in the reign of Henry VI., one of the street cries is mentioned, "Gods Pescode"; while old Fuller speaks of peas being brought as rarities from Holland in the reign of Queen Elizabeth, which were no doubt of the more delicate kinds, the same as the garden peas now cultivated.

It is a plant that does not grow in either very hot, or cold climates; since it requires a certain degree of moisture, and suffers in a droughty, hot season, while it is soon affected by cold, and does not stand severe weather, the leaves becoming blackened by frosts.

138. VARIETIES.—Although the varieties of garden peas which are cultivated for the use of the table are almost endless, and some of the kinds are grown as field crops by farmers, who send them up by rail to London, or to other large towns in their own more imme-
The Crops of the Farm.

diate neighbourhood; yet those commonly known as field-crops, and sold in a dry state as pulse, are of only two species, which are known as the grey, or hog-pea, and the white, or boiling-pea.

There are only two varieties of the grey field-pea; but of the white peas there is a long list of varieties, named, in individual instances, either after the name of the first persons who have brought them into notice, or from the place where they were first grown.

Of the two kinds of grey peas, one ripens earlier than the other, and are called respectively: "cold" and "hot" seed. The "cold" seed ripens late, and requires to be sown early, while the latter arrives at maturity earlier, and may be sown as late as April. The cold seed is sometimes sown with beans, and, as they produce a good deal of haulm, the bean-stalks support the young plants of peas. When managed in this way, they are known by the technical names of "polts" and "blendings," being sown in the proportion of one-fourth to the beans, and they are the means of shading the ground, and in this way are often looked upon as performing a useful office; but when grown separately, the produce is very uncertain. The hot seed, on the other hand, seldom fails to yield a good crop, and is of a dwarf species.

The grey, or field-pea, is chiefly used for feeding pigs, and splitting for soup; and, where not much attention has been paid to the purity of the seed, several shades of colour may be found amongst them, from a dark hue, almost approaching black, to a very pale, or nearly white hue.

The two broad distinctions of the varieties are, therefore, the white, or garden-pea, of which some well-known varieties of the dwarf kind are: Early Frame, Early Warwick, Early Charlton, &c.; and Tall Marrowfat, Knight's Tall Marrowfat, &c., of the tall-growing peas; and the grey, or common field-pea. Different soils and different methods of cultivation have produced all the various varieties under these two sorts, although there is such a great difference in colour and qualities, and even in the number of flowers and pods growing from each peduncle; the sub-varieties of the garden-pea being never-ending.

The Early Warwick pea is one of the earliest for common field-cultivation; Grey Rouncival, Giant, or Dutch pea is about the latest of the field varieties; Grey Hastings is also a late sort; the Partridge pea, also called Grey Maple, or Marlborough, the pods of which contain peas that are speckled like the neck of a partridge
Peas.

The Purple-podded, or Australian pea, is a prolific variety of superior quality; and the Winter Field Pea stands cold weather without any very great injury.

Most of the garden peas, which it is not our intention to speak of here in detail, are supposed to have been originally derived from the Early Charlton, which sort may be profitably grown as a field-crop for table use.

139. SOIL BEST SUITTED FOR PEAS.—Peas grow best upon soils that partake of sand and loam, mixed with calcareous particles, that is neither exposed to drought nor cold humidity; or, where the soil is not calcareous, the land must be previously well chalked, marled, or limed. Without lime good crops of peas cannot be grown.

Good crops of peas can also be grown on strong clay soils, and on clayey sands, when the latter are not too dry. On rich, soft, alluvial soils, peas can never be grown successfully; while, on peaty or boggy land, the crop is always a failure.

140. INGREDIENTS TAKEN BY PEAS FROM THE SOIL.—A leading characteristic constituent of peas is legumen, which contains about 16 per cent. of nitrogen; and leguminous plants are thus of great benefit to the soil, which they enrich by those properties they draw from the atmosphere; but, in determining the amount of ingredients taken by peas from the soil, it must be borne in mind that the ash of the haulm of peas, which forms 73 per cent. of the whole crop, contains about 40 per cent. of lime; and the pulse about 5 or 6 per cent.; while the ashes of both are rich in sulphuric acid. It may thus be readily seen, why peas should thrive so well upon calcareous soils; and why liming, and marling, are so beneficial in a soil where these constituents are deficient. Peas also contain considerable quantities of sulphur in a certain organic combination with carbon, hydrogen, oxygen and nitrogen; which demonstrates the value of an application of gypsum, which supplies both lime and sulphuric acid to the growing plant.

141. SEASONS FOR SOWING.—With the view of obtaining very early crops, peas have been sown in a dry soil about the end of October, standing through the winter in favourable situations, when, if the crop does well, and the season is a forward one, the peas may be ready for gathering at the end of May, or beginning of June. Being a very precarious crop when grown this way, the risk is hardly worth running; and in ordinary cases, the period of sowing must depend upon the character of the pea; the late kinds being sown as early as the beginning of January, and continued
during the two following months. Early sorts are frequently not sown till the beginning of April, and are sometimes even deferred until May; the crop being in the meantime more or less subject to be thick in the husk, according to soil and climate. Early sowing is, however, thought to be a preventive of mildew, and it is considered by some the safer practice to make three or four different sowings, at intervals of ten or fifteen days between each.

142. SOWING.—The seed should be drilled in at twelve inches apart, and three or four inches deep, at the rate of three bushels per acre. In Scotland, a good many peas are sown broadcast; but the objection to this method is, that the land cannot be kept clean of weeds. On dry, easy, friable land, peas are sometimes ploughed in under the second furrow, not lower than four inches from the surface. But whatever may be the nature of the land, or however clean the land may be, peas are always best sown in rows, so as to give an opportunity of destroying the surface weeds that are sure to spring up amongst the young plants; and after they are dug up, the intervals should be carefully hand-hoed, and repeated, if necessary, just before the plants begin to meet at the top.

143. WEEDING.—These measures will keep down the weeds, at the stages spoken of; but previous to this, when the seed has germinated, which can be seen by disturbing a part of the row, and before the peas begin to show above ground, the land should be twice harrowed, rolled, and then harrowed again, to loosen the surface and kill any weeds that may have sprung up. After the operations mentioned have been carried out, a slight casting up should be given, to support the plants; and so as to allow this to be done conveniently, instead of sowing in single rows every second furrow, which is often done, it will be found better to sow in double rows, upon land of a suitable nature, nine inches apart, with two furrows between them. This will be carrying out the same principle adopted in garden cultivation, and can be easily managed when the furrow-presser has two wheels.

144. DISEASES, INSECT ENEMIES, &c.—Mildew upon peas is probably occasioned when in flower by Aphides, and a great number of insects assail them. The snake millipedes attack the seed as soon as it is sown, especially in wet seasons; while, as soon as they show themselves above ground, the weevils (Sitona crinita, S. lineata, and Otiorhynchus fuscipes) sometimes sweep them up. The small flies (Phytomyzae) attack the leaves, and the maggots of small flies take up their residence in the pods, as well as the caterpillars of a
moth (Grapholitha Pisana), which live upon the green peas contained in them, and make them maggoty. The larvæ of a destructive beetle, called Bruchus granarius, eats out the farina of the pea, and undergoes its transformations in its interior, so securely hidden that its presence can only be suspected by the lightness of the pea. These will not make their appearance if the seed is kept till the second year, when they will have left it. If peas are immersed in boiling water for one minute only, the insects they contain will be destroyed, without affecting the vitality of the seed.

Mice are also very destructive to peas, unearthing the seed, and often making long gaps in the rows; and these are to be caught and destroyed in various ways, while birds need to be kept away from a pea-crop.

145. HARVESTING.—The early kinds of peas are ready for harvesting about the middle of July, generally speaking—the time selected being when the lower pods are ripe; for if the upper ones are waited for, a good portion of the crop may be lost.

The reaping is performed by a scythe-hook, by which the haulm is pulled towards the reaper, the haulm sometimes being so matted together as to cause the crop to be cut with difficulty. When peas are sown in drills, each worker takes two rows, and the rest follow in succession. The sheaves are not bound, but are left lying loose until the haulm is somewhat dry, which takes about a week; but ten days if the weather is damp. The haulm shrinks very much when dry, which allows of the sheaves being easily bound up, being turned over and laid on their dry side in the binding, so that the uppermost side in the unbound sheaf becomes the undermost when bound.

The sheaves should not be lifted with hooks, which men commonly do for the sake of expedition; but be lifted by the hands in a cautious manner, as in hot weather a good deal of the grain may be shed. If the weather is showery at harvest-time, the swaths should be gathered into rather large cocks, and left so while the rain lasts, without changing their position, merely lifting them occasionally with the handle of a rake.

146. YIELD PER ACRE.—Nothing, perhaps, is so various as the yield per acre of the grain. In a dripping season, as much as 84 bushels of the Partridge or Marlborough pea have been taken from a single acre; 60 bushels being considered a very heavy crop, and 48 bushels a full one, while on light chalk soils from 30 to 35 bushels may be expected; but on very inferior land no more than 10 or 12 may be looked for. Thirty-six bushels is generally looked upon as being about an average crop on good land, and 22 bushels on somewhat inferior soils.

147. STACKING.—After the haulm has got sufficiently dry, it is rolled up, and bound in small bundles, or "wads" as they are termed; and these are in due time carried to the stack-yard, without being set up in shocks. Very often the crop is put loose into barns,
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where there is plenty of barn-accommodation, when the "wadding" process is dispensed with.

In some parts of the country, and especially in Scotland, a three-legged vent or boss, the top of which is as high as the eaves, is placed inside each stack, which permits the air to pass into the very heart of it, care being taken in building the stack, to have the centre higher than the outside.

148. COST OF CROP FROM SEED-TIME TO HARVEST.—The old-fashioned methods of reckoning the cost of a crop of peas was generally somewhat as under; but labour being dearer than formerly, an allowance must be made on this score:

<table>
<thead>
<tr>
<th>SOWN IN DOUBLE ROWS.</th>
<th>£</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribbing land before winter</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Two harrowings in spring</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ploughing...</td>
<td>0</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Press-rolling and sowing seed</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Seed, three bushels at 4s.</td>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Harrowing-in seed</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Harrowing and rolling before the plants are up</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Twice scarifying between double rows</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Twice hand-hoeing between single rows</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Reaping and binding</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Carrying, &amp;c.</td>
<td>0</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

£2 4 2

<table>
<thead>
<tr>
<th>SOWN BROADCAST.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribbing</td>
</tr>
<tr>
<td>Two harrowings in spring</td>
</tr>
<tr>
<td>Ploughing...</td>
</tr>
<tr>
<td>Press-rolling each furrow</td>
</tr>
<tr>
<td>Seed, four bushels at 4s.</td>
</tr>
<tr>
<td>Sowing</td>
</tr>
<tr>
<td>Reaping and wind-rowing</td>
</tr>
<tr>
<td>Carrying, &amp;c.</td>
</tr>
</tbody>
</table>

£1 19 8

To the above calculations must be added rent of land and cost of manure—the propriety of applying farm-yard manure to peas being questioned by some as tending to cause the crop to run to haulm, unless it has been ploughed into the land previous to winter. On soft soils, farm-yard manure is better away, as it is likely to produce too much straw, while gypsum and common salt are good, and have a direct tendency to increase the grain.

149. HOW TO JUDGE OF PEAS.—It is somewhat difficult to judge of the quality of peas in some respects, as they contain a latent principle, at times, which is derived from the soil, or manure. Shell marl or lime is said to forward a pea-crop very materially, but
Peas.

communicates a degree of hardness to the peas which causes them to be unfit for boiling. When the dung of sheep or hares has been used, the peas are said to possess a better flavour.

This is sometimes important as regards the kinds used for culinary purposes, but a good deal of mystery appears to hang over the subject, with respect to the boiling properties of peas; good boilers having come off land that has afterwards produced hard, indissoluble grain from the same seed, the effect being attributed by some to variations in the season; but it is generally understood their boiling properties are improved where lime is abundant in a soil.

150. ANALYSIS OF PEAS.—The average composition of peas has been set down as under:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Air-dry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legumin</td>
<td>23.4</td>
</tr>
<tr>
<td>Starch</td>
<td>37.0</td>
</tr>
<tr>
<td>Fatty matters</td>
<td>6.0</td>
</tr>
<tr>
<td>Grape-sugar</td>
<td>2.0</td>
</tr>
<tr>
<td>Vegetable fibre</td>
<td>10.0</td>
</tr>
<tr>
<td>Gum</td>
<td>5.0</td>
</tr>
<tr>
<td>Inorganic matters (ash)</td>
<td>2.5</td>
</tr>
<tr>
<td>Water</td>
<td>14.1</td>
</tr>
</tbody>
</table>

which will accordingly contain the following proportion of constituents:

151. NUTRITIVE VALUE OF PEAS.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Air-dry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogenised, or flesh-forming compounds</td>
<td>23.4</td>
</tr>
<tr>
<td>Matters free from nitrogen, and calculated to produce fat:</td>
<td></td>
</tr>
<tr>
<td>Starch, sugar, fat</td>
<td>50.0</td>
</tr>
<tr>
<td>Vegetable fibre</td>
<td>10.0</td>
</tr>
<tr>
<td>Ash, to make bone</td>
<td>6.0</td>
</tr>
<tr>
<td>Water</td>
<td>14.1</td>
</tr>
</tbody>
</table>

This analysis shows peas to be highly nutritious food, and, judiciously used, they are very useful in feeding and fattening stock.

152. PEAS AS FOOD FOR CATTLE.—Pease-meal, mixed with barley-meal, makes capital food for fattening pigs, and is largely used for this purpose. They are very warming in their nature, and given whole in moderate quantities, they have often been found useful. Too free a use of them is, however, objectionable, as they are apt to produce eruptions behind the ears.

It is also used (in the form of meal) together with oil-cake or bruised oats, in the feeding of sheep and cattle; and they may be given in small quantities whole, at times, to great advantage.

As Human Food.—There is no vegetable so universally eaten as green peas, except potatoes, but these are of the garden kinds chiefly cultivated. White
The Crops of the Farm.

Peas are used for split peas, used for soup, and for making pease-pudding; the principal point, when applied to this use, being that they are soft-boilers, those which do not dissolve easily being called hard-boilers. In Scotland, pease-meal is used mixed with barley-meal, or oatmeal, in making "bannocks," which are baked on a griddle. The best meal is made from the common field kinds for baking, being sweeter than that made from white peas; but for boiling, the latter are to be preferred. Bread made of pease-meal is eaten by the lower classes in Scotland, with "kail," made of greens and mutton boiled with each other; but its use is unknown, in the present day, amongst the peasantry and lower orders of the middle, eastern and southern counties of England.

153. Pea-haulm—Pea-haulm forms a very valuable fodder, and in Scotland it is looked upon as being only second to hay for feeding purposes; and in order to ensure its good quality, it is commonly cut with a green tinge, and carried to the stack-yard as soon as possible, so that the full amount of its succulency may be retained.

There is, of course, the risk of heating to be considered, but the contrivance spoken of before as a boss, or three-legged vent, vastly diminishes the risk of danger arising from this cause. Extra precautions are however taken, if the haulm is very damp, and another horizontal vent, something resembling a mason’s trestle, is placed at the bottom of the stack, and this causes the air to permeate the whole freely.
CHAPTER VIII.

BEANS.


154. NATURAL HISTORY.—Faba vulgaris, the bean, or, according to Linnaeus, Vicia faba, who regarded it as a species of vetch, has been cultivated in England from remote times; and may, perhaps, have been introduced into this country by the Romans, they being indebted to the Greeks for it, who are thought to have obtained it, in their turn, from Egypt. One of the noblest Roman families, that of Fabii, derived its name from an incident connected with the plant, as one of our own royal families, that of Plantagenet, from plante de genet.

The bean is cultivated in countries as far eastward as China and Japan, and is commonly used in various parts of Africa, some of the best varieties having been brought by the Moors into Spain. In Barbary it ripens at the latter end of February, and continues in bearing during the whole course of the spring, forming a very considerable portion of the food of many classes.

All the cultivated beans are annuals, with upright fibrous stems, growing from two to four feet high. The flowers are usually white, with a black spot in the middle of the wing: these are followed by long, thick legumes, enclosing large flat seeds, which vary in size according to their variety, embedded in a woolly covering. The flowers of the bean being very fragrant, there are few more delightful objects in nature than a beanfield in full blossom emitting its rich perfumes.

Beans, like peas, are divided into two main varieties—field and garden beans; the seed being dicotyledonous, or composed of two cotyledons or lobes, adhering closely together, but being distinctly separate in their parts, except at the base, or eye, where they are
connected by the embryo of the future plant: when they are in an unripe state, the cotyledons can be easily separated from each other; but when thoroughly ripe and well-dried, the albuminous matter hardens, when they are not easily separated.

The shape of the food varies very much in different sorts; some of the smaller-seeded beans being straight and cylindrical, and others, such as the larger garden, being flat and curved.

155. **VARIETIES.**—The beans grown as field-crops are confined to the long-podded common horse bean, which is called the “large tick,” the seeds being flat, broad, and of a brownish colour; and the “small tick,” which is nearly round in shape, hard, and almost black, but is liked best for feeding horses, and fetches the highest price in the market. These are included under the head of field beans, *Faba vulgaris arvensis*; and the different varieties of the garden bean under that of *Faba vulgaris hortensis*; they are, however, included by botanists under one species.

The early Mazagan bean, suitable for both field and garden cultivation, is supposed to have been introduced from a Portuguese settlement on the African coast, and, though not usually very productive, have in some instances yielded heavy crops.

The Heligoland is early and productive, being a hardy sort, especially well-suited for cultivation on rich alluvial soils on account of its being short-strawed, and when too great a bulk of haulm is to be apprehended from other varieties, on account of richness of the soil.

The Common Scotch, or Horse bean, is the one almost entirely cultivated as a field-crop in Scotland, being extremely hardy and prolific, the straw averaging about four-and-a-half feet in length, and yielding an average crop of grain of about 30 bushels per acre, ranging in weight from 60 to 68 lbs. per bushel.

The Common Tick, or Field bean, with seeds about one-third smaller than the preceding, is the variety most cultivated in England, being shorter-strawed, and more adapted for growing upon lighter soils than the others—the large ticks—which latter farmers prefer for strong lands; both covering the ground better and ripening a fortnight sooner than the smaller variety, and yielding heavy crops. There are several varieties of the small sort, respectively known as Essex Tick, Harrow Tick, Flat Tick, and French Tick, but they are very like one another for all practical purposes.

The Pigeon bean is the smallest-seeded of any of the varieties, being early, and yielding well, the stem being short, and the grain
dark-coloured and round. In the southern counties of England, this variety is often grown in conjunction with cabbage, being sown in autumn in wide drills, the spaces being planted with cabbages in June. The beans ripen early and are removed from the land in July, when the cabbages grow in August and September, which are fed off in October. This variety suits light, dry soils, and its earliness recommends it, especially when a green crop is required as well; but it is not so useful as the larger kinds, when viewed simply as an ordinary bean-crop.

The Russian, or Winter bean is the hardiest of all the field species, and stands through winters of moderate severity, being seldom injured by frosts in the milder districts of the kingdom, and is generally ready to be reaped about the end of July, or commencement of August, and this gives plenty of time for the land to be got in order for the reception of a wheat-crop; in some instances, a crop of whitestone turnips being taken off the land after the beans have been harvested, and before winter has set in.

The seeds are smaller than those of the Scotch bean, and about the size of the Tick bean, the stem being from three to four feet long. Of all varieties, too, they are the least likely to be attacked by the bean aphis, or "black dolphin," as it is called, with which beans are frequently greatly infested.

Of the garden variety there is a long list of names, of which a few may be alluded to, as the Broad Windsor, Green Windsor, Dwarf Fan or Cluster, Early Hang-down, Long-pod, Dutch Long-pod, Common Long-pod, Sangster's Imperial Long-pod, Red and White Blossom, &c., and Early Mazagan, before spoken of.

156. SOIL BEST SUITED FOR BEANS.—The same description of soil upon which wheat is best grown suits beans, which are well adapted as a preparatory crop to wheat upon heavy clays; all soils of an aluminous, or clayey nature when well drained, being adapted for the growth of beans. The best soils for the crop are, however, those occupying a position between heavy clays and light loams; dryness, firmness, and depth of soil being the principal conditions requisite for the most profitable cultivation of beans.

Wet soils are not suited for the growth of beans, nor shallow soils, however dry they may happen to be, though occasionally in dry years a wet clay has produced a good crop, and the reverse has happened in a wet summer upon a dry, shallow soil; but these are the kind of exceptions which prove the rule. Nor is a loose soil, however deep it may be, of a favourable order; the bean requiring a somewhat adhesive soil; for rich, soft soils are apt to develop an
unhealthy luxuriance, the plant being soft, and too succulent, with “lanky” stems that are laid low by high winds, or heavy rains, before the pods have attained maturity; firm loams, well-drained clays, and hard black land being the best soils upon which to grow heans.

157. INGREDIENTS TAKEN BY BEANS FROM THE SOIL.—The composition of the mineral constituents of the grain and straw of beans, is found by analysis to be as under, these constituents being taken from the soil; but heans abound largely in the nitrogenous substance termed legumine, which frequently amounts to 25 per cent., but is not always the same, as its volume depends upon the amount of water present:

**Average Mineral Composition of Grain and Straw of Beans.**

<table>
<thead>
<tr>
<th></th>
<th>Beans</th>
<th>Bean-straw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>0.88</td>
<td>3.86</td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>31.87</td>
<td>7.35</td>
</tr>
<tr>
<td>Sulphuric acid</td>
<td>4.59</td>
<td>3.21</td>
</tr>
<tr>
<td>Carbonic acid</td>
<td>1.94</td>
<td>22.73</td>
</tr>
<tr>
<td>Lime</td>
<td>8.65</td>
<td>21.29</td>
</tr>
<tr>
<td>Magnesia</td>
<td>6.55</td>
<td>4.88</td>
</tr>
<tr>
<td>Peroxide of iron</td>
<td>0.36</td>
<td>0.90</td>
</tr>
<tr>
<td>Potash</td>
<td>44.13</td>
<td>21.26</td>
</tr>
<tr>
<td>Soda</td>
<td>0.90</td>
<td>4.56</td>
</tr>
<tr>
<td>Chloride of sodium</td>
<td>1.90</td>
<td>9.05</td>
</tr>
<tr>
<td>Chloride of potassium</td>
<td>0.34</td>
<td>0.90</td>
</tr>
</tbody>
</table>

158. SEASONS FOR SOWING.—The season for sowing heans has to depend in a great measure upon the condition of the land, and whether the seed is an early variety or not. Beans ripen slowly, and should be put into the ground as early as possible under favourable circumstances. They are commonly sown during February, and sometimes even in the beginning of January, but this must entirely depend upon the condition of the soil, for if land is worked in a cold, wet condition, the doing of it is equivalent to a loss of a fortnight, or three weeks’ growth; the land being certain to get so hard afterwards as to delay very materially both the germination of the seed, and the springing of the young plants.

The operation had always better be deferred till drier weather, March not being too late to sow beans; some writers, as Von Thaër, even advocating late sowing, and many considering the middle of March quite early enough, except in the case of Russian, or Winter beans; and although the first opportunity should be embraced for harrowing, and otherwise preparing the land, it is dangerous to be too precipitate.

159. MANURE.—Upon light soils where beans follow barley
Beans.

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according to the system pursued in a five-course rotation, the ground is sheep-folded with turnips, oil-cake, and cut hay; and immediately before being ploughed, in February, about fifteen loads per acre of farm-yard manure are put on.

On heavy soils beans are sown alternately with wheat, these being commonly the only two crops grown; and when preparatory to wheat, the manure should be long dung ploughed under during the winter, or as early as the season will permit in the following spring. The land should be stirred more deeply under these circumstances than when merely intended as a preparation for corn-crops, in order to loosen the earth, and afford sufficient room for the long, tapering root of the plant to go in search of its nourishment.

160. SOWING.—Beans at one time used to be sown broadcast, but this method is very seldom followed now, the usual plan being that of either drilling, or dibbling. By either of these a decided superiority is obtained, for the beans throw out pods from the bottom of the stem which they rarely do when grown close together, and the crop is found more free from insects and disease. The rows, if possible, should be placed east and west, as more shelter will be thus afforded to the young plants from the cold March winds; this will afford an opportunity, when hand-hoed, of employing two men closely following each other in different drills, the one drawing the soil from north or cast to the plant, and the other from the south or west, according to the situation of the field, by which means the plants are kept erect without being broken by the weight of the soil on either side.

The Essex plan is for beans to follow wheat in a six-course rotation, the beans being dibbled on the newly upturned furrow, two in each hole, three men dibbling to one plough, making the holes with a single dibble in one hand, and dropping in the beans with the other; and as soon as the young plants are above ground they are well harrowed, and afterwards hoed.

In Scotland, beans are seldom dibbled, which is now thought the best plan, but are either drilled, ploughed in, or sown broadcast. The land is cleaned, ploughed before winter, and allowed to lie till the beginning of February, when it is harrowed to break the winter furrow, and then drilled fourteen inches wide with a strip-plough.

Some cultivators place their beans at twenty-seven inches from row to row, which makes three rows to a land, marking out the lines for the dibblers by the drill, which gives them the opportunity of putting in the seed in a straight row. June cabbages are then planted between the rows; the cabbages, as before stated, being ready to be fed off during October.

161. WEEDING.—When beans are sown in ten-inch rows, the land is kept clean between the plants by a large-sized Dutch hoe, or hand-shim, and when placed in twenty-inch rows, the horse-shim is used, which hoes two rows at once.
Diseases and insects destructive to beans.—The diseases to which beans are subjected have been compared to rust, or mildew; "honey-dew" manifesting itself first, about the middle of May, generally upon the tops, accompanied by swarms of plant-lice, the *aphis fabae*, or bean-dolphin, or collier, or black dolphin, as it is indifferently called. A great deal of good may be done at an early stage by walking between the rows, and pricking the tops off, taking care to carry the tops off the ground, and afterwards burn them. The humble-bees, *Bombus terrstris* and *B. lucorum* tap the blossoms, and cause the pods to be imperfect, while little beetles, *Bruchus granarius*, and *B. flavimanus*, lay their eggs in the flowers, to prey upon the afterwards developed seeds.

The false wire-worm, *juil*, and *Polydesmi*, in cold, wet seasons, bore into the seeds as they lie in the earth, which is the means of causing them to rot; and as soon as the shoots appear above ground the weevils (*Sitona lineata* and *Otiorhynchus picipes*) nibble off the young leaves.

The weevils can be collected at night when they come out to feed, and by steeping the seed in brine, or immersing it for a brief time in hot water, the larvæ and pupa of the little beetles can be destroyed, while soot dropped in with the seed has been found to protect it from the false wire-worm.

Harvesting.—The bean-harvest is generally a subject of some little anxiety, as the weather is usually somewhat changeable about the time of "bean-harvest"; while in hot weather loss is incurred by the shedding of the seed from the pods, if the crop is allowed to stand upon the ground until fully ripe, which is the general custom with English farmers. The period of ripening is often unequal, as in late seasons the plant sometimes begins to take on a second growth, and the time of cutting must be determined by that which is ready. There are two evils to be feared; if not tolerably well ripened, the pods will shrink, and the quality be lowered, yet when allowed to get dead ripe much loss is incurred by the scattering of the seed. The best time to cut is when the greater part of the pods have become black, leaving others green, or when the eye of the bean has become thoroughly blackened, and the skin has acquired a yellowish, leather-like colour and look; no time should then be lost, for if the yield is somewhat diminished by prompt cutting it will be amply made up for in the increased value of the haulm, while the land will be clear for future operations.
Beans.

In England, the practice of allowing the beans to stand in the field till the stalks, leaves, and pods are all perfectly black, is not thought to be so good a one as that followed in Scotland, where the crop is cut while the straw is still in a greenish condition; for while the English haulm is generally a mass of woody fibre, totally unfit for fodder, that of the sister kingdom is made a very valuable item of food for stock. By cutting when the pods, leaves, and stalks begin to assume a brownish appearance, mixed with patches of green, a fair quality of grain may be assured, as well as a large amount of valuable fodder from the straw.

If cut at this stage, the crop should be allowed to stand a week or ten days longer on the ground, in order to get in good stacking order, and should be bound up in small sheaves at once, if in dry condition; beans being often allowed to lie on the ground for two or three days, which is only necessary when they are wet.

Beans are commonly "bagged" close to the ground, the best implement for reaping being a scythe-hook, with a smooth and sharp edge, each reaper taking so many drills, and cutting upwards towards the standing crop, holding the hook in one hand, and guiding the cut stalks with the other. The best material for binding beans is oat-straw, twisted into short ropes which should be got in readiness beforehand.

The crop is sometimes mown, and some small farmers pull them up by the roots, which, while leaving the ground in a better condition, requires a number of hands, and can only be done on those soils that are loose and friable, while great care is necessary in clearing the dirt from the roots before the crop is threshed.

164. STACKING.—If the beans when cut, are stood up in small sheaves, five or six together, so placed as to allow them the full benefit of the air, they will get well dried, and if heavy rain does not fall, they will be ready for stacking in ten days or a fortnight; but great delay is sometimes experienced from the difficulty in getting the haulm thoroughly dry. In this case, if the sheaves are piled in the form of a small, round stack, and placed in such a manner as to allow the air to thoroughly permeate them, they may be kept thus for a long time on the field without incurring any material damage.

Danger from heating in the stack is not to be apprehended when the natural sap in the haulm is dried up, which is so frequently the case as described, but when cut so that the haulm is valuable for fodder, care is needed in drying it thoroughly, and when carried to the stack-yard, and stacked, if a "boss," or vent, previously described; is placed in the rick, they will be kept free from mould or heating, if even not perfectly dry.

In order to obviate this danger, stacks are sometimes constructed with divisions in the body of the rick, consisting of cross-rails at separate heights, which prevent the pressure of any greater weight than the load contained in each division, and these separate portions being kept a little way apart from each other, admit the air freely between the sheaves.

165. COST OF CROP FROM SEED-TIME TO HARVEST.—The cost of a crop of beans will vary somewhat according to the method of cultivation followed, but in Scotland the standing estimate of ex-
The Crops of the Farm.

Penses per acre, made upon the basis of the rate of wages paid some years ago, was as follows:

- Cross-ploughing once... £ 7 6
- Harrowing to break the ground in spring for drilling... £ 2 6
- Once rolling... £ 0 9
- Drilling twice... £ 0 5 0
- Sowing by the drill... £ 0 1 8
- Four bushels of seed at 4s. £ 0 1 6
- Harrowing and rolling before the beans are up... £ 0 2 0
- Paring once with the strip-plough... £ 0 3 4
- Scuffling twice... £ 0 3 4
- Earthing up with double-mould plough (one horse)... £ 0 1 8
- Reaping and binding... £ 0 9 0
- Carting, ricking, and thatching... £ 0 4 0
- Thrashing 4 quarters by steam... £ 0 1 0

Total: £ 2 17 9

166. How to Judge of Beans.—Cutting the bean-crop early, so as to save the straw as fodder, will sometimes cause the grain to shrink, which, although a course to be recommended, provided the haulm is not cut too soon, will point out the necessity of using full, plump, unshrunken grain for seed. For sowing, or any other purposes, where quality of grain is essential, that which is smooth-skinned, plump, and hard will be found of the best quality, and the other inferior.

167. Analysis of Beans.—The following composition of field beans that has been deduced as the result of several analyses made by eminent chemists, is the average that has been given:

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Legumine</td>
<td>23.30</td>
<td>27.34</td>
</tr>
<tr>
<td>Starch</td>
<td>36.00</td>
<td>42.25</td>
</tr>
<tr>
<td>Fatty matter</td>
<td>2.00</td>
<td>2.35</td>
</tr>
<tr>
<td>Grape sugar</td>
<td>2.00</td>
<td>2.35</td>
</tr>
<tr>
<td>Woody fibre</td>
<td>10.00</td>
<td>11.73</td>
</tr>
<tr>
<td>Pectic acid</td>
<td>4.00</td>
<td>4.60</td>
</tr>
<tr>
<td>Gum</td>
<td>4.50</td>
<td>5.28</td>
</tr>
<tr>
<td>Ashes</td>
<td>3.40</td>
<td>4.01</td>
</tr>
<tr>
<td>Water</td>
<td>14.80</td>
<td></td>
</tr>
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<td></td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

168. Nutritive Properties.—Divided into the main elements of nutritious substances, the following results are obtained from the above analysis:

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Nitrogenous substances</td>
<td>23.30</td>
<td>27.35</td>
</tr>
<tr>
<td>Starch and woody-fibre, or substances free from nitrogen</td>
<td>58.50</td>
<td>68.65</td>
</tr>
<tr>
<td>Ashes</td>
<td>3.40</td>
<td>4.00</td>
</tr>
<tr>
<td>Water</td>
<td>14.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Uses.—Bean-meal, unlike pea-meal, is seldom used for human food in the present time, although it formerly was often eaten, and resorted to in seasons of scarcity; though in their green state, and in the garden varieties, they are largely consumed under the designation of broad-beans; and bean-meal is occasionally resorted to in Scotland, for mixing with oatmeal, or barley-flour, for making unfermented bread, which is baked upon a griddle, that ploughmen relish; but it is somewhat hard of digestion by ordinary stomachs.

They, however, form excellent food for stock of all descriptions, and the crop can economically be disposed of in feeding cattle and sheep on the farm. Mixed with oats, in the proportion of one-third beans to two of the former, they are given very extensively to horses. When given alone, beans are, however, apt to produce flatulency; though, when doing regular work, horses may be safely fed upon beans and hay, without any risk of danger from this cause.

Bean-straw.—When the haulm has been cut in a greenish condition it makes better fodder than straw for cattle, and is but little inferior to hay. It must not be given until perfectly dry, for unless it is, it will produce flatulency the same as the grain, and the manure made from the straw that is thus eaten is very strong and rich.

Used for litter only, it takes a long time to decompose, but by the ordinary methods of managing litter upon a farm, and mixing all sorts together in the yard, the decomposition of bean-straw proceeds pari passu with the rest.

Cultivation of Beans Abroad.—Beans are largely cultivated abroad, and great quantities are imported every year into England from Egypt, and eastern districts of Europe, and from various other foreign countries.
CHAPTER IX.

TARES, VETCHES, LUCERNE, SAINFOIN AND CLOVER.

172. NATURAL HISTORY. — Tares (* ervum*) belong to a genus of hairy, leguminous plants. They resemble vetches (*vicia*) very much, from which they are best distinguished by the long teeth of the calyx, which is equally narrowed to the base, and not protuberant at the base on the upper side. *V. sativa*, the common vetch, or tare, is universally cultivated over Europe, the flowers being either solitary, or two, or sometimes three together, the pod slightly hairy, containing several globular seeds. Although the seed of the tare is very nutritive—which somewhat resembles that of the pea, and is frequently given with advantage to pigs—yet it is seldom used, the plant being consumed in a green state for feeding purposes.

173. VARIETIES. — Tares, or as they are sometimes called, “vetches,” are confined to one species according to botanists, but there are several varieties, which are known to farmers as the *White Tare*, the *Strangle Vetch*, the *Tufted*, the *Wood Vetch*, besides the *Broad-leaved Vetchling*, or Everlasting Tare, cultivated in gardens for the sake of the flowers.

The tares of agriculture are, however, generally confined to Winter and Spring tares, which, as before stated, are generally consumed as a green crop.

174. CULTIVATION. — Tares are easily cultivated, and the land should be manured at the rate of about ten cart-loads of good farm-yard manure to the acre, or if the soil is rich, manure may be dispensed with; but in this case, a top-dressing of guano, or other fertilizer should be given.
175. **WINTER TARES** are sometimes sown as a bastard fallow prior to wheat, or upon wheat stubble, with the intention of being either soiled, and followed in the ensuing summer by turnips, or left to stand for a crop of hay in seed; for the latter the crop is very precarious. The time for sowing the seed of winter tares is from the middle of August, till the latter end of October; but if the land is poor, or exposed, the earlier the better; in all cases it being advisable to sow at different times, so as to ensure a succession of food at different seasons. The quantity of seed used on ordinary soils is about two-and-a-half bushels per acre; but less seed is required for land that is moderately rich, and sown early, than upon lands which are poor and late.

176. **SPRING TARES** can be sown any time during the months of March and April; and for a succession, as late as up to the end of June. Spring tares produce rather a lighter crop than those grown in winter, and are more subject to risk from droughty weather.

**Uses.**—Tares are often fed off by folding sheep upon them, in some cases even pigs; but for the larger cattle they are most commonly cut, and served to them in their stalls. Horses improve upon them more rapidly than upon clover, while sheep fatten upon them better than upon any other kind of herbage. Horned cattle also do remarkably well upon them, while milch-cows are said by some to yield more milk upon tares than from any other provender. Tares are made into hay, and the crop should not be cut until the flowers have for the most part given way to the pods, and some of the seeds have become well formed. The seeds are chiefly used for sowing, but they are nearly equal to corn as food for live-stock, being equally relished by horses, sheep, pigs and poultry.

177. **VETCHES.**—Of the several varieties of vetches, only two are distinguished by farmers as before described, under the terms of Winter and Spring tares, and though they are of the same species they have acquired habits of a different nature. The blossoms, which are purple, are both nearly the same, as well as the seeds, which are black, it being a difficult matter to tell one sort from another.

There is one species which is called the White Vetch, both the seeds and flowers of this variety being white, and the grain more succulent, and ripening earlier than the others, standing the winter well; but it is not so generally cultivated as the others.

The soil for the ordinary kinds of vetches should be clayey, and the plant does not succeed well unless the land be somewhat moist and well manured; unless meant to stand for seed, when a drier soil is to be preferred.

The seed is smaller than that of the grey pea, and the crop is reaped, threshed, carried, and stacked in the same manner. The
haulm is so tough when it has stood for seed as to be of very little use except for litter; though cattle, when extremely hungry, will eat it.

The common lentil belongs to the same family as the vetch, which is grown so largely through the south of Europe, and is said to be the most nutritive of all the leguminous plants. It has been grown in England under the name of "Dill," thriving best in light, dry, sandy soils, upon which it is generally sown broadcast in March, or April, at the rate of a bushel-and-a-half of seed to the acre. It is, however, more delicate than the vetch. The produce of grain is not abundant, but the haulm, though good in quality, is deficient in quantity. In a green state it is considered particularly beneficial to ewes with sucking lambs.

Although distinct in variety, vetches and tares, for all practical purposes, may be considered one and the same thing, so far as the common kinds that are mostly cultivated are concerned.

178. LUCERNE (Medicago sativa).—Properly cultivated, lucerne, in a soil that is thoroughly suited to it, is one of the best of our green fodder plants, being tap-rooted, and rising when in bloom to more than two feet in height, bearing purple or violet-coloured blossoms, followed by pods containing kidney-shaped seeds.

179. NATURAL HISTORY.—Lucerne is highly praised by the Roman writers, and is a plant the cultivation of which is of great antiquity in Spain, Italy, the south of France, and in other climates; in Persia being mown all the year round. The plant appears to have excited but little attention in Great Britain till Harte brought it into notice in 1757, and, though highly extolled, did not meet with the reception it merited in this country.

180. VARIETIES.—There are no other varieties with which we are acquainted, but the ordinary plant mostly cultivated in England, and the Yellow, or Swiss lucerne (M. falcata), which is coarser and much more hardy plant than the other; but in France there are several varieties which may possibly be well worthy of attention.

181. CULTIVATION.—A rich, light, deep loam is the best kind of soil adapted to its cultivation, though it will succeed upon any friable ground that is well-drained, or upon a calcareous sub-stratum. It sends out very long roots, which penetrate so far that they are quite out of the reach of drought, and in sultry weather, when grass is drooping for want of moisture, lucern will be unaffected, and hold its head erect.

From fifteen to twenty pounds of seed are used per acre, sown in drills about twelve inches apart, and the seed is sometimes sown broadcast. If not sown separately, it may be planted along with any grain-crop that it is intended to follow, which is a good method of treating it, as its produce during the first year is but trifling, it generally being put in with barley or oats.
Tares, Vetches, Lucerne, Sainfoin, and Clover. 105

Many cultivators are, however, opposed to this course, and consider it ought to be sown alone, as it requires careful treatment during the first season, which benefits its future growth; but whichever plan is pursued, the ground ought to be ploughed to its full depth. Spade husbandry, where the labour is to be obtained, answers the best.

The weeds should be destroyed—especially root weeds—both by the harrow and hand-weeding; for, if this is not attended to, the crop will turn out unproductive. Ashes and gypsum have been used as a top-dressing with great advantage; farmyard dung, though very generally used, not being so appropriate, as it makes the plants so tender as to injure their future growth, and fills the land with weeds, which have to be carefully guarded against.

182. FREQUENT CUTTING.—Lucerne has been mowed frequently as often as four times between May and November, it being best to cut it before it flowers, for green food, as afterwards the stalks become tough and fibrous. When allowed to flower, the plant undergoes those constitutional changes preparatory to seed-bearing, which both weaken the growing crop, and cause that which is cut to be of poorer quality; so that a double loss is incurred by not cutting it before it approaches the season of flowering.

183. DURATION.—It is estimated that a crop of lucerne will stand about eight or nine years. When growing in a good soil, and cut three times in the course of a season, the yield varies from three to six, and sometimes reaches even eight, tons per acre in the aggregate, being ready for the scythe towards the end of April, or beginning of May, and can be cut in a month or six weeks' time afterwards again, and at similar intervals during the summer; one acre of good lucerne being enough for three or four cows during the soiling season.

Many have tried to grow lucerne upon land that is unfitted for it, and have afterwards spoken disparagingly of the crop; but good loams, or loams over a chalk substratum, or that are interspersed with fragments of chalk, will grow crops that will not disappoint the expectations of the agriculturist.

Even a small patch of lucerne, to a person who keeps but one cow or a horse, would prove very valuable, and of great assistance with other feed, it being literally a "cut-and-come-again" crop; so that, beginning at one end of it, and cutting onwards, when small quantities are only wanted, by the time it has been all gone over, the first part cut will be ready for the scythe again.

184. SAINFOIN.—Sainfoin (hydesarum odoratus) is a very similar plant to lucerne, being a deep-rooting perennial with branching, spreading stems, compound leaves and red flowers. It is found
The Crops of the Farm.

growing in many parts of Europe on dry, chalky soils, where it has long been cultivated—in France especially; its special value consisting in the fact that it may be grown on soils unfit for being kept constantly under tillage, and which would yield but little grass.

It sends down its roots for a great distance into chalky fissures, many of which attain an enormous length, and it is a most valuable herbage plant.

We are indebted for its introduction to the French, some time after its introduction it being known as "French finger-grass"; the year 1651 being generally assigned as about the date of its introduction into England.

It is assumed to have been but little cultivated until the middle of the last century, but this is a mistake, for Tull, in his work, says it is called in French, Sain Foin, on account of its quality of wholesomeness, i.e., Sanum Panum and Sanctum Panum, Holy Hay.

From its long continuance it has also been called "Everlasting Grass," though not strictly a gramin.

From the scale upon which Tull cultivated it, it must have been largely planted in the end of the 17th or quite at the beginning of the 18th century, for he wrote a chapter on it in his work praising it very highly, and in his "notes on the preface," the period of its cultivation by him is clearly fixed at an early date, for he says: "I am surprised to hear that some gentlemen pretend I brought the instrument (he is speaking of the drill of which he was the inventor) from France or Italy; when it is well known it had planted two farms of St. Foin before I travelled, which was not till April, 1711, being above ten years after making use of my drill"; the fact being that, not able to get along very well with his farm-servants, whom he roundly abuses (as they doubtless deserved from what he states of them), he resolved to plant the whole of his farm with sainfoin.

185. VARIETIES.—The common variety of sainfoin is the kind principally cultivated, but in the central provinces of France the species usually grown is termed Sainfoin à deux coupes, which is distinguished by an early and rapid growth; so that two crops of hay may be taken, or one of hay, and one of seed, in a single year.

Another is a kind of giant sainfoin, which appears to be of much the same species as the "sainfoin à deux coupes," but with rather more leaf. This was said to have been accidentally found growing in a field, and the seed saved, and planted again until enough was obtained for a crop, after which it became regularly propagated.

186. USES OF SAINFOIN.—Sainfoin is mostly applied to the purpose of making hay, the proper season for cutting it being
when the plant is in full bloom, when it is mown, and made in much the same manner as clover, and other trifoliated plants. It requires great care in the making; the object being to retain the natural bloom and figure of the blossom, and the clear and healthy green of the stem and leaves.

If rain comes upon it in the course of making, it is easily spoiled; the porous nature of the stalks causing them to be dried with great difficulty, and the richness and flavour of the hay is injured. Upon chalky soils, a larger crop is obtained from it than a first crop of clover, but it is seldom cut a second time, in this country, in the same year, the after-grass being pastured by cattle and horses. Sheep are fond of it, but they bite it down rather too closely and injure the stalks.

187. CULTIVATION.—Upon the alternate system, sainfoin takes the place of clover, on the better-class soils, standing for one year only, but on sandy or light soils it is allowed to remain for two years; which gives the land time to gain heart for corn; but, on the lightest soils of all, sainfoin is allowed to stand for four years, which thus makes no break in a four-course shift.

A drawback to this method is the expense of the seed, which is not sufficiently well repaid for a short time; for it will cost fully £1 per acre, and it is considered a good plan to drill upon young wheat, when the land is in good condition and thoroughly clean, the seed vegetating with more certainty when the land has a fine, crumbly surface.

By the permanent method of cultivation, it stands for several years; about five bushels of rough seed being sown per acre, and four lbs. of hop-clover are added, with the view of filling up the deficiency of the first year’s growth. But, in order to improve the tone of land intended to remain for some time under sainfoin, swedes are sometimes sown, followed by a crop of rape; the latter being fed off early, and the land sown with wheat, five bushels of sainfoin-seed being drilled across the rows of corn in the spring. The two successive green crops fed off by sheep, and the amount of tillage the land receives, prove a great check to the growth of weeds.

188. CLOVER.—(Trifolium.) Clover in its various varieties is a tribe which contains several of the most valuable plants that are cultivated.

189. NATURAL HISTORY.—Clover is a genus of the papilionaceous tribe of leguminous plants that belong to a division, distinguished by herbaceous, not twining stems; and is distinguished from the other genera of the same division by the flower forming
a compact, globular, oblong, or cylindrical head; and by the seed-pod, which is not larger than the calyx, and is always straight, containing but one or two, generally, and rarely three or four seeds.

The Red and the White clover are the most useful of this genus, the former for mowing and the latter for pasturage; these excelling all other plants according to the opinion of Loudon, for these special purposes.

The Yellow clover (T. procumbens) and the Cow, or Meadow clover are both cultivated, but they are inferior to the others.

190. VARIETIES.—White or Dutch clover (T. repens), a most valuable plant for pasturage, is a low, smooth perennial, with creeping stems, often half underground and root-like; and is a capital plant to form a bottom in pastures.

T. pretense or Common Red clover, is the most nutritious of all the species of clover, and is, perhaps, the one most generally cultivated; the heads of the flowers being very compact, and nearly globular, closely resting upon a pair of opposite floral leaves.

The Perennial Red, or Meadow clover, or Cow-grass (T. medium) resembles T. pretense in its botanical features, but it is of more creeping habit, and the root is of longer duration, the flowers being larger and of a bright red, and although of longer duration than the common red clover, it is not so sweet or nutritive.

The Alsike, Hybrid, or Swedish clover is a useful kind for cold, moist, stiff soils, resembling the common red clover in duration height, and mode of growth.

Hop Trefoil (T. procumbens) and Small Yellow clover or Suckling, differ very little from each other, the one often being mistaken for the other, not only by farmers but by seedsmen. They vary in size and number of their flowers, the T. procumbens being the larger plant, affording excellent forage, though not a large quantity; the T. filliformes being smaller in every respect, the flowers especially so.

There are many more sub-varieties of which the late-flowering Crimson clover is a prominent specimen, the plants being very tall as well as more branched, and the weight of crop fully a third more than the other sorts coming into flower when the blooming of the others is nearly over. It has been obtained by us from France, where it first came into notice about the year 1836.

191. CULTIVATION.—Red clover is the only species grown in the ordinary course of cropping, wheat that has followed after white clover leys having been found to be inferior crops on the same soil to those which have succeeded the red variety.

From 10 to 14 lbs. of seed per acre is used on light friable soil,
when sown with barley, and from 12 to 18 lbs. with wheat, or oats, upon cold clays; poor soils requiring more seed than good ones.

The time of sowing depends upon the nature of the land, the weather, and the crop which goes with it, but is oftenest put into the ground in March. When following wheat, it is lightly harrowed in before the young crop has made much progress; or, when the wheat has turned out "winter proud," it is a capital plan to feed the wheat down with sheep, and afterwards harrow the land, sow the clover, and then roll it. Among barley grown after turnips, April to the beginning of May is the usual season; and, if the barley has been drilled, the sowing is sometimes deferred till a fortnight after, or till the plants have taken root, when the clover is sown, bush-harrowed, and rolled; an operation that both covers the seed and fixes the roots of the barley more firmly.

The weather has much to do with the success of a clover crop, both at the time of sowing and when standing for a crop. Gentle showers at the time of sowing bring the plants forward, and root them in the ground—or they may be hurt by a severe frost, or, when mature, the crop may be burnt up for want of rain in the ensuing summer.

A top-dressing of lime, Dutch ashes, and gypsum, will be found efficacious, but, under the best management, at times the crop partially fails, or turns out patchy; the best course to pursue under such circumstances being to harrow in tare-seed upon the vacant spots, either in autumn or spring, in such quantity as the deficiency would seem to require.

The treatment of the crop depends upon the purpose for which it is required. It is sometimes made into hay, partially fed, or allowed to stand for seed. In favourable seasons, it sometimes makes quick progress, and if the corn is cut close, will make valuable fodder in conjunction with the straw, while at others it will scarcely make its appearance before harvest, and then the corn should not be cut so close as to injure the plants. In the following year it produces two, and sometimes three cuttings, the common use being to mow it once, and feed off the second crop. If allowed to stand another year, it is almost invariably pastured, by penning the stock upon small patches, and removing the hurdles when the crop has been consumed, to a fresh portion.

192. SEED-TIME.—The time for cutting, when saved for seed, will be indicated when its verdant appearance begins to change to a light brown colour, and the leaves begin to grow hard and shrivelled, and, when the crop may be considered quite ripe, commence to fall off; these being the common external signs of maturity, but this is best ascertained by an examination of the seed itself. These signs, however, will indicate its approach to maturity.
CHAPTER X.

POTATOES, TURNIPS, CARROTS, AND PARSNIPS.


193. POTATOES.—There is no vegetable production which is more useful than the potato, if we except corn; though in the case of Ireland, from its universal cultivation at the time of the Irish famine, it was productive of a national misfortune, and in a measure seemed to justify Cobbett's remarks upon the pauperising effect the extension of its growth and habitual use occasioned amongst the Irish peasantry.

194. NATURAL HISTORY.—The potato belongs to the Linnaean class, Pentandria, order Monogynia, being a perennial herbaceous plant rising to the height of two or three feet. Besides the true roots of the plant, there are numerous runners which grow out from the stem, and which bear the tubers. There are also numerous eyes on the tuber, from whence proceed the rootlets, and future germs of a new plant.

Humboldt believed that the plant described by Molina under the name of Maglia, is the original stock of the potato, and that Chili is its native soil. The story of the introduction of it into Ireland by Sir Walter Raleigh on his return from Virginia, though disputed, is well authenticated by corroborative testimony to the effect that when his gardener at Youghal, in the county Cork, had reared to full maturity the apples that grow upon the haulm of the potato, the man brought one of them to his master, and asked if that was the fine fruit he had brought from America? When Sir Walter, having examined it, was so dissatisfied with it (or no doubt pretended to be so) that he ordered the "weed" to be rooted out when, the gardener obeying, came duly upon the potatoes.

That Raleigh introduced the potato is proved by the manuscript minutes
Potatoes, Turnips, Carrots, and Parsnips.

of the Royal Society, where it may be found that Sir R. Southwell distinctly stated to the Fellows that his grandfather was the first who cultivated potatoes in Ireland, and that he was indebted for the first roots to Sir Walter Raleigh. The zeal of the Royal Society, however, to promote the growth of this vegetable, failed for a long time to exercise much influence upon the habits of the nation, but it was taken up with spirit in Lancashire about 1694, and its cultivation soon became general, and spread to the other counties of England.

In contradiction to the generally received account of Raleigh’s introduction of the potato, Dr. Campbell, in his Political Survey states, that it was not introduced until 1670. Another supposition is, that the root was brought from Santa Fé into Ireland in 1565; but it is found that the plant carried to Ireland by Captain Hawkins at that time was the Spanish batata, or sweet potato.

195. VARIETIES.
—The list of the varieties of potatoes is almost endless, and fresh ones are being introduced every year by leading seedsmen—especially American varieties, each being recommended for some special quality or other, such as the Early Rose for earliness, and others for abundant crops; but for real flavour nothing will beat the old Ash-leaf Kidney, or, as a useful stock, fit for field-planting, the Yorkshire Regents. Useful and well-known kinds that have an established reputation are American Early White, Yorkshire Regents (before mentioned), and Lincolnshire Regents; American Second Earlies, Forty-folds, Round, as well as Ash-leaved, Kidney, Rose-hearty—which are all an early kind.

Amongst the late species are the well-known Lumpers, Hen-nest, Orkney Long Red, Jersey, or Wellington Blues, Daly’s Wonder, &c.; but the field-crops cultivated are almost all of the variety of
Regents—as, Yorkshire Regents, Lincolnshire Regents, and Scotch Regents; the last being least appreciated in the London market, Scotch white potatoes turning black after they are boiled, which is supposed to be due to some peculiarity of the soil. The Champion, a new variety, has been remarkably free from disease.

196. SOIL AND CULTIVATION.—Different methods of cultivation are followed upon various soils, there being four methods pursued; one in raised drills made by the single or double-mould board plough; another in every third furrow, as in ordinary ploughing; next, when the soil is wet, in lazy-beds; and, lastly, by digging in the seed in rows by the spade.

The first is considered the best plan upon all well-drained, deep, alluvial, or clayey soils; the second being adapted to dry, thin, hilly land. The lazy-bed system to wet, undrained soils, where the beds are raised, with two-feet alleys between, from which the earth is shovelled out to the depth of 18 inches or 20 inches, and thrown over the intermediate beds where the potatoes are planted; the deep alleys serving the temporary purpose of carrying off the surface-water while the crop is growing.

The last mode by digging is, however, the best of all methods for growing potatoes, wherever enough labour is to be had to carry on a system of spade husbandry.

Potatoes do well upon any fresh-broken ground, particularly delighting in decaying vegetable substances, as old turf land, for which they have a great avidity; and, on this account, good straw manure increases the produce of the crop, though farm-yard manure does not bring potatoes of such good quality. Lime on some soils has been found a most useful addition, but it is apt to give the skins a speckled or scabby appearance, which is objectionable, and too frequent application of lime will turn out injuriously to potatoes.

197. PLANTING.—Potatoes are planted sometimes very early in the season, but from the fact that the late frosts often cut off the tops, the potato would appear not to be suited for early planting in this climate; so that, under ordinary circumstances, April is early enough, and in cold seasons, and exposed situations, the planting might well be deferred till the beginning of May in order to avoid the chilling winds, and night frosts, which check their vegetation severely, and in some cases destroy them altogether; but if early planting is resorted to, with the object of dividing the labour on a farm, they should be placed somewhat deeply in the earth.
The ploughing-in of potatoes upon every third furrow is recommended upon all soils of a friable nature, but many growers dibble-in the sets at distances in the rows from 18 to 30 inches wide, according to soil, nature of species, &c.; but when the spade is used they do very well by being planted in open trenches, and the soil filled in over them. But the method of planting must be necessarily left to the judgment of the farmer, and be considered in relation to the general circumstances connected with his land, situation, &c., &c.; various methods being pursued in different localities with respect to planting, each of which is more or less appropriate to its own particular case.

Whole potatoes are sometimes planted, and for this purpose small ones are used, but experience has shown that, when planted whole, the crops are much heavier when large tubers are used.

Cutting is of course practised on the score of economy, but it will be found false economy when the produce is taken into account, as an increase of 15 per cent. may be reckoned upon in the crop when large tubers are used for seed.

When the potatoes are divided however, it should be borne in mind that those which are cut from the top end have far greater vigour and luxuriance than those which spring from the root end, and while some cut off both ends, and make use of the middle, others cut the tuber longitudinally from nose to tail, making use of both parts indiscriminately; while very good crops of potatoes have been grown by merely scooping out the eyes, and planting them singly.

198. LIFTING POTATOES. — When potatoes are lifted it is necessary that they be as ripe as possible, to prevent heating, though this plan is attended with an after danger in a different direction, to which we shall again allude. If the haulm is suddenly cut down by disease or frost, ten days or a fortnight should be suffered to elapse, to allow the tuber to become dry and firm, and the skin to form sufficiently.

It is well also to sort the potatoes when being lifted, by passing the small ones through an inch-and-a-half riddle, the process facilitating the getting ready the crop for market, the small potatoes being afterwards sorted separately; and if the crop is slightly diseased, the affected tubers may be separated at the time of riddling.

199. DISEASES AND INSECT ENEMIES.—What is termed the "potato disease" has made sad havoc of late years amongst potato crops, for which numerous reasons have been assigned, and various preventives recommended; which, unfortunately, the space at our command will not permit us fully to describe, such as pulling the haulm up immediately upon the first approach of disease, and avoiding all undue forcing of the crop by ammoniacal manures; but the disease is to be evaded by laying down the potato stalks on each side of the drill, and covering them over with earth, except the tops of the haulm.

In support of the feasibility of this plan, there is an instance recorded of a field of potatoes that suffered frightfully from disease, upon which, on one
portion, some planks of wood had been hurriedly thrown down, so that the haulms were covered, and pressed to the earth; and in this particular portion there was not the slightest appearance of any disease, which appears to be communicated through the haulm to the tuber during certain conditions of the atmosphere.

In reference to the disease known as the "curl," some years ago, a writer so far back as 1827, started a somewhat ingenious theory, to the effect that the potato tuber is a perfectly organised system, in which the circulation proceeds regularly, and if suffered to ripen will then tend to decay, but if separated before ripe from the stem, or stalk, that furnishes it with sap, descending from the leaves, the circulation of the sap is suddenly arrested. The ripe potato having finished all its operations becomes more inert, but the circulation of the sap in the unripe tuber having been arrested, it starts more readily, and with greater vigour when planted; the one appears to die, worn out with age, the other as it were has accidentally fallen asleep and, when awakened, possesses an unspent vigour.

The theory of underground growth, without external organs of vegetation, is denied by some, but it is an undisputed fact that those potatoes which are found in the land in the spring, and which it is presumed have grown since the main crop was lifted, always turn out the best seed.

An Irish farmer upon one occasion found a potato field so dreadfully diseased that he came to the conclusion that it was not worth his while to dig them up; but, upon ploughing the land in the spring, he was surprised to find that he turned up a very fair crop of sound potatoes, the diseased ones having disappeared.

In a healthy condition wire-worms are very injurious to potatoes, and *Aphis Rapae* infests them as well as the turnip. *Thrips minutissima* and *Smythurus Solani* take up their residence beneath the leaves, which are also pierced, and the sap imbibed by the plant-bugs *Lygus Solani, Contaminatus bipunctatus* and *umbellatarum*, as well as the frog-flies *Eupteryx*. While *Altica exoleta* bore holes in the leaves, the caterpillars of *Sphinx atropos* consume them. The roots are also infested as well with the wire-worms of *Agriotes lineatus obscurus* and *Sputator*, and other pests; while hosts of the maggots of flies, and beetles, and worms hasten the destruction of the rotting tubers.

200. **STORING POTATOES.**—The single plough takes up potatoes better than the double mould-board plough, though not so cheaply, as it turns the potatoes over without cutting them, while the
double plough often bruises them. When dug up, the fork should have four prongs, with an inch between each prong. In addition to the crop being ripe when they are dug, they should be allowed to lie and season on the surface of the land, and, wherever they are stored, they should be kept cool, dry, and free from untimely vegetation. There are several methods of storing, but in the case of pits, narrow wicker-work funnels should be stuck up at regular distances along the centre, so as to form cavities or chimneys for the escape of steam. The potatoes when heaped should remain uncovered for a while, except with straw or litter of some sort, till thoroughly seasoned.

201. COST OF CROPS.—The cost of a crop of potatoes per acre, including seed, lifting and cultivation, will amount to £8 10s. to £10 on average soils, but something less on dry, easy soils.

202. ANALYSIS OF POTATOES.—The analysis of healthy potatoes shows the following result:

<table>
<thead>
<tr>
<th>Natural State</th>
<th>Dry State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>75.52</td>
</tr>
<tr>
<td>Starch</td>
<td>15.72</td>
</tr>
<tr>
<td>Dextrin</td>
<td>0.55</td>
</tr>
<tr>
<td>Sugar</td>
<td>3.30</td>
</tr>
<tr>
<td>Albumen, Casein and Gluten</td>
<td>1.41</td>
</tr>
<tr>
<td>Fat</td>
<td>0.24</td>
</tr>
<tr>
<td>Fibre</td>
<td>3.26</td>
</tr>
</tbody>
</table>

203. NUTRITIVE VALUE.—The result of the assumed nutritive value of potatoes from the above analysis will thus be as under:

<table>
<thead>
<tr>
<th>Natural State</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogenised or flesh-forming constituents</td>
<td>2.49</td>
</tr>
<tr>
<td>Matters fitted to lay on fat, and support respiration:</td>
<td></td>
</tr>
<tr>
<td>Starch, Sugar, &amp;c.</td>
<td>18.00</td>
</tr>
<tr>
<td>Fibre</td>
<td>3.66</td>
</tr>
<tr>
<td>Ashes</td>
<td>0.90</td>
</tr>
<tr>
<td>Water</td>
<td>74.95</td>
</tr>
</tbody>
</table>

204. USES.—A very large proportion of the potatoes raised are used as human food, and a good many for cattle, as also for starch, &c., which can be made from diseased potatoes; the owners of the starch mills giving a more liberal price for these than can be obtained from any other application, except by an economical method of feeding stock with them, which is occasionally put in practice.
205. **POTATOES FROM ABROAD.**—A good many potatoes are now sent to us from abroad, especially from Flanders. The first early potatoes sold in the London market as "new potatoes," the first of the season, are grown in the sandy soils of Flanders especially for that particular market, as well as large quantities of old potatoes.

206. **TURNIPS.**—The turnip (*Brassica rapa*) may be placed at the head of the family of the cruciferae, for its introduction to field cultivation was one of the most important events that has ever occurred in the history of British agriculture, the system of turnip husbandry having effected quite a revolution upon the former method of farming upon the light lands of the country.

207. **NATURAL HISTORY.**—The turnip is a biennial plant indigenous to Britain; in the second year of its growth a stem shooting up, crowned with numerous four-petalled flowers in the form of a cross, containing six stamens, the seeds being contained in an elongated pod.

The turnip was well-known to the Romans, Columella recommending them to be planted freely, as those which were not required as food for man could be used by cattle. Pliny also speaks of turnips, and it appears that the best grew in the country of the Sabines, and were worth at Rome a sestertius, or about twopence each—rather a long price it would now be considered for a turnip.

208. **VARIETIES.**—There are six main varieties of turnips, each of which contain several sub-varieties. First in importance is the Swedish turnip (*Brassica campestris rutabaga*), of which there are about a dozen sub-varieties; next, the common field turnips, or green-top yellow turnips (*Brassica rapa*), which has about the same number of sub-varieties; next, the purple-top yellow turnips, of which there are three or four. White turnips, of which there are seven or eight sorts, come next. Green-top white varieties, about half-a-dozen sub-varieties; and red-top white turnips, of which there are four sub-varieties.

209. **SOILS, CULTIVATION AND MANURES.**—The turnip grows with vigour in a rich, free soil, like all bulbous-rooted plants, the best turnip soils being the black and hazel-coloured loam, and the red, green, and yellow sand. The largest proportion of turnip soils in the United Kingdom are, however, composed of loose black or brown earth, of a sandy texture.

There are inferior soils of a thin, rubbly, or stony nature, and the flinty soils of the upper chalk, each possessing very different capacities, but which may yet be classed as turnip soils.
While the cultivation of the plant can be followed without any great difficulty upon proper soils, it is a very difficult matter for the clay-land farmer to raise turnips, on account of the great risk attending them.

On light soils, turnips are generally taken after a crop of wheat or oats, being what is termed a clearing crop. In ploughing, the depth of the furrow must be regulated by the soil, the deepest, however, seldom being more than 8 or 9 inches; and deep ploughing should always be done in winter, and better still in autumn. As soon as the corn-crop is removed, the grubbers should be used, and a pair of harrows follow. The same ground should then be gone over again backwards, followed by harrowing, the end ridges being thus done before they are trampled on by the horses. The ridges are then begun horizontally, going about half the depth of the furrow, followed with a stroke of the harrow, the ridges being then crossed with the grubber a little deeper, and harrowed.

By this course the weeds will have nearly disappeared by spring, and what few there may be are easily freed from the earth, and may be collected by the hand-rake. The months of April and May having arrived, the land should be well ploughed across, harrowed, rolled, and receive one more turn of the grubber to complete the pulverisation, this being considered a better system than that of winter ploughing; and the method described is intended to apply to land that is full of weeds, and needs a good deal of cleaning.

On light chalky soils, the preparation for turnips consists of autumn scarifying, or grubbing, harrowing and picking weeds; and when farmyard manure is laid on, it is applied in well-rotted condition, and ploughed-in early in winter.

The spring operations consist in keeping the land clean by grubbing and harrowing as often as it is found necessary to do so, performed at no greater depth than is absolutely required for uprooting the weeds. When the time has come round for sowing, the drill is set to work, and made to sow 8 to 10 bushels of bone-dust, or three-and-a-half cwt. of dissolved bones, or two-and-a-half cwt. of guano, or a mixture of these, supposing the land to have been previously dressed with farmyard manure.

On clayland, the stubbles should be dunged after having had a previous clearing by the grubber, and deeply ploughed in winter, as early as possible, and left to the action of the weather till spring, followed up by the usual processes, being worked wholly in spring by the grubber and harrow, with as little rolling as possible.
The cheapest method of growing turnips on light and medium turnip-soils, is to apply from 8 to 10 bushels of bone-dust per acre, by means of the crop-drill. On clay lands, the best manure is considered to be good farmyard dung and Peruvian guano.

210. SOWING.—A variety of machines are in use for sowing turnips, many farmers preferring to have two rollers, one to smooth the top of the drill, and the other to cover the seed; but, in damp weather, the one-roller machine is to be preferred.

Turnips are sown in the south of England and Ireland from the 25th of May till the 1st of July; and in Scotland from the 1st of May to the 25th of June. In the north of England, where Swedes appear to thrive best, they are mostly sown between the 15th of May and the 1st of June.

211. SINGLING.—A good deal of dexterity is required to single turnips well, some men performing the job much better than others. Swedes should be hoed as soon as the plants are in rough leaf, being cut out so as to stand in a space a foot apart, taking care to have strong plants, and the job should never be done when the land is wet, as the young plants do not thrive afterwards.

212. HOEING.—In turnip cultivation horse-hoeing is very important, the double and single-horse drill-grubbers being the best implements, but it should not be done too near the young plants, so that when singled they are deprived of their necessary support.

213. DISEASES AND INSECT ENEMIES.—Turnips are subject to a great many insect enemies, the most universal of which is the fly, flea, or beetle (*Allia nemorum*) which devour the seed-leaves as soon as they make their appearance. Sprinkling with fine lime-dust early in the morning is the best remedy for these, and there are many that are prescribed for other pests which our space will not allow us, unfortunately, to give the full details of, as we should otherwise desire.

214. PULLING, TOPPING, TAILING AND STORING.—The practice in the north, where growing turnips is considered to be best understood, is to plough in the shaws as manure when the crop is lifted to make room for wheat.

In pulling the workers take each a couple of drills, throwing the bulbs between and the shaws behind them; and when the tops are intended to be ploughed-in they should be cut off a little above the bulb, so that the leaves may fall separately on the ground, and allow of their being more easily spread and ploughed-in.

When turnips are to be stored for several months, the roots should not be cut off, as they keep better with, than without them; and the best way of storing them is to lay them up between strong burdles, placed upright in two rows apart,
firmly fixed in the ground, and propped from the outside. Another hurdle is then placed across the lines thus formed, to which the side ones are fastened, and thatched over; the bushy eaves of the thatch, interlocking at each side over the rows, furnish a protection against frost, the three great requisites being thus supplied: sufficient ventilation, and protection against rain and frost.

Some stow them against the northern side of the wall, and place a few hurdles over a covering of straw that is laid upon them.

215. COST OF CROP.—The expenses of cultivating a crop of turnips is about £8 10s. per acre, though part of this expense is undoubtedly due to the succeeding crop, especially if all the shaws are ploughed in as manure.

216. ANALYSIS OF TURNIPS.—The following is an analysis of the bulbs of turnips in the natural state:

<table>
<thead>
<tr>
<th></th>
<th>White Globe</th>
<th>Swedes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>90.430</td>
<td>89.460</td>
</tr>
<tr>
<td>Sugar, gum pectin, &amp;c.</td>
<td>4.697</td>
<td>4.637</td>
</tr>
<tr>
<td>Albuminous compounds</td>
<td>1.743</td>
<td>1.443</td>
</tr>
<tr>
<td>Vegetable fibre</td>
<td>3.102</td>
<td>3.837</td>
</tr>
<tr>
<td>Inorganic substances (ash)</td>
<td>0.628</td>
<td>0.623</td>
</tr>
</tbody>
</table>

217. CARROTS.—Although carrots have been grown for a considerable period in the eastern division of Suffolk upon the sandy and light loams which are especially fitted for their cultivation, as a field-crop, it is only in comparatively recent times that they have been extensively grown.

218. VARIETIES.—There are several varieties of carrots, but such as the Early Horn, which are only fitted for garden culture, need not be specified here; but the common red carrot, which grows entirely in the ground, is cultivated in the Eastern Counties, and in game districts, where hares and rabbits commit depredations; but the White Belgian and the Altringham grow with a considerable portion of the root above ground, which causes them to be fitted for a thin or adhesive soil; the Belgian, as a rule, producing heavier crops than any others.

219. CONDITIONS OF SUCCESSFUL CULTIVATION. — The principal conditions for the successful growth of a good crop of carrots are: perfect pulverisation of the soil, and entire freedom from weeds and stagnant water. The best soils are those of deep sandy loams; on these heavy crops may be obtained, and the expense of cultivation and harvesting is less than upon a stiffer soil. On highly-cultivated lands of this order, carrots may be grown
without much reference to the composition of the soil. Upon free, sandy loams, the crop may be carted off without injury, and it may be stored in good order; but a stiff, tenacious loam would be injured by the carting, while the roots, on account of the soil adhering to them, would not be stored in such good condition.

220. SOWING.—March to the middle of May is the usual time of sowing, April being considered the best month; for, if sown too early, and they do not vegetate freely, weeds grow thickly; while if the sowing is deferred later than April, they do not attain their full growth. About 8 to 10 bushels of salt, and 20 to 30 bushels of soot, per acre, is considered a good manure for carrots. Fine charcoal also hastens the germination of the seed by attracting moisture, and guano also stimulates it; a good start for the crop being a very important point.

Broadcast sowing was at one time almost universally practised, about 6 lbs. of seed being used, but carrots are now mostly drilled-in. Before sowing the seed, it is rubbed in the hand to remove the hairy fibres by which it is covered, that, interlocking with each, otherwise interferes with regularity in sowing; and is afterwards mixed with dry sand, or ashes (the common corn-drill being the best implement for sowing), two or three bushels of ashes being used with half-a-dozen lbs. of seed.

The land needs to be well rolled and harrowed to make it as fine as can be, before the seed is put in, which should be sown as shallow as possible.

If the seed is mixed with damp sand before it is used, to "chip," germination will be hastened by some days, and it is found a good plan to sow a few seeds of mustard, barley or oats, so as to mark the position of the drills, and thus enable the horse-hoe and the hand-hoe to be employed. When the width of the drills exceeds 18 inches, the horse-hoe may always be resorted to, which is a great advantage on stiff, loamy soils.

221. LIFTING CARROTS AND STORING.—Some writers advocate the practice of leaving carrots standing in the ground during winter, and lifting them as wanted, but there are plain objections to this course. The cultivation of the land cannot be proceeded with and got in readiness for a succeeding crop, and they cannot be got at in frosty weather, while they throw out lateral fibres while standing, and in wet seasons the land is injured by being trampled on.

Dry weather should be chosen for lifting the crop, and a fork used. On sandy soils the practice is to use a light fork with one hand, and
apply the other to the tops of the carrots gathered up loosely in a bunch, to assist their being drawn.

The leaves should be cut off close to the crown; some cut off part of the crown itself, but this is not necessary, and they should be allowed a few hours to dry in the field before being stored.

A good way of storing carrots is to pile them top and tail alternately, so as to make them stand evenly, against a wall inside a roomy barn, or building of some sort, with a little sand strewn between the rows. In Suffolk they are often piled in long narrow heaps on the ground, and covered over first with straw and then with earth, through which the straw at the top of the ridge is allowed to protrude, in order to give ventilation, and from these heaps they can be easily taken when wanted. Another plan is to pack them between hurdles in the same way as pursued with turnips and mangold-wurzel.

222. ANALYSIS OF CARROTS.—The following is an analysis of the Belgian carrot:—

| Component                | Percentage
|--------------------------|-------------
| Silica                   | 1.19        |
| Phosphoric acid          | 8.55        |
| Sulfuric acid            | 6.55        |
| Carbonic acid            | 17.30       |
| Lime                     | 8.33        |
| Magnesia                 | 3.96        |
| Peroxide of iron         | 1.10        |
| Potash                   | 33.00       |
| Soda                     | 13.52       |
| Chloride of sodium       | 6.50        |
| **Total**                | **100.00**  |

223. NUTRITIVE VALUE.—The alimentary constituents of the carrot consist of the following:—

| Component                           | Percentage
|-------------------------------------|-------------
| Nitrogenous, or flesh-forming parts | 1.48        |
| Heat-giving ingredients for the support of life | 11.61 |
| Ashes                               | 0.81        |
| Water                               | 86.10       |
| **Total**                           | **100.00**  |

The land should always be deeply trench for carrots when it is possible to do so.

224. USES.—Besides being largely consumed as human food, and often profitably grown for market, they are excellent food for all sorts of stock, and, as an article of winter and spring forage, take the same place on light soils that mangold does on heavier ones.

Working horses can be kept upon two bushels of sliced carrots and chaff per day, and they fatten oxen and sheep, as well as young cattle and milch cows; and no food is found to bring horses to condition sooner.
225. PARSNIPS.—Parsnips may be grown upon stronger land than carrots, it is true, but they do not affect a stiff soil, as is erroneously supposed by many; preferring a rich, light, deep loam that is entirely free from stones. Like the carrot, it sends its root deep into the earth, and well-trenched land is necessary for a good crop.

226. VARIETIES.—In its wild state, the parsnip may be found growing on the bank-sides and the borders of fields in some soils that are suitable to its habits, and loses the acrid taste which distinguishes it in its natural state when properly cultivated.

The varieties of the parsnip are not numerous, the best kind for field cultivation being the hollow-crowned Jersey, the root having been extensively cultivated in Guernsey and Jersey for the purpose of feeding cattle.

227. CULTIVATION.—Like the carrot, parsnips require a deep soil, and succeed best in a free-working loam, but good crops have been grown in stiff, clinging soils, when they have been properly cultivated, by good draining in the first place, and afterwards winter exposure, and the earth being thoroughly well pulverised.

They may be sown in drills upon ridges in the same manner as turnips, in those cases where the nature of the soil would seem to point out that course as the better method of cultivation; but they are mostly grown on the flat.

The method of cultivation is much the same as that followed with the carrot, but it may be sown earlier; February being often chosen when the land can be got ready in time for their reception.

New seed should always be used, as old seed frequently does not germinate; and if it is mixed with damp sand, preparatory to its being sown, it will help on its progress.

228. ANALYSIS OF NUTRITIVE VALUE.—The following is the composition of the parsnip:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>82.050</td>
</tr>
<tr>
<td>Vegetable fibre</td>
<td>8.022</td>
</tr>
<tr>
<td>Inorganic matter attached to the fibre</td>
<td>0.208</td>
</tr>
<tr>
<td>Insoluble albuminous compounds</td>
<td>0.550</td>
</tr>
<tr>
<td>Soluble casein</td>
<td>0.665</td>
</tr>
<tr>
<td>Nitrogen, in the form of ammoniacal salts</td>
<td>0.033</td>
</tr>
<tr>
<td>Pectin and gum</td>
<td>0.748</td>
</tr>
<tr>
<td>Salts insoluble in alcohol</td>
<td>4.555</td>
</tr>
<tr>
<td>Sugar</td>
<td>2.882</td>
</tr>
<tr>
<td>Salts soluble in alcohol</td>
<td>3.393</td>
</tr>
<tr>
<td>Starch</td>
<td>3.502</td>
</tr>
<tr>
<td>Fatty oil</td>
<td>0.546</td>
</tr>
</tbody>
</table>

Total: 100.000
Potatoes, Turnips, Carrots, and Parsnips.

229. **COST OF CROP.**—The cost of a crop of parsnips will chiefly depend upon the preparation of the land, which should be deeply trenched, if possible, the same as for carrots, the heavier crop being found to pay well for the extra labour that is given it; but, by the ordinary methods of cultivation, a crop will cost something like £8 per acre, or much the same as a crop of carrots, but the yield is much smaller than that of carrots.

230. **USES.**—Parsnips, like carrots, are used for human food, but not to the universal extent of carrots, being consumed more at particular seasons, as during Lent, when they are eaten with salt-fish; but on the farm they are very valuable on account of their superior fattening qualities for stock, containing 6 per cent. more mucilage than carrots, while the meat of the animals fed upon them acquires in exquisite flavour and juicy quality—this being particularly the case with pigs that are fed upon them—and all animals become fat much sooner, and are kept in better health, when fed upon parsnips than upon any other root.

231. **DISEASES AND INSECT ENEMIES.**—Parsnips, like carrots, are subject to the depredations of a variety of insects, the roots becoming rusty if left too long in the ground; the maggots of small flies attack them—*Psila Rosae* and *P. nigracornis*—and the flowers and seeds are injured by the caterpillars of flat-bodied moths—*Depressaria cicutella*; *D. depressella*; and *D. daucella*—while the maggots of another fly—*Tephritis Onopordinis*—cause large blistered blotches on the leaves; the best remedy being to pinch the blisters as soon as they appear, which destroys the maggots that have taken up their abode between the skin of the leaves.
CHAPTER XI.

CABBAGE, KOHL-RABI, BEET, MANGOLD-WURZEL, HOPS, GRASSES.


232. CABBAGE (Brassica).—Savoy, York, and other cabbages are occasionally grown as a field-crop, though these kinds are ordinarily met with in the instance of garden cultivation; but the large Drum-head cabbage is the kind best suited to the purpose of the agriculturist. These often attain enormous weights and sizes.

233. SOIL.—Cabbage is not suitable to such a large variety of soils as the turnip and many other crops, but on most farms where a portion consists of loamy, or adhesive soil, a piece of cabbage will be found extremely useful; as by good management the crop will come in for use at a season when food for stock will be running short; that is, in spring, after the turnips are consumed; and in autumn before they are ready to be fed off; when they will come in handy both for cattle and sheep, being particularly adapted for milch cows, and ewes that have just lambed.

Cabbage attains its largest size on rich, loamy soil; but it will be found to answer on land that is generally too tenacious for a turnip-crop. It does well upon ground that has been freshly broken up, pared and burnt; but wherever it is planted, it requires a plentiful supply of rich manure, being a grass-feeder that will absorb rank dressings.

234. CULTIVATION.—The manure should be carted, spread and covered in, as soon as possible while fresh; and the cabbages planted in the newly turned-up earth with as little loss of time as possible.

In some cases, the land is prepared in the same way as for turnips, and where the soil is not very rich the ridges are fixed at the usual distance of 27 inches, and the distance between the plants (which of course have been raised previously on a separate bit of land for the purpose, or in a garden), is 24 inches. This will take at the rate of 10,000 plants per acre, and a man accustomed to plant cabbages,
having a boy to assist him to fetch the plants, and render what help he can, will be able to plant half an acre per day.

But this space will not be sufficient for the large Drum-head variety, or cattle-cabbage; on rich ground, on some soils, 3 feet apart being considered not too great a distance. But 5 feet is generally assumed to be a proper distance for stiff soils, the usual plan pursued being, to open double furrows across the field, at 5 feet asunder, and plant the cabbages 21 inches apart on the drills that have been rolled, in the centre, immediately over the manure which has been spread, and covered in by four furrows. Upon this method of planting, the rows being 5 feet asunder, and the plants standing 21 inches in the row from one another, an acre will take about 4,500 plants.

When the plants have taken firm hold, the land is ploughed from the plants as closely as possible, so as not to injure the leaves, and then reversed, each alternate space being left unploughed. The object of this is, that as a number of roots are taken off in the ploughing, if both sides were done at once they would suffer too much; but by allowing a few days to intervene—say about a week—the plants will send out fresh rootlets, and will be adequately supported while this is going on by the unploughed side.

These alternate ploughings should be done as often as necessary in dry weather, so as to get the land in a fine condition; by breaking the roots, a number of fine fibres are thrown out by the plant, which absorbs a larger amount of nutriment from the soil, and attains a greater bulk than if left undisturbed.

Planted in May, there will be good cabbages for feeding stock in September and October; and successive plantings may be made to arrive at maturity throughout the autumn and winter. If planted in June, or the early part of July, upon land that has been occupied by tares, mown and fed, they will come in for spring use.

Young, overgrown, weakly plants should not be used, and, if transplanted beforehand by pricking out they will do better, as by this means they attain fibrous, bushy roots; but breaking the roots by the plough really effects a similar object. In drawing the plants, as much soil as possible should be left adhering to the roots, and they should be firmly fixed in the ground at the time of planting, but not sufficiently deep to interfere with the lower leaves.
235. KOHL-RABI, or Turnip-rooted Cabbage (*Brassica caulis-rapa*).—This useful plant thrives in the dry summers that are unfavourable to turnips and cabbages, though its cultivation is not nearly so general as might be supposed would be the case; for during long-continued droughts, when other crops have suffered severely, kohl-rabi has stood, not only uninjured, but has flourished. Sheep do well when folded on it (yielding plenty of green fodder at
Cabbage, Kohl-Rabi, Beet, &c. 127

Christmas, or later), while, when boiled with grain for cows and horses, it is found extremely nourishing.

236. CULTIVATION.—A piece of land is selected in the first place for a seed-bed, and well dug and manured in the winter, and got in good condition for sowing the seed by the middle of February, or last week in March. The seed is sown thinly in drills, like cabbage, about 12 inches apart, the intervening space being kept thoroughly clean by weeding, and hand-hoeing, until the plants are large enough for transplantation.

By the middle of May, the land destined to receive the crop is manured as if for turnips, being deeply ploughed and harrowed to a fine surface. The plants, which will then be about six inches high, are removed from the seed-bed and planted by the dibble in rows one yard asunder, the plants standing about twenty inches from each other in the rows.

This is supposed to be the method for one main bulbing crop, but a second crop is planted in July by some cultivators, but the leaves and bulbs of the later plantings never attain the size of those that are earlier sown.

The ground between the rows has to be kept constantly stirred by the horse-hoe until the leaves are so fully expanded as to render the operation impossible.

Upon good soil, that has been well cultivated, the average weight of the bulbs will be 7 or 8 lbs., 14 to 16 lbs. being attained in individual cases.

237. THE COMMON BEET (Beta).—To this order belong all the varieties which are separately known as red-beet, yellow-beet, sugar-beet, mangold-wurzel, &c., the last of which is a very important crop to farmers on account of its excellent keeping qualities.

Each of the above differ in size, form and colour, and in the relative sweetness of their roots; but are, in all other respects, much the same. On the Continent, the sugar-beet is largely cultivated for the production of sugar; but although it has been grown in England for the same purpose, it has only been in exceptional cases, and never universally.

Beet is but little known in this country as a farm-crop, being mostly used for garden purposes. The kind known as the red Castelnaudary is considered the best, its roots being small, of deep crimson colour, and almost wholly underground.

238. CULTIVATION.—On account of the much larger size and more profitable nature of mangold-wurzel, beet is seldom grown as a farm-crop; but when this is done, the seed should be sown in drills in
May, in a deep, rich, light soil. It should be soaked in water for forty-eight hours before being used, as in dry weather it is otherwise apt to lie very long in the ground without germinating.

As the crop is soon injured by the frost, the roots require to be lifted early in winter, the details of which we give in the following account of its kindred and more important variety, mangold-wurzel:

239. **MANGOLD-WURZEL**, or the Field Beet, is cultivated largely in five principal varieties: first, the sugar-beet, which is grown for the manufacture of sugar, and which, as before-stated, is but very little cultivated in England; the long red, the globe-red, the orange-red, and the orange-globe.

240. **CULTIVATION**.—Mangold-wurzel is generally made to follow a corn-crop in rotation, the stiffer portions of the land being chosen for the reception of the crop, and ploughed deeply, and manured heavily in autumn, the manure being spread and ploughed in.

In April, good harrowing need to be given, and the grubber used and the weeds gathered off; and, if necessary, cross-ploughed in wide lands, and harrowed and cleaned again. Artificial manure is added, sown broadcast over the drills; about 3 cwts. per acre of guano being used, and 2 to 4 cwts. of common salt has been found a useful application for mangold-wurzel in inland situations. The drills being split, the manure is covered, and the guano, or other artificial manure, is thus mixed with the soil over it, just in the situation where it will be useful for the young plant.

The seed is then sown in the drills in the usual manner, and, it soaked for twenty-four hours in water beforehand, germination will be considerably accelerated.

As soon as the plants have attained sufficient size, they are singled out in the same way as turnips, and if any blanks occur in the field, they may be readily filled up by transplanting plants from where they stand thickly.

The horse-hoe should be used between the rows, and the land kept clean of weeds.

241. **COST OF CROP**.—The cost of a crop of mangold-wurzel is much the same as a crop of turnips, the processes of cultivation, manuring, harvesting, &c., being also much the same, though enormous crops are sometimes obtained on rich land; those of the long-red species obtaining a weight of 35 lbs., and in particular cases, even much greater weights.
Cabbage, Kohl-Rabi, Beet, &c.

242. USES.—Mangold-wurzel is especially useful to the farmer as a spring food for cattle and sheep, at a season when most food gets scarce. It remains juicy and palatable long after the Swede has become spoiled by age, as it can be kept for a long period far into the new year, and up to the time when the artificial grasses begin to come in for use; the yellow-globe being a better keeper than the long-red variety.

243. ANALYSIS OF MANGOLD-WURZEL.—The composition of mangold-wurzel is as follows:

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<tr>
<td>Water</td>
<td>85.18</td>
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<tr>
<td>Gum</td>
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<td>0.67</td>
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<tr>
<td>Sugar</td>
<td></td>
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<td>9.79</td>
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<tr>
<td>Casein</td>
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<td>0.32</td>
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<tr>
<td>Albumen</td>
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<td>0.39</td>
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<tr>
<td>Fibre, pectin, and pectic acid</td>
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<td>3.68</td>
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<td></td>
<td>99.20</td>
</tr>
</tbody>
</table>

There will be slight variations of the component parts in different varieties, the above referring to the long-red species.

244. HOPS.—The hop (Humulus) in its wild state is an indigenous plant in this country, the cultivated kinds having been brought over to England from Flanders in 1525. They are only cultivated to any extent as a field-crop in certain districts of the country where the geological formation is favourable to their growth, these conditions being found in Kent, Sussex, Surrey, Hampshire, Worcestershire, and Herefordshire, and to a small extent in a few other counties; and there is no crop so precarious in its nature, or which so frequently disappoints the hopes of the agriculturist, who, frequently buoyed up to a certain date by the thriving appearance of his hop-garden, may find it the next day, owing to some atmospheric change, in a condition that will give him occasion for the most serious apprehensions.

245. VARIETIES.—Hops are often referred to after the names of those districts in which they are grown, the hop-pockets being stamped with a distinguishing mark or figure, as the “rampant horse” for Kent, the “bell” for Farnham country, &c.; and they are classed in the following order:—Farnham, East Kent; Mid-Kent; West Kent, and the Hill Grounds; Weald of Kent and Sussex, and Worcester.

The kinds held most in esteem are the Farnham and Canterbury white-bines, a delicate variety, which is chiefly used in brewing pale ale. Next, the goldings, which are rather stronger than the first-
named, the bine being somewhat larger, and the hops hanging more singly on the bine, which is covered with reddish-brown spots.

These varieties take the largest poles, their roots striking deeply into the soil, and are very enduring, lasting for many years. There are several sub-divisions of what is termed the "grapes" variety, which hang in clusters, the small kinds being superior to the larger. The Jones' are suitable for light and inferior land, requiring poles of 10 feet or so only in length, for which the refuse poles that have been broken off in the ground are made use of, where other kinds

are grown that take longer poles. The Colegates are a hardy variety which will run up a long pole on a stiff soil, but are late in ripening. The Flemish red-bines, which grow in light, sandy soils, will close the list of leading varieties; and as these generally escape the aphid, or black blight, they are often called "never blacks."

246. **CULTIVATION.**—The plants are raised from sets, or shoots of the preceding year, cut off at the stool by opening the "hill," as it is termed, and these are planted in deeply-dug and trenched ground in squares and triangles; the plants standing 6 or 7 feet apart. No manure is required at the time of planting, but the ground must be constantly kept clear of weeds, and the soil kept in a thoroughly well-pulverised condition all over; a stick about 4
or 5 feet high being placed at each hill for the hop to twine round; or if nursery plants have been used of one year's growth—which saves time in making a plantation—rather a taller stick. About the beginning of June, or a little earlier, about 3 cwt. of guano, and 1 cwt. of superphosphate of lime should be applied per acre, and a similar dressing in July, when the hills should be earthed-up 6 inches.

Cultivators of hops, as a rule, have a great objection to grow anything else but hops, but, as the land needs to be richly manured while the hop garden is being formed, during the first year some heavy crops of mangold-wurzel may be grown between the rows of hop plants, 50 tons or so to the acre being often the result.

A description of the entire process of hop-cultivation would easily fill a small volume, but it may be briefly said that the main points of cultivation consist in keeping the ground well pulverised by constant stirrings, and the application of manures of whatever kind the soil may need.

The bines are tied to the poles about the beginning of May, three of the strongest shoots being chosen, and the rest allowed to remain for a time, and then cut off, as sometimes deficiencies have to be remedied.

Picking generally commences about the beginning, and middle, of September; but the hops must not be picked until they are fully ripe, and not be allowed to hang an hour longer after ripeness has been attained, or they deteriorate in value. The hops are dried in kilns constructed for the purpose, on a horse-hair cloth, by currents of heated air passing rapidly through them; an operation of some nicety, particularly in the better qualities, purity of colour being a great point with the pale-ale brewers, who buy the best qualities, and give the longest price for them; but it is of not so much consequence in the inferior sorts used for strong ale, beer, and porter. Sulphur is used in the drying process, which both bleaches the hop and takes up the vapour, thus materially aiding quick-drying.

247 COST AND RESULT OF CROP.—A good deal of labour is required in a hop-garden, as the land requires to be often stirred and kept very free from weeds, but the chief expense is for manure, which requires to be applied with a liberal hand. At a critical time, when the young plant is infested by fly, by stimulating the growth of the plant it is sometimes so effectually started as to get beyond the reach of material damage; and the cost of cultivation ranges from £20 an acre to £50, the latter being the case when the highest methods of cultivation are resorted to.

The amount of yield varies very considerably in what may be
termed an average good year, everywhere. For some of the smaller and firmer varieties, from 5 to 8 cwt. per acre may only be obtained, where the poles are low (poles being always used to suit the habit of growth of the plant, varying in height from 8 to 18 feet), while 20 cwt. per acre is sometimes obtained from the larger kinds that are grown in Kent. The price varies considerably according to the crop, but of late years we have had a good many foreign hops imported into this country, and in some parts a good many hop-grounds have been grubbed up lately.

248. NATURAL GRASSES.—The term "grasses" is often used in a double sense, but they are usually separately spoken of as "natural" and "artificial" grasses, the latter including the crops we have spoken of, as clover; sainfoin; lucerne; rye-grass, &c., &c.; but the practice prevails of sowing grass-seeds either with clover for laying down permanent pastures, or of shaking the seeds of some of the best grasses on established pastures to improve their quality; or of laying down fresh ones.

Timothy and Cock's-foot grasses have been introduced from North America, and have been found very useful, while Crested Dog's-tail, Sheep's Fescue, and some of the bent grasses, which much increase the bulk of the hay-crop, are freely resorted to; and seeds of Meadow Fescue; Meadow Fox-tail; and the sweet vernal grasses, may be often resorted to with great advantage.

Seeds may thus be selected, or, rather we should say, a mixture of seeds appropriate for permanent pasture, for lawns which are kept constantly under the scythe; for lands in preparation for irrigation; for those overshadowed by trees, as orchards, &c.; for heathy, and moor-lands, to be improved with a view of better pasturage; for deep, mossy ground, intended to be kept in grass; or those occasionally overflowed by fresh-water rivers; for pasturage and cover in thick shady woods; or for covering barren, rocky, or gravelly soils of the worst description; some of which, in gravelly situations, resist a sward from all ordinary means; even to drifting, or blowing sands, upon which a stray tuft or two of bent grass may sometimes be seen solitarily growing.

For all of these varied soils, and necessarily different situations, appropriate grass-seeds are to be obtained, which in many instances will be the means of transforming dry and arid tracts of waste land into districts of green and smiling verdure,
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