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SCIENCE AND PRACTICE

IN

FARM CULTIVATION.

BY

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TO

JOHN CHALMERS MORTON, ESQ.,

The talented Editor of the "AGRICULTURAL GAZETTE,"

MANY OF THE FACTS AND OPINIONS ALREADY DETAILED
IN WHICH INFLUENTIAL JOURNAL
ARE HERE BUT REPEATED,

THIS WORK

IS DEDICATED

AS A SMALL TOKEN OF ADMIRATION AND RESPECT,

BY HIS FAITHFUL FRIEND,

THE AUTHOR.

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THE SCIENCE AND PRACTICE OF ROOT CULTIVATION.

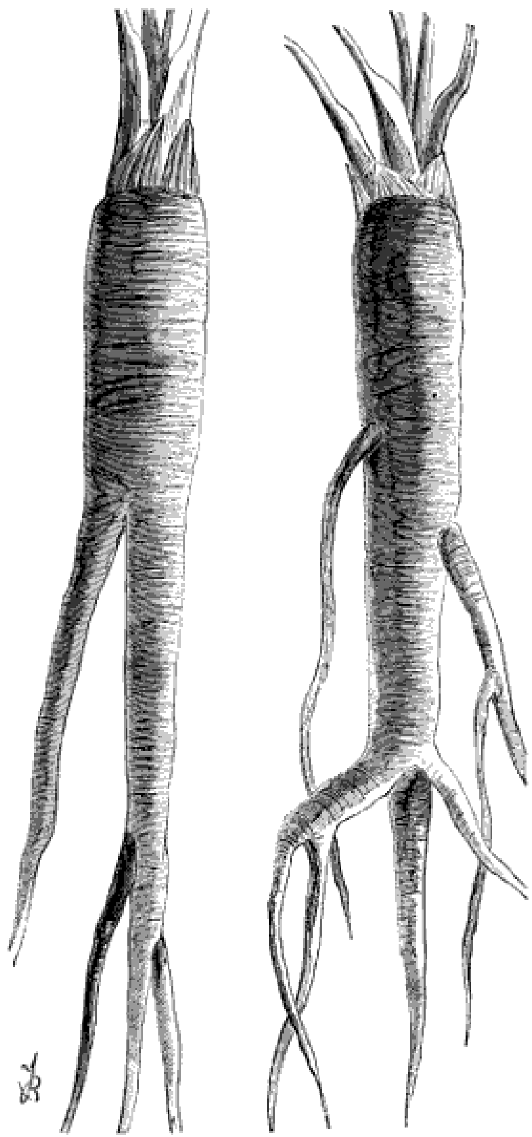
CHAPTER I.

ON THE ORIGIN OF ROOT CROPS.

Few people who have studied the matter attentively but have arrived at the conclusion that those plants which we cultivate for their roots were not naturally endowed with the root portion of their structure either of the size or form which would now be considered as essential for a perfect crop plant. Thus the parsnip, carrot, turnip, beet, &c., as we find them in nature, have nowhere the large, fleshy, smooth appearance which belongs to their cultivated forms; and hence all the varieties of these that we meet with in cultivation must be considered as *derivatives* from original wild forms, obtained by *cultivative processes*; that is, collecting their seed, planting it in a prepared bed, stimulating the growth of the plants with manures, thinning, regulating, weeding, and such other acts as constitute farming or gardening, as the case may be.

Hence, then, it is concluded that such plants as are grown for their roots have a peculiar aptitude for laying on tissue, and thus increasing the bulk of their "descending axis," that is, that portion of their structure which grows downwards—root. Besides this, they are remarkable for their capability of producing varieties—a fact which, united with a constancy in the maintenance of an induced form, renders it exceedingly easy to bring out new sorts which will maintain their characteristics under great diversities of climate, soil, and treatment.

The facility with which different sorts of roots may be procured can readily be understood from the many varieties, not only of *turnip*—which may perhaps be considered as an original species—but also of swede, which is a hybrid of the turnip and rape plant. Of the former we have more than thirty sorts grown by the farmer, and as many peculiar to the garden; whilst there are probably more than twenty well-recognized sorts of swedes. Of beets, with mangel-wurzel, we have almost as great a variety; so also of carrots. Of parsnips we have fewer varieties, to which may now be added the new form called the Student parsnip, the growth of which is so interesting that we shall here give a short history of its production, as an illustration of the origin of root crops.



Figures 1 and 2.—Roots of Wild Parsnips. Natural size.

In 1847 we collected some wild parsnip seed from the top of the Cotteswolds, where this is among the most frequent of weeds. This seed, after having been kept carefully during the winter, was sown in a prepared bed, in the spring of 1848, in drills about eighteen inches apart. As the plants grew they were duly thinned out, leaving for the crop, as far as it could be done, the specimens that had leaves with the broadest divisions, lightest colour, and fewest hairs. As cultivated parsnips offer a curious contrast with the wild specimens in these respects, we place the following notes, side by side, on the root-leaves of plants of the same period of growth.

1st. Wild Parsnip.	Ft.	in.	2nd. Student Parsnip.	Ft.	in.
Whole length from the base of the petiole to the apex of the leaf	0	8	Whole length from the base of the petiole to the tip of the leaf	2	0
Breadth of leaflets	0	0¾	Breadth of leaflets	3	0¼
Length of ditto	0	1	Length of leaflets	0	6½
Petiole and leaflets, hairy. Colour, dark green.			Petiole and leaflets without hair. Colour, light green.		

We have before remarked that neither in size nor form are the wild roots at all comparable with the cultivated ones. Our figures 1 and 2 were taken from fine roots of the wild parsnip of the first year's growth; that is to say, just at the same time as a crop parsnip would be at its best. They were purposely taken from specimens obtained from the same district as the seed with which our experiments were commenced.

Our first crop of roots from the wild seed presented great diversities in shape, being for the most part even more forked than the originals, but still with a general tendency to fleshiness. Of these the best shaped were reserved for seeding; and having been kept the greater part of the winter in sand, some six of the best were planted in another plot for seed. The seed, then, of 1849 was sown in the spring of 1850, in a freshly-prepared bed, the plants being treated as before, the results showing a decided improvement, with tendencies in some examples in the following directions:—

1st. The round-topped long-root, having a resemblance to the Guernsey parsnip. (*Panais long* of the French.)
2nd. The hollow-crowned long-root. "Hollow-headed" of the gardener. (*Panais Lisbonais* type.)
3rd. The short, thick turnip-shaped root. "Turnip-rooted" of the gardener. (*Panais rond* form.)

These three forms were all of them much mis-shapen, with forked roots, that is, *fingers and toes*; but still each of them offered opportunities of procuring three original varieties from this new source.

As an example of progress, we offer the following engraving of a specimen of our Round-topped parsnip of 1852. Fig. 3.

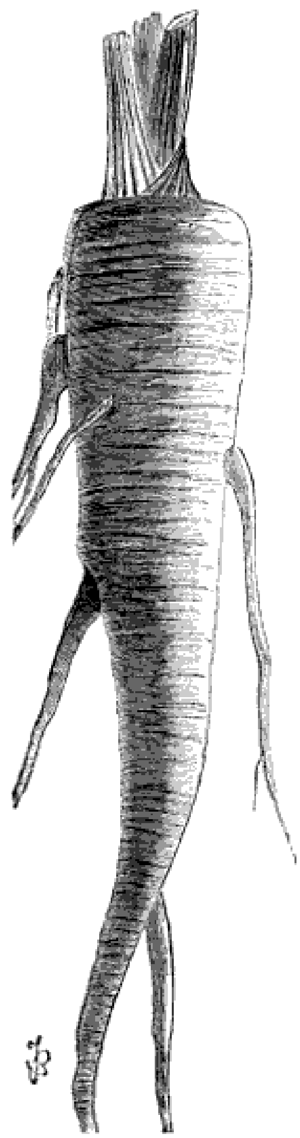


Fig. 3.—Round-topped Parsnip, five generations from wild root.

This it will be seen has strong, fleshy forks, and a tendency to form divided tap-roots; otherwise the shape is greatly improved, and the skin is tolerably smooth.

At this time our stock was for the most part fleshy and soft on boiling; the flavour, too, though much stronger than that of the usual esculent parsnip, was rather agreeable than otherwise.

This matter of flavour is a subject of interest, as most lovers of the parsnip, as a garden esculent, had got to complain of this root becoming more and more tasteless. That this was so our own experience most fully confirms; we have now, however, mended this root very materially in this respect.

Our experiments were only carried on with examples of the Hollow-crowned form, which following out from year to year, we at length obtained so perfect in form, clean in outline, delicate in skin, and unexceptionable in flavour, that we were induced to cause its seed to be distributed through the medium of the trade.

In 1881 we sowed a parcel of seed in our own garden obtained from the Messrs. Sutton, after having received from them the following notes upon the growth of the roots in their grounds:—

> We are happy to tell you that in lifting some of each of all the varieties of parsnips in our trial-ground, your "Student" was decidedly the best shape, varying in length, but always clean and straight.

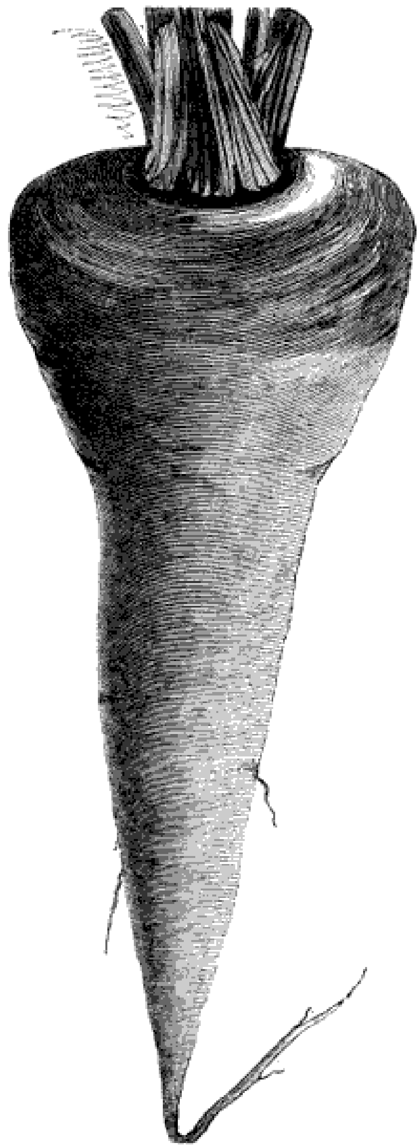


Fig. 4.—Student Parsnip of 1861. Two-thirds of natural size.

The engraving (Fig. 4) is taken from our garden stock of 1861, as being a common shape of this new variety. It is not quite so long and slender as the usual Long-horned parsnip, but its clean unbranched outline and solidity of structure recommend it as a good variety, whilst its flavour has been highly extolled by the lover of this, to some, favorite root. In size it is scarcely large enough for a field crop, but though not at present recommenced for the farm, its history may well serve to explain the origin of crop plants, as derived from the cultivation and improvement of wild species.[1]

[1] It may here be noted that the Student parsnip took the first prize for this root at the International Show at the Horticultural Society’s Gardens in 1862.

CHAPTER II.

ON THE ORIGIN OF SORTS OF ROOTS.

As crop plants are derived from wild ones, as the effect of cultivation, it follows as a matter of course that these will be varied, both in form and constitution, according to the circumstances under which they have been produced. Thus we may expect that any attempts to ennoble a wild root in different countries would not, even if successful, be sure to bring about the same results. Much depends even upon the individual root with which our trial may be started, and more upon the judgment employed in selecting the stock from which the experiments are to be continued.

That position and soil may make a great difference may be inferred from the fact that the attempts to improve the wild parsnip and carrot have met with varied success. De Candolle is reported to have tried to improve the carrot with success, whilst with the parsnip he utterly failed; whilst Professor Lindley, in Morton’s “Cyclopædia of Agriculture,” tells us that M. Ponsard has ascertained that “the wild parsnip becomes improved immediately when cultivated, and that experiments in improving its quality promise well:” how well, indeed, may be seen from the foregoing chapter. But still, we utterly failed with the wild carrot. Having collected seeds of the *Daucus Carota* (the common wild carrot) from some fine specimens growing on the road-side between Cirencester and Cheltenham, they were subjected to experiment at the same time as the parsnip, but with little, if any, favourable result. Upon this plant Professor Lindley observes as follows:—

> That the hard-rooted wild carrot is really the parent of our cultivated varieties, remarkable as they are for the succulence and tenderness of their roots, has been experimentally proved by M. Vilmorin, who succeeded in obtaining by cultivation perfectly tender, eatable roots, from seeds saved from plants only three or four generations off the wild species.

Still, a modern French naturalist of great experience, M. Decaisne, tells us that he has tried to ennoble the wild carrot, and has not succeeded; and from this he draws the conclusion that our cultivated forms were created specially for the use of man. As we should suppose that very few botanists agree to this theory, we shall let the facts we have already brought forward stand in maintenance of its opposite, namely, that cultivated forms are derived from wild species often apparently very different; but at the same time it may be well to state, that in all probability some of the discrepancies of experimenters may have arisen from some confusion in the species operated upon.

In 1860 we gathered some seed of the *Daucus maritima* (sea-side carrot) at Bognor, which, on being sown in a prepared plot the following spring, certainly resulted in fairly succulent roots, which on being cooked were pronounced by our party of four to be excellent. While on this subject, it may be mentioned as not a little remarkable, that so many of our garden esculents should be derived from sea-side plants. Thus, probably carrot, but certainly celery, sea-kale, asparagus, and cabbage. This would seem to point to the fact that cultivation requires a complete change of the circumstances necessary to maintain a wild condition; and hence cultivated plants can only be kept up by the labours of a cultivator.

Now, as regards the sea-side carrot, we are after all inclined to the belief that it is the parent of the cultivated varieties, whilst, on the other hand, we view the *Daucus Carota* (the wild inland carrot) as a probable descendant from the cultivated or garden stock; and if this be so, the *Daucus maritima* is the original species from which both the wild and cultivated races have descended. Bentham, indeed, carries this view a little further, the following remarks tending to throw doubts upon the carrot in any form as being a true native. Under the heading of *Daucus Carota* he says:—

> Probably an original native of the sea-coasts of modern Europe, but of very ancient cultivation, and sows itself most readily, soon degenerating to the wild form, with a slender root, and *now* most abundant in fields, pastures, waste places, &c., throughout Europe and Russian Asia; common in Britain, especially near the sea. *Flowers the whole summer and autumn.* A decidedly maritime variety, with the leaves somewhat fleshy, with shorter segments, more or less thickened peduncles, more spreading umbels, and more flattened prickles to the fruits, is often considered as a distinct species.

Seeing then that crop plants are derivatives from a wild stock, we can readily understand how the varying circumstances attendant upon the development of the former should tend to the production of varieties, and this merely as the result of the treatment of the fairly derived legitimate seed. If, again, we take these variations for the purpose of obtaining hybrids, we need not wonder at the infinite variety of sorts which can be brought about, but rather that any sort could be maintained in that trueness of character or in that state of permanency which we sometimes find to be the case.

CHAPTER III.

ON TRUENESS OF SORT IN ROOT CROPS.

The importance of trueness and purity of seed arises from the evenness of growth of a good genuine strain; while if this quality be wanting we have some parts of our crop growing well, whilst others get on but poorly. Thus a free-growing plant beside one over which it has got the advantage, maintains it for the most part through the whole period of growth. Again, some sorts are of value for being early, others for lateness of growth, and some kinds are better fitted for early than late sowing; if, therefore, we have a mixture in these respects, we may at least expect a partial failure; for whichever is *best* for our purpose, if mixed will be accompanied by those which are not so good. A want of trueness to sort may arise principally from the following causes:—

1st. Want of selection in seeding bulbs.

2nd. Hybridization.

3rd. A mixture of seeds.

1st. The propriety of selecting the specimens from which seed is to be grown is admitted by all: by the seedsman, who always advertises his turnip and swede seed, for example, as being "from selected bulbs;" and by the farmer, as this announcement is only made to induce him to buy. It is not only important that the roots should be selected, but that they should be stored and then planted in a fresh soil; for as these latter are among the *cultivative processes* by which sorts have been obtained, so should they be repeated in order to ensure a continuance of the induced condition. Seeding upon the same soil and in the same bed in which the seed is sown is hardly the way to keep up a form induced by cultivation, as this is exactly what would be done by the plants in a state of wildness.

In selecting roots for seeding, care should be taken to choose good-shaped examples, in which a clean unbranched bulb, not too large, with a small tap-root and a small top, confined to a single central bud; a branched root and a many-headed top being true signs of degeneracy. And no less so is neckiness in swedes and mangels, as well as a coarse corrugated skin in roots of all kinds.

Taking such points as these into consideration, how absurd must appear most of the huge mis-shapen roots to which prizes are usually awarded at shows, where the specimens are chosen for size, and trimmed up with the knife, to make them look more presentable. As an evidence of the mistaken principles upon which prizes are awarded to bundles of roots, let any one seed such examples, and we will venture to assert that such seed would produce a large proportion of degenerate examples, without affording so good a crop as would seed, from middle-sized but well-shapen specimens.

2nd. Some of the forms of roots, and more especially those belonging to the *Brassicaceæ*, such as turnips and swedes, seem to have a wonderful facility for hybridizing; and this not only to the extent of one sort of turnip with another, but sports may be caused by the fertilization of the turnip with rape and its congeners. Indeed, the hybrid with turnip and rape is doubtless the origin of the Swedish turnip; but there is reason to believe that mixtures may accidentally be made with such wild plants as charlocks and mustards, the growth of which in the vicinity of a seeding crop tends to the production of degeneracy. Seeding-patches, then, and the ground about them, cannot be kept too clean.

Again, if trueness be aimed at, there should be no mixture of sorts in seeding examples; all of the same kind should be selected for seeding-plots, as even one or two of a wrong sort may result in a very mixed sample, as it would seem that sometimes strange plants exert more than ordinary influence.

Of course, the putting seeding-patches of different sorts side by side is to be reprehended. If more than one sort be seeded in a season, it is advisable to place the patches as remote from each other as possible. And we would here remark, that, for seeding, the roots should, as a rule, be farther apart than when grown for bulbs, both in rows and in sets; as, if too close, the stems grow up thin instead of robust, and a smaller seed, with a tendency to the growth of smaller roots, will be the result.

3rd. Mixtures of seeds should be avoided for the reason assigned, that “sorts” do not usually grow evenly; and when one sees (as is by no means infrequent) a patch of swedes overshadowed by a mixture of some large early turnip,—the Tankard, for example, our crop of swedes will certainly suffer for it, even supposing the turnip to be as useful as the swede, which is seldom the case.

Mixtures, again, do not come up at the same time; sorts may differ in this respect, but especially do old and new seeds vary as to their germinating powers: two-year-old seeds taking four or five days more to come up than a new sample; thus giving a greater chance for the ravages of the flea-beetle than where the seed all comes up quickly.

Now, as a practical application of these remarks, we here quote from an article in the *Agricultural Gazette* of May 24th, 1862.

> Who among seedsmen does not profess to offer the seeds of swedes and turnips from *selected bulbs*? And though it is quite true that the practice is not so universal as is the profession of it, yet the general assumption of its being so on the part of seed growers and sellers is an admission that it would be for the advantage of the buyer of seeds were the roots from which seeds are to be grown carefully selected. And on the other hand, let the observant agriculturist take a journey on any of our great lines of railway (in early summer), and he will be struck with the many patches of bright yellow flowers which he will not fail to notice on either hand. In nine cases out of ten, these are fields or portions of fields of turnips, either the Swedish or common kinds, which, from the abundance of keep, it has been thought would be more profitable to seed than to eat off, especially as they have so rapidly grown out of the way. Are these patches of selected bulbs? We happen to know, from a more than ordinarily careful examination, that not one *per cent.* of seeding-patches are from selected roots; but they are seeded just as they grew, and we do not know of a single instance where in such seeding the objectionable roots have been removed; but we do know of plenty of cases where the worst part of a field has been saved for seed, doubtless as the most profitable way of dealing with it under the circumstances wrought out by the spring of 1862.
>
> Of course, this will all come into the market, and too much of it, under a stereotyped declaration of '*from selected bulbs*.' That all the seed grown in 1862 will be sown in 1863 is simply impossible; but no matter, it will find a market somehow, some time. With such facts as these before us, who can wonder that any plant should become degenerate? Let some of the seed of this year be watched,[17] and we will answer for its evil results; and if these be facts, it then behoves the farmer to look well to pedigree in the matter of his seed.
>
> But even here, his forethought must not end; for however select the parent may be, there is still something in 'bringing up;' for, however good the *sort* of turnip, we shall not grow its seed in perfection by selection merely, but we should *transplant* well-chosen roots, and so put them in a new scene, away from subjects which might contaminate them. This is indeed to bring them up in a *good school*, for which their seed will amply repay the trouble and expense.

CHAPTER IV.

ON DEGENERATE ROOTS.

If the reader revert to page 6, Fig. 3, he will see that the progress from a wild to a better root-form is marked by a more fleshy, but still a much forked, or finger-and-toed example. Now as it is held that a clear unbranched outline is essential to a well-formed root crop of every kind, whenever a crop becomes fingered-and-toed, it is looked upon as a disease. It must be understood that we are here speaking of finger-and-toe as distinct from anbury, which latter is a decidedly diseased condition, whether caused by insects or resulting, as some affirm, from a defect in the soil.

The difference in the two states may be briefly summed up as follows:—

Finger-and-Toe.	Anbury.
Root simply branched or forked, with tapering fleshy rootlets; occurs in turnips, parsnips, carrots, and mangold. (See figs. 1, 2, 3, 5, 6, 7, 8, 9, 10.)	Root infested with irregular nodular protuberances, or with tumours suspended by roots, having very much the aspect of rows of ginger; occurs in turnips alone. (See fig. 12.)

The example of a root at page 6 is a good form of a parsnip progressing from wildness to a better cultivated form. We now offer an engraving (fig. 5) of a hollow-crowned crop parsnip, fingered-and-toed, and evidently of a very objectionable form, as it will be seen on comparison how nearly alike are figs. 3 and 5.

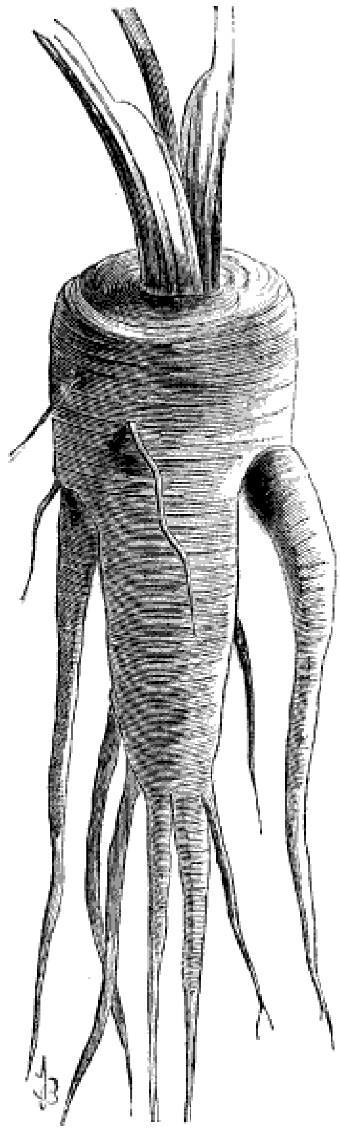


Fig. 5.—Finger-and-toed degenerate Parsnip.
Half nat. size.

Now, as every degenerate crop of parsnips will be found to offer a large proportion of such roots as fig. 5, we seem bound to conclude that, inasmuch as our fig. 3 *represents a root in progress towards ennobling*, so fig. 5 is that of a root declining to its level,—in other words, degenerating; seed, therefore, that produces such roots can only come from a poor stock.

Our next fig. (6) is of a parsnip that had prematurely flowered. Sending up flowered stems the first year, in the case of a biennial, can only be looked upon as an instance of degeneracy. Plants that "run," as it is termed, being comparatively useless, the best use, indeed, that can be made of them being that of pulling them up and giving them to the pigs.

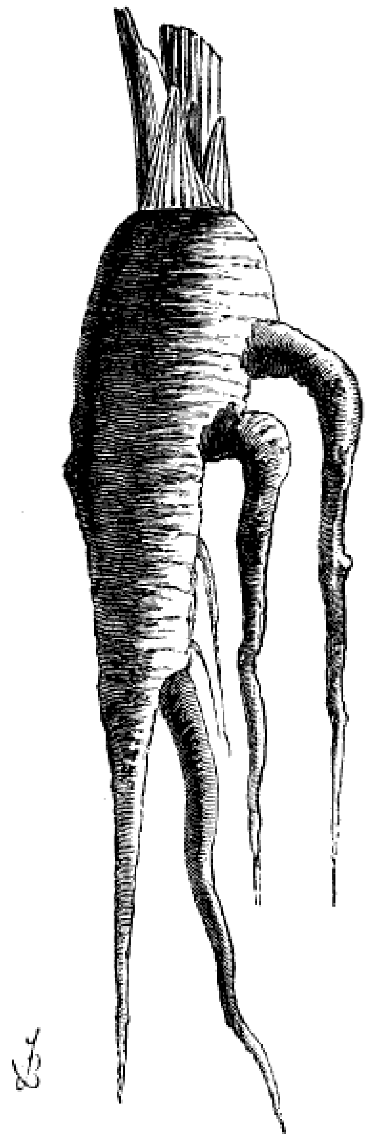


Fig. 6. Carrot of First Year run to Seed. Half nat. size.

Now this propensity is always accompanied with forked roots, more especially in carrots, which roots are even more degenerate than those represented in figs. 3 and 5, as those were fleshy and succulent; but when the roots of runners are examined, they are always found to be tough and woody, and, in fact, they very nearly resemble the wild examples.

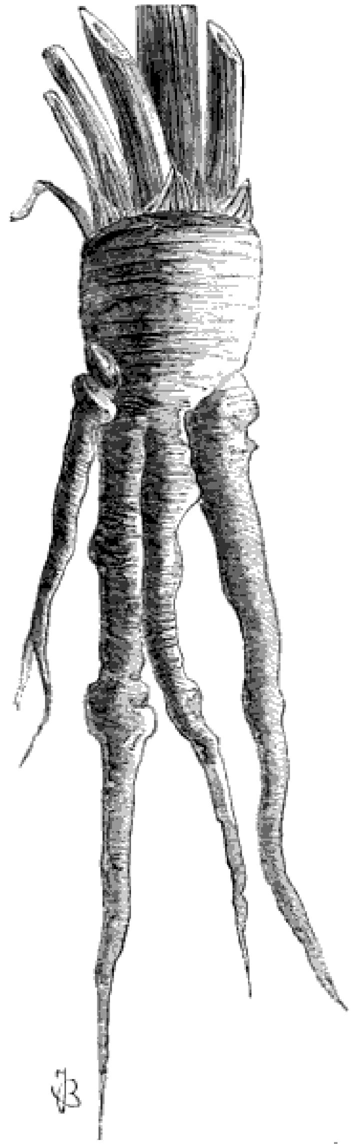


Fig. 7. Forked Carrot run to seed.
Half nat. size.

Fig. 7 is taken from a carrot that has run, and its rough, woody, nodular, forked root is fully apparent.

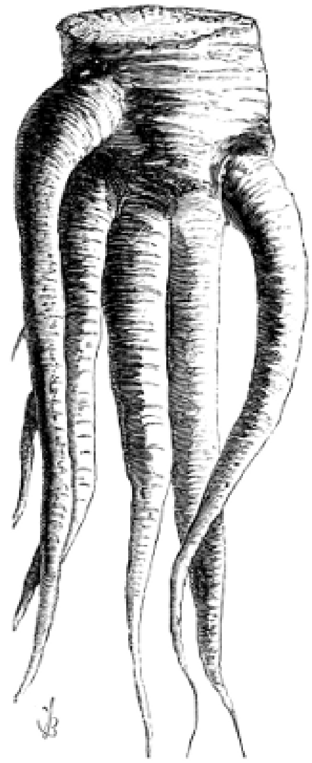


Fig. 8. Forked Belgian Carrot. Half nat. size.

Fig. 8, from a specimen of White Belgian carrot, forked as it is, is yet not uncommon; still, here the divided roots are succulent. This differs from the annual or run-to-seed roots, as this is a real biennial; but its other mark of degeneracy, besides that of finger-and-toe, was in its possessing a top (removed for experiment before the drawing was made) of many buds or heads. Now a *multiheaded* root, whether in turnips, carrots, parsnip, or mangel, is another sign of degeneracy, especially in the carrot or mangel, as the wild examples are remarkable for this condition; and in ennobling these roots, one of the difficulties is to get rid of this propensity. Hence, at root shows all forked examples of bulbs, multiheaded and necky examples, should be rejected; they are, however, sometimes made so fat with manuring that they pass muster for size, which indeed seems to be the great quality required at shows: which is a serious mistake, as being no sort of criterion of the state of a field of roots, unless it be an adverse one: as a 10 lb. malformed root, with its huge top, will require more ground to grow than will half a dozen roots averaging 2 lbs. each; whilst the latter are certain to be better and will keep longer.

CHAPTER V.

EFFECTS OF GROWING SEED FROM DEGENERATE ROOTS.

That the seed of malformed roots would be likely to produce a poor crop was a subject admitted by all; but neither the form nor extent of the mischief resulting therefrom had been stated upon the authority of exact experiment. In order, therefore, to arrive at direct evidence upon a point upon which so much of practical importance depends, we carefully carried out the following experiments.

Fig. 9. A Malformed or Degenerate Parsnip. Two-thirds of nat. size.

On the 26th of March, 1860, we selected two roots from a store, namely, one of a Student parsnip from our own stock and one of a Skirving's swede. Before committing these to the ground for the growth of seed, we made careful portraits of the two roots, of which that of the parsnip will be found in fig. 9, that of the swede in fig. 10.

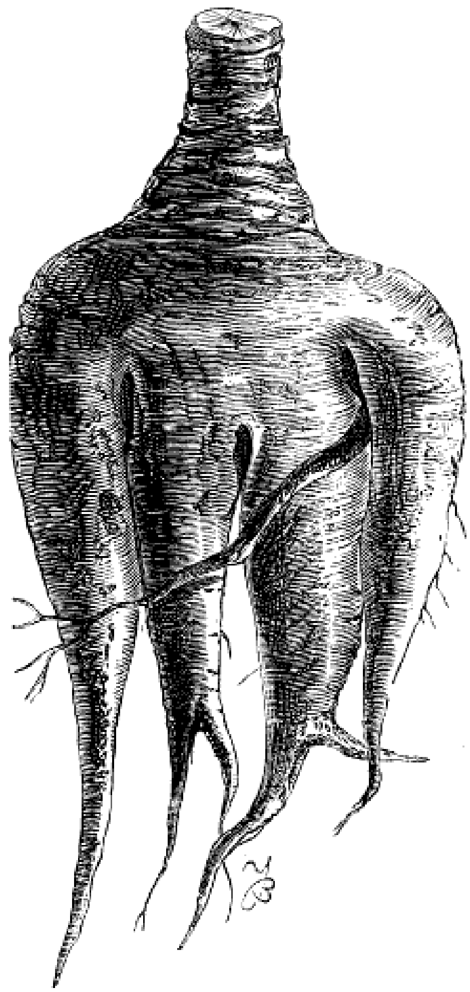


Fig. 10. A Malformed or Degenerate Swede.
Two-thirds of nat. size.

Now had we been going to grow the best of seed, we should of course have selected the best-shaped roots for our purpose; but in this case, as will be seen, the most viciously formed examples were chosen.

Both of the examples whose portraits we have here given, were planted in our private garden (where, it is right to say, they were the only seeding specimens), in due time their seed ripened, which was carefully collected and stored.

Early in April, 1861, these seeds were sown in our experimental plots, *without manure*, in the following order:—

Plot *a.* Seed obtained from the malformed parsnip, fig. 9.
b. Seed of Student parsnip of the same year as that of plot *a*.

c. Seed of malformed swede.

The plot *b* was sown by way of comparison, and we can only regret that no plot of good swede seed was sown with the same object, and we must, therefore, compare with a piece of swedes in an adjoining field.

The following are the tabulated results:—

TABLE OF RESULTS OF EXPERIMENTS.

		lb.	oz.
Plot *a.*	75 roots, forming the crop from seed of the malformed parsnip (fig. 8) weighed in all	7	4
Plot *b.*	63 roots forming the crop from seed of good Student parsnips	14	0
Plot *c.*	70 roots of swedes from seed of malformed plant (fig. 10.)	19	8
	70 roots from a row in the field, at a distance of about 30 yards	35	0

The roots from plot *a* may be described as small, though not so much fingered-and-toed as we had expected; still there was only about half the crop when compared with plot *b*, which latter, indeed, was only small in weight, which may be accounted for from being grown without manure. During their progress of growth the difference was very perceptible—the small leaves of *a* contrasting most unfavourably with the broader, brighter coloured ones of *b*.

As regards the swedes, they were indeed a very poor crop, presenting all the evils of degeneracy—neckiness, for which it will be seen that their parent was distinguished—want of a bulboid form; none of the 70 roots being better than a thin tap-root, and these were forked, shapeless, and fingered-and-toed in endless variety. Their spindle-shaped roots were quite remarkable, and they were the rule, although in good seed, however bad the soil, they would have been the exception. Those in the field hard by were bulboid, and averaged half a pound each—no great weight, as the land in which they were grown is only second-rate. They, however, were grown with manure, to which, of course, much of the difference is due, and yet not so much as may fairly be imputed to the difference in seed. From these experiments we conclude:—

1st. That a degenerate stock will, as a rule, result from the employment of degenerate or badly-grown seed.
2nd. That besides ugly, malformed roots, degenerated seed does not produce nearly the weight of crop of good seed, under the same circumstances of growth.
3rd. That by means of selection we may produce roots that are well-shaped, and have the capabilities of affording the best crop.
4th. That by designedly selecting malformed degenerate roots for seeding, we may produce a seed that will result in as great or greater degeneracy.

"That these are important conclusions"—we quote from the *Agricultural Gazette*—"few will be disposed to deny. They have most interesting bearings on the subject of vegetable physiology, and consequently should be studied by the farmer."

It is a practice much to be desired, that not only should a proper choice be made of seeding examples, but that there be a change of situation, and, if possible, a time of storage before being planted for seed. These are all cultivative processes, and to the care with which they are carried out must we look for permanence in our derivative root-crops.

It cannot be too strongly urged, that, as an efficient sort of root has only been arrived at as the result of great care—that is, by successful breeding,—so every care must be taken for its maintenance. Defect in seed results in defect in the produce of that seed; and downward tendencies of this kind are common results of even most careful cultivation. With carelessness in this respect we must not be surprised at rapid degeneracy.

CHAPTER VI.

ON THE ADULTERATION OF SEEDS, MORE PARTICULARLY OF TURNIPS.

In order to make the experiments which illustrate this chapter tell their tale to the fullest extent, we would set out with the two following postulates:—

> 1st. All well-grown, well-preserved new seeds should be *capable* of germinating to the extent of at least 90 per cent.
> 2nd. Seeds in general, and more especially turnip seeds, as usually delivered to the farmer, are generally *incapable* of germinating to the extent of from 25 to 30 per cent., and very frequently even more.

We shall hereafter see, that this want of germinating power is too often the result of mixing charlock, Indian rape, and the like, by way of adulteration, which latter are killed to prevent "their telling tales." But to our experiments:—

A number of tin cases were made of the following proportions: Length, 15 inches; width, 10 inches; depth, 4 inches. These, which were well perforated at the bottom, were divided across into ten equal parts, each of which was filled to within an inch of the rim, with a mixture of fine mould and silver sand. In these, seeds of different sorts of turnips were sown, and the whole was put into a bed of sand in our forcing-house. We could, however, see no difference in the results, nor could we trace any in the germinal or cotyledon leaves of swedes, turnips, or charlock. But, of course, samples of turnip-seed could not be tested as to freedom from charlock by this experiment, because charlock is killed before being mixed with the turnip.

Now, seeing that we could get no trustworthy results by this kind of experiment, it struck us that our germination-pans might be used to test the germinating power, not only of the samples we had obtained for a different purpose, but of others also. We first, then, counted a hundred of each of the following sorts of seeds, and carefully dibbled them in a fresh mixture of soil, in September, 1860; the results, which were as carefully noted from day to day, are shortly given in the following table:—

TABLE 1. *Germination of Ten Sorts of Turnips.*

No.	Name, Copy of Label.	Came up per cent.	No. of Days.	
1	Mousetail, 1859	96	10	
2	Pomeranian, or White Globe, 1859	86	11	
3	Nimble Green Round, 1859	96	7	
4	Lincolnshire new Red Globe, 1860	90	9	
5	Yellow Tankard, 1859	92	9	

6	Smart's Mousetail, 1860	98	7	
7	Green-topped Stone, 1860	84	8	
8	Sutton's Imperial Green Globe, 1860	98	9	
9	Green-topped Scotch, 1860	90	9	
10	Early Six-weeks, 1860	90	10	
	Came up =	92		
	Failed =	8		

We would remark upon these results, that the temperature of the house was kept at between 60° and 70°, and the greater part of the seeds came up in four days; the numbers for the days, then, have reference to the time occupied before all that would germinate came up. Now this table is not a little instructive, as showing that samples of turnip-seed can be got in which only a very few of the seeds fail to germinate; but as experience had taught us that these samples by no means represented the usual market condition of turnip-seeds, in order to test this we begged to be allowed permission to take samples direct from the bags of a retail seedsman as they were exposed in his shop, and the following results will speak for themselves.

It should, however, be here premised that the samples were not grown by the seedsman, but were said to be just as received from the wholesale dealers.

TABLE 2.—*Germination of Ten Sorts of Turnip Seeds from Market Samples.*

No.	Copy of Label.	Came up per cent.	No. of Days.	
1	Norfolk Green round	76	9	Taken from the bags by the Author.
2	White Globe	78	15	
3	Early Grey-topped Stone	80	10	
4	Red Tankard, or Pudding	62	11	
5	Orange Jelly	52	15	
6	Norfolk Round Red	80	10	
7	Purple-topped yellow Scotch	76	11	
8	White Dutch	64	12	
9	Early Green top	64	13	
10	Yellow Tankard Pudding	48	12	
	Came up =	68		
	Failed =	32		

Eight samples of swedes from the same source are in the next table associated with a sample of Skirving's swede, grown in our own garden (8), of the following table, and another of turnip (9), grown on a neighbouring farm. We may remark upon the last-named sample, that we had observed the growth of this seed, which was from a very poor crop, half of which had decayed on the ground with the early frost of 1860, and the rest, without transplanting or selection of any kind, was allowed to seed. Now, as this whole crop was so degenerated that it ought never to have been seeded at all, we were anxious to get some of the seed from the bulk, in order to test from its growth this year whether it will not bring forth a degenerate progeny. Its germinating qualities will be seen from the table, and yet it is by no means the worst sample, which seems to show that the others are not naturally bad, but so by mixture.

TABLE 3.—*Germination of Swedes, &c., from Market Samples, &c.*

No.	Copy of Label.	Came up per cent.	No. of Days.	
1	Ashcroft's improved Purple Top	58	12	Taken from the bags by the Author.
2	New Bangholm	96	10	
3	Skirving's Liverpool	62	16	
4	Green Top	78	10	
5	Marshall's improved Purple Top	90	10	
6	Hewer's Improved White	68	17	
7	Green Major	86	10	
8	Skirving's Swede (own grown)	96	10	
9	Green Top Turnip, neighbour's farm	78	6	
10	Fosterton Hybrid Turnip	64	10	
	Came up =	77·6		
	Failed =	22·4		
	Failed of seedsman's specimens =	24·8		

Now, as "0 0 0" seed is supplied to customers under the designation here given, for the purpose of mixing, it is of little consequence whether it be used by the wholesale house or the retail dealer; if, however, it be employed by both, we should, indeed, get a bad sample.

As regards the seedsman's samples in the Tables 2 and 3, we are quite unable to give exact details of their history, but we have reason to believe that the stock whence they were taken was purchased in the ordinary course of business from different "wholesale houses," as, though the tradesman whence the samples came combines the business of "nurseryman" with that of seedsman, we happen to know that he is not a grower of seeds, at least of turnip seeds. The average, then, of eighteen samples of turnips and swedes from this source is that 28 *per cent.* are non-germinating seeds. The next samples are from people in a large way of business, who are not mere retailers, but to whom we must accord all the immunities of the trade as seed-growers, wholesale and retail seed-merchants, &c.

Before giving the tables with the results as regards these samples, it is necessary to state that they were not sent to us direct, but were forwarded through a farmer to whom they were sent in the ordinary small packet samples.

We would further remark, that as all that would germinate took so few days about it, being an average of six days, whilst those of Table 1, being seeds partly of 1859 and partly of 1860, occupied nine days, and those of Table 2, whose date we do not know, eleven days; in all probability the seeds in question were tolerably new, most probably of the last seed season.

TABLE 4.—*Germination of Ten Samples of Turnips.*

No.	Copy of Label.	Came up per cent.	No. of Days.	
1	Green Globe	62	8	Turnips from sample papers communicated.
2	Dale's Hybrid	84	4	
3	Red Globe	90	6	
4	Orange Jelly	100	4	
5	White round, or Norfolk	42	5	
6	Green Tankard	50	6	
7	Scarisbrick (*sic*)	88	11	
8	White Globe	74	4	
9	Golden Yellow	82	4	
10	Green round	30	6	
	Came up =	70·2		
	Failed =	29·8		

The specimens in next table were obtained in like manner as those of Table 4.

TABLE 5.—*Germination of Samples of Common and Swede Turnips.*

No.	Copy of Label.	Came up per cent.	No. of Days.	
1	White Stone or Stubble	46	6	Swedes and Turnips from sample papers communicated.
2	Red Tankard	60	5	
3	White Tankard	60	4	
4	Yellow Tankard	88	5	
5	Green Top Yellow Scotch	84	6	

6	Purple Top ditto	62	8	
7	Tankard-shaped Swede	74	7	
8	White-fleshed ditto	84	8	
9	Skirving's Improved Purple Top ditto	64	8	
10	Lawhead Green Top	80	7	
	Came up =	70·2		
	Failed =	29·8		

Of these samples we see that within a fraction of 30 per cent. is the average of non-germinating seeds, and this is only so low on account of two or three unusually good samples, the general range being from 20 to 30 per cent. of non-germinating seeds for the last twenty samples.

If we compare No. 5, Table 2, with No. 4, Table 4, we see a difference in the Orange Jelly Turnip; in the former little more than half came up, in the latter every seed. This is of importance, as showing what genuine seed may be, the latter being doubtless as unmixed as the former was mixed.

Now as regards the charge of mixing, we are not going to make it without some evidence. In looking over the tables we have now given, it will be seen that genuine seed has but a small per-centage of non-germinating seeds—say from 5 to 10 per cent.; but not only the examples herein referred to, with hosts of separate ones which have fallen under our notice, show a general amount of dead seeds, of from 20 to 30 per cent. For these figures compare Table 1 with Tables 2, 3, 4, and 5. In those of the first lot the samples were sent direct to us from a seedsman, and their behaviour shows us clearly enough that good seeds are to be obtained, but the other tables are as clear that from *some* seedsmen, at any rate, though inferior samples, they are as good as are actually sold.

That seeds are mixed we have, then, good internal evidence; but we are also in possession of facts more conclusive upon this important point, and we shall in this next chapter endeavour to enlighten our readers as to the art and mystery (especially) of turnip-seed adulteration.

Confining our present remarks to turnip seeds, we assert that if farmers will try the germinating powers from the *bulk* of the seed which may be sent to them, they will find pretty nearly one-third to be rubbish. It is of no use to try from samples, except in comparison with bulk; and if all the farmers of Great Britain did this, and would communicate the results, what an extraordinary tale would be unfolded, more especially if the evidence be completed by notes on the purity or otherwise of the crop grown from such seeds!

CHAPTER VII.

ON THE ART AND MYSTERY OF TURNIP-SEED ADULTERATION.

It has already been shown that turnip-seed is largely adulterated; it remains now to point out the nature of the admixtures, which may be summed up under the following heads:—

1st. Old seeds are mixed with new.
2nd. Charlock, "Indian rape," and other seeds of the *Brassicaceæ*, are mixed with genuine seed.

1st.—The crops of seeds vary so much in their produce per acre, in one year, as compared with another, that in most years there is a superabundance of some kinds and a scarcity of others.

Now, as most seeds are of comparatively little use except for sowing, the surplus stock can only be disposed of at extremely low prices. Accordingly some wholesale seedsmen buy large quantities in the "glut season," as it is termed, and store them until the same articles fail in crop. For instance, swede and turnip seeds, 1857 crop, could be bought everywhere at from 15 to 20 shillings per bushel; but owing to the destruction of the roots in the winter of 1859, seedsmen in 1860 had to pay the growers 50s. per bushel. Now, in 1860 there were wholesale houses selling those seeds which they had by them for the same price. Such people can, it is true, warrant their seeds to be genuine, as they well know how much turnip-seeds deteriorate by keeping; the mixing of this with good seed is still a species of adulteration; and if not mixed at all, we can then only say that the evil is so much the greater.

As an evidence of the amount of deterioration caused to turnip-seeds by keeping, we here re-produce the table of trials of ten sorts of good seeds made in September, 1860, in contrast with experiments from the same sample, in the same month of the present year (1862), premising that the samples were kept in what we should consider a dry but not too warm a temperature.

TABLE 6.—*Germination of Ten Sorts of Turnips.*

No.	Name. Copy of Label.	Came up 1860. Percent.	Came up 1862. Percent.

1	Mousetail, 1859	96	46
2	Pomeranian or White Globe, 1859	86	44
3	Nimble Green Round, 1859	96	94
4	Lincolnshire New Red Globe, 1860	90	58
5	Yellow Tankard, 1859	92	62
6	Smart's Mousetail, 1860	98	92
7	Green-topped Stone, 1860	84	88
8	Sutton's Imperial Green Globe, 1860	98	80
9	Green-topped Scotch, 1860	90	86
10	Early Six-weeks, 1860	90	70
	Came up (average) =	92	72
	Failed =	8	28

These figures are interesting as showing that though the different sorts are not affected equally, yet the seed of 1859 failed on the average to the extent of 38.8 per cent., as against 24.6 for the seed of 1860, and 28 as the average of the whole samples. Such is the great difference between two and three year old seeds.

2nd.—Even the above *genuine seeds* (!) are not unfrequently mixed, and we may now examine the nature of some of these mixtures. Charlock and Indian rape are all *prepared* for this purpose: that is to say, they are rendered incapable of germinating before mixture—"Dead men tell no tales." Now rubbish, so prepared, is well known in the trade as 000 seed. Under this denomination all seedsmen know it, and it can be procured by the trade at about 7s. per bushel.

With respect to this 000 seed, we direct attention to the following letter addressed to a most respectable firm.

SOUTHAMPTON, *April 27, 1860.*

GENTLEMEN,—Being in possession of a new and improved method of killing seeds without the use of any chemicals, so that the seed when in a 000 state has not that unpleasant smell it has when killed by the old method, and does not look perished if it be crushed. A man by the new process may kill ten or twelve quarters per day, and the apparatus is so constructed that it is impossible for a single seed to leave it alive; and one great advantage is, that if you want a sack of 000 seed in a hurry you may kill a sack of rape or turnip, or any seed, and have it fit for use in an hour. Seed in the process of killing increases in measure and weight, and when you send it out to be killed, of course, the seed-killers keep the extra weight and measure. If you think it worth your attention, I will send you a small working model, so that you may kill a few pounds of kale or cauliflower, or any small seeds in a few minutes, and instructions for making a large one on receipt of a Post-office order for £2.

Yours truly,

——

To this the Messrs. Sutton append the following remarks:—

The writer of the above being unknown to us, we had the curiosity to call at the address given, and ascertained that it was no "hoax," but was assured by the "inventor" that he had supplied several tradesmen with the apparatus, and that he was *formerly* in the seed trade himself. We may add, that we have since heard from the same individual at another sea-port town to which he has removed.

Having got possession of this circular, and being desirous of becoming acquainted with so notable an invention, we lost no time in setting on foot a negotiation for the possession of the secret, and having traced the inventor in his removal from Southampton to Gosport, we then had letters addressed to him upon the subject, and, if promises had been of any avail, we might possibly at this time have been in possession of a very improved and expeditious method of making 000 seeds, only that we have learnt the undesirable nature of pay beforehand.

Our next inquiry was for a sample of 000 seed itself; but, although it is well known in the trade, we have hitherto failed in procuring it. We had hoped that our seedsmen might have been able to procure some through some of their friends. The result was, that we made application to a most respectable London firm, receiving the following reply:—

London, *February 27, 1861.*

Sir,—In reply to your favour received this morning, we take leave to say that we shall have pleasure in complying with your request for a sample of 000 turnips, if we can obtain it. But we do not keep it ourselves, nor do we know the parties who prepare it, it being something of a trade secret. We will, however, apply to some of our friends here to let us have a small quantity, but doubt if they[41] will let us have it, as it is a matter they are rather chary respecting, and *although perfectly well known and understood in the trade, they do not care to have it known beyond*, and our asking for a small quantity will be sure to lead to the question, "What do we want it for?" We could obtain a large quantity without hesitation.

We remain, &c.,

——

The sentence we have placed in italics will be quite sufficient to show how well the matter of 000 seeds is understood in the trade, and how easy it is to get bushels of it, no questions being asked, while a small quantity, required only for investigation, may be refused.

It appears, then, that the machinery exists by which any one in the seed trade may quietly and easily commit enormous frauds. And it is plain that the very notoriety of this machinery, together with the condition of many of the samples of seed which we have examined (see Chap. VI.) prove that this machinery actually is employed by many seedsmen to the great injury of their customers.

We cannot, then, be doing wrong in urging any one to make trial of the seeds he is about to buy before he sows them, or even before he purchases them. Where the experience of a number of years already exists, the character of the seedsman is a guarantee for the good quality of his goods, and experience of this kind is indeed a more perfect carrying out of the system of preliminary trial or experiment, which we recommend especially to all new customers.

CHAPTER VIII.

ON THE INJURIES CAUSED BY INSECTS.

Root-crops are especially liable to injury from the depredations of insects. Thus the turnip may have its seed more or less destroyed by weevils. Immediately the seed appears above the ground, commences the attack by the turnip flea-beetles. The bulb is pierced by beetles, ending in those excrescences called "turnip-warbles;" and there is reason to think that even the root-fibrils are in some soils made the depositories of the eggs of insects, which give rise to extraordinary malformations.

Carrots and parsnips are liable to have the best-grown root made useless by its being pierced and eaten by the larvæ or grubs of a small fly, known as the *Psila rosæ*.

Even the mangel-wurzel, which has been so strenuously recommended as a substitute for the turnip on account of its freedom from insect attacks, and connected with which Curtis only describes a single insect, a leaf-miner, called *Anthomyia Betæ*, upon which he remarks that "these insects will seldom cause any loss to the mangel-wurzel crops should they ever abound to any extent." In spite, however, of this, we find that the increased growth of this crop has caused a corresponding increase in the insect, to such an extent that, during the last two seasons, many crops have entirely failed from its depredations; as witness the following communication to the *Agricultural Gazette* for August 23rd, 1862:—

> My mangel crop was drilled the 17th May, and came up most favourably. On Monday, the 2nd June, I asked my bailiff what was the matter with it; he said, "Oh, it was a sharp frost last night;" but on examination I found that instead of frost the leaves had within them a maggot, which had caused the plant to brown and die off. The late rains and growing weather have enabled the plant somewhat to revive, and also fresh plants to come up (for I had drilled 7 lb. per acre), but found to-day several leaves with maggots in them. My man told me "a quantity

> had eaten themselves out of the leaf and dropped;" and that he saw "a vast number of sparrows picking up those maggots." I send you herewith some plants I brought up from the farm. My idea is that the seed was damp and bred the maggots, or that the leaves had been "struck with a fly," and then the maggot followed. You will please let me have your ideas upon these points.—S. S.

The maggot, or larvæ, here described is that of a fly called the *Anthomyia (Pegomyia) betæ*, mangel-wurzel fly. An allied species will sometimes be found on the common dock-leaves, mining their galleries between the dermal cells of the leaves.

We have for some time observed the increase of this pest, and we are prepared to state that now we seldom see a crop that is not greatly injured by its attacks. Mr. Curtis thinks that the best method to destroy them is to employ boys to crush the leaves between the thumb and fingers at the part where the larvæ can be seen; and with this we fear we must for the present be content, unless we could devise some means to take the fly before its eggs are laid in the leaves.

We need not here dwell at length upon the natural history of those pests of the turnip—the *Haltica nemorum* (striped flea-beetle), and *H. concinna* (black flea-beetle), as the nature of their ravages are tolerably well known. Thus much, however, may be said; namely:—

> *a.* These insects are called fleas because they have the power of hopping on being disturbed, much after the manner of a flea.
> *b.* They have some five or six broods each year; the earlier ones probably being bred on charlocks and other weeds of the same natural order as the turnip; and hence, then, charlocks are pests, not only as being weeds, but as breeding-places for one of our most mischievous insects.
> *c.* They migrate from their weed-haunts to the first crop of turnips, where much of their mischief may be prevented by simply dusting over the young plants with any fine powder, road-dirt answering the purpose as well as anything else.

Various devices have been employed for keeping away and killing these little creatures. We have used a contrivance for catching them, which may be described as follows:—

Some thin board (or boards), making a surface of about 4 feet long by 2 feet wide, is furnished at one end with a pair of light wheels of just sufficient diameter to lift the board about 2 or 3 inches above the plants. To the other end may be attached two crooked handles in such a manner that the machine can be wheeled flatly over the plants, or if four wheels be employed, one at each corner, a single handle can be used either to push or pull the implement. When used, it should have its underside painted over with tar or any handy viscid substance.

This should be used on bright days, the operator pushing it over the rows of turnips, so as, if possible, not to throw his shadow before. The middle of the day will be best, not only for this reason, but also because these creatures feed more actively at that time.

Now, our experience in the use of this simple contrivance on small experimental plots convinces us that a small boy could easily keep under the enemy in a good-sized field.

But now comes a very important question for consideration. Cannot we do more than kill a few of these creatures? cannot we adopt such plans as will render our *crops* tolerably safe from their depredations? We think so, and to this end advise the following method of proceeding:—

Let each turnip-grower prepare for the enemy by sowing from the eighth to a quarter of an acre of turnips in a sunny part of the farm as early as the first week in April. These patches would quickly attract all the turnip flea-beetles from the wild *cruciferæ* on which the first broods seem to depend, and in this small compass they can be killed in detail with the simple contrivance just described, so that when the real crop comes up there will be none, or at least only a few, beetles to emigrate to it; whereas, as we now manage, by the time the crop of turnips is sown, enough of the creatures are too often bred to render it necessary to sow two or three times before we can secure a crop.

Anbury is an affection to which only the different sorts of turnips are liable, in which case it differs from finger-and-toe, with which it has been very much confounded, as this latter occurs in all kinds of roots; namely, turnips, carrots, mangel-wurzel, &c., as well as both the common and Swedish turnips.

As a sample of an extreme case of finger-and-toe—*digitate* root,—we repeat the following figure of a Belgian carrot, in which it will be seen that the forks gradually taper to the extremities; in fact, the whole, instead of being a succulent fleshy tap or *fusiform* root, in which case it could readily be stored, is divided in fingers-and-toes, which are liable to break off, and this renders the product next to useless. Now, this affection may occur in any soil, as it is the result of a degeneracy in the stock of the plant; but in the affection now to be described the case is wholly different, as here the bulk of the swede (fig. 12) is affected with rough, cancerous knobs, whilst the rootlets support irregular knobs of a like kind, which have more the aspect of suspended rows of ginger than fingers-and-toes.

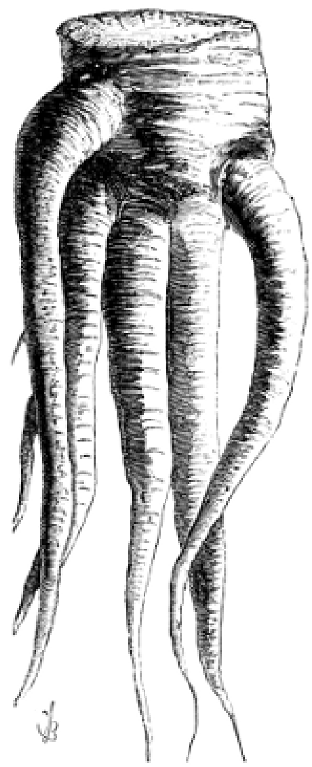


Fig. 11 (Fig. 8 repeated).
Finger-and-toe Carrot. Half natural size.

Roots so affected soon rot, and have a fœtid odour, so that they are not only useless themselves, but communicate canker and decay to the whole store. In the putrid mass will be found maggots and flies and beetles of different kinds; but as yet naturalists are not agreed as to whether the nodules of disease are caused by insects, or whether these creatures are merely attracted by the fœtid matter. We are, however, inclined to the belief that some insects are connected with the diseased appearance in the first place, whilst others afterwards step in to fatten upon the decaying matter, induced by the first lot; but still it must be confessed that the subject requires much more attention than it has yet received, in order to settle these important questions.

Still it may be observed that one point has been universally admitted; namely, that anbury only occurs to any extent in sandy soils, where there is an absence of lime, a good dressing of which mineral is the best safeguard against this affection. Still, in soils that are liable to anbury, we should not recommend the continuance of turnip-growing, or at least not so frequently in the rotation as has hitherto been the case, and more especially as the soils which produce anbury to the greatest extent are just those best adapted for parsnips and carrots, which, if not wholly, may occasionally be very profitably grown in the place of the turnip.

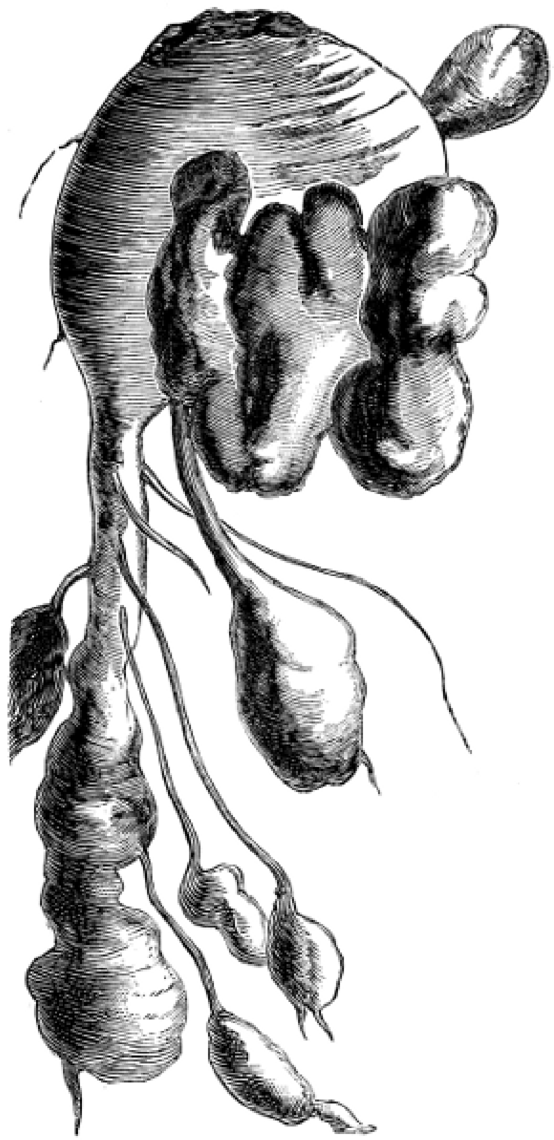


Fig. 12. Swede affected with Anbury. Nat. size.

Having given a few notes on the more prominent forms of insect attacks to which root crops are liable, we would now close this chapter, as details of all the insect pests would occupy more space than we can here allot to the subject; but to those who would inquire further upon this fertile theme, we would advise the perusal of "Farm Insects," by J. Curtis, Esq., F.L.S., &c.

GENERAL CONCLUSIONS.

To render our subject as complete as possible, we direct attention to the following practical conclusions, to which our whole argument upon the science of root-growing points:—

> First.—Cultivated roots are improved wild ones, only to be obtained by gardening on the small, or farming on the large scale; this gardening or farming being carried on by certain operations at certain seasons which we have comprehended under the term of cultivation processes.
>
> Second.—The difference in sort of roots is caused either by cross-breeding as the result of accident or design, or of the education of some particular propensity which has been acted upon by the intelligent seed-grower.
>
> Third.—The maintenance of sorts in purity depends upon careful selection of the right variety for the seeding examples.
>
> Fourth.—The preservation of a good outline or shape of root can only be maintained by selecting those of good *form* to seed from; for, as running to seed, multiform top, forkiness, "finger-and-toe" in roots, is evidence of wild growth, so, then, cultivated plants assuming this form are considered as degenerate, and seed from such roots produces a malformed and poor crop.
>
> Fifth.—The difficulties of getting good seed—whether of trueness to sort, from carefully selected bulbs, or free from adulteration either of old with new seed, or a mixture of charlock and others of the same family—are very great. Where, however, good seed can be depended upon, it is much cheaper, though at a considerable increase of first seeds cost, as not only quality but the quantity of live so considerably depends upon the truth and honesty of the seedsman.

Sixth.—Injuries from insect attacks, though serious as affecting the yield, are yet not due to the seed; and anbury, if it be due to insects, only occurs in the turnip-crops, and then in particular soils. The true insect attacks to be averted by simultaneous action.

In fine.—*Good seed, of a true sort,—care in growth,—and a watchfulness of enemies, includes the* SCIENCE *and* PRACTICE *of Root Cultivation.*

Bangholm Swede,
East Lothian Swede,
Ward's Beauty Swede,
Dropmore Swede,
Marshall's Champion Swede,
Green-top Swede,
White Swede,
Improved Skirving's Swede,
White and Red Globe, and
Norfolk Turnip,
Scotch Yellow Turnip,
Dobito's Yellow Oval Mangel,
Ward's Ditto,
Improved Yellow Globe Ditto,
Improved Orange Globe Ditto,
Improved Long Red Mangel,

Improved Long Yellow Mangel,
Improved Red Globe Mangel,
Improved White Field Beet,
Red Clover, Cowgrass,
White, Yellow, and Alsike
Clovers.
Pacey's Perennial Rye-grass,
and other sorts.
Italian Rye-grass, Foreign
and English Seed.
Natural Grass Seeds, in
mixture or separate, suitable
for various soils and localities.
Light Rye-grass and other
Cheap Grasses, for sowing on
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HOW TO GROW GOOD GRASSES.

CHAPTER IX.

ON THE NATURE OF MEADOWS AND PASTURES.

The terms "meadow" and "pasture" are usually employed together, as though they were really distinct things; yet few people think of them as different,—the fact being, that when a field is occupied with grass, it may be called a *meadow*, in contradistinction to that land under the plough, or *arable*: this yields meadow-hay if mowed for that purpose, or *pasturage* when fed off or depastured by our flocks or herds.

The meadow, then, as being fixed, is termed "permanent pasture." Pasture-herbage, however, is grown in the shifting crops of arable cultivation; in which case it gets the term of "artificial pasture." Hay from the first of these is called "meadow-hay," whilst the mixture of grasses, clovers, &c., gets the name of "artificial grass," or "hay," as the case may be.

As regards permanent pasture, this may be *old* or *new*,—some meadows having been in green herbage even for centuries, whilst others, though sufficiently old, yet show traces of having been once arable in the more or less high-backed ridges left by ancient ploughing. Viewed in this way, original pasture is not so extensive as may be supposed; indeed, there is scarcely such a thing at all, as all pastures are the result of something like cultivation,—as, left to themselves, that is, to Nature, they would soon resume the aspect of jungle, moor, or marsh, according to soil and situation.

Meadows and pastures may, then, for our present purpose, be conveniently tabulated as follows:—

a. Permanent Pastures.

1. *Moors and uplands*, unenclosed or but partially fenced in.
2. *Commons*, unenclosed land, usually about villages, conferring the right of cattle and goose grazing.

3. *River flats* and lowlands, liable to floods.
4. *Irrigated Meadow*, in which the water is controllable.
5. *Meadows*, or permanent grass enclosures.

b. Artificial Pastures.

6. *Seeds*, shifting crops of some grasses, clovers, saintfoin, &c., used either mixed or separately.

1. Moors, uplands, and downs (such as Dartmoor and Salisbury Plain) are more or less wild according to their elevation and the geological formation on which they occur. They consist of large tracts of land either without fences at all, or only those of the most inefficient kind, rather boundary-lines than otherwise. They are never used for haymaking, nor are they cultivated beyond depasturing. These are dotted with patches of rough grass, thorns, briers, and shrubs or stunted trees where the surface is much broken, and the animals they are made to carry are few; but on the more rounded and smooth lines of the downs is a finer herbage, kept so not only from the nature of the case, but from the fact that such a position favours the more thickly stocking it with that close-grazing animal the sheep.

These pasturages, though very extensive, are yet being encroached upon by a higher cultivation, and the hayfields one occasionally meets with around the squatter's cabin even in the wild mountainous parts of Wales sufficiently testify to the greater productiveness of which the most unfavourable districts are capable.

2. The village common is sometimes extensive; it, too, as the former, is only grazed. Many of them have of late years been enclosed. Where much depastured—and they usually carry as much stock as they can bear—there is a remarkable absence of plants other than grasses. Indeed, grass-herbage, and usually of the best species, will prevail, unless in places where there may be stagnant water, in which cases a little drainage would produce a large public benefit; but as what is everybody's business is done by no one, the common is too often left much wilder, and thus made poorer than it need be.

3. The river flats here meant are, for the most part, large fields partaking of the nature of common; that is, certain farmers and others have the privilege of grazing during the autumn; but it is *aimed up* early in spring, for the purpose of taking a crop of hay. Such lands would be impoverished by such constant haymaking; but the winter floods leave behind them a deposit of silt and

fluviatile materials, and perhaps beside act as a solvent; so that their fertility is wonderfully maintained.

Many such wide stretches of meadow occur on the banks of the Severn, as in the neighbourhood of Gloucester, Tewkesbury, Worcester, &c., where they get the name of *Ham*. It is much to be regretted that these hams are not made the most of, for the same reason as applies with respect to common, for the want of some efficient officer to direct improvements; and so from the water here and there stagnating good herbage is ruined, and from the floods not being controllable, even hay is lost with the summer freshets. But where such land is vested in single enterprising proprietors, not only is drainage insured, but embankments are made to keep out the waters when not required, as so much met with on the banks of the Thames; and such fields are at once an evidence of the capabilities of river flats, and the great importance of individual enterprise.

4. The last case approaches very nearly to that of *irrigated* meadows; but these latter are mostly situate on small streams, which can be directed to flow through, not over them, at any time: they offer a most important means of augmenting our pasturage in certain districts, and will therefore receive a chapter to themselves.

5. Permanent grass enclosures are of very varied sizes, from hundreds of acres, forming perhaps a park, to the small meadow of the homestead; they may be seldom or never used for haymaking, but most of them are aimed up for hay once, twice, or thrice in four or five years. These form the greater part of the grass-lands of our country, and are indeed nowhere greener or more productive than in the British Isles; still, as we are an advocate for their cultivation—which, if it does not quite realize the position of making two blades of grass grow where one grew before, may at least do much in this direction—we shall reserve further remarks upon this subject until we have particularly analyzed the contents of a meadow.

6. As shifting crops, grasses, and other fodder plants may be made exceedingly useful, these may therefore well occupy a chapter to themselves.

CHAPTER X.

ON THE SPECIES OF MEADOW-GRASSES.

Although we possess more than a hundred species of native grasses, we shall rarely find a fourth of them even in a wide range of meadows; and if we do so, it is rather an argument against than in favour of the quality of their herbage, as, so few are the best grasses in number, that it is almost a law for the best meadows to contain the fewest species of true grasses.

If, then, the good grasses be so few, whatever is not of these must be inferior, and, indeed, so bad are some grasses that they can only be considered as weeds. These weed-like forms are known to the farmer from his observing that the cattle usually refuse to eat them, and hence he has got to call them "sour grasses,"—a term which, though perhaps meant to convey the idea that such are objectionable in flavour, yet it is oftener that they are refused from their want of flavour, or from some mechanical objection arising from their roughness of growth, some having sharp serrated cutting edges to their leaves, whilst the spicular awns, so conspicuous in the beard of barley, cause great irritation by sticking beneath the tongue and in the gums. Of these, the first are objectionable for pasture, the last for hay, and should, therefore, not be found in really good meadows.

The figures and descriptions which follow are given in illustration of some of the more usual meadow species, which, though not fully or botanically described, will yet aid the practical farmer in estimating the species, and their value and significance, which he will commonly find in his fields.

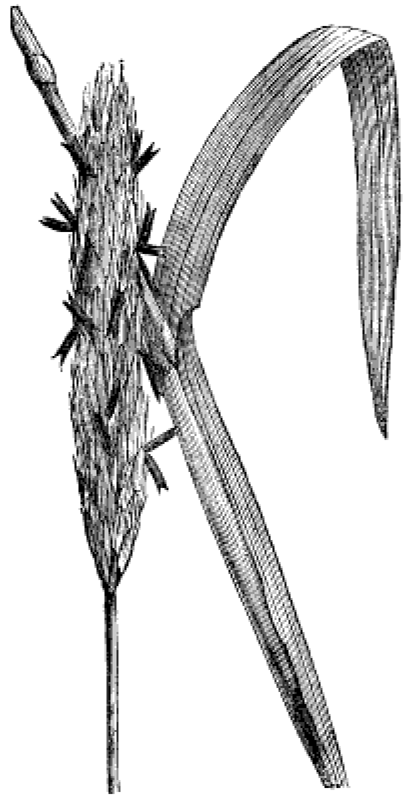


Fig. 13. The Meadow Foxtail.

The Meadow Foxtail (*Alopecurus pratensis*, fig. 13) is an early species of the *spicate* form—*i.e.*, the flowers grow close together, into a more or less dense head. It yields a great quantity of herbage, especially in moist situations; and is particularly adapted for the irrigated meadow. It should be distinguished from the *A. geniculatus* (Kneeling Foxtail), whose spike is only about half the length and size, as this is particularly a water species, so that if found when a meadow is dry, it is yet an evidence that water must have lain where it occurs for a considerable period of the year. Also from the *A. agrestis* (Slender Foxtail), which has a longer and thinner spike, as this latter is a weed in poor hungry clays, which is useless except as serving to indicate that the land wants perhaps both drainage and manure. Here, then, our first genus presents us with species indicating the varied conditions of rich meadow, wet places, and poor arable; and it is this variableness in adaptability that makes the grasses such important indicators of the nature and condition of soils.

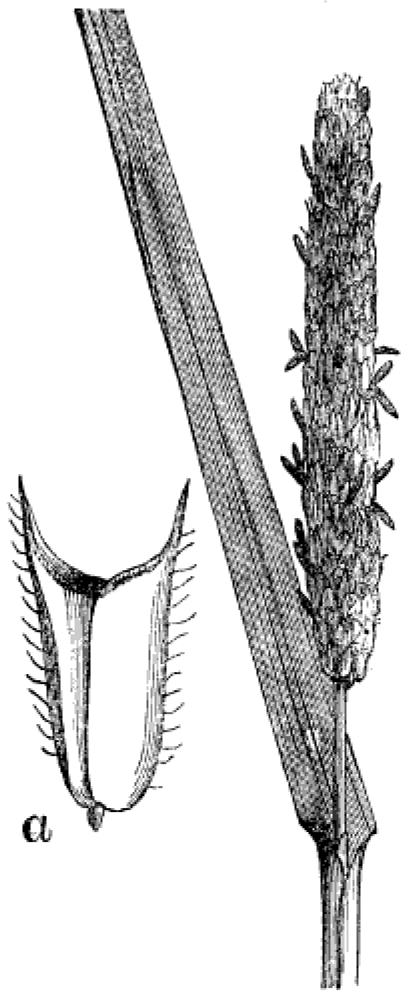


Fig. 14. The Catstail Grass.

The Catstail Grass (*Phleum pratense*, fig. 14) in general form is not unlike the preceding, but it is much rougher in all its parts, and is one of the latest instead of one of our earliest species. Its name of catstail is due to its rough flowers, an enlarged drawing of one of which is given at *a*. It has also got the name of Timothy Grass, from one Mr. Timothy Hanson, an American, to whom, probably, is owing its first introduction as a "self-crop," large fields of this useful species, mostly by itself, being grown in Canada and the States as a fodder plant. It is very useful in the meadow, as supplying a late crop of stems and leaves; greatly augmenting the amount of herbage in some of the colder though not poor districts.

We have never seen this grass used as a self-crop in England, but we are convinced that on some of the rich alluvial flats, as in the lands reclaimed from the Severn, and warp soils in general, it would yield a large bulk of good feeding matter, which, though somewhat rough, would yet mix well with clovers, &c., in chaff-cutting.

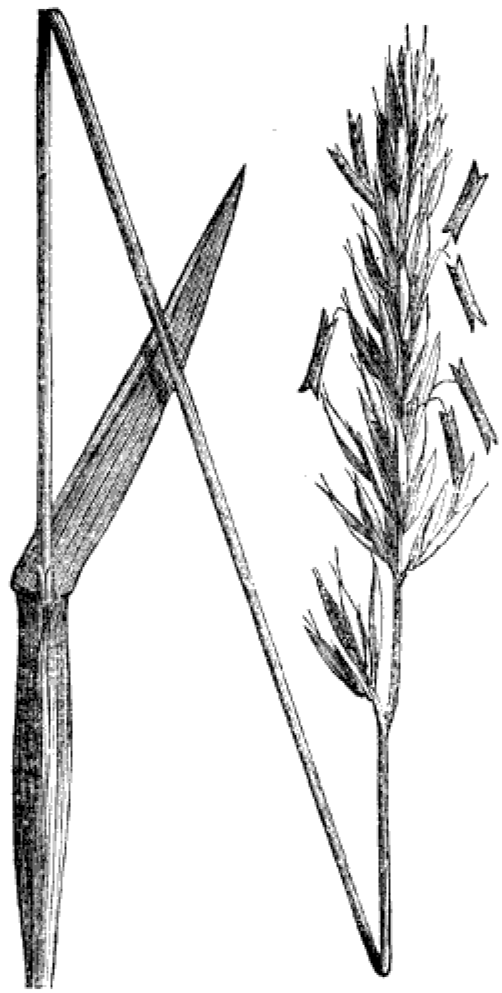


Fig. 15. The Sweet Vernal Grass.

The Sweet Vernal Grass (*Anthoxanthum odoratum*, fig. 15) is a very early species, with a somewhat lax spike of flowers, which usually become of a bright straw-colour by the time the hayfield is ripe for the scythe. It does not yield much bulk, but its grateful bitter when fresh, and the peculiarly sweet hayfield odour which it yields on drying, would seem to make this grass of importance, from the flavour which it imparts to the produce of the field; indeed so much so, that much of the value of natural meadow hay over that of artificial pasture may be traced to the presence of this grass.

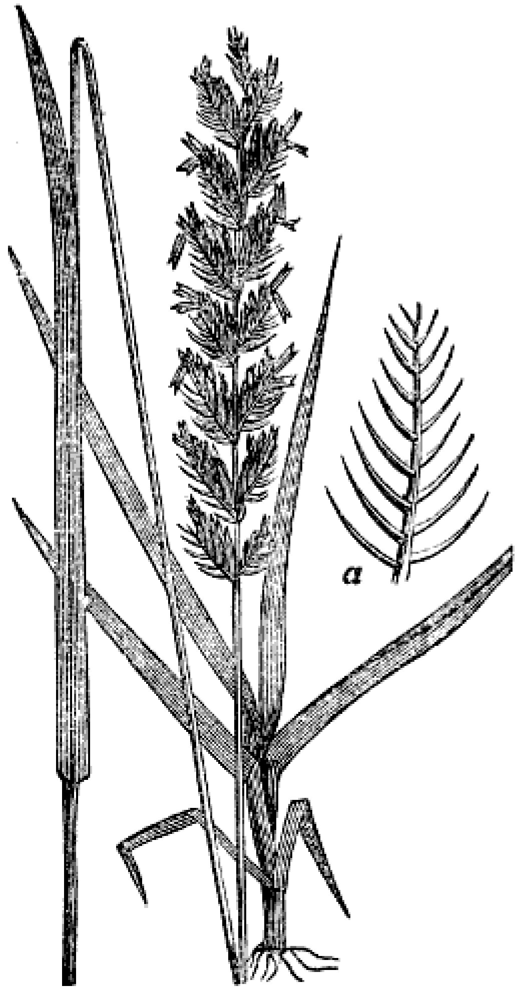


Fig. 16. The Crested Dogstail.

The Crested Dogstail (*Cynosurus cristatus*, fig. 16) has its florets arranged in front of a series of abortive branches, as represented at *a*, enlarged. It has a very slender stem, which is hard and wiry when ripe—a condition which it so universally attains, even in spite of constant depasturing, that we never recommend its use in mixtures for permanent pasture, as its stems are particularly innutritious, and its herbage is so small as to be of little value. It never prevails much in our best pastures.

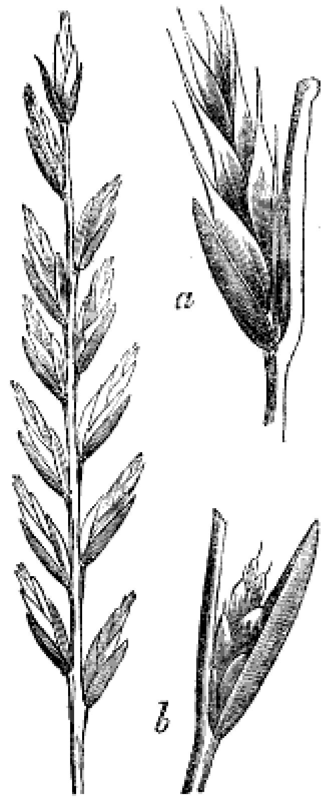


Fig. 17. Rye Grass, or Ray Grass.

Rye Grass, or Ray Grass (*Lolium perenne*, fig. 17), has no connection with the Cereal Rye. It is one of our commonest and most useful species, both as a plant for the natural meadow or for arable culture, especially in mixture with clovers, which has the name of "seeds." It yields good bulk for the rick, and will so readily grow after cutting or close depasturing that it commonly affords the greater part of the herbage of a pasture. From being so valuable, its seed has been much cultivated; and as it has a tendency to form more or less permanent varieties, so we find in the market several different sorts; as "Pacey's, Ruck's, Russell's, Stickney's, Rye Grass," &c. It should always form part in any mixture in laying down permanent pasture, in which case it should be distinguished from the *Lolium Italicum*, the florets and seeds of which are awned-pointed, as at *a*. This latter is useful as an annual self-crop, but seedsmen too often mix it in permanent-pasture collections, for the reason that it grows faster, and so makes a show the first year, and so satisfies the customer; but it soon dies out, while its large growth has kept under the more enduring forms. *b* represents a bunch of the tumid flowers of the *Lolium temulentum* (Drunken Darnel), once a pest in cornfields, but now, fortunately, of rare occurrence, if we are to believe the tales told of its so-called poisonous seeds.

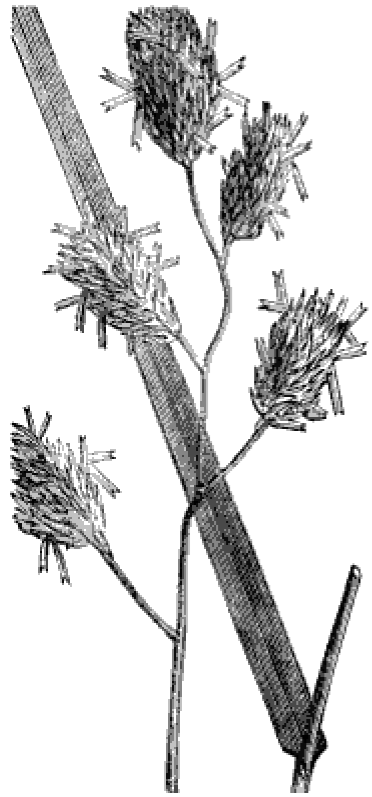


Fig. 18. The Cocksfoot.

The Cocksfoot (*Dactylis glomerata*, fig. 18), though a large and somewhat coarse grass, is by no means inferior in quality, its hay being highly nutritious, whilst its cut or cropped herbage is so quick of growth that it is capable of yielding a great deal of keep. It sends its root deep into the soil, so that it can grow well in poor land if dry; but it never flourishes in very wet situations. It is constant in good meadows, unless when they are always depastured, as there the constant treading greatly interferes with it: it is, therefore, by no means so abundant in sheep pastures; whence has arisen the idea with some farmers that "too much sheep-grazing wears out the richer grasses."

We should always recommend cocksfoot as a part of mixtures for permanent pasture, taking care to well roll the meadow once or twice a year—a process of great importance—to keep the turf in an even pile, and so prevent that growing of large clusters or hassocks of one sort, a method of growth to which the cocksfoot is somewhat prone.

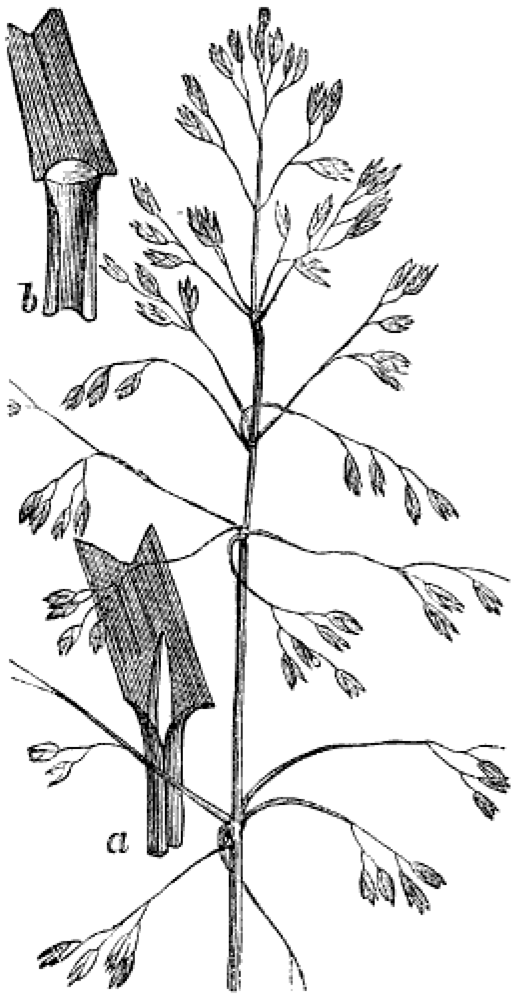


Fig. 19. The Rough-stalked Meadow Grass.

The Rough-stalked Meadow Grass (*Poa trivialis*, fig. 19) is a common species in moist meadows, where it often forms a considerable portion of the herbage: it is distinguished from the smooth-stalked by the long-pointed tongue (*ligule*) to the leaves (*a*), and a stem which is somewhat rough to the feel, especially when drawn downwards through the fingers. This grass yields a quantity of herbage, but our experience leads us to conclude that it does not possess quite so good a quality as Sinclair and authors who have copied from him would lead us to suppose, as we have found it wanting in feeding qualities, or what the farmer calls "proof." It usually forms a large part of the hay of the irrigated meadow, which, though often large in quantity, is yet not equal to that of ordinary good meadows in feeding properties.

The Smooth-stalked Meadow Grass (*Poa pratensis*), distinguished by a blunt ligule (*b*) and smooth stem, is as abundant in dry situations as the former is in damp ones. We confess to a great partiality for this grass, notwithstanding that authors speak slightingly of its value; but the truth is, that it varies with soil and situation, it being a species which, when growing on a wild moor, is poor in both quantity and quality. But we know of no better sign of the improvement of a bad meadow than the increase of this grass, and its putting on, as it will do under such circumstances, of its richest green tint.

Poa nemoralis (Wood Meadow Grass) is a more slender form, whose wild *habitat* is in woods and shady places, especially on calcareous soils. This points it out as a useful grass for wood-glades and positions beneath trees, in which it may very properly be employed.

In laying down permanent pastures we should, then, employ these three poas as follows:—

> *Poa trivialis*, for low, damp situations and irrigated meadows.
> *Poa pratensis*, for sound dry pastures and uplands.
> *Poa nemoralis*, for rides between woods, wood-glades, and shady places.

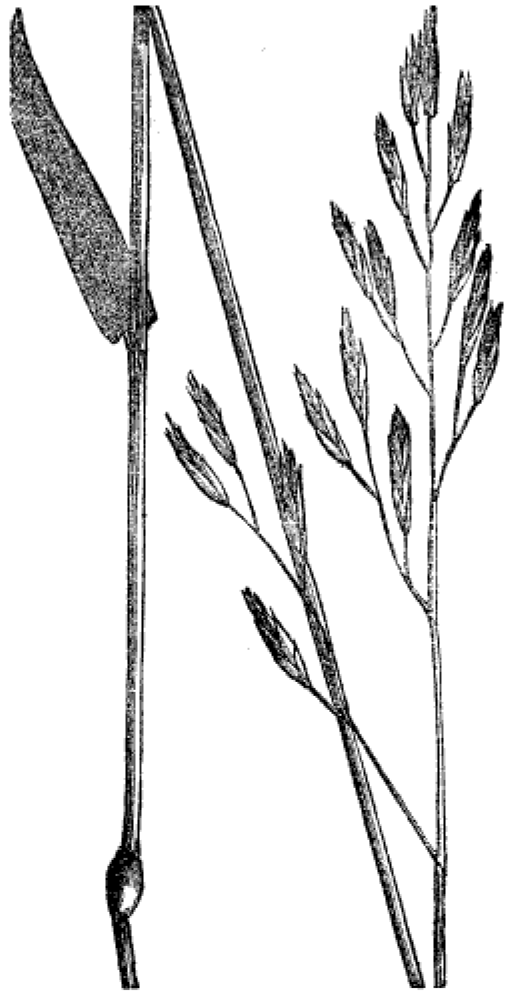


Fig. 20. Meadow Fescue.

Meadow Fescue (*Festuca pratensis*, fig. 20) may be taken as the type of the broad-leaved fescues. It is a common and good succulent grass in rich meadows, and should always be employed in seed mixtures for such situations, A variety, botanically known as *F. loliacea*, is unbranched, like the lolium or rye grass. The position of this is on rich river flats: we have seen it on the banks of the Isis at Oxford, forming a large part of most excellent herbage.

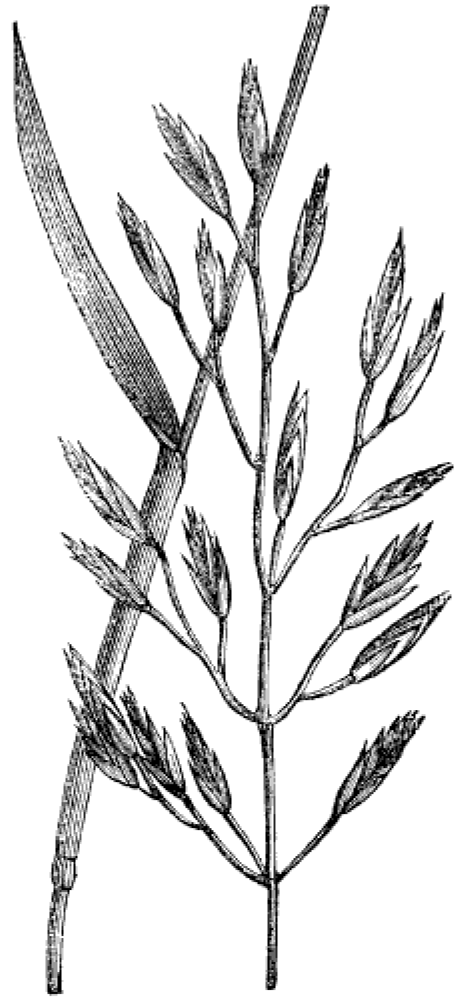


Fig. 21. The Tall Fescue.

The Tall Fescue (*Festuca elatior*, fig. 21) is a larger and coarser form of *F. pratensis*, as seed of the latter will become the former by being sown on some stiff sandy clays. It occurs abundantly on the stiff alluvial deposits of our estuaries and river flats. It is an exceedingly coarse grass, with a tendency to grow in large separate bunches; and hence its presence is destructive to good pastures: it may, however, be encouraged as a rough growth in its indicated *habitats*.

Fig. 22. Sheep’s Fescue.

Sheep’s Fescue (*Festuca ovina*, fig. 22) may be taken as the type of the small-leaved fescues. It is a native of our downs, and forms a large proportion of the sweet down sheep-pastures. It is known by its fine leaves, which come up immediately after the closest feeding; and if its quantity equalled its quality, it would be even more valuable than it is. A larger form, the Hard Fescue (*F. duriuscula*), is common to sound meadows and the hill valleys. This has much the same properties as the former, but it is taller, with longer and broader leaves. This should always be encouraged, and in laying down grass for permanent pasture, it should be plentifully added to the seed mixture.

Fig. 23. The Downy Wild Oat.

The Downy Wild Oat (*Avena pubescens*, fig. 23) is a common grass on thin calcareous soils. As it is very light in structure, and yields but little grass, it is not worth much as a first-rate pasture plant,—and indeed it would scarcely prefer to grow on them.

There is, however, a smaller-flowered species, the *Avena flavescens* (Yellow Oat-grass), which is better. It, too, occurs on chalky soils; while the *Avena pratensis* (Meadow Oat-grass) is found too frequently in poor clays or on starved moors, in which its rigid leaves and harsh structure render it little, if any, better than a weed.

One of the most interesting species of the genus is the *Avena fatua* (Wild Oat), well known as a weed in stiff arable soils. This is the parent of the crop oats in cultivation, and there is reason to know that by degeneracy the crop oat in some districts leaves behind a pest of wild oats.[2]

[2] See "Natural History of British Meadow and Pasture Grasses," by the Author.

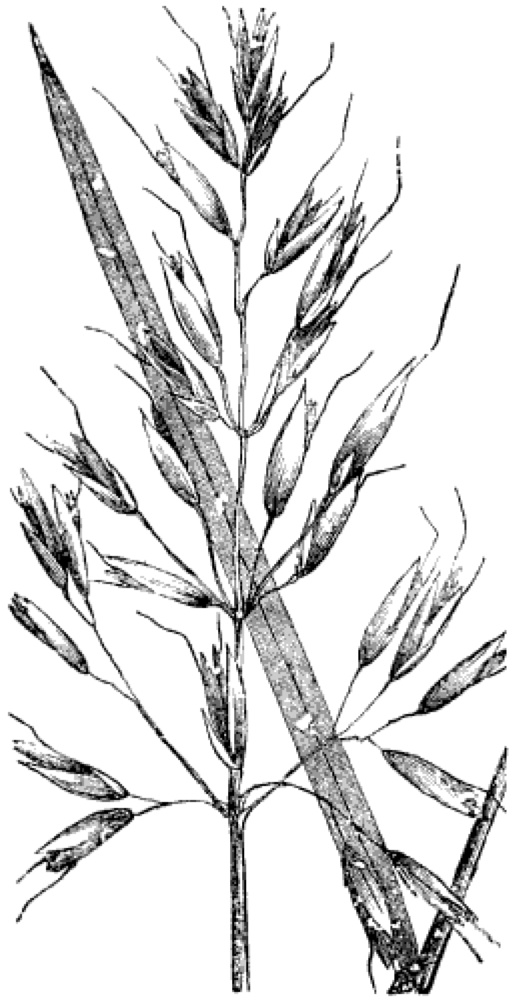


Fig. 24. The Oat-like Grass.

The Oat-like Grass (*Arrhenatherum avenaceum*, fig. 24), though a tall, succulent-looking species, is still too common in poor soils, as its herbage is bitter and nauseous, and not liked by cattle; and hay from it is always inferior in quality. It is sometimes recommended by seedsmen, and usually put with their mixtures; but we should at all times refuse it.

There is a peculiar form of this which occasionally occurs in sandy districts, called *A. avenaceum*, variety *bulbosum* (Onion Couch), the trivial name of which has been given from the fact that its nodes thicken below the soil, and present the appearance of small races of onions. This pest is got out of the land by harrowing and hand-picking; but as every bulb grows like joints of real couch, it is very difficult to entirely eradicate it.

Fig. 25. The Soft Brome, or Lop Grasses.

The Soft Brome, or Lop Grasses (*Bromus mollis*, fig. 25), and its congeners, is an annual grass, and therefore very objectionable, whether in the meadow or in "seeds," to both of which, when poor and neglected, it becomes attached. In both positions it is sometimes mixed with a kind that droops pretty considerably to one side; from which it has got the name of "lop." From the meadow it is soon got rid of by manuring and depasturing; haymaking, though it cuts off the main stem, only encourages smaller ones to spring up late, and so the seed is sown. In “seeds” it is frequently mixed with rye-grass seed, as it too often occurs that a patch of rye-grass with much lop is seeded, as the most profitable way to deal with it, as its seeds are heavy and large, and therefore tell well, either by weight or measure. Our enlarged drawing of a seed with its envelopes is given to contrast with rye-grass seed, which is narrower and more pointed.

Within the last few years a species of brome grass, which was formerly very rare, has become a common weed: we mean the *B. arvensis*, Corn Brome-grass,—a species with smaller and more numerous heads of flowers than the one just described. This has spread with the growth of foreign seeds, and so suddenly has it appeared in some places as to cause farmers to come to the conclusion that poor cultivation has made the land spontaneously bring forth “a nasty sort of wild oat,” while others have even concluded that a cereal crop had been transformed into this grass.

The *Bromus erectus* (Upright Brome Grass) is very constant to poor calcareous soils. This is a perennial species, but very poor indeed in feeding qualities; however, it looks green in park-glades, and if kept down by rough stock, it may then be made useful.

Fig. 26. The Bent Grass.

The Bent Grass (*Agrostis stolonifera*, fig. 26) is probably only a variety of the common marsh species, *A. alba*. Under the name of Fiorin Grass, this plant has been much extolled for the meadow; but our experience shows it to vary in value according to the nature of the position in which it is placed: as thus, in an irrigated meadow it sends up a large quantity of quite rich pasturage, whilst in poor or dry districts its herbage is hard and harsh, and not at all relished by cattle or sheep.

The form we have figured is more particularly agrarian where its creeping underground stem forms a kind of mischievous couch, and this, united with a tangled growth derived from shoots rooting above the ground, renders this one of the most pernicious weeds, especially in thin soils, on calcareous, brashy, or stony soils.

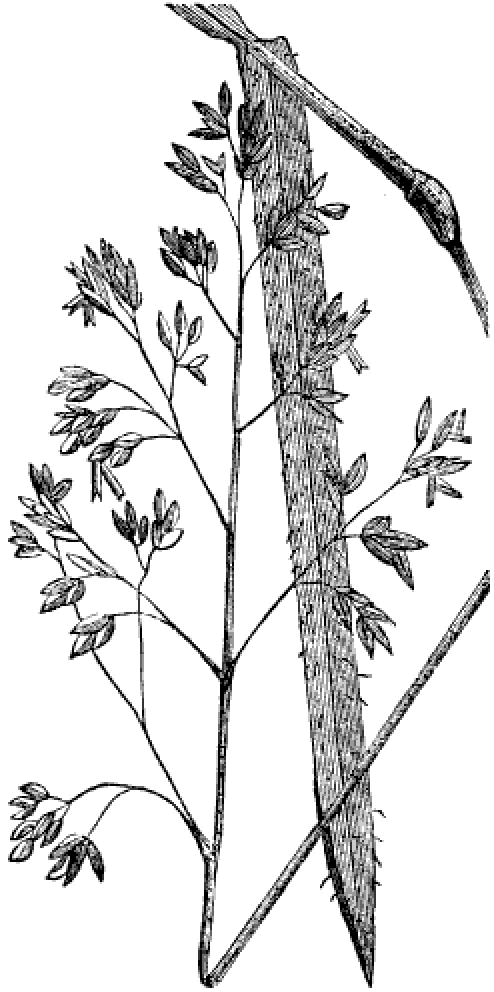


Fig. 27. Woolly Soft Grass.

Woolly Soft Grass (*Holcus lanatus*, fig. 27), though exceedingly pretty from its contrast in colour and form with its congeners, is still so worthless in point of feeding properties as to be little, if any, better than a weed. It is too abundant in some moist meadows; and where it forms a very large portion of the herbage, it speaks of poverty as well as wet, and would lead to the inference that a little draining, less frequent haymaking, and liberal doses of manure, would have a most decidedly beneficial effect.

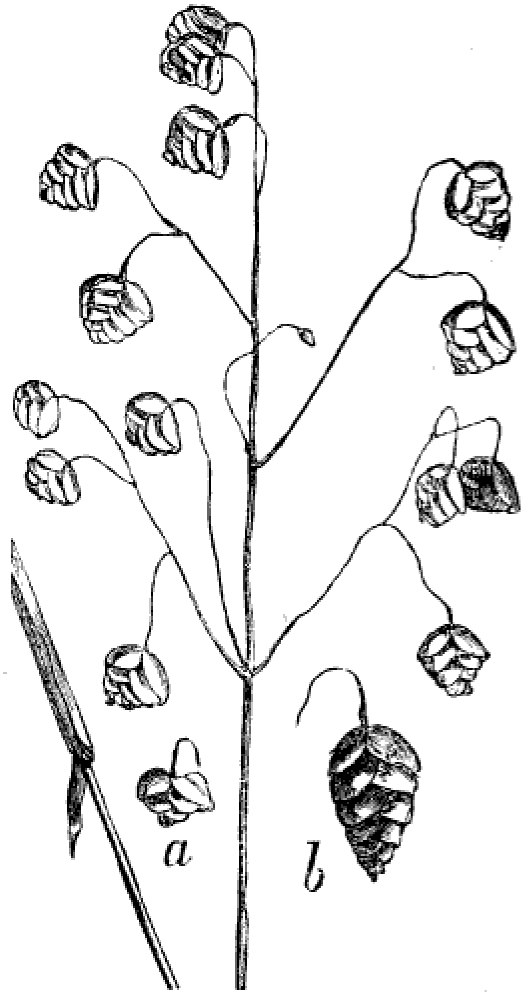


Fig. 28. Quaking Grasses.

Quaking Grasses (*Briza media*, fig. 28, *B. minor*, *a*, and *B. maxima*, *b*), though certainly amongst our pretty species, are all useless to the farmer. The common species is well known in all wet or poor clay meadows, and where very abundant we should usually make our calculations for something less than a ton of hay to the acre, and this would generally be late, and offer little *aftermath*. Like the preceding, its indications are want of draining, manure, and depasturing. If after the drains begin to act, sheep be folded upon a quaking-grass meadow, and fed with turnips, hay, pease, or cake, it will soon be eradicated. *a*, the smaller species, is an annual, and is only noticed here by way of distinction: its smaller and broader bunches of whitish, not purple, flowers, and rectilinear branches, will distinguish it from the common form. It is comparatively rare; but we have had some fine specimens communicated by H. C. Watson, Esq., from Thames Ditton. *b* is a garden specimen, remarkable for its larger flower bunches.

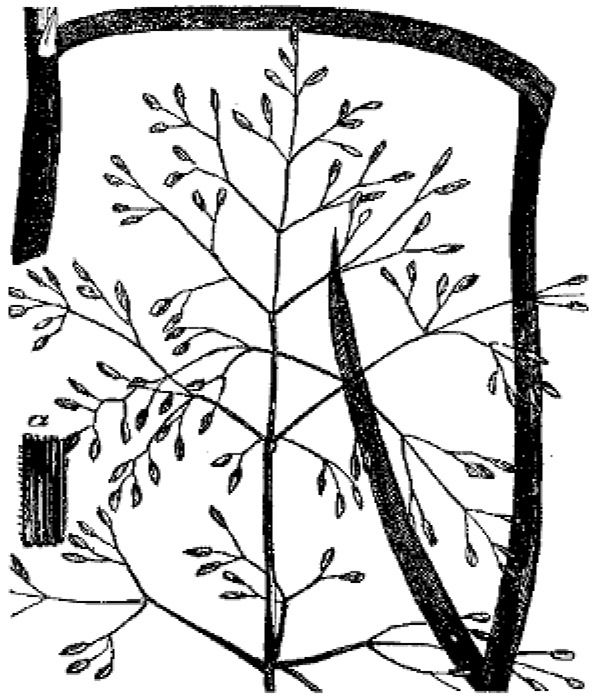


Fig. 29. The Hair Tussac Grass.

The Hair Grass (*Aira cæspitosa*, fig. 29) is commonly called hassock, or tussac grass, or bull-pates—names which its massive bunches of root-leaves clearly indicate the meaning of. Its leaves are so rough, with serrated edges, that cattle mostly refuse it, unless when very young. This grass is a never-failing indicator of wet,—so much so, that if a meadow be drained in which it abounds, the action of the drains is clearly indicated by its more or less gradual dying out. The quickest way, then, to subdue this large, coarse weed-grass is to drain, and then fold sheep upon the drying meadow: these animals tread the tussac grass into manure, which goes to feed the better species. By this means, not only this, but other rough or "sour" grasses are more quickly and more certainly removed than by spudding them out; and this leads us to remark, in concluding this chapter, that in the meadow there will usually be found growing together two sets of grasses, which may be designated as follows:—

a. Grasses more or less nutritious—sweet.
b. Grasses more or less innutritious—sour.

In a good meadow, the section *a* maintain the ascendancy, and so keep under those of *b*. In a bad meadow, the section *b* will be master, and so tyrannize over what would be better.

Perfect cultivation, then, of a meadow—for meadows should be cultivated—whilst it encourages the growth of *good* herbage, equally discourages the progress of the *bad*.

CHAPTER XI.

ON MEADOW PLANTS OTHER THAN GRASSES.

With the grass of the field will usually be found a large proportion of plants of a very varied, variable, and different kind. Of these, many are useful as augmenting the mass, and even improving the quality of a pasture; whilst, as others are altogether objectionable, we shall presently notice them under the head of "Meadow Weeds."

Of the more useful adjuncts of the meadow we may tabulate the following:—

No.	Trivial Names.	Botanical Names.
1	Red clover	Trifolium pratense.
2	Zigzag clover	„ medium.
3	White or Dutch clover	„ repens.
4	Birdsfoot	Lotus corniculatus.
5	Yellow vetchling	Lathyrus pratensis.
6	Purple vetchling	„ palustris.
7	Saintfoin	Onobrychis sativa.
8	Burnet	Sanguisorba officinalis.
9	False burnet	Poterium Sanguisorba.
10	Tormentil	Tormentilla officinalis.
11	Yarrow	Achillæa millefolia.
12	Agrimony	Agrimonia Eupatoria.
13	Plantain	Plantago lanceolata.

		Some of the smaller Compositæ.
		Ditto Umbelliferæ.

Of these, which are arranged pretty nearly in their order of merit, the clovers are by far the most important. These, as meadow plants, will usually be found under the following circumstances:—

No. 1. Plentiful in good, rich, sound meadows.
„ 2. Frequent in meadows on light sandy soils.
„ 3. On thin but good soil, upland meadows.

The clovers, and indeed the clover allies, *Papilionaceæ*, as a whole, are partial to lime,—so much so, that a dressing of this mineral to some fields in which clovers are scarcely represented will very quickly cause an accelerated growth of them; hence road dirt, when made from calcareous stones, as are the *oolitic* and mountain limestones, affords a good vehicle for the admixture of manures or ameliorators, such as guano, burnt ashes, soot, nitrate of soda, &c.

The following remarks upon these three clovers are from a paper by the author in the *Bath and West of England Agricultural Journal*, vol. x., part 2:—

> 1. *Trifolium pratense*—Meadow or Broad-leaved Clover—in its wild state is too well known to need any lengthened description. A careful examination of field specimens will show that even in the wild state this plant is liable to run into numberless variations; thus, we may have the leaflets of one plant broad and almost obcordate at the extremity, whilst others will be more or less ovate and lancet-shaped. In some we may see dense heads of purple flowers, varying in shade until almost white, whilst less dense heads of flowers and general variations in height, size, and luxuriance of the whole plant, are all circumstances in the natural history of this species in the wild state, which will prepare us duly to understand the nature of the many forms of the plant which are found in cultivation. Of these we have, besides others, English, French, American, and Dutch sorts, which differ in such minor details as a greater or less hairiness, or variations in the colour and size of the flowers, leaves, *&c.* The most important point connected with the broad-leaved clover is its permanency; some sorts scarcely maintaining a plant for two years, whilst others are said to be more or less perennial. This, however, is a matter which we conceive depends more upon the soil and the[75] kind of cultivation than upon the sort; for although all seedsmen supply two sorts, namely, *Trifolium pratense* and *T. pratense perenne*, yet they run so much the one into the other, that it is oftentimes exceedingly difficult to distinguish them. If, therefore, a farmer wants a good strain of broad clover, he should purchase his seed from seedsmen possessing judgment and character; for experience has taught us that a seed which may be all that is required in one district may result in next to a failure in another. Thus, clover-seed from the warmer parts of England does not succeed well when sown in

cold, exposed positions; but that from the latter is improved on transmission to the former, whilst good changes are effected by the occasional use of foreign seed.

The sort known in the market as *T. pratense perenne* is probably intermediate between the wild species *T. pratense* and *T. medium*. Our own experiments have shown that, on cultivating *T. medium*, which is a sand-lover, in strong land, in three years it has been very difficult to distinguish it from some of the varieties of *T. pratense*. We incline, therefore, to the opinion that as the *T. medium* holds to sandy soils in the wild state, its seed was brought into cultivation with a view to light-soil cropping; and from this source has probably been derived the so-called *T. pratense perenne*, which variety is certainly more perennial in such light soils as would be quite unfit for the true *T. pratense*. The latter, indeed, seems to be more permanent in soils containing a quantity of lime, while the former, where it can be got of a good sort, is certainly best adapted for sandy soils.

2. *Trifolium medium*—Zigzag Trefoil—is distinguished from the *T. pratense* by its larger, but more lax, head of reddish pink (not purple) flowers, which are solitary, on the apex of a stalk, which at each joint is bent at a considerable angle; hence its name. Its leaflets are elliptical, and not broader at the upper margin. This plant is a constant denizen of sands and light soils. In fact, its naturally growing in soils unfitted for the broad-leaved clover seems to recommend it for cultivation; and though, as before pointed out, we more than suspect that the so-called cow-grass clover was originally derived from this source, and that the *T. medium* is after all but a variety of the *T. pratense*, it is now quite merged as a farm-plant into the broad-clover forms; so that, if we are to possess it as a separate plant, it must be again grown from the wild seed; and then, if it is to be kept pure, it must not be cultivated on clays or limestones, or, if our view be correct, it will soon lose its true distinctive character.

3. *Trifolium repens*—White Dutch Clover—has been long in cultivation[76] throughout Europe and America. It is one of our commonest native plants, and appears to have become less changed by cultivation than most other plants; yet there is reason to think that with careful selection a much improved strain may be brought about. In pastures an immense accession of Dutch clover is often seen to follow some kind or another of top-dressing, especially of lime, old mortar, or town rubbish. This is accounted for by the fact that this clover is in reality of universal occurrence; and its creeping habit of growth, besides seeding, causes it soon to make a rapid increase where its conditions of growth are made suitable. As an agricultural plant its position is in light soils, for which it is usually mixed with other clovers and grasses in varied proportions.

4 and 5 are often found scattered in meadows, though not usually in any abundance in those of the richer kind; still, in laying down land for permanent pasture, there can be no objection to a small admixture of their seed.

6, the *Purple Vetchling*, though local in rich river pastures, is yet a good plant, and might perhaps be advantageously brought out as an addendum to mixtures designed for good lowland positions.

7, *Saintfoin*, is a good pasture plant for chalks and limestones; and in laying down land for permanent pastures in such position, should not usually be omitted. It is also a good species to sow on railway banks, not alone for the beauty of its flowers, but for the binding effects of its deeply-diving roots.

8 and 9, the *Burnets*, will be found,—the *true* in rich damp bottoms and on river flats, the *false* on dry, calcareous soils. They are neither plants that we should care to grow; but in their wild state in their respective pastures we should, on the other hand, not be inclined to make war against them as weeds. The same opinion, indeed, might be briefly expressed as regards Nos. 10, 12, and 13. In fact, the whole here grouped may be said to possess more or less bitter and astringent qualities, and so become useful in checking the vapidity which is sometimes found in purely grass herbage.

11, the *Yarrow*, should be encouraged in most pastures, as it not only possesses the qualities just mentioned, but its leaves are so small and its stems and flowers so easily dry when cut, that there is no chance of its smothering out the grass in growing, or of its retarding the process of haymaking. It also bears constant nibbling with sheep, which are remarkably fond of it, without injury, as it rather becomes finer for being depastured.

12. The larger composite plants, as dandelion, the hawkweeds, blackhead, &c., are, from their coarseness and the room they take up, highly objectionable; but the yellow hawkbits, thrincia, and the before-mentioned yarrow, are by no means objectionable.

13. The above remarks will equally apply to the *Umbelliferæ*. Large plants like the cow-parsnip and common beaked parsley are objectionable from their size and want of feeding properties, whilst the small pimpinella and earth-nut do not offer these objections. Here, however, it must be confessed that we are bordering on the domains of weeds in pasture, to which we must devote a separate chapter.

CHAPTER XII.

ON THE WEEDS OF PASTURE.

“Weeds in pasture!” said an old farmer friend; “I thought hay and grass was all weeds.” This, which is by no means an uncommon notion, sufficiently explains the want of care in the cultivation of the best kinds of meadow produce, which can only be effected by the destruction of what is useless or mischievous.

Now, if we proceed upon the assumption that the best kinds of meadow are remarkable for the possession of little else than the best kinds of the true grasses, we shall see that pasturage should, in the main, be composed of good grass-growth, with only some few other plants which may be capable of augmenting quantity, by their nutritive matter, giving flavour, or improving quality.

It follows, then, that all plants having none of these requisites must be, to all intents and purposes, only *mischievous weeds*; as thus a large useless plant in a meadow, as in an arable field, must not only occupy the space that would be better taken up by good plants, but it appropriates a large quantity of food to the prejudice of the better crop.

Viewed in this light, then, what a mass of weeds some of our pastures will be found to contain! In fact, what with useless plants, other than grasses, and coarse, sour, or useless grasses themselves, we meet with so-called meadows to which the terms of “barren moor” or waste land would be especially applicable.

The following table is offered as an attempt at the classification of the weeds of pasture, the different divisions of which we shall presently describe in the order of their arrangement.

TABLE OF PASTURE WEEDS.

1. *Plants which take up space but yield no Produce.*

Trivial Name.	Botanical Name.	Remarks
Broad-leaved Plantain.	Plantago media	The leaves of these plants grow too close to the ground to be eaten off by cattle or to cut for hay.
Dent-de-lion	Leontodon taraxacum	
Daisy	Bellis perennis	

Cowslip	Primula veris	These plants take up much room in growing, they are not eaten by cattle, and, as they die before haymaking, yield little or nothing to the rick.
Primrose	„ vulgaris	
Green-winged Orchis	Orchis Morio	
Early Purple Orchis	„ mascula	

2. *Plants which take up space, but simply dilute the hay with useless matter.*

Blunt-leaved Dock	Rumex obtusifolius	All common, especially in damp meadows, are not usually depastured, and have little or no feeding properties when made into hay.
Crisp-leaved Dock	„ crispus	
Marsh Dock	„ palustris	
Field Sorrel	„ acetosa	
Burdock	Arctium Lappa	Common about the borders of fields.
Butter Burr	Petasites vulgaris	Common near water courses.
Cow Parsnip	Heracleum Sphondylium	Very common and unsightly in pastures.
Wild-beaked Parsley	Anthriscus vulgaris	
Ladies' Smock	Cardamine pratensis	In damp places.
Yellow Rattle	Rhinanthus crista galli	In poor cold clays.
Larger Hawkweeds, &c.	Hieracium species	About fields in upland districts.

3. *Mechanical Plants, those with Spines, Prickles, Stings, &c.*

Musk Thistle	Carduus nutans	Mostly a weed in "seeds."
Welted Thistle	„ acanthoides	In hedgerows, borders of fields, or the open meadows.
Creeping Thistle	„ arvensis	
Cotton Thistle	„ eriophorus	
Spear Thistle	„ lanceolatus	
Marsh Plume Thistle	„ palustris	Damp or marsh meadows.
Meadow Plume Thistle	„ pratensis	
Stemless Thistle	„ acaulis	Common to poor calcareous uplands.
Carline Thistle	Carlina vulgaris	
Common Stinging Nettle	Urtica dioica	About the homestead, corners of fields, &c.
Smaller Stinging Nettle	„ urens	

Wall Barley	Hordeum murinum	About sandy soils, both in the meadow and arable.

4. [80]*Poisonous Pasture-weeds, &c.*

Meadow Saffron	Colchicum autumnale	Usual in calcareous soils or marls.
Upright Buttercup	Ranunculus acris	In damp meadows.
Diseased Grasses	Secale cornutum	In places where mist and damp prevail.

5. *Ill-favoured Weeds or Plants which communicate bad flavour to Produce.*

Crow Garlic Hogs' Garlic	Allium vineale „ ursinum	More or less in meadows and corners of fields.
Jack-by-the-Hedge	Erysimum Alliaria	About the hedgerow.

6. *Useless Grasses, or Grass-like Plants.*

Rough Grasses	Species	Poor land and wet places.
Sedges	Species	In boggy, marshy, or wet sandy spots.
Rushes	Species	In sandy spots on clays and poor soils.

1. Taking the broad-leaved plantain as the type of this list, we shall have no difficulty in estimating the amount of mischief which it does. Here is a plant, a single specimen of which not unfrequently occupies nearly a square foot of ground, and as its leaves grow close to the soil, it effectually prevents the growth of the grass, while few, if any, leaves are cut with the scythe. The bare patches which result from the cutting up of plantains from a lawn will sufficiently establish the first position, whilst, if one occasionally meets with a few of the leaves cut off in haymaking, it commits the further mischief of being so long in drying as to retard the process of haymaking, or else to endanger the safety of the rick. It is on account of this that the plantain has in some districts got the name of the "Fire Grass."

These are easily removed by the spud, especially if a little salt be added to their crowns.

2. Taking it for granted that grasses are for the most part the best plants for pasturage and hay, it follows that the plants of this list can only be weeds, from their taking up space and living at the expense of the wished-for crop, when, after all, the produce is either useless, or so inferior that the whole product of the field is vitiated by their presence. The best way to eradicate these and other large-leaved and tall-stemmed plants is to pull them early in the season—the true theory being, that by the repeated destruction of the leaves the rootstock ultimately decays. Close depasturing also keeps them under for the same reason, as the feet of horses and cattle so damage the leaves as to ruin the growth and progress of the other parts of the plant, which latter are requisite for its continuance.

3. Added to the evils just adverted to, this group is injurious from its adverse mechanical appliances in spinous leaves, stings, and the like. As regards thistles in pasture, they certainly argue great neglect, as they may be so readily spudded out, in which the individual is destroyed, and all hope of its progeny. It is, however, the fact that these plants are sometimes left to seed that makes the matter of destruction appear so hopeless, as the winged seeds of thistles may even find their way to a clean farm from a dirty one, and roadsides and waste places are constant sources of annoyance from this cause.

So fast has the corn thistle increased in Tasmania, as to make the people groan under a "plague of thistles," for which they have invoked the aid of special State legislation.

The spud should be kept in active operation in the field, so as to prevent these plants seeding, or indeed at all occupying any space; and roadsides and waste places should be freed from these pests, either as part of the duties of some public servant, or else as a matter of private necessity.

As an illustration of the fecundity of thistles, we append the following estimate of their seeding powers:—

SEED-DEVELOPMENT OF THISTLES.

Name.	Seeds to a single plant.	Description.
Musk thistle	3,750	150 seeds to a single flower-head.
Spear thistle	30,000	300 seeds to each.
Corn thistle	5,000	This plant also increases by creeping underground stems.
Stemless thistle	600	This is sometimes so thick on the downs that we have seen its flying seeds almost like a snowstorm in quantity and whiteness.

Farmers, however, mostly refuse an early summer attack both upon thistles and nettles, quoting the following rustic rhyme for their neglect:—

> If thistles be cut in April,
> They appear in a little while;
> If in May,
> They peep out the next day;
> If cut in June,
> They reappear very soon,
> If in July,
> They'll hardly die;
> If cut in August,
> Die they must.

The truth is, that with spring-time they will bud forth again, but always in a weakly condition. However, towards August the thistle has performed all its functions for the year, and so prepared its larger rootstocks for the future season; so that he would not be altogether so mad who, in reference to the cutting of thistles and nettles in August and September, should say—

> Kill a fool's head of your own;
> They'll die of themselves if you let them alone.

Beating nettles in the early part of the year with lithe ash sticks is more effectual than the cleaner cut with the scythe, as the injuries are not so easily got over.

4. That there are many plants in pastures which if eaten exclusively would act as poisons we can have but little doubt, but there are a few which would seem to be dangerous, even when partaken of in grass mixtures. Of these, the meadow saffron is one of the most powerful.

This plant is abundant on the oolitic rocks of the Cotteswolds, about which range we constantly hear of mischief from it. We extract the following from a Cheltenham paper for September, 1844:—

> It is only a few days since a farmer at Eyeford, near Stow-on-the-Wold (Gloucestershire), had *ten calves killed by eating of the flowers of the colchicum*, and two or three years since three cows were destroyed by this plant in flower in the same neighbourhood, whilst we frequently hear of many accidents to cattle in the spring from eating the leaves, although it is sometimes refused by them on account of its bitter and nauseous taste. Yet there is no doubt but that accidents would be still more frequent were it not that farmers keep their cattle from the meadows in which it occurs in any quantity during the spring and autumn months.

Pulling the leaves of the meadow saffron or colchicum will destroy it; but a much more simple remedy is that of a thorough rolling with a Croskill at the season when the flowers begin to expand, and again when the broad leaves come up in spring; this so crushes and bruises the whole plant, that a season or two of such treatment will be enough to keep it under, if not to destroy it outright.

As regards the buttercups, the most acrid one—viz., the upright tall species, a constant plant in marshy meadows and wet places—is the only one to be particular about. Cattle do not usually eat it, but it finds its way into the hay, and there is reason to think to its prejudice. It is to be got under by draining and close depasturing, so that by treading down it shall not seed; but poverty, induced by frequent haymaking and wet, by keeping under the growth of what is better, gives greater facility for the success of trash of this as well as of other kinds.

Ergotised grasses, by which we mean those affected with the black spur, in the place of the seed, or grain, is a common affection of grasses in autumn in low-lying or in damp places, or where fields may be enveloped in mist, as on some of our hill-ranges. This black spur is largest in the cereal rye, but it occurs in most other species of grasses, differing according to the size of their seeds.

Ergot of rye is used medicinally, and there is little doubt but that ergot in other grasses is equally active. Its effects seem to be to favour abortion; and there is reason to believe that it has caused many valuable animals to abort. Some few years since the late Earl Ducie suffered a loss of calves to an extent which he calculated to equal as much as £1,000 in one year; at that time the grasses, consisting mostly of the perennial rye-grass, were submitted to our inspection, and they were much affected by ergot.

Keeping the cattle away from meadows known to present much of this affected grass is the best remedy; but this will seldom be necessary, except in unusually wet and warm seasons, which are sure to produce these fungoid affections.

5. All the plants in this section are known to give a garlic-like flavour to the dairy produce of the fields in which they grow. The two first especially render butter unfit for market; so that if abundant they would take off a large portion of the value of the field. They occur mostly in patches, and should be pulled out as soon as strong enough: if this be done year by year, it will be found to diminish in an increased ratio; and two or three seasons will be enough to rid the field of so great a pest, and would be well worth doing if it cost much—which it ought not to do—as these weeds usually occur in otherwise tolerably good meadows.

The jack-by-the-hedge is usually confined to the vicinity of the fences, and may be removed by the hand or spud. It is a prolific seeder; so that on no account should it ever be allowed to ripen its seed.

6. Rough grasses and grass-like weeds are far too common in poor, wild, and neglected pastures. In their action they come closely to those of our second section; they are indications of a want of drainage, which operation well performed soon causes the death of this group, which end is greatly facilitated by manuring and depasturing as the drains begin to act.

In concluding this description, it may be well to remark that many more plants might have been included in the different sections; but enough has been done to show that a pasture, to be good, must not consist of any plants which chance, accident, or more commonly neglect, may throw together. In arable culture one-half the expense is, in one way or other, connected with weeding, and we are of opinion, that if only one shilling per acre was spent on the weeding of pasture, it would yield 300 per cent. profit on the outlay.

CHAPTER XIII.

ON THE IRRIGATED MEADOW.

Irrigation, as a means of increasing the amount of pasturage, is so important a process that it may be well to describe it in this place.

For a perfect irrigated meadow, we should have full command of water whenever it may be required. This water should be capable of flowing through, not of pouring over, and standing on the land,—this latter being flooding. The drainage should be so perfect that the land will be sound enough for us to walk over in the dry in a few hours after the water has been turned off.

Where these conditions can be secured, irrigation will be found most useful, not only in augmenting the supply of grass, but in producing it so much earlier than in the higher meadows that the farmer hereby gets a fresh green pasture, of great utility, especially in fattening and bringing on early lambs. From these circumstances it follows, that although some land is occupied in the water-conduits, yet the value is so far increased that meadow at 30*s.* per acre before irrigation has, under one's own eye, become worth £5 per acre in four years. There are, however, some necessary expenses in setting out the work, making floodgates, &c., the extent of which will of course depend upon the nature of the ground. In Gloucestershire, on the banks of the Churn, where irrigation has been successfully carried on for years, there is a permanent cost of about 6*s.* an acre for keeping the works in order, and charges of the "drowner," the name given to the man who overlooks the works, in some instances of several proprietors or tenants.

A peculiarity in irrigated meadow of the best quality is, the general absence of coarse grasses on the one hand, and of any plants other than grasses on the other; hence, then, good succulent and nutritious herbage is the rule, and anything that can be otherwise described is the rare exception. Indeed, so much is this the case, that a bit of coarse grass—such, for instance, as *Aira cæspitosa* (Tussac Grass)—making successful growth in any part of the meadow, is at once an evidence of a stagnation of water at that spot—a condition that a clever drowner at once looks to when he has discovered it.

As an evidence of the changes which go on as the process succeeds, as well as of their nature, we give the following as the tabulated result of the irrigation of half of a meadow whose slope was too great to allow of the whole being operated upon. From these it will be seen that the proportionals of different pasture plants before and after irrigation offer a material change; and it may be added, that in some cases, what would otherwise be a bad and useless grass, may become succulent and useful from the beneficial action of water. One of this kind is the *Agrostis stolonifera* (Fiorin Grass), which is in arable couch-grass weed, but in the irrigated meadow it becomes of a fine green colour, is nutritive in quality, and will bear with any amount of clipping. It may here, too, be remarked that in cases where only a part of a meadow can be irrigated, good accrues to the whole, as in depasturing the whole is ranged over by our cattle and sheep.

We here give the following

TABLE OF CHANGES IN GRASSES AND OTHER PLANTS UNDER IRRIGATION.

Trivial Names.	Botanical Names.	Before Irrigation.	After 2 Years' Irrigation.	After 4 Years' Irrigation.
Meadow Foxtail Grass	Alopecurus pratensis	1	2	3
Field Meadow Grass	Poa pratensis	2	3	4
Rough-stalked ditto	„ trivialis	1	2	1
Quaking Grass	Briza media	2	0	0
Dogstail Grass	Cynosurus cristatus	2	1	0
Hassock, or Tussac Grass	Aira cæspitosa	1	0	0
Marsh Bent	Agrostis stolonifera	1	2	3
Cocksfoot Grass	Dactylis glomerata	1	2	3
Yellow Oat-grass	Avena flavescens	2	3	3
Soft ditto	„ pubescens	1	1	1
Meadow Barley	Hordeum pratense	1	2	2
Perennial Rye-grass	Lolium perenne	2	4	6
Meadow Crowfoot, or Buttercup	Ranunculus acris	1	3	1
Bulbous ditto	„ bulbosus	3	1	0
Narrow-leaved Plantain	Plantago lanceolata	3	1	1
Broad-leaved ditto	„ asiatica	3	0	0
Dutch Clover	Trifolium repens	2	0	0
Broad Clover	„ pratense	1	2	2
Common-beaked Parsley	Anthriscus vulgaris	1	2	1

The general conclusions from this table are, that large and innutritious herbage is, for the most part, destroyed by irrigation, and its place is supplied by grasses; hence, then, the increased value conferred by the regulated action of water is due to an increase in quantity and quality of the grasses, added to a much more certain, as well as early, production of these.

Of course the districts best adapted to irrigation will be valleys of denudation, the centres of which are occupied by more or less copious and rapid streamlets. Some of these valleys in the Cotteswolds having been scooped out of the oolitic freestones, have left the spoils of the rock as a gravelly deposit, sometimes on the lias, at others on the fuller's earth, and then on the Oxford clays; so that, stiff as these soils would be by themselves, they now only tend to throw out the waters by natural drainage, which are again conducted over the porous gravels through which they flow with great regularity; thus fertilizing what would otherwise be but a scanty thin-soil herbage, and to such an extent that early depasturing, haymaking, and later pasturage (*lattermath*) are the rule year by year.

These circumstances make water-rights of great value, and which, if not in possession, are secured at a fixed charge per acre; this, however, is usually included in the expenses, which, as before stated, are covered by about 6*s.* per acre.

Before concluding this chapter, we must say a few words in reference to flooded meadows. These will be found on the banks of the larger rivers or on streams of sufficient importance to be called rivers, as distinguished from brooks or streamlets. Here the flooding is caused by the water overflowing the banks, as the result of sudden thaws or an unusual quantity of rain. Here then the flood is not under control, and as it may happen at any and all times of the year, the grass may be spoiled by being covered with silt and drifted materials, or even the hay may be carried away by the flood.

These river flats, then, have seldom the requisites for carrying on irrigation, although the waters are of course more abundant than those supplied by the smaller streams; for even if we could by embanking so far control the water as to get it over the field when we might wish, yet alluvial flats like those of much of the Thames and Severn would not readily drain.

From facts like these it will at once be seen that there is a wide difference between irrigation and flooding; and we have hence endeavoured to separate what is too often confounded.

CHAPTER XIV.

ON THE LAYING DOWN OF PERMANENT PASTURE.

If we reflect upon the fact that much of the meadow of Great Britain is ribbed by the ridge and furrow of former arable culture, we shall conclude that the laying down of land to permanent pasture is an ancient no less than a modern process.

Formerly new pastures were made by sowing the collected seeds from a hayloft, but as in modern farming no one in his senses would let his grass get ripe enough for seed before cutting, present practice necessitates the mixing of such seeds as may be considered best in suitable quantities for our purpose. We shall have, then, in this place to consider:—

1. The preparation of the land;
2. The kinds of seed best adapted for different places; and
3. The after-treatment of the new meadow.

1. The plan usually adopted in a preparation for grass seeds is that of sowing our mixture with the barley crop. Now this, in the case of a tenant who is not sure of his tenure, would obviously recommend itself; but to a proprietor wanting a quicker and surer result it offers many objections.

We recommend, after turnips have been fed off on the land, to make the ground as level as possible, then harrow and roll smooth with an iron or wooden roller. Upon this surface our mixture should be carefully sown; then harrow with very light harrows just to cover the seed, and roll again.

By this plan you start the seeds in good soil instead of in that from which you have carried off a crop of ripened grass, straw, and seed; but besides this, your grass will get a stronger constitution than when grown as seedlings amid taller plants, which draw up the “seeds,” and thus make them so weak and attenuated as scarcely to be able to withstand the rigour of winter—a matter of great consequence when our object is to get a vigorously-growing swarth quickly.

2. We come now to consider the kinds of seeds which should be sown; these, though few in number, will yet vary according to soil and situation.

Our remark that few kinds of grasses are required in laying down for permanent pasture may surprise those who have seen the usual prescriptions for this purpose; but if we start in our selection by leaving out coarse grasses,—such, for instance, as *Phalaris canariensis* (Reed Canary Grass), for damp meadows; annual forms, or at least not permanent ones, such as *Lolium Italicum* (Italian Rye-grass); and useless varieties, as *Poa nemoralis sempervirens*, *Phleum pratense majus*, and the like,—we shall be then confined to as few species of grass as we shall ever find will form the best parts of our best meadows.

Now, as regards sowing useless or annual species, we should recollect that the better they come up the more mischief they create, as they take up the room that the more permanent forms should occupy, and so smother them out. How often have we seen our friends in ecstasies at the success of their new pasture, when the smiling face had been suddenly put upon the matter by the quick-growing Italian rye-grass having taken a possession, which, however, in a year or two it would most probably yield; and so it has happened, that while the seedsman has been advertising a certificate vaunting of success, the pasture is declining, and the proprietor, looking for the reason for such a result, either himself concludes, or is led so to do, that as the seeds came up well, these were not in fault: it must then be the nature of the soil!

In giving such directions for grass mixtures as experience would seem to warrant, we confess to a great deal of diffidence; for as scarcely two cases are alike, the difficulty is as great as would be that of a medical man prescribing for his various patients without seeing them; indeed, to profess to do so in either case, as a general rule, savours somewhat of quackery.

The following tables, then, it must be understood, are only meant to convey some very general notions as to sorts of grasses and other fodder plants, and their quantities, which we should employ under the specified conditions of soil; albeit, even the quantities should be variable, depending upon the quality of the seeds, the season, and the climate in which they are to be sown:—

1. *Proposed selection for rich loams in best grass-growing positions.*

Botanical Name.	Trivial Name.	Quantity Per Acre.	
		lb.	oz.
Lolium perenne	Perennial Rye	10	0
Poa pratensis	Meadow Grass	2	0
Dactylis glomerata	Cocksfoot	5	0
Festuca pratensis	Meadow Fescue	3	0
„ duriuscula	Hard „	3	0
Alopecurus pratensis	Foxtail	2	0
Phleum pratense	Catstail	2	0
Anthoxanthum odoratum	Sweet Vernal	0	8
Trifolium pratense	Common Clover	4	0
„ repens	Dutch „	2	0

2. *Proposed selection for a poor stiff soil on a clay subsoil.*

Lolium perenne	Perennial Rye	12	0
Poa pratensis	Smooth Meadow Grass	3	0
„ trivialis	Rough „ „	2	0
Festuca loliacea	Lolium Fescue	2	0
„ duriuscula	Hard „	2	0
Phleum pratense	Catstail	2	0
Dactylis glomerata	Cocksfoot	6	0
Anthoxanthum odoratum	Sweet Vernal	0	8
Trifolium pratense	Common Clover	6	0
„ repens	Dutch „	2	0

3. *Proposed selection for thin uplands on calcareous soils.*

Lolium perenne	Perennial Rye	12	0
Poa pratensis	Smooth Meadow Grass	4	0
Festuca ovina	Sheep’s Fescue	2	0
„ duriuscula	Hard „	2	0
Avena flavescens	Yellow Oat-Grass	1	0
„ pubescens	Soft „	1	0
Anthoxanthum odoratum	Sweet Vernal	1	0
Trifolium pratense	Common Clover	3	0
„ repens	Dutch „	5	0
Achillæa millefolia	Yarrow	0	8

4. *Proposed selection for light soils on sands.*[96]

Lolium perenne	Perennial Rye	14	0
Poa pratensis	Smooth Meadow	3	0
Festuca duriuscula	Hard Fescue	3	0
Avena flavescens	Soft Oat-Grass	1	0
Anthoxanthum odoratum	Sweet Vernal	0	8

Trifolium medium	Zigzag Clover	4	0
„ pratense	Meadow or Corn Clover	2	0
„ repens	Dutch Clover	5	0
Lotus corniculatus	Birdsfoot Trefoil	0	8
Achillæa millefolia	Yarrow	0	8

The above positions may so far be considered to present generic types of land which would be laid down in permanent pasture in the ordinary course of farming. Selections for park glades, covert, and the like, are exceptional, which must be provided for according to circumstances.

We should advise care in the selection of these seeds; the newer and fresher they are the better, as, perhaps, no seeds suffer more from keeping than do those of the grasses. And we would further add that, as a rule, we should prefer to procure our seeds separately and mix them ourselves: for this we should expect to have more to pay at most houses, but they will be much better. Of course, in all such strictures about seeds, we mean them to apply only to those who are not sufficiently particular to keep from trade tricks, or who do not observe that care in selection and mixing that would be necessary to ensure the fullest amount of success; for, as we are well aware that seeds, however old or worthless, are seldom destroyed, we should expect to have some of them sold to us if we did not look to the character, position, and judgment of our seedsman on the one hand, and be prepared to go to such, and so pay a fair price, on the other.

We will now suppose that the seed has come up regularly, and so must describe the after-treatment. In the first year it will be all-important to look after weeds: should these make their appearance, it will be well to hoe or spud them out at once before they can seed, as then the grass will not only have a better chance, but little provision will be left for weed-continuance.

In the following winter, say about January, if the weather will suit, a slight but even dressing of not over-rotten manure will act as a protection to the young plants, and provide food for their spring growth by its gradual decomposition and mixing with the soil.

Towards the latter end of February, or early in March, bush-harrowing should be employed to break up and disseminate the manure, and then the roller should be actively used to consolidate the whole; and, if the grasses have at all thrown out, the croskill will prove a most efficient implement. In the following May we should stock with sheep just thick enough to prevent any extent of seeding; and if the next year should show vacant spaces, which it would be likely to do from failure or wire-worm (the latter will be less than when corn is grown), we must re-sow, mixing our seeds with a little mixed guano and soot.

These, then, are some of the simple rules upon which to act in growing a permanent pasture; and the more rigidly they are kept to at first, the sooner and the more perfect will our meadow assume the aspect we should desire for permanency.

CHAPTER XV.

ON THE MANAGEMENT OF PERMANENT PASTURES.

However good our meadows and pastures may be, it is but natural that we should wish to keep them in good condition, and, if not so good, our object should be to improve them.

We have already adverted to weeding as a requisite in the improvement of meadow; we are equally clear upon the subject of draining. On both of these points, however, we have met with opposition. The farmer who considers that all is hay that he can get together in a rick, may look more to mass than quality, though even here we are inclined to think that if we take hay and pasture together, the more grasses and the less of rubbish we can get a field to grow, the greater will be our produce in quantity and quality.

With regard to draining, we are told that it takes the goodness out of the meadow; but if we have a meadow on clay—we will suppose lias or Oxford clay,—with only a few inches of a stiff soil at the surface, we shall find that those few inches are the only available root ground. Drain, and then we shall soon see that air will follow the water: this united, air and water will decompose plant-feeding matter never before reached.

Now, where the mistake has been made is, that from this time the herbage gets less and less coarse, and perhaps in some seasons would not produce the weight of hay; but what there is both of hay and grass would be much improved, and would become capable of carrying better stock.

The following reply[3] of Mr. Bailey Denton to some objectors to draining in Middlesex is, we think, much to the point on this important subject:—

> Mr. Denton stated that he had been recently over the estate of Lord Northwick, near Harrow, in company with the noble lord and some friends and tenants. On that occasion the question of the reluctance of hay farmers to drain the land was discussed, and the farmers said that as they always had a great deal of custom in London for hay, of whatever quality it was, they did not seek so much for quality as for quantity, and consequently did not think it worth while to drain the land for feeding purposes, although they admitted that draining made the herbage sweeter and better for cattle. The present system, under which the grass-land of the Harrow district had been cultivated for many years, alike impoverished the hay farmers and the land; and he was of opinion that if drained, the latter would produce grass of a much better quality, and equally as much in quantity. He thought a good plan would be to feed off part of the land and put the other into hay.

[3] Discussion Royal Agricultural Society, March 21, 1863.

If asked what would be our criteria as to the necessity of draining, we should say stagnant water at any time.

Plants, however, afford evidence to be depended upon; as thus take the indications of a few weeds common to wet meadows:—

<table>
<tr><td>Sedges</td><td rowspan="3">Show a want of thorough drainage.</td><td rowspan="9">Full drainage certainly required.</td></tr>
<tr><td>Rushes</td></tr>
<tr><td>Bull-pates and other coarse Grasses</td></tr>
<tr><td>Devil’s-bit Scabious</td><td rowspan="2">Perhaps partial or grip drainage may do.</td></tr>
<tr><td>Buttercups (R. acris)</td></tr>
<tr><td>Lousewort</td><td rowspan="4">Perhaps less haymaking and more manure is indicated, and draining may be done without.</td></tr>
<tr><td>Field Orchids</td></tr>
<tr><td>Cowslips</td></tr>
<tr><td>Moss</td></tr>
</table>

Now, as regards very wet meadows, it is found that they are seldom if ever manured; for, just as I was told as regards some of the low lands on the banks of the Yeo, in Somersetshire, that it did not pay to manure them; so one might easily imagine that where the land is full of water, and perhaps of moist *humus*, manure would not tend to the increase of good grass, though it might to that of thistles and buttercups.

Meadows that are sufficiently sound to yield tolerable hay are too much worked to this end, and are, we think, getting poorer. The Cheshire pastures offer a good example of the effects of greed in this matter. A century ago we feel sure its grass-producing powers were far beyond what they are now. Grass is gone in hay and bones and cheese, but for generations the farmer has gone on depasturing to make manure; but as it will be seen, on reflection, that cattle can only deposit as manure, matter which they have taken from the field and converted into manurial substance, they cannot add any new material: so then this method of restoration must fail at last. Another restoration employed in this county was that of using their salt as a top-dressing. This, as it killed all the coarse grass, and so converted it into manure, recovered the pasture, by, out of bad and rough grass, growing good ones; but this too would fail in time. Hay, the framework of growing cattle, and cheese, have gone on converting the phosphates and the bone matted of the soil into their substances, and it is now found that returning this in the shape of bones and superphosphates is rapidly effecting an improvement.

Hence, then, we would recommend less of greed in haymaking. Do not ripen the grasses too much before cutting. Don't trust to grazing for restoring the phosphates and other ingredients of the hay, but bring them in the shape of manure.

Use heavy rollers in spring to smooth and consolidate the soil; replant the roots thrown out by worms; mat the turf more thoroughly together; and crush larger but useless plants.

There is, then, less difference between the cultivation of pasture and of arable land than would at first be thought.

Drainage, acts of husbandry, amelioration of soil by rubbish of all kinds where too tenacious, manuring them by farmyard dung, or, failing this, such artificial manures as bones, superphosphates, guano, nitrates, soot, &c.,—these are the sheet anchors in the improvement of our pastures; and by these we should realize the hope of *making two blades of good grass grow where one did before*.

CHAPTER XVI.

ON THE MANAGEMENT OF LAWNS.

The homes of our fair country are so much beautified by our nicely-shaven lawns, which nowhere are so green and smooth as in “Merrye Englande,” that a few words upon their management can hardly be out of place in a treatise on grasses; we would, therefore, direct attention to the following questions connected with the maintenance of lawns in a good condition.

1. Lawns should have grasses which combine the finest possible leaf-growth with a capability of restoring growth and colour under constant cutting.

2. Lawns should be entirely free from plants other than grasses, unless we except the Dutch clover.

3. Lawn grasses should possess the property of intimately weaving one with the other.

4. After cutting, they should grow as near the same height as possible.

Fig. 22 (*bis*). Sheep's Fescue.

1. *Fine Lawn Grasses.*—The annexed engraving (*Festuca ovina*) represents one of our finest-leaved grasses; it is one, too, that will even bear the constant nibbling of sheep without losing either its vitality or its colour. This, and a larger variety called the *F. duriuscula*, are two forms of this genus well adapted for lawns.

If to these we add the *Lolium perenne*, *Poa pratensis*, and *Cynosurus cristatus*, we shall have nearly all the useful lawn grasses. As regards *Poa pratensis*, we should, however, leave it out where we have borders cut in the turf, as its creeping underground stems are mischievous, from their habit of getting into the borders with the flowers. This, of course, would lead us to discourage any couch-like grass. If, then, we have plots, and the soil of the lawn be sufficiently moist, we should recommend *Poa trivialis* to be sought in its stead.

Something like uniformity of colour is desirable; as, if we see bunches of the silvery-leaved Soft Grass, or the brown patches of the *Fiorin*, it is so unsightly that we should feel the necessity of introducing a new turf where it occurs.

2. *Lawn Weeds.*—Plantains, dandelions, and daisies can only be considered weeds whenever they occur in grass, but especially in the lawn. They are easily guarded against, if in laying down turf we only choose clean specimens, or in laying down seeds we obtain pure samples, and sow them on well-cleaned ground. But however careful we may be, we shall be sure of a few weeds. These can be kept under by cutting them out with a knife, taking care to drop a pinch of salt on the crowns that we leave behind; and then, if we use a little fine lawn-grass seed to the vacant places, and well roll after the process, we shall certainly keep them under. This should be done in spring, and not in autumn, as we shall then be more certain of success, upon the principle before explained.

If, despite all we do, a few crowns still send up shoots, our mowing must always be frequent enough to prevent their seeding; and as in the height of summer, seeding, in the case of all three of the plants, will take place in a few days, such neglect as our own lawn once got when we were away for a month's vacation, in not being mowed sufficiently often, may take years to remedy.

3. *The Mixture of Grasses* is secured by constant mowing and rolling, by which means anything like a wild method of grass-growth is avoided. When, however, a lawn is left for a long time without such careful treatment, some of the grasses are sure to stool out and grow bunchy. In this case, the quickest way of putting the matter to rights will be to remove the offending tufts, and introduce new turf, taking care to keep the whole in order by the scythe and the roller.

Talking, however, of these implements of lawn-culture reminds one to remark that with some the scythe and roller are almost discarded, at least in summer. Our own lawn is rolled with an iron roller during the winter and early spring; but when mowing begins, we prefer the new lawn-mowing machines. We have now used one of Samuelson's for four years, and it has not cost us a single sixpence for repairs; a strong boy can use it, and it possesses the advantages of cutting close and evenly, collecting not only the cut grass but scattered leaves as it goes, and, withal, most completely rolling the turf at the same time. We are, too, not awoke by scythe whetting at four o'clock in the morning, to secure the dew upon the grass, as the dry part of the day is perhaps the best for the use of the mowing-machine.

There is, then, no excuse for weeds or bunchy grass with a mowing-machine, as the whole operation, as here described, is done in less time than was formerly occupied in the scythe in mowing alone.

4. *Evenness in height* is a matter of importance for the lawn; for if we have grasses together, some of which make three inches of growth while the majority are growing but one inch, the whole look uneven and ugly.

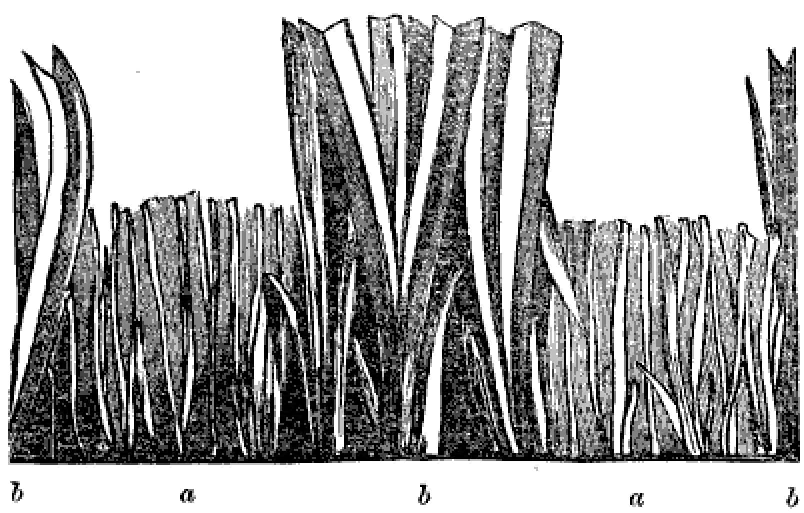


Fig. 31. The Taller Grasses.

The annexed cut (fig. 31) shows the effects of this, the taller grass being a root of cocksfoot, which is not only bunchy, but its leaves are too broad for a good lawn grass, and it grows twice as fast as the smaller species (*a*); its colour, too, would be so much lighter than that of the surrounding herbage as to be at once visible, and to strike one as a great blemish. Here, again, the offending patch should be removed, and better turf introduced, which operation should be performed in the autumn if possible, so as to have the full benefit the following summer.

These points in the cultivation of lawns are more particularly applicable in the process of laying down lawns with cut turves, which is the usual practice, and especially when an immediate effect is required. In this case, then, it cannot be too strongly urged that much trouble and expense may be saved by choosing the finest turf for our purpose; and the trouble of picking out an objectionable grass or weed before laying down will be amply rewarded.

If it be thought desirable to sow grass seeds to get a lawn, we would propose the following mixture:—

5. *Proposed mixture for lawns, cricket-grounds, bowling-greens, &c.*

Botanical Name.	Trivial Name.	Quantity Per Acre.	
		lb.	oz.
Lolium perenne	Perennial Rye	25	0
Festuca duriuscula	Hard Fescue	4	0
„ ovina	Sheep's „	2	0
Poa pratensis	Smooth Meadow	1	8
„ trivialis	Rougher „	1	8
Cynosurus cristatus	Dogstail	7	0
Trifolium repens[4]	Dutch Clover	8	0

[4] As some people object to Clover in a lawn, we should add a little more Sheep's Fescue in its stead.

These seeds should be sown upon clean, well-pulverized, and smoothly-rolled ground, and the garden roller should be actively employed from the time the grass seeds have well come up until they are fairly established, when, if mown the second year with the machine, its rolling will be sufficient.

Occasionally there will be bald places in parks, such as some of the worn spots in Hyde Park, which it would be advisable to provide seed for, that should have an immediate effect. In this case we should mix a small quantity of the *Poa annua* with the above, as it not only effects the object of making the whole look green very quickly, but so small a grass scarcely interferes with the growth of the more permanent species, which would meanwhile be making their position, and so ultimately drive out the annual.

It now only remains to point out that the constant mowing of lawns, although it only takes away young grass, must in time have the effect of impoverishing the lawn. In such case, the grass will not be of so bright a colour as formerly, and it will become more or less mixed with moss. In this state of matters the grasses die, and different species of agarics live upon the decaying roots.

In this condition we find that colour and fertility are restored by a good sprinkling of soot, which usually operates very beneficially for four or five years. After this period a little guano, say one part to three parts of soot, will do better. Another method of restoring fertility is that of an occasional use of house slops, diluted with five parts of water; this showered evenly from a watering-pot, engine, or hydropult, usually has a most beneficial effect.

In concluding this subject of "How to Grow Good Grass," the author would wish to impress upon his readers the important fact, that as our country is so peculiarly adapted for the growth of pasturage, and as this interesting genus of plants furnishes the best kind of herbage, so then the grass tribe is deserving of the most careful study of the home-producer of MEAT, MILK, CHEESE, and BUTTER.

NOTE.—Belcher's Plantain Extractor and Turf Inoculator will be found a most efficient implement in extracting plantains, and preparing good turves to fill up the holes. We fancy, too, that it will be found useful in laying down land for permanent pasture by a system of inoculation, but await the result of experiments before stating more positively.—*The Author.*

E.B. 1769.

Trifolium repens. White Clover.

HOW TO GROW GOOD CLOVER.

CHAPTER XVII.

ON THE NATURE AND PROPERTIES OF THE CLOVER FAMILY OF PLANTS.

Clovers are admitted by all to be such important adjuncts to the fodder plants of the farm as to render a scientific and practical treatise upon them and their allies a matter not only of interest, but of general agricultural utility; for, if we except the grasses, perhaps no natural order of plants is of greater value to the farmer than that to which the clovers belong; for, though they differ in every point of their structure, yet in their farm products they offer an interesting analogy. Thus, whilst in the Graminaceous plants we have cereal or corn-seed products, and meadow and pasture herbs, in the Leguminous plants we have a seed-producing group termed pulse, and a herb-growing green-food or fodder series. On either hand, in both groups, there are differently-cultivated forms; for, while the grass-cereals are wholly the result of arable culture, the fodder grasses are for the most part grown under conditions distinguished by the farmer as pasture. So of leguminous plants, pulse, such as peas and beans, belongs exclusively to the arable part of the farm; but the fodder kinds, as clover, either mix with the grass of the meadow, or are grown by themselves or with grasses in shifting green crops: indeed, it is by reason of clovers eking out grass, or being used as pasturage, that they have come to be designated “artificial grasses.”

The tribe of plants under review forms an exceedingly natural group, which has been named *Papilionaceæ*, from the fancied resemblance in the arrangement of its flowers to the form and varied colouring of butterflies: by others it is designated *Leguminosæ* from the two-valved seed-pod, which by the botanist is termed a *legume*,—most perfect examples of which are seen in the fruits of our more ordinary pea and bean.

Though the flowers of the group are infinitely varied in size and in colour, yet they afford most permanent characters in their irregular petals, which, after all, have the same parts in the variously coloured and showy sweet-pea as in the most minute clover; so that, once examine the pea or bean, and the significance of the name of the order depending upon the flowers, will be easily understood. Again, varied as is the seed-pod, yet a little examination will show that its type is simple, there being no structural difference between the straight legume of the pea and the spirally-twisted one of the lucerne and medicks, or the many-seeded smooth pod of the common broom and the single-seeded wrinkled pod of the sainfoin.

The seeds, again, may vary in colour; some, like those of the scarlet-runner, are curious as affording an infinite variety of self-colours for their different sorts, from pure white to absolute black; or these may be so pencilled as to make a *testa* or seed-covering as variously mottled as are the eggs of some of our birds. Yet, whether rounded as in the pea, flat as in the bean, lenticular as in the lentil, or kidney-shaped as in the clovers, they are all readily referred to one group by the flat, oval eye (*hilum* of the botanist), and the fact of their ready capability of separating into two valves (*cotyledons*), so observable in our split peas and beans.

But of all the varieties in their parts presented by the pea-flowered tribe of plants,—if we except the fact that some are larger trees, as the locust tree, ebony, laburnum, &c., whilst some are among our smallest plants, as clovers and medicks,—the principal differences will be found in the foliage. The grass vetchling, for example, is so named from its leaves being not unlike those of grasses, while the yellow vetchling, in its mature state, has the whole leaf converted into a tendril and the appendages at the bases of the leaves (*stipules*) are so enlarged as to be often mistaken for leaves: in another of the vetchlings, the everlasting sweet-pea, we find that, as so much of the leaf is converted into tendrils to enable this handsome plant to climb over the hedges and thickets, the stem is made four-winged with leaf-matter, to ensure the due performance of the leaf function. Now parts called stipules are present in this whole tribe, and, like all other parts of these plants, they vary in form, size, and markings, and hence afford important aid in the discrimination of species. Again, the old furze-bush will have its leaves converted into spines, though the seedling started with a trifoliate leaf. Points like these, however, though most interesting to the student of vegetable physiology, are beyond the scope of the present work.

Like every other point connected with this interesting natural order of plants, their uses and properties are greatly varied, and perhaps variable. The Sennas are renowned for their medicinal properties, being in some kinds aromatic and purgative. A powerful aroma is given off from the Melilots, similar to that of the well-known sweet vernal grass (*Anthoxanthum odoratum*), on which account it has been recommended to mix a little of their seeds with clovers, or to cultivate separate patches of either the white or the yellow Melilot to place here and there, sandwich-wise, in the clover hay-rick.

In speaking of this matter of flavour in food for cattle, we may here mention that the seed of one of this order, which is now being extensively employed for its flavouring principle, is the Fœnugræc (*Trigonella fœnum-græcum*), which was formerly used in large quantities by horse and cattle doctors as an ingredient in drenches or drinks for horses, cows, and pigs. Latterly, however, it has been still more largely employed as a flavouring matter in the different kinds of "Cattle Feeds."[5]

[5] We have cultivated these seeds in England, and found them to ripen very well, and if the flavouring of food be correct in principle, the seeds might readily be ground with feeding stuffs, while the dried plant could be mixed with hay and straw in chaff.

Now, whether medicinal properties reside as a rule in all of the order, it would perhaps be difficult to determine; but, as we sometimes find that certain clover crops are accused of causing "scouring," there is perhaps reason to conclude this, but that its amount varies according to season, soil, and cultivation.

CHAPTER XVIII.

ON THE FARM SPECIES OF CLOVERS.

All the true clovers belong to the genus *Trifolium*, of which the following may be tabulated as agricultural species:—

(*Flowers red or purple.*)

1. *Trifolium pratense*—Broad-leaved clover.
2. *Trifolium medium*—Zigzag, or true "cow-grass" clover.
3. *Trifolium incarnatum*—Carnation clover.

(*Flowers pink.*)

4. *Trifolium hybridum*—Alsike clover.
5. *Trifolium fragiferum*—Strawberry-headed clover.

(*Flowers white.*)

6. *Trifolium repens*—Dutch clover.

(*Flowers yellow.*)

7. *Trifolium filiforme*—Suckling clover.
8. *Trifolium procumbens*—Hop clover.

1. *Trifolium pratense*—Meadow or broad-leaved Clover,—in its wild state, is too well known to need any lengthened description in order to its being understood. A careful examination of field specimens, however, will show that, even in the wild state, this plant is liable to run into numberless variations; thus, we may have the leaflets of one plant more or less ovate, whilst those of another may be broad and almost obcordate. In some we may see dense heads of purple flowers, varying in shade until almost white, whilst less dense heads of flowers and general variations in height, size, and luxuriance of the whole plant, are all circumstances in the natural history of this species in the wild state which will prepare us duly to understand the nature of the many forms of the plant which are found in cultivation. Of these we have, besides others, English, French, American, and Dutch sorts, which differ in such minor details, as a greater or lesser hairiness, or variations in the colour and size of the flowers, leaves, &c. The most important point connected with the broad-leaved clover is its permanency; some sorts scarcely maintaining a plant for two years, whilst others are said to be more or less perennial. This, however, is a matter which we conceive depends more upon the soil and the kind of cultivation than upon the sort; for, although all seedsmen supply two sorts, namely, *Trifolium pratense* and

Trifolium pratense perenne, yet they run so much the one into the other, that it is oftentimes exceedingly difficult to distinguish them.

In order that the reader may see the differences and agreements of the three sorts,—1, *Trifolium pratense* (of the meadow); 2, *Trifolium pratense* (the arable plant); and 3, *Trifolium pratense perenne* (also of the arable),—we give their characters in parallel columns, on p. 115.

CHARACTERS OF CLOVERS.

1. *Trifolium pratense.* From a Natural Pasture.	2. *Trifolium pratense.* From Messrs. Sulton's Trial Grounds.	3. *Trifolium pratense, perenne.* From Messrs. Sulton's Trial Grounds.
Heads of flowers dense, proceeding from two leaves by a very short stem, of from 50 to 80 sessile florets of a more or less lilac or pink colour.	*Heads of flowers* dense, with from 70 to 120 sessile florets.	*Heads of flowers* somewhat lax, with from 50 to 100 florets, proceeding from leaves by an evident stem.
Calyx of 5 fine ciliated teeth—the lower of which is the longest—about half the length of the flower.	*Calyx*, much as 1.	
Corolla, Standard with a long straight tube.	*Corolla*, much as 1.	
Leaves trifoliate, more or less hairy; leaflets ovate, either broadly lanceolate, or notched at the apex; all having a more or less triangular white marking in their centre.	*Leaves* of 3 leaflets, more or less ovate, with the white triangular marking 3 times the size of 1, but less hairy.	*Leaves* of 3 ovate leaflets, with less distinct triangular spot than 2, clothed with silky hairs.
Stem solid, channelled or angular, purple.	*Stem* sometimes fistular, more or less channelled or ribbed, mostly free from hairs, purple upwards.	*Stem* variable, sometimes fistular mostly quite round and smooth sometimes; but not generally hairy.
Root descending, but considerably branched.	*Root* tapering with lateral branches.	*Root* as 2.
Whole plant more or less clothed with silky hairs.	*Whole plant*, smooth, compared with 1, still more or	*Whole plant*, remarkable for its hairy leaves and generally

	less hairy.	smooth round stems.
Height from 5 to 8 inches.	Height 16 inches.	Height 18 inches.

Now, although the study of the characters, as here laid down with the specimens in our hand, may render it tolerably easy to distinguish the three forms here described, yet it must be confessed that whether we examine a series of the wilder plants from different positions, or different samples of the cultivated broad-leaved clovers, we shall find great variations; the principal of these will be discussed in another chapter: we may here, then, for the present leave this difficult subject of how to distinguish cow-grass and broad-leaved or red clover, with the observation that the common red clover is uniformly in flower two or three weeks before the other.

2. *Trifolium medium* (see Plate)—Zigzag Trefoil—gets its English name from the peculiar bends in its stem, which being at alternate sides, make up the zigzag outline. The stems are rounded—not channelled,—mostly of a purple colour, and clothed with short hairs. The leaves are smooth, with elliptical—not emarginate—leaflets, sometimes, but seldom, with the white lunulate spot. The calyx is smooth. The heads of flowers are solitary, on very short footstalks; they are of a bright pinkish red hue, and not of the lilac colour of the common clover.

Trifolium medium.   Zigzag Trefoil.

In its wild state the zigzag clover will be found in districts remarkable for the absence of lime, such as the sandstones. In the sandy deposits accompanying the coal in Wales, as also in Staffordshire, this is the prevailing form of clover. Hence, then, this species seemed to recommend itself for sandy lands, in which the common clover does not so well succeed; and we conceive that, as a consequence, it was brought into cultivation for this capability of “holding on” to such soils, which, if they will not grow the other kind, is considered clover sick. We have reason to think that the *T. medium* and *T. pratense* are not distinct species, but that the difference in their usual habitats has determined their difference in form, and we think that the *T. pratense perenne* of the seedsman is a form intermediate between the two: if so the position of the three may be expressed as follows:—

Trifolium pratense. *Trifolium medium.*
Trifolium pratense perenne.

At all events, if this plant was ever distinct in cultivation, it has merged into broad clover forms; so that, if we are to possess it as a separate plant, it must again be grown from wild seed, and then, if it is to be kept pure, it must not be cultivated on clays or limestone, or, if our view be correct, it will soon lose its true distinctive characters.

3. *Trifolium incarnatum*—Annual Carnation or Crimson Clover—is a large species with oblong heads of flowers of a fine carnation colour, hence its common name of "Carnation Clover." It is a native of Southern Europe, and is said to have been found wild at the Lizard, in Cornwall. As a cultivated plant, it has not long been introduced into England, where it has been much grown in the southern counties, as there it can be sown soon enough on the wheat stubbles with only just a simple harrowing-in, when it has time to make a plant sufficiently strong to resist winter; this soon makes growth in the spring, giving an early feed, or it may be mown; in either case it is off the land sufficiently early to allow of a late sowing of turnips: so that, where the climate will allow of it, we may snatch an intermediate crop by means of the carnation clover. It yields a large crop, but its feeding qualities, according to Dr. Voelcker, are somewhat inferior to those of the broad-leaved clover. It should be noted that varieties having white flowers are in the market, and of both red and white there are earlier and later sorts which may be useful for succession.

4. *Trifolium hybridum*—Alsike Clover—has, perhaps, got its specific name from possessing appearances and qualities intermediate between the broad-leaf and the Dutch clovers. This species has been introduced from Sweden, and its growth, duration, and feeding qualities certainly entitle it to rank high, and more especially for growth on some of the stronger soils. In our experience we have not found it to possess such eminent perennial habits as

have been claimed for it. It thins very much after the second year, and almost disappears in three years, unless it be renovated by being allowed to seed, when the new plants by no means attain to the vigour of their parents.

5. *Trifolium fragiferum*—Strawberry-headed Clover—has been named from the strawberry-like form which its head, of enlarged coloured calyxes, assumes after flowering; its flowers are pinkish, but otherwise of much the same size and form as those of the Dutch clover, which latter it again approaches in its creeping habit and form of its foliage. It is, however, here mentioned only to point out the difference of its habits and indications when compared with the Dutch or white clover. The strawberry trefoil is a native of cold wet pastures, such as bear the name of "hungry clays;" when present in quantity it is not to be confounded with Dutch clover, which would indicate a sound fertile soil.

6. *Trifolium repens*—White Dutch Clover—is a plant of very general cultivation, both at home and in the States, and in both of which quarters of the globe it maintains its character with great constancy.

Dutch clover is a valuable pasture plant either in meadows or in seeds. In the former it is much increased by the addition of nitrates, soot, &c., with guano or superphosphate. As a plant, in seed mixtures, it is usually sown with other trifoliate plants and rye grasses, but if the soil be very light the Dutch clover may be increased or wholly used.

7. *Trifolium filiforme*—Small Yellow Clover—is one of the least of our small yellow-flowered division. It is a common native species occurring on the waysides, and has been brought into cultivation to only a limited extent, under the impression that its small herbage is suitable as a first bite for young stock, and hence the term "suckling clover" has been applied to it. It is of little value, and does not seem capable of being greatly improved. This species is often mistaken for the following, even by pretended botanists, but its lax head of smaller flowers will well distinguish it.

8. *Trifolium procumbens* is called by the botanist "Hop Trefoil," from the fact that its dried head of persistent flowers[6] exactly resembles small bunches of hop *strobiles* (fruiting heads). The foliage is much like that of *Medicago lupulina*, nonsuch, or black medick, which is the "hop" of the farmer; but the whole plant of the true hop trefoil dries up so quickly under

the sunshine, and is withal so wanting in succulency and quality, that it cannot be compared with *M. lupulina* as a fodder plant, and hence it is but little cultivated in the present day.

[6] Flowers are so called that remain enveloping the seed while it ripens, which they do in all the clovers.

There are other clovers which have been recommended for cultivation, but they are mostly foreign, and do not appear to possess those qualities which should lead us to prefer them before those in common use. There are, too, several additional wild clovers, but they possess no agricultural interest, unless, perhaps, as indicators of soil. The *Trifolium pratense* (Hare's-foot Trefoil) is a pretty, wild species, native to light sandy soils, the seed of which is sold for growing "bedding plants."

CHAPTER XIX.

ON THE VARIETIES OF RED CLOVERS.

The *Trifolium pratense* of botanical authors is remarkable for the great number of varieties it assumes, even in its wild growth; but these are exceeded in the number of cultivated forms: thus in any rich meadow we may make out several sorts which may be expected to be more or less permanent, whilst the market samples of seed will offer us several varieties for the different countries of America, England, France, Holland, Germany, &c.

The following are some of the more prominent of our native wild varieties:—

1. *Trifolium pratense*—Common Red Clover.—Head of pink; flowers, somewhat compact; leaves more or less broad; plant smooth[7] in proportion to its size, the smaller wild specimens being usually very hairy; stem more or less purple.
2. *Trifolium pratense*, var. *pallidum*—Pale-flowered Clover.—Head of very light pink; flowers large, full, and more rotund than 1, and almost double in size and in the number of its flowers; whole plant more or less hairy; stem green.
3. *Trifolium pratense*, var. *album*—White Clover.—Flowers white; herbage a very light green; in other respects much the same as the last.
4. *Trifolium pratense perenne*—Perennial Red Clover.—Flowers less compact than the

common clover, whole plant having stems inclining to dark purple; leaves narrower.

[122]5. *Trifolium pratense perenne*, sub-var. *pallidum*—Pale Perennial Clover.—A larger plant than the parent form, and less hairy.

6. *Trifolium pratense perenne*, sub-var. *album*—White Perennial Clover.—Not common, but still, like 3, an albino form, and is, perhaps, more delicate in constitution than the coloured sorts.

[7] In this, as well as the generality of forms, the smoother and larger growth indicates cultivation, manuring will sometimes make the difference.

Now, it appears to us that the descendants of the two types, *Trifolium pratense* and *T. medium* (see Plate) form the basis of the red or broad-leaved clover on the one hand, and the perennial or cow-grass clover on the other; whilst the market varieties have, perhaps, been modified by climate, soil, and probably hybridization with other sorts. It may, indeed, be that, after all, the plants described in chapter XVII. as two distinct species are only varieties, for though the common form of *T. pratense* grows everywhere on mixed soils, the more sandy positions, as the sandstones connected with the coal in South Wales, offer a greater abundance of the *T. medium*; and, from experiments conducted with seed of this latter obtained from near Swansea, Glamorgan, and sown on forest marble clay of the Cotteswolds, we certainly obtained plants differing very much from the typical form of *T. medium*, and assuming the usual broad-leaved clover variations.

Here, then, is opened up a curious subject for inquiry, which the history of the seed trade as it relates to clover-seed may tend in some measure to elucidate. Some few years ago *T. pratense* and *T. medium* were advertised as on sale by most seedsmen; in fact, the latter was the name by which what is now called cow-grass clover was known. Now, however, it is doubtful if any seedsman would pretend to send out the *T. medium*; but the label *T. pratense perenne* has been substituted for it.

Sinclair's figure of "Trifolium medium, marl-clover, cow-grass," in the "Hortus Gramineus Woburnensis," facing page 141, is scarcely a true form of the plant, as its more or less emarginate leaflets incline to the form of *T. pratense*; and yet, at the time this author wrote, even this was doubtful. *T. medium* was difficult to obtain, as he says, "All the seeds and plants I have had for this (except that from Messrs. Gibbs & Co., which proved to be the present plant—*T. medium* of Sinclair) have turned out only two-year lived plants, or never exceeding three, though cultivated on various soils." We have repeatedly written for seed, and ten years ago were always supplied with samples so labelled; but in no case did we get it. Latterly seedsmen honestly confess that they have not the seed, but can send *T. pratense perenne*.

Now, that this latter is merely a variety of the broad-leaved clover there can be but little doubt; still the fact that it is usually more perennial in its habit is of importance. We may easily understand why it should be so, if we consider that the common broad-leaved clover in its cultivation is so much earlier than the cow-grass form, so that this enables two cuttings of the former to be made in one season, two crops of hay being taken very commonly indeed; and as the plant gets well in flower before it is cut the first time, and seed is saved from the second crop, a more exhaustive plan for the crop itself or its future perennial powers could hardly be brought about. The cow-grass clover, however, is a fortnight and more later, which renders it difficult to cut two crops; and so its method of growth is not so exhaustive. We know that the common wild clover is said to last only two years, but with constant depasturing we see no reason why the same roots should not send up herbage for five or even ten years.

However theoretical such inquiries may be deemed, yet it must be confessed that they are of great practical importance; for, if a plant has a tendency to run into varieties, it makes it daily more difficult to get its seed true to sort; and if we are liable to have a sample, part of which may be less hardy or part more tardy in its development, it follows that much of it may never arrive at maturity, whilst if it does, as the crop will be uneven, it can never be reckoned upon for so good a yield.

Much of the variable nature of the sorts which we observe in a clover-field may be the result of the mixing of seeds from different and distant localities: if so, it is much to be regretted. But this only tends to show us how important it is that seed should be grown with care, to which end, as regards clover-seed, we sadly want some well-conducted experiments on different varieties, especially of a wild native plant, with a view to obtain a sample with good, permanent, and even qualities. In fact, the question of true of sort is altogether different from that of purity of sample; but that very serious mischief arises from the want of the latter will be discussed in another chapter.

CHAPTER XX.

ON THE CLOVER ALLIES.

Besides the clovers proper, there are many native plants of the same natural order that have been found useful as fodder: these it is now proposed to comment upon, premising that as we have had them all under cultivation, we are enabled to discuss their merits from a practical point of view.

Of these, the following is a list of the genera:—

I. ULEX.—A spinous shrub.
II. ANTHYLLIS.—Flowers in a dense head, with white expanded calyces.
III. LOTUS.—Flowers in lax heads; pod straight, many-seeded.
IV. MEDICAGO.—Flowers various; pod spirally twisted.
V. MELILOTUS.—Flowers in spikes, drooping to one side; pod straight, few-seeded.
VI. ONOBRYCHIS.—Flowers in spikes, drooping; pod wrinkled, one-seeded.
VII. VICIA.—Flowers single or spicate in the axils of the leaves; pod straight, many-seeded.
VIII. LATHYRUS.—Flowers one or many on long footstalks.

I. ULEX—*Furze.*

A genus of shrubby, spinous, pea-flowered plants, by far too common on our sandy heaths and wild hilly places, with varieties occupying wet commons.

We possess, according to authors, some two or three native species; but we incline to the belief that they are only varieties of the common *U. Europæus*, of which these seem to be large and dwarf forms. This plant, under the name of furze or gorse, has been from time to time highly extolled as a fodder plant, and machines have been invented for bruising its complicated spines; but although it will doubtless grow where scarcely anything else can be got to succeed, yet, taking into consideration the expense attendant upon its growth and utilization, and the low feeding powers which it possesses, we cannot at all agree in recommending its general use. It is, however, but right here to say that articles are from time to time inserted in such journals as the *Agricultural Gazette*, the authors of which advocate the growth of furze as an agricultural plant, and highly extol its feeding qualities; still, as our own experience would lead us to conclude that as even young stock scarcely hold their own upon this plant, we cannot recommend it as possessing very valuable properties.

II. Anthyllis—*Ladies' Fingers*.

The *Anthyllis vulneraria* is well distinguished in its young state from its sometimes entire lancet-shaped, at others pinnate leaves, growing close to the ground. These are usually clothed with long hairs, and it has expanded downy calyces, when full grown. In its young condition it has been very much extolled for sheep pasturage, while its hay is said to be abundant and nutritious, though grown on the very poorest of soils. That it will grow more upright where sown, one plant drawing up another, we know from experience, but we have little faith in any very superior qualities being found in plants that can grow so well under extremely poor conditions of soil; still it is just possible that its herbage may improve in quantity and quality by liberal treatment; yet we must conclude that, as we already possess much better plants for growing on better soils, we do not think much can be gained by its cultivation.

As a plant for hay it will yield a good cut, but its extreme hairyness and general want of what the farmer calls "proof" will never allow this plant to be extensively grown.

III. Lotus—*Bird's-foot Trefoil*.

This plant is well known by its loosely-packed heads of bright yellow flowers, which are succeeded by long slender pods, dark-coloured or even black when ripe, and not inaptly likened to a crow's foot; and hence the name "Crowsfoot" which it commonly bears. We have three species, as follow:—

1. *Lotus corniculatus*—Common Bird's-foot Trefoil—is common, especially in dry meadows, in which its herbage is duly appreciated by sheep and cattle, if one may judge from the pertinacity with which it is kept down. It is no bad adjunct to the rick. We are so convinced of its value as always to recommend its use in the laying down of light land for permanent pasture, and a little seed sown in old meadows after a dressing of rubbish—old mortar, town refuse, &c.—will tend greatly to the improvement of the herbage.

2. *Lotus tenuis*—Slender-leaved Bird's-foot Trefoil—is, perhaps, only a variety of the former; it is, however, smaller in all its parts, and, though a denizen of stiff soils, occurs chiefly in a wild state on the margins of fields and on hedge-banks. It might be employed under the same circumstances as the *L. corniculatus*, especially in thin clay-beds on upland brashes; but it hardly possesses such good qualities.

3. *Lotus major*—Larger Bird's-foot Trefoil—is much larger in all its parts than the other species. It occurs in moist situations, about bushes in wet land, in ditches, watercourses, and damp places generally. We have experimented upon the growth of this plant in artificial meadows, and from the size which it attains quite early in summer, and the quantity of wholesome keep it is capable of affording, we are disposed to think well of it as an occasional shifting crop, or it might be well combined with rye-grass in deep stiff soils.

IV. Medicago—*Medick, &c.*

This genus is principally distinguished from *Trifolium* by its twisted seed-pods, which in the *Medicago maculata* (Spotted-leaved Medick) form quite a spiral coil, ornamented with a double fringe of stiff spines. This plant is now becoming general as an agrarian weed, having been greatly spread, owing to its intermixture with foreign seeds of different kinds.

The agricultural species are:—

Medicago lupulina—Yellow Sickle Medick.—"Hop trefoil" of the farmer, but not of the botanist, who gives this name to the *Trifolium procumbens* (which see). From this latter the medick is easily distinguished by its heads of naked, blackened, incurved seed-vessels. As an agricultural plant it is of great value, especially in mixtures called "seeds." It is a good adjunct to rye-grasses and common clovers, especially on light soils; but on good strong land which will bear a full crop of broad-leaved clover it would be mostly smothered out, and, if not, as we think it is properly held to be less nutritious than clover, its use is not recommended where first-rate clover crops can be grown.

We have seen this trefoil grown with sainfoin to great advantage, as it yields a tolerable crop for the first two years, and then declines, just as the sainfoin has got possession of the soil.

2. *Medicago sativa*—Lucerne—is a perfectly perennial plant, which, though not so much grown in England as it deserves, yet scarcely needs description; however, its purple flowers and smooth twisted seed-pods serve to distinguish it from the rest of the genus. We have grown this plant upwards of a foot high by the 1st of May, and taken no less than three cuttings of a good succulent herbage in one season. These qualities point out lucerne as an excellent green-food plant, for which purpose we should always, where practicable, recommend that at least a patch should be grown near the stable, as there is reason to believe that its alterative effects upon the horses are of a most salutary kind. It should be cultivated in drills of from 15 to 18 inches apart; and, if properly weeded and not let get too old before cutting, it will last for many years with an occasional dressing of manure.

We once had a patch one half of which was purposely neglected by way of comparison with the other half, which was well cared for; that portion left to itself yielded but poor crops, and almost disappeared at the end of four years, whilst the other portion scarcely began to decline after ten years. This remark applies with full force to all the green-food crops of this order. Weeding early, mowing when cut, and an occasional top-dressing, would increase the durability of all the perennial species.

V. Melilotus—*Melilot*.

These are pea-flowered plants, with ternate leaves, and spikes of flowers drooping to one side: it is named from *mel*, honey, in allusion to its flavour, and the genus *Lotus*, by which we may understand it to be a sweet-scented lotus-like plant. We have two native species, distinguished thus:—

Melilotus officinalis, an annual, with yellow flowers.

M. leucantha, a biennial, with white flowers.

Of these we may conclude that the flavour, which is like that of the *Anthoxanthum odoratum*—sweet vernal grass—is too strong and bitter to allow of its being recommended for culture alone; but we are inclined to think that, if grown in small quantity with seeds, or if a separate patch be cut and arranged sandwich-wise in the seed-rick, the melilots would give that sweet flavour which seems to be the principal cause of the superior qualities and sweetness of natural meadow as compared with artificial grasses.

Seeds have been forwarded to us of what is named "Cabool Clover," and another packet labelled "Bokhara Clover," both of which appear to belong to the *M. leucantha*, though certainly of a larger form than our native species, and probably consisting of the *M. leucantha major*. This latter must be cut young if used as recommended, as it soon gets woody. A correspondent of the Royal Agricultural Society has recently recommended the full-grown plant for paper-making; and, if of value for this purpose, we can affirm from experience that a large yield can be got from soils of a very inferior quality, as our experiments on its growth have been made on a very stiff and poor bed of forest marble clay.

VI. Onobrychis—*Sainfoin*.

Sainfoin, or "holy fodder" of the French, is distinguished by its brilliant spike of pink variegated flowers, which droop to one side, its winged leaves of from six to eight pairs of oval leaflets, which are entire, that is, undivided at the margin, and its short, rounded, wrinkled, and spinose seed-vessels. The forms in cultivation are—

Onobrychis sativa—Common Sainfoin. *Onobrychis sativa*, var. *bifera*—Giant Sainfoin. Of these the former has the preference in England, whilst the latter is much grown in France. Our experiments with both lead us to conclude, that although the former flowers but once and the latter twice in the season, the *O. sativa* still gives the greatest amount of food, as the second crop of the giant sort is usually poor and straggling, with but little leaf; while the common sort sends up a thick growth of leaves after being cut.

The *O. sativa bifera* is but a variety of the *O. sativa*, as by long continuance of growth from the same seed in this country it reverts to the common form; and hence the giant sort should be frequently renewed from an imported stock. Sainfoin has been much cultivated on calcareous soils, more especially on the free-stones of the oolite rocks, and on the chalk, off which formations it is scarcely known, except on some calcareous sands in the eastern counties. In the limestone and chalk districts sainfoin is grown as a permanent crop, and formerly lasted six or eight years. In the eastern counties the little there grown is by way of a shifting crop, in the same place and manner as common clover. The permanency of sainfoin is yearly becoming greatly diminished from the circumstance that its seed is so much mixed with that of the burnet, *Poterium sanguisorba*, var. *muricata*. To such an extent does this evil occur, that we have examined samples of sainfoin seed in which there were at the rate of from twenty to forty thousand of burnet seed-pods per bushel; and when we consider that these pods have for the most part two ripened seeds, and those of a plant growing so much more rapidly than the sainfoin, we can form some notion how the desired crop is soon smothered and overpowered by the burnet, which at best is but a rank weed, of no agricultural value; for whatever of good there may be in our ordinary native salad burnet, which is a smaller and more succulent plant, this sticky foreign interloper cannot possibly have any claim to our regard.

The reason why it has gone on so long unchallenged is that the burnet-seed, though of an entirely different shape from the sainfoin, is somewhat of the same colour; and then in their growth both plants have winged leaves, and the difference between the entire leaflets of the sainfoin and the toothed leaflets of the burnet did not at first strike the farmer; now, however, the difference is better understood, and farmers begin to require that the burnet-seed shall be sifted from the sainfoin. This of course will demand the payment of a better price for the better sample, as in the process of sifting many of the smaller sainfoin seeds go through with the burnet; but this will be well worth a better price, as the larger seeds will undoubtedly tend to produce a better crop.

If, however, there should be any doubt about pure sainfoin seed, we should recommend the decorticated seed being used, as in it the burnet could not possibly escape detection.

As the history of burnet is so important in connection with the sainfoin crop, it cannot be out of place to introduce the following description of this weed:—

The *Sanguisorba officinalis* (false burnet), as a wild plant, never attains any great size, and as it is a denizen of dry calcareous pastures and broken ground on limestones, and perfectly harmless in its properties in this condition, it is scarcely noticeable as a weed; indeed, it is sometimes recommended for permanent pasture admixture on calcareous uplands. There is, however, a larger form of the false burnet, which is now attracting considerable attention, as being by far too constant an attendant upon sainfoin seed.

This plant is referred by Professor Babington and the Continental botanists to another species, viz., *Poterium muricatum*, which is by them distinguished from the *P. sanguisorba*; but is "usually larger in all its parts" (Bab.), with a larger and more decidedly four-winged fruit. We, however, agree with Bentham in considering this to be a variety only, and, in fact, an agrarian form, induced by its seed being gathered with a crop and treated as a crop plant, so that its larger form may be easily accounted for; and we are not wanting in evidence to show that, under cultivation, the *P. sanguisorba* greatly increases in size, while, if left to grow wild, the cultivated form relapses into the wilder state. But we incline to think that the agrarian burnet has got into agriculture by being introduced with foreign seeds; and as its introduction seems to have been small at first, it attracted but little notice; for as the leaves both of the burnet and sainfoin were pinnate, the difference that the botanist would observe in the leaflets, *i.e.* the former being serrate, and those of the latter having an entire margin, would hardly attract the attention of the farmer; however, it soon became so serious a matter that some crops of so-called sainfoin, in their second or third year, presented as much as 90 per cent. of burnet, and as the latter grew taller than the sainfoin, it effectually smothered it out, and in its place supplied a sticky, non-succulent, and innutritious herbage, that made farmers begin to inquire seriously about the seed.

Here, however, as the seeds, or rather the fruits, of both plants were pretty much of the same colour, and both wrinkled, samples of fully half burnet passed muster in the seed-market; and, though these fruits are so different in shape and size, yet we were astonished to find that, during the trial of an action against a seedsman for supplying sainfoin seed containing a large quantity of burnet when good sainfoin seed was paid for, the judge, jury, and most of the farmers present confessed their inability to distinguish them; it becomes, therefore, at this point, a duty to describe the two.

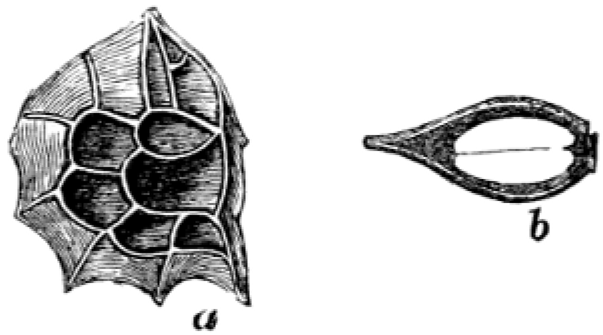


Fig. 32.

Fig. 32 *a* represents a short wrinkled pea-pod, broad at the back and thin in front, as seen in the section *b*. In the interior is a single pulse-seed, which is easily freed from its wrinkled shell.

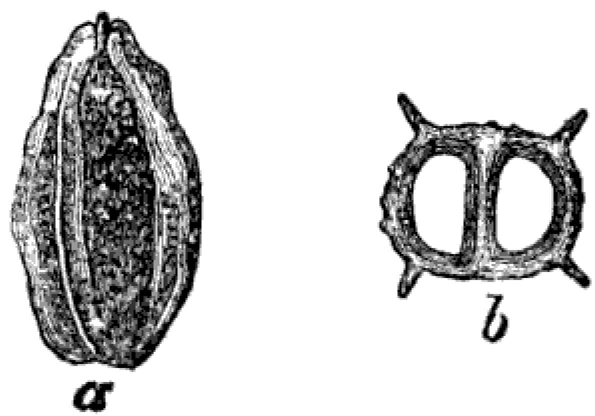


Fig. 33.

Fig. 33 *a* is a drawing of a fruit of false burnet. The section *b* shows it to be quadrangular, with a wing at each angle, and to possess two seeds in each capsule. The capsules are rather muricated (*i.e.* furnished with short excrescences, and not regularly wrinkled, like the sainfoin). Now the burnet is easily separable from a sample of sainfoin, as the former readily passes through the sieve; but the objection to sift it may be well understood when the bulk is diminished by the amount of the burnet, and also that of the smaller sainfoin seeds, which pass through at the same time.

The best plan, then, to pursue is to mill the sainfoin seed, in which case its outer covering is removed, and you simply have a sample of kidney-shaped pure seed-like enlarged clover-seeds, in which the burnet may be detected, because it will not mill, but simply gets its wings broken off, so that the wrinkled two-seeded capsule still remains.

Now the fact of the burnet being a two-seeded capsule is most important to be noticed, as, from analyses we have made of dirty sainfoin crops, we have estimated as follows:—

Crops.	Sainfoin Plant.	Burnet Plant.	Other Weeds.
Crop in Berkshire, 3rd year	10	50	40 = 100
Crop in Cirencester, 3rd year	5	25	70 = 100

Here, then, we have a large proportion of burnet, surely much more than could be accounted for from the number of capsules, at least we will hope so; but when we consider that the capsule of the sainfoin is *single-seeded* and that of the burnet is *two-seeded*, we may readily conceive how each capsule of the latter may at least grow a single seed, but the best sample of the former could hardly be expected to all come up. Now, as we have as many as 64,000 capsules of burnet in a bushel of sainfoin seed, that × 2 = 128,000 seeds, and when we consider that the burnet grows so much faster than the sainfoin, we have two elements for the success of the former, namely, the certainty of getting its crop, and the equal certainty of smothering out a large proportional of what may germinate of the seeds of the sainfoin.

This matter would not be of such importance if the burnet was equal in point of feeding properties, but it is not so, for whatever quality be in the smaller and more succulent *P. sanguisorba* form, the *P. muricatum* is, on the contrary, hard and woody, and almost useless.

CHAPTER XXI.

ON CLOVER SICKNESS.

In considering the important question involved in the term "Clover sickness," we would first direct attention to the fact that crop clover is a derivative plant which has been so *forced* that it is many times larger and more juicy and succulent than the wild plant from which it sprung. This *derived* nature (the propensity, as it were, for fattening) can only be maintained by a continuance from one generation to another of those luxuries to which the cultivated family has been accustomed; hence, then, if seed be brought from a richer soil to a poorer, or from a warmer to a colder climate, we may expect that its plants grown amid barley and drawn up during the summer would have but a poor constitution to withstand the rigours of winter; but can we in such a case say that the *land* is clover-sick, that is, sick of growing clover?

Of course the seed here supposed will grow better in one place than in another, as, for example, we have traced some American seed of broad-leaved clover grown by itself in a deep rich soil in the Vale of Gloucester, where the climate is so much milder as to be a fortnight before the elevated land of the Cotteswold Hills and producing an abundant crop; while the same forming part of a mixture of "seeds" with rye-grass and plantain on the hills, the two latter have taken possession of the soil, and the clover made no progress at all; whilst other seed, under precisely the same circumstances, has done remarkably well.

That there is much reason for these conclusions will be found in the fact that the more seed we import from warmer climates the more difficult is it found to make the land produce a plant; still importation is rapidly on the increase, because warmer climates can produce seed more certainly and in greater quantity than we can at home.

The difficulty of growing from foreign seed increases in proportion to the thinness of the soil and the backwardness of the climate, so that the elevated districts on the stony Cotteswolds just adverted to present, perhaps, more of the so-called clover-sick land than any other of like extent.

The seed of clover, then, has become more and more pampered—more the offspring of large crops from deep alluvial soils under the tropical summer heat of the south of France and the United States, where it is grown as a self-crop and not fed merely on what the corn could not carry away; and so while this enervation, or, if preferred, this civilization, of plant has gone on, we expect its seed all at once to withstand the shock of a lower temperature with constant climatal changes and cutting winds; and if it does not succeed, we say that the land is clover-sick, when, in truth, it is the seed that sickens under these new and trying conditions. As well may we say that the Northern States sicken of the negro, because he there dies out so rapidly, or that the warm south sickens of humanity, because those who are unacclimated sicken and die there.

Another circumstance which has contributed to an increased difficulty in growing clover on thin soils will be found in the farmer discarding as antiquated the practice of paring and burning, which was formerly the usual preparation for the turnip crop. In a paper on "Paring and Burning," in the 18th volume of the *Journal of the Royal Agricultural Society*, Professor Voelcker remarks:—

> The ashes produced by paring and burning are especially useful to turnips, and also to other green crops, because they contain a large proportion of phosphates and potash—constituents which, it is well known, favour in a high degree the luxuriant growth of root-crops.

Further, the learned professor closes a most able paper with the following conclusions:—

> Paring and burning, instead of being an antiquated operation, is a practice the advantages of which are fully confirmed and explained by modern chemical science.

Paring and burning, to judge from our own experience, had the effect of converting some of the hard limestone brash into lime, in which case it broke up by the influences of air and rain, and so restored the lime and alumina which mostly exist together in limestone, the former of which is quickly lost in thin soils,—so much so, indeed, that not unfrequently the whole depth of soil, even upon a limestone, will often be curiously devoid of lime, which is a necessary ingredient in the constitution of a clover crop.

Again, we should conclude that the operation under discussion, from its decomposing that dark vegetable matter called *humus*, which is always found in large quantities on some of the soils which are called "*dead*," from their inability to produce crops, and which often cause astonishment that such black, nice-looking earth should be unproductive. Now this soil, though it would favour the growth of some species of peat-loving plants, as

Ling, Heath, &c., is not suitable for clover, as the wild plant is curiously absent from peaty positions.

Professor Voelcker remarks that "the excess of undecomposed organic matters in soils is decidedly injurious to vegetation. Roots, stems, and other vegetable matters remain buried in the ground for years without undergoing decomposition, and if we attentively study the subjoined analysis of soil in the neighbourhood of Cirencester, well adapted for burning, we shall see how the *lime*, *alumina*, and *organic matter* might be beneficially affected by the process:—

ANALYSIS OF SOIL ADAPTED FOR BURNING, BY PROFESSOR VOELCKER.

Moisture	·93
Organic matter	10·67
Oxides of iron and alumina	13·40
Carbonate of lime with a little sulphate of lime	23·90
Carbonate of magnesia	1·10
Phosphoric acid	trace
Potash	·38
Soda	·13
Insoluble silicious matter	49·66
	100·17"

The ashes, however, are obtained by burning a thin slice pared from the surface of the land, so that they are derived from surface-soil and vegetable matter, the latter often yielding a sufficient amount of phosphoric acid with which to procure a crop, and, what is all important for us to consider is, that this phosphorus, the alkalies, and lime, are rendered by the burning in a state just fitted for the growth of the plants that are to be grown upon them; whereas, before the process, these ingredients were in a measure locked up, so that plants could not grow for the want of sustenance; not that it was not in the soil, but that it was insoluble. If, then, clover or any other plant had not succeeded, it would have been called "clover-sick."

The following analysis of vegetable ashes from a field in the neighbourhood of Cirencester will well repay attentive consideration, as illustrating these points:—

ANALYSIS OF ASHES FROM PARING AND BURNING,
BY PROFESSOR VOELCKER.

Moisture and organic matter	9·12
Oxides of iron and alumina	14·56
Carbonate of lime	17·17
Sulphate of lime	1·73
Magnesia	·40
Chloride of sodium	·08
Chloride of potassium	·32
Potash	1·44
Phosphoric acid	1·84
Equal to bone earth	(3·98)
Soluble silica (soluble in potash)	8·70
Insoluble silicious matter	44·64
	100·00

Now, that land so burnt and containing such ingredients would, after the process, refuse to grow clovers we cannot at all believe; but we do know that some of the land of a like composition will not grow even a crop of turnips until prepared as described; and though the taking a subsequent barley crop off before the clover would not tend to the improvement of the latter, it will be too often because the barley has taken all the available manurial matter, so that there is little left for the clover to feed upon. In such cases we have seen the clover saved by top dressing. Paring and burning had also a salutary effect upon the clover crop in the destruction which it wrought to various insect pests, and more especially the wire-worm, which now makes such increasing inroads upon our crops of wheat and barley, and so afterwards in the clover; so that bare patches, often of great extent, will be the consequence in every crop in the rotation. Now, these bare patches in the clover crop are often appealed to as evidence of clover-sickness, whilst we do not at the same time say that land is wheat-sick or barley-sick.

Insects, indeed, are yearly becoming more destructive, not only on account of the difference in the mode of farming, but greatly from the determined destruction of birds. The food of birds is in general very mixed, but at one season of the year, when they are breeding, they are most industrious destroyers of insects; but it is just at this time that they are kept from the crops, exactly when insects are working the most mischief: hence, then, as the exigencies of a small growing family become more and more pressing, birds are driven to feed their young upon seeds, fruits, buds, and other vegetable matters, as unsuitable to build up the constitution of the young bird as bread diet for an infant.

Let, however, our grand birds of prey be encouraged, instead of being shot by the keeper as vermin, or knocked over by the prowling bird-stuffer, in order to be perched up in a box for sale to some Cockney, who would fain be considered as fond of sport because his "den," perchance, contains a stuffed owl, hawk, magpie, or some other *specimen*.

On a recent visit to Dorsetshire, on our own farm, we saw a man employed to "keep the birds" from a field where several labourers were engaged barley sowing; and it is quite true that, unless he had been there, the rooks would have as industriously followed the drill as they do the plough; but, as we thought, scarcely to pick up barley in the breeding season, when there was metal more attractive in the recently-hatched *Elater obscurus*, parent of the wireworm, which were thicker than we ever saw them before, and, doubtless, the disturbance of the soil brought these and two or three generations of wireworms to the surface. Now, we do not hesitate to give as our opinion that this birdkeeper would have done more good to the barley and the succeeding clover crop by picking up a hundred or two of these beetles and destroying them than by blazing away at rooks for a twelvemonth, and this certainly might have been done in an hour or two.

Still, that some soils do get incapable of growing a clover crop is pretty certain; and it may, we think, be equally settled that this does not entirely depend upon their having been exhausted of the ingredients which analysis demonstrates clover to contain, for we certainly have seen clover succeed after the burning of so-called clover-sick land; and though there is reason to think that this result was partially due to the setting free of a fresh supply of manurial ingredients, we are still convinced that the burning out of humus or peaty vegetable matter and the destruction of insects had their share in the induced change.

Still, however much we may suppose that the failure of the clover crop is influenced by the alteration of its constitution as the result of cultivation, the presence of choking weeds, or by the presence of prejudicial ingredients, especially in thin soils, there can be no doubt that the principal cause of the difficulty will be found in the fact that the corn crop with which the clover is grown exhausts the soil, in the most unsparing manner, of the very chemical ingredients which the clover requires.

Thus, if sheep are folded on a crop of turnips, the whole of this crop is converted into a manure at once available for the grain crop, by which it is quickly appropriated and then taken away. Here, then, we may suppose at starting that the clover is half starved; and, with a constitution drawn up in the effort of the plants to obtain a glance of sunshine, and weakened for the want of nourishment, it is expected to bear our inclement winters.

This argument will be made all the clearer if we place side by side the result of the analyses of barley and clovers, and especially if we consider what a quantity of mineral matter is taken in a short time, and by a crop ripening its straw and seed.

Now, if we look at these figures we shall see how much of the mineral matter required for the clover has been previously abstracted by the barley, and if at the same time we reflect that this robbery may, and too often does, co-exist with the other causes which we have instanced as tending to clover-sickness, we should no more call land sick of clover because it will not bear this crop under our exhaustive system of cultivation than we should call a barren sand wheat-sick for refusing to grow corn.

ANALYSES OF BARLEY AND CLOVER.

	PLAYFAIR		WAY.	
	Barley Grain.	Barley Straw.	Red Clover.	White Clover.
Silica	28·97	46·30	3·34	3·68
Phosphoric acid	35·68	3·22	6·35	11·53
Sulphuric acid	1·22	2·61	4·18	7·21
Carbonic acid			16·93	18·03
Lime	3·06	7·59	35·39	26·41
Magnesia	8·04	3·55	11·22	8·15
	and loss	and loss		
Peroxide of iron	1·94?	4·35?	0·97	1·96
Potash	15·61	22·17	14·85	14·33
Soda	5·03	0·84	1·40	3·72
Chloride of sodium	0·45	9·37	2·36	4·94
Chloride of potassium			2·96	
	100·00	100·00	99·95	99·96

We cannot better conclude this chapter than by quoting the following from Baron Liebig's *Letters on Modern Agriculture*, so ably translated by Professor Blyth:—

> The simplest peasant has sense enough to see, and all agriculturists agree with him, that clover, turnips, hay, &c., cannot be sold off from a farm without most materially damaging the cultivation of the corn. Every one willingly admits that the sale and exportation of clover, turnips, &c., exercise a detrimental influence on the growing of corn. "Above all, let us take care to have plenty of fodder; the corn crop[146] will then take care of itself." But that the *exportation of corn* may possibly exercise an injurious influence on the cultivation of clover or turnips; that it is, above all, indispensable to restore to the soil the mineral constituents of the corn, to enable the clover or turnip crop to "take care of itself;" in other words, that in order to grow clover, turnip, &c., we must manure the land—this is a notion utterly incomprehensible, nay absolutely impossible, for most agriculturists. For, is not the clover grown for the sake of manure? What advantage, then, would there be if it were necessary to manure again to produce the clover? *This clover the farmer expects to grow for nothing.*
>
> The mutual relations existing in the order of nature between the two classes of plants are, however, as clear as daylight. The mineral constituents of the clover, turnips, &c., and of the corn, form the conditions for the production of the clover, turnips, &c., and of the corn, and they are in their elements quite identical. The clovers, &c., require for their growth a certain amount of phosphoric acid, potash, lime, magnesia,—so does the corn. The mineral constituents contained in the clover are the same as those in the corn, *plus* a certain excess of potash, lime, and sulphuric acid. The clover draws these constituents from the soil; the cereal plant receives them,—we may so represent it from the clover. In selling his clover, therefore, the farmer removes from his land the conditions for the production of corn. If, on the other hand, he sells his corn, there will be no clover crop in the following year; *for in his corn he has sold some of the most essential conditions for the production of a clover crop*.—pp. 183-5.

This discussion, then, upon the so-called clover-sickness leads us to adopt the following propositions:—

First. That the larger induced plant of our cultivated clovers has not, as a rule, that perennial constitution of the smaller wild species.

Second. Even its induced habit is much deteriorated by transportation under adverse climatal circumstances.

Third. The seed itself is often full of weeds, which, by gaining the mastery, kill out the young clover plant.

Fourth. This effect is enhanced by growing clover with barley, in which, if not smothered, it must become weakened.

Fifth. We ought not to expect to grow clover where we have taken away the necessary substances for its growth in the corn crop.

CHAPTER XXII.

ON THE WEEDS OF CLOVERS.

That clover crops are often very full of weeds every farmer must be fully aware, but few among them have used sufficient penetration to have discovered the source of most of the weed growth, not only in clovers, but in other crops: how much, then, may they be expected to be astonished if told that they cultivate weeds by sowing their seeds as carefully as they do those of their crops, and that they pay the same price for weed as for crop seeds!

In the spring of 1859 we published the results of some analyses of the weed admixtures in several samples of different kinds of clover seeds, which we annex (table 1, p. 149), adding to them some further results obtained during the present spring, 1863, by way of comparison.

This presents a formidable array of figures, as it shows how much of more than mere harmless matter is purchased and sown instead of good seed; and the fact of the mischief likely to accrue from putting so many enemies in the place of friends will become all the more plain by a careful study of the next table (No. 2, p. 150).

Now, in order to make this part of our argument still more complete, we add another table (No. 3, p. 150), intending to show the number of weed plants absolutely separated from a single square yard of old seeds taken from a field on the great oolite rock.

1. TABLE OF WEEDS IN CLOVER SEEDS.

Date.	Label.	Number of Weeds per Bushel.	Average.

1859	Red Clover	66,560	
	Ditto	140,880	
	Ditto	245,760	728,333
	Ditto	307,200	
	Ditto	1,085,440	
	Ditto	5,524,160	
	Cow-grass Clover	40,960	
	Ditto	102,400	
	Ditto	307,200	401,066
	Ditto	409,600	
	Ditto	768,000	
	Ditto	778,240	
	White Dutch Clover	256,000	
	Ditto	1,024,000	
	Ditto	1,299,840	2,768,106
	Ditto	1,843,200	
	Ditto	4,505,600	
	Ditto	7,680,000	
1863	Ditto	1,331,200	
	Ditto	819,200	
	Alsike Clover	1,976,080	
	Ditto	1,474,560	820,140
	Red Clover	614,400	
	Ditto	266,240	
	Trefoil		
	Ditto	79,440	

2. TABLE OF THE NUMBER OF WEEDS SOWN IN CLOVER SEEDS.

	Weeds to a Pint.		Pints to an Acre.		Weeds to an Acre.	Weeds to a Square Yard.
Broad Clover	7,840	×	13	=	100,920	21
Ditto	8,400	×	13	=	109,200	22
Cow-grass Clover	12,000	×	13	=	156,000	32
Ditto	6,400	×	13	=	83,200	17
White Dutch Clover	26,560	×	12	=	318,720	66
Ditto	70,400	×	12	=	844,800	174

3. TABLE OF WEEDS IN A SQUARE YARD OF SEEDS.

No.	Botanical Name.	Trivial Name.	Number of Weed-plants.
1	Plantago lanceolata	Narrow-leaved Plantain	7
2	Ranunculus repens	Creeping Crowfoot	8
3	Centaurea scabiosa	Hard Head	2
4	Leontodon taraxacum	Dandelion	2
5	Apargia autumnalis	Autumnal Hawkbit	1
6	Glechoma hederacea	Ground Ivy	6
7	Prunella vulgaris	Self Heal	4
8	Convolvulus arvensis	Corn Bindweed	1
9	Æthusa cynapium	Fool's Parsley	1
10	Cerastium arvense	Mouse-ear	2
11	Sherardia arvensis	Field Madder	6
12	Triticum repens	Common Couch	2
13	Agrostis stolonifera	Creeping Bent	4
	Total of weeds in a square yard besides annual grasses.		46

These three tables show us not only the fact that the farmer sows weeds with his crop, but, as will be seen from table 2, quite enough of these in some cases to stock the land,—how effectually, indeed, may be seen from table 3, where in arable land we find no less than forty-six plants other than the crop, and mostly of those species whose seeds will be traced in dirty samples. To further show that clovers and their mixtures with grasses called "seeds" have their own peculiar weeds, we subjoin one other table of the species of weeds observed in three kinds of seed crops as under:—

1. Old clover and common rye grass (second year).

2. "Old seeds,"—clover, trefoil, common and Italian rye grasses (second year).

3. New seeds, clover and rye grass (first year).

No. 1 examined on August 31; 2 and 3 on the 24th September, 1859.

4. TABLE OF WEED-PLANTS IN SEEDS.

The dashes (—) in three columns intimate the occurrence of the plants signified in the fields 1, 2, and 3 respectively.

No.	Botanical Name.	Trivial Name.	Old. 1.	Old. 2.	New. 3.
1	Knautia arvensis	Corn Scabious	—	..	..

2	Centaurea Jacobea	Hard Head	—	—	—
3	„ nigra	Black Head	—	..	..
4	Achillea millefolium	Milfoil	—	..	..
5	Chrysanthemum leucanthemum	Ox-eye	—	..	..
6	Tussilago farfara	Coltsfoot	—	..	..
7	Gnaphalium Germanicum	Cudweed	—	—	—
8	Anthemis arvensis	Corn Chamomile	—	..	..
9	Bellis perennis	Daisy	..	—	..
10	Senecio vulgaris	Groundsel	—	—	—
11	Leontodon taraxacum	Dandelion	—	—	—
12	Apargia hispida	Rough Hawkbit	—	..	..
13	„ autumnalis	Autumnal ditto	—	..	..
14	Sonchus arvensis	Corn Sowthistle	—	—	—
15	Carduus arvensis	Corn Thistle	—	—	—
16	„ lanceolatus	Lancet-leaved Thistle	..	—	..
17	„ nutans	Nodding or Musk Thistle	—	—	—
18	„ acanthoides	Welted Thistle	..	..	—
19	Arctium lappa	Burdock	—	—	..
20	Sinapis arvensis	Charlock	..	—	—
21	Sisymbrium officinale	Treacle Mustard	..	..	—
22	Rumex obtusifolius	Round-leaved Dock	—	—	..
23	„ crispus	Curled-leaf Dock	—	—	—
24	Veronica serpyllifolia	Thyme-leaved Speedwell	—	—	..
25	„ agrestis	Field Speedwell	..	—	—
26	„ Buxbaumii	Buxbaum’s ditto	..	—	—
27	Euphorbia exigua	Petty Spurge	—	—	—
28	Geum urbanum	Common Avens	—	..	..
29	Prunella vulgaris	Self Heal	—	—	—
30	Acinos vulgaris	Bastard Thyme	—	—	..
31[152]	Polygonum aviculare	Knot Grass	—	—	—
32	„ convolvulus	Climbing Buckwheat	..	..	—
33	Plantago media	Broad-leaved Plantain	—	—	—
34	„ lanceolata	Lancet-leaved ditto	—	—	—
35	Ranunculus repens	Creeping Crowfoot	—	—	—
36	Geranium molle	Soft Cranesbill	—	—	—
37	„ Columbinum	Long-stalked ditto	..	—	..
38	Galeopsis Ladanum	Red Hemp Nettle	..	..	—
39	Glechoma hederacea	Ground Ivy	—	—	..
40	Stachys sylvatica	Hedge Stachys	—	..	..
41	Stellaria media	Chickweed	..	—	—
42	Cerastium arvense	Mouse-ear	—	—	—
43	Arenaria serpyllifolia	Thyme-leaved Sandwort	—	—	—
44	Lychnis dioica	White Campion	..	..	—
45	Convolvulus arvensis	Small Bindweed	—	—	—
46	Urtica dioica	Nettle	—	..	..

47	Petroselinum segetum	Corn Parsley	—	—	..
48	Torilis anthriscus	Hedge Parsley	..	..	—
49	„ nodosa	Knotted Parsley	—	—	..
50	Anagallis arvensis	Pimpernel	—	—	—
51	Capsella Bursa-pastoris	Shepherd's Purse	—	—	—
52	Sherardia arvensis	Field Madder	—	—	—
53	Chenopodium polyspermum	Goosefoot	—	..	—
54	Potentilla anserina	Silver Weed	—	..	..
55	Bartsia odontites	Red Bartsia	..	—	—
56	Linaria spuria	Round-leaved Toad Flax	..	..	—
57	„ elatine	Fluellen ditto	..	..	—
58	Myosotis arvensis	Corn Forget-me-not	..	..	—
59	Lamium amplexicaule	Henbit	..	..	—
60	Poa annua	Annual Meadow-grass	..	..	—
61	Agrostis stolonifera	Creeping Bent	—	—	..
62	Bromus mollis	Lop or Soft Brome-grass	—	..	..
63	„ „ var. racemosus	Lop or Smooth Brome-grass	..	—	..
64	Triticum repens	Couch	—	—	..
			44	39	38

These three fields are situate on the Agricultural College Farm, the substrata of which are forest marble and great oolite, and 2 and 3 were absolutely adjoining each other. How different, then, are the species of wild plants in fields so close together, when out of a list of sixty-four species only twenty-four, or a little more than one-third, are common to all three of the fields examined; and yet we can safely affirm that the aboriginal flora of any three fields of the district would scarcely offer half a dozen species in the one field that could not be found in all; and, indeed, in a field that had lain fallow for several years not half of the present list would be found.

That these, then, have to a great extent been sown with the seed is quite certain; but what tends further to strengthen the argument is, that the *Veronica Buxbaumii* (Buxbaum's Speedwell) and the *Petroselinum segetum* (Corn Parsley) are not native to the farm; and, indeed, it is doubtful whether very many of our agrarian weeds are true natives, as on examination many weeds will only be found in special crops, and these occur in the same crops all over the world wherever those crops can be cultivated. Our own country, then, has, doubtless, imported a large portion of her weed flora from abroad, just as we have traced in the United States, European (not American) plants, tracking the settlers from England, Ireland, and Scotland. It is thus that the

European daisy (*Bellis perennis*) has got the name of the “White Man’s Foot.”

Seeing, then, that the clover seeds are so liable to be dirty, it becomes an important inquiry as to whether it is possible to get pure seed; and in reply to this query we should answer, from a long experience, that though one seldom sees pure clover seed, yet it sometimes falls in our way, or at least so pure that its weeds are reduced to a minimum. Such samples may be expected to be high-priced; but still, how much cheaper than a dirty article!—for, independently of having only the seed of the crop you wish to cultivate, you are saved the annoyance which must arise when a weed has taken root, in that then the clover cannot grow, and you ultimately see the ground occupied by a spreading noxious plant, or, this dying out, there will be a vacant spot,—in either case resulting in a loss of nutriment.

But, besides the more natural method of selling dirty seed from weedy patches, seedsmen are too apt to mix the seed of plantain (*Plantago lanceolata*) with that of clover; for, as the colours of the seeds are not unlike, and some people speak favourably of plantain as a sheep-feed, it is unblushingly mixed and sold with clover seed, though the plantain at most is only worth about half the price.

Where it occurs naturally amongst clovers, it may be separated to make a good sample, but only to be ultimately mixed again and sold to greenhorns with a cheap sample. We have had before us samples of clover containing plantain as under:—

5. TABLE OF PLANTAIN SEEDS IN CLOVER.

	Plantain Seeds.	
White Dutch Clover	1,024,000	In an Imperial Bushel.
Red Clover	1,085,440	
Ditto	1,568,000	
Ditto	2,508,160	

In the instance where we had estimated as many as 1,568,000 plantain seeds to a bushel of clover seed, the seedsman admitted that he had put it with the clover at the rate of one pound of plantain to eleven pounds of clover, under the impression that it was a desirable pasture plant. Now this we know is often done; but is it not always charged for as clover in cases where it is used for adulteration?

This matter, then, of dirty seed is clearly one of importance: it, however, only wants the farmer to become acquainted with the true form of clover seed to enable him to detect any admixture in this; and then, if he has this knowledge, so requisite for his well-doing, and steadily abstains from purchasing the nasty, however cheap, he will soon find that his seedsman will supply him with a genuine article, which, all things considered, will be even cheaper than the opposite.

CHAPTER XXIII.

ON THE PARASITES OF CLOVER.

Of the truly parasitic plants affecting the clover crop, we have two genera—namely, *Cuscuta* or Dodder, and *Orobanche* or Broomrape. Both of these, some few years since, were comparatively rare as farm pests; but as they are probably more abundant on Continental than on our home farms, they are greatly increasing from the constant influx of foreign seeds.

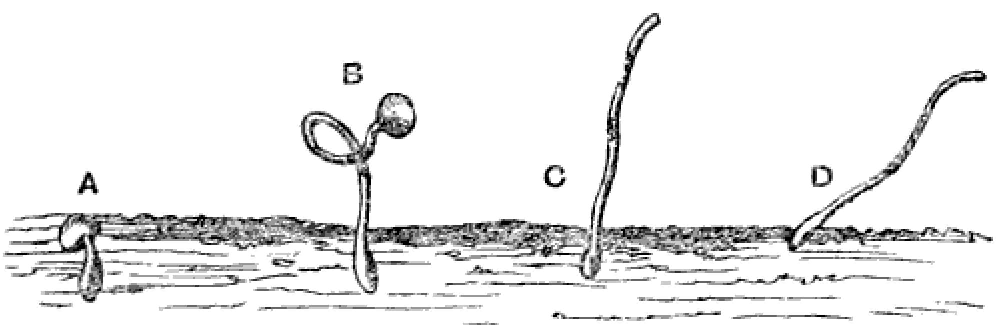
Cuscuta—*Dodder*.

Of the genus *Cuscuta* we have two species of agricultural importance,—*Cuscuta epilinum*, the Flax Dodder, and *C. trifolii*, the Clover Dodder. In both, the plant itself consists of a mass of pink and yellowish tendrils, upon which are placed here and there compact bunches of flowers varying alike in colour. The whole plant, in both species, being entirely parasitic—that is, it lives wholly on the juices of its foster-parent,—it has no leaves of its own; still, however, the Dodder plant is in the first instance produced from seed, each flower being succeeded by a capsule containing two small wrinkled seeds, which, not being larger or lighter in the *C. epilinum* than a linseed, or in the still smaller seed of the clover, in the case of the *C. trifolii*, the seed of flax or clover crops affected with dodder will never be entirely free from it: as an evidence of its large increase, we remember once seeing a crop of flax grown from Riga seed diminished about one-twentieth by the dodder; but on the seed so produced being sown in another field of the same farm, the crop of flax was well-nigh destroyed.

Our friend Professor Voelcker had some seed of the flax dodder sent to him for analysis, the reason being that, as his correspondent had separated a great number of bushels of this weed pest from a single crop of flax, he was desirous of ascertaining whether it possessed any feeding properties or the reverse; and on this head it is satisfactory to learn that it is considered useless, though innocuous.

It was part of this sample with which we experimented on the mode of growth of dodder, which, although being the dodder of the flax or linseed plant, yet its natural history will doubtless be that of the clover dodder;[8] we shall, therefore, describe the progress of our experiments, and their results.

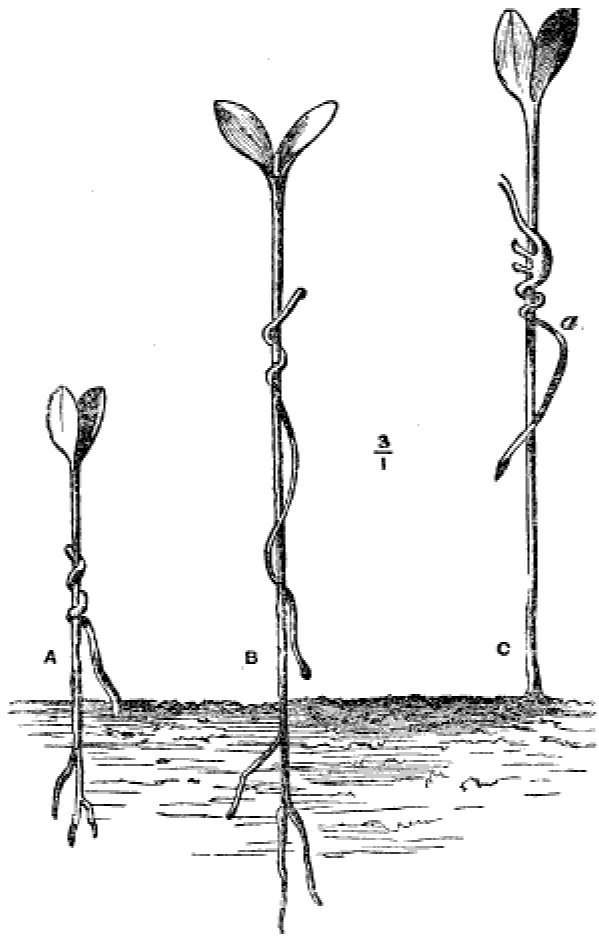
[8] We are desirous of instituting special experiments on the growth of clover dodder, but have failed to procure ripe seed, the reason being that the seed does not ripen after the clover has been cut down for its first crop.



A. Seed-covering beneath which *radicle* or young root is pushing.
B. Leafless stem or tendril growing upwards, bearing seed-covering on its apex.
C. Young thread-like plant freed from seed-covering, on the look-out for a foster-parent.
D. Not finding a foster-parent, droops and dies.

Having prepared some finely-sifted soil in a garden saucer, we sowed a small quantity of flax seed with which had been purposely mixed a few of the seeds of flax dodder; this, on being placed in a hot-house, showed the progress indicated in the diagram.

Our next diagram shows the progress of dodder-growth when the parasite has germinated sufficiently near to a young flax plant to be attracted to it. In such case, instead of dying, it seems all at once to be animated by new vigour. The highly elastic thread, which now represents the whole dodder plant, goes through the following stages:—



A. The dodder, having just clasped a flax plant, has made two coils round the stem of the latter.
B. Meanwhile the flax in growing lifts the dodder out of the soil.
C. While the flax is getting still taller, the dodder sends out rootlets, which pierce and fix themselves into the flax. During this the dodder sends out buds upwards, which, elongating until new flax plants are met with, explains not only how the dodder commences a growth quite independent of the soil, but, by spreading, from plant to plant, thus increases to an indefinite extent.

In this way, then, the dodder of flax, commencing from seeds at different points, spreads in more or less extended patches, which, if such centre be few, will be distinct; if many, the pest may occupy the greater part of the crop by spreading, and so becoming confluent.

Such is the method of growth of flax dodder, and we have no doubt but that the dodder of the clover progresses in like manner; at all events, we see the latter occupying more or less isolated patches in the affected crop; and in this case, as in the former, the crop-plant is not only starved, from having "its verdure sucked out," but it is borne down to the ground and ruined.

As regards its destruction, we should be careful to look at our crops in their early growth, as, if the sickly-looking, wire-like tendril be observed then, it is easily removed by hand; if, however, it has made head, the best way would be to make a trench of a foot wide around the plague-spots, which will prevent its spreading, as the plant must have contiguous clovers to twist round if it is to extend; and then burn some straw on the dodder plot, and it will be wasted to death. Probably, however, the easiest plan is to depasture the crop,—certainly not to seed it down—in which case it will be impossible for any dodder seeds to ripen.

But here, as in other cases, the evil will be prevented by sowing pure seed, whether of flax or of clover; and as the dodder is a small, brown, roundish little seed, so different from that of either crop, there is no difficulty in recognizing it where present.

Orobanche—*Broomrape*.

The Broomrape is now becoming a very pernicious clover weed, especially in lighter soils. We have seen it on clover near Stonehenge so thick as to have positively spoiled the crop; and we should expect from its bitter, disagreeable flavour, that if cattle did not universally refuse to eat it, it might prove mischievous to them.

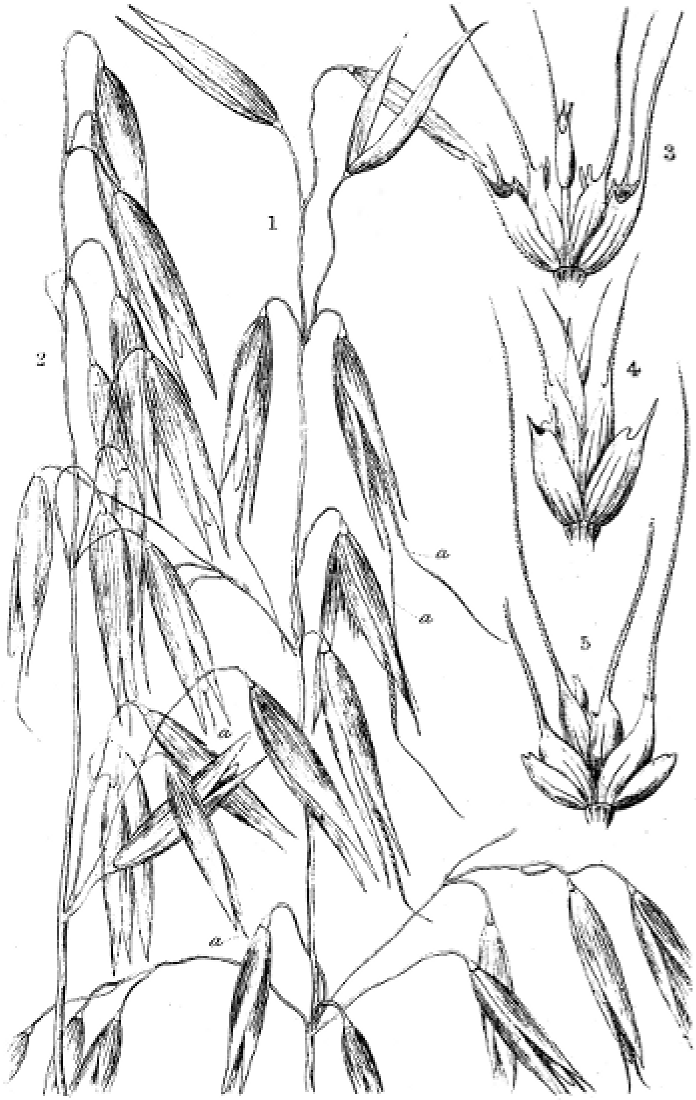
The species which attacks clover is the *Orobanche minor*—Lesser Broomrape,—which is at once distinguished in a clover field by its upright brownish spike of dead, dry-looking, lipped flowers; the stem without true leaves, but clothed with small brown leaf-like processes (*bracts* of the botanist), which, with the stem, are clothed with hairs.

This plant, which is much larger and very different from the clover, is parasitic on the principal division of the clover root; so that if the soil be carefully removed from the broomrape, it will be found to swell at the base, into which the clover root may be detected to be fastened, and a very odd appearance indeed has the small-stemmed clover united to so comparatively large a parasite.

The seeds of the broomrape are so small as scarcely to be detected in a sample of clover seed; indeed, several may be fastened to a seed as dust, so that whatever care may be used in the selection of seed will hardly prevent this pest. Any great injury to the clover crop may be speedily stopped by hand-picking the broomrape; for, although it will sometimes branch up again, it will be much lessened, and the few secondary shoots will usually be very weak.

Clovers are attacked by *Epiphytes*—that is, minute fungoid plants growing upon the leaves; but the natural history of these is too obscure for a general treatise, nor are they of sufficient interest to the practical farmer.[9]

[9] To such as may be interested in the study of the "rusts" of Clover, and some other plants, we would earnestly recommend a perusal of some most interesting papers on the subject, by M. C. Cooke, Esq., beautifully illustrated by Messrs. West & Sowerby, which will be found in the *Popular Science Review*—a serial which should have a place in the house of every country gentleman.



J. B. del. Tuffen West sc. W. West imp.

Corn.

HOW TO GROW GOOD CORN.

CHAPTER XXIV.

NATURE OF CORN.

By corn, in its enlarged sense, the farmer means all such crops as are grown for their seeds; so that all kinds of grain and pulse, such as peas and beans, belong to the corn crop, as distinguished from roots and green crops. In America the word “corn” is restricted to maize or Indian corn, and other crops are called after their respective names. Our dictionaries define corn as “seeds which grow in ears, not pods;” and it is to these that the present treatise is meant exclusively to apply, confining our remarks for the most part to such kinds as are more commonly cultivated in this country.

Corn, then, may be said to be derived from different species of grasses, whose seeds are sufficiently large to enable them to be threshed from the ear and become stored as grain, in which case it differs from the smaller kinds, whose seeds may be grown for pasturage crops.

Hence, then, grasses afford us two sets, which are differently used,—one, as affording corn fabled to be the gift of the goddess Ceres, and so called cereal or corn grasses; the other, not grown for the sake of the grain, but for herbage, and named meadow and pasture grasses.

Corn grasses, then, belong exclusively to arable cultivation; and, indeed, it may be concluded that such have been derived from wild species, and that continued culture has brought them about, and still maintains them in all their endless varieties, and also gives us a power to add to these to an extraordinary extent.

It is this facility for improvement, this capability for forming grain on the one hand, and running into varieties on the other, which enables corn to be grown under so wide a range of temperature and in such varied and variable climates; and it is a knowledge of the laws affecting these changes, and the modes of action in the growth of corn consequent thereupon, which will constitute "Science and Practice in Corn Cultivation," and should lead to a knowledge of "How to Grow Good Corn."

In following out this inquiry, we shall, for the most part, confine our observations to the following crops:—

1. Wheat, 2. Oats, 3. Barley, 4. Rye,	Their Origin, Cultivation, Diseases, Enemies, &c. &c.

CHAPTER XXV.

WHEAT: ITS ORIGIN AND ACCLIMATIZATION.

It is a popular belief that wheat, in a state fit for food, was a direct gift to man, and handed down to him unaltered in form, except in so far as relates to varieties; but if we consider how varied are the details of this plant, how very different from each other are the more remote varieties, and yet how easy it is to fill up the links on the one hand, or to arrive at equally distinct and yet new forms on the other, we can only conclude that wheat, like most, if not all, our vegetable esculents, is but a *derivative* plant obtained from a wild form of grass, and in very early times brought into cultivation because of the facilities for change which it was capable of undergoing.

Nowhere is wheat, as such, found wild; for, although its grain has been cultivated in all parts of the world, its scattered seeds cannot maintain a position for any length of time; for, as it has been obtained by cultivation, so its derived status can only be maintained by careful culture, without which there seems reason to believe that cereal wheat would indeed become extinct.

Many botanists had arrived at these or kindred views from observation and reasoning upon the subject, but it was not until a comparatively recent period that we possessed any direct evidence derived from experiment: this we now have, and upon it we quote the following from Mr. Bentham, in the *Cyclopædia of Agriculture*, article "Triticum":—

> It has never been contended that their original types have become extinct, and various, therefore, have been the conjectures as to the transformations they may have successively undergone; and as no accidental returns towards primitive forms have been observed, we have till lately had but little to guide us in these vague surmises. Within the last few years, however, the experiments and observations of M. Esprit Fabre, of Agde, in the south of France, seem to prove a fact which had been more than once suggested, but almost always scouted, that our agricultural wheats are cultivated varieties of a set of grasses common in the south of Europe, which botanists have uniformly regarded as belonging to a different genus, named *Ægilops*. The principal character by which the latter genus had been distinguished, consisted in the greater fragility of the ear, and in the glumes (*i.e.* the chaff-scales) being generally terminated by three or four, and the pales by two or three points or awns (beards). But M. Fabre has shown how readily these characters become modified by cultivation; and, wide as is the apparent difference between *Ægilops ovata* and common wheat, he has practically proved their botanical identity; for, from the seeds of the *Ægilops* first sown in 1838, carefully raised in a garden soil, and re-sown every year from their produce, he had, through successive transformations, by the eighth year (1846) obtained crops of real wheat as good as the generality of those cultivated in his neighbourhood.

It was the description of the experiments of M. Fabre, in the *Journal of the Agricultural Society*, which led us to institute independent inquiries, to which end, having purchased some seeds of *Ægilops ovata*, we sowed them in our experimental garden at Cirencester, in a prepared plot of five yards square, on a subsoil of forest marble. From this seeds were selected to carry on the experiments, whilst the mass of the plants in the plot were allowed to seed and come up spontaneously, which it did year after year, and so preserved the original type with which we started. The preserved seeds were sown in fresh plots year by year, but—perhaps owing to the coldness of the soil and the general lower climate of the Cotteswolds—progress was only slow at first; however, in the warm summer of 1859 our plot of the season had made fresh advances, which will be best understood by an examination of the accompanying drawings.

Fig. 3 represents a spikelet of the type of *Ægilops ovata*, introduced into our garden in 1855. In this some of the pales have double awns, others single ones. Fig. 4, a spikelet of 1859, modified by cultivation. In this the awns are single. Fig. 5, a spikelet from an ear of bearded wheat.

Now, the close affinity of these three forms must strike any one; but we feel justified in concluding that, had not our experiments been peremptorily stopped, and the results, as far as possible, spoiled from the ignorance and jealousy of the new Principal, we should before this have arrived at results much more satisfactory.

The principles of the observed changes will be understood by stating the following facts.

a. Ægilops ovata has a seed of sufficient size to be called a corn grain, and which, though not so large as that of wheat, yet rapidly improves by cultivation, which includes selection.

b. The *rachis* (the part on which the spikelets are placed in the wild grass) is exceedingly brittle, so that it readily breaks into bits below each spikelet; this brittleness annually gets less under cultivation.

c. The wild grass has a trailing habit of growth; but uprightness and a longer culm is at once induced by the closer contact of drilling the seeds in thick rows.

d. The cultivation of *Ægilops*, and especially subjecting it to rich soil, produces the same kinds of fungoid attacks as are found with wheats under like circumstances, as thus:—*Puccinia graminis* (mildew) of the leaves and culms; *Uredo rubigo* (red rust) of the chaff-scales; *Uredo caries* (smut or bunt) of the grain.

Now, all these circumstances seem to point to a similarity in essential structure, and a uniformity of habit somewhat remarkable in plants which at first sight would strike one as being so different; but as these differences between *Ægilops* and any variety of wheat are often all scarcely greater than is to be met with on contrasting two known varieties of wheat, we may agree in concluding that the evidence warrants the assumption that wheat, as a cultivated cereal, has been derived from *Ægilops*.

If, then, we view the wheat plant as a derivative, we shall be at no loss in understanding how the vast number of varieties have been brought about—

varieties applicable, too, to a wide range of climatal conditions; and the ease with which new forms can be brought about by hybridization and selection is a matter of importance, because older varieties, too often repeated, are apt to degenerate both in quality of grain and quantity of crop. But when we speak of acclimatizing wheat, we think it would be excessively difficult to make any existing form grow well in a climate not congenial to it, though it might be easy to arrive at a new variety possessing some desired quality. We believe, however, that it is not difficult to alter a climate to suit a sort, and, in all probability, this at the present day much-used term of "acclimatization" simply means no more than making our cultivation and climate accord as nearly as possible to the habits of the plant or animal to be entertained under new conditions.

Thus, when we see the finer white wheats growing good crops on farms where such would have been impossible a few years ago, we are hardly to conclude that we have at length got this more delicate sort to become more hardy; but the climate has been ameliorated by draining and better cultivation.

We distinctly recollect when the lias clays of the Vale of Gloucester could scarcely be made to grow a good crop of even the hardier sorts of red wheat, the common cone being the sort generally grown. This was succeeded by many sorts of red wheat, and now only the best-cultivated farms produce white wheats. These, however, are facts which will be more strongly brought out when we consider the subject of cultivation; for the present we would be content with the expression of a belief that wheat, as a cereal grain, is derived by cultivation from a wild grass, and it is due to the effects of cultivation that we have so many sorts, with such variable adaptability.

CHAPTER XXVI.

THE WILD OAT AS THE ORIGIN OF THE CULTIVATED VARIETIES.

Crop oats, like wheat, have ever been considered as a direct gift from Ceres, and few, indeed, amongst scientific men were willing to believe that they were derived from a wild and weed species. Still, the farmer had long maintained that oats, when cultivated, often left behind them weed oats; and in some districts of Worcester, Gloucester, and Warwick, we have known men refuse to grow oats as a crop from their fear of producing the terrible weed, which, indeed, the wild oat is on all hands admitted to be.

Now, although we by no means wish to advance the theory of transmutation, and cannot believe that by any plan barley can be converted into oats, or oats into barley, we are yet confident that what has been termed *ennobling*, or the producing of a cultivated plant from a wild one, is oftentimes comparatively easy, and in none more so than in the production of crop oats from the wild species, *Avena fatua*.

Professor Lindley, in the article "Avena," in Morton's *Cyclopædia of Agriculture*, suggests that the cultivated oat "is a domesticated variety of some wild species, and may be not improbably referred to *Avena strigosa*, bristle-pointed oat;" but our experiments would show that the *Avena fatua* is the form from which at least the domestic sorts in general cultivation seem to have sprung.

The *Avena fatua* (wild oat) is an annual grass which almost universally accompanies agrarian circumstances; that is to say, it seldom, if ever, occurs in a truly wild aboriginal state, and is therefore not found in uncultivated tracts, but is the common attendant on tillage, and in some soils is a most common and disagreeable weed in various agricultural crops, but more especially amid grain, whether of wheat, barley, or oats. Sometimes it is found with beans, peas, and vetches, and, indeed, it may be said to be a common weed in some districts in any crop from which it has not been eradicated by the hoe—an operation almost impossible in grain, as its growth is so much like that of the crop itself.

It is a tall grass, rivalling the height of the finest cultivated oat crop, from some forms of which, and especially those with a lax panicle, it is at first not easily distinguished; however, a more careful examination and comparison with the so-called *Avena sativa* (cultivated oat) enables us to make out the following differences:—

Avena fatua, L.	*Avena fatua*, var. *sativa*.
The valves of the inner pales, which adhere to the seeds, thick, and covered with stiff hairs, especially towards the base. The external valve has a long stiff awn, which in the ripe seed is usually twisted at the lower part, and bent at nearly right angles at about the middle. The grain-seed very small and worthless.	The valves of the inner pales not so coarse as in *A. fatua*, and quite devoid of hairs. The outer valve with or without an awn, which when present is not so stiff as in the wild plant, sometimes twisted at the base, but seldom bent. Seeds large and full, forming the grain for which the crop is cultivated.

The experiments about to be detailed were performed with the *Avena fatua*.

In 1851, a quantity of this plant was noticed by the author on the farm of C. Lawrence, Esq., near Cirencester. It was mixed with a patch of mangel-wurzel which had been planted for seed; and from these specimens sufficient seeds were preserved wherewith to sow one of our experimental plots.

It should be noticed that the substratum was forest marble, and no doubt the seeds of the oat were brought with the manure by which the mangold patch was dressed.

In the spring of 1852 a plot of two and a half yards square was sown with seed which had been kept during the winter—a fact which should be carefully noted, as it forms a first and most important link in the chain of evidence, and constituting what we term a cultivative process, inasmuch as in wild growth the seeds are sown as soon as they become ripe.

The seeds of the first crop came up well, and on ripening, towards autumn, the plants were tall and robust; the grains presented a scarcely appreciable difference from the wild examples; if any, there may have been a slight tendency to an increased plumpness of grain.

The seeds of crop No. 1 were again collected and preserved throughout the winter, and sown in a patch of similar size, but in a different part of the garden, in the spring of 1853, repeating the process with the successive crops in 1854 and 1855, with slight alterations from year to year, though in some examples the following tendencies seemed from the first to be gaining strength in some few of the specimens:—

1st. A gradual decrease in the quantity of hairs on the pales.
2nd. A more tumid grain, in which the pales were less coarse and the awn not so strong and rigid, and less black than in the wild example.
3rd. A gradual increased development of kernel or flower.

The seeds of 1855 crop, without selection, were treated in the same manner during the winter, and were sown in the spring of 1856, the resulting crop in August of the same year presenting the following curious circumstances:—

1st. *Avena fatua* (typical wild oat), with large loose panicles of flowers,[10] thin hairy florets, with a bent awn twisted at the base. Five parts of crop.
2nd. *Avena fatua*, var. *sativa*, with loose panicles of flowers, florets quite smooth, tumid, with or without straight awns, some few examples slightly hairy towards the base. This is the potato-oat type. Six parts of crop.
3rd. *Avena fatua*, var. *sativa*—Panicles more compact, flowers inclining to one side, grains more tumid than 2nd, quite devoid of hairs, awn straight. These present the type of the white Tartarian oat. Twelve parts of crop. Fig. 2. See plate.

[10] Some examples of this plant, gathered at Framilode, in the Vale of Gloucester, in the past autumn, gave as many as 750 seeds to a root, from which its rate of increase as a weed may be imagined.

Having now procured a crop of separate types of oat from the same seed, we preserved them distinct, and this year carried on our experiments by cultivating a patch of each, whilst the plot of 1856 was left with self-sown seeds, in order that it should again become wild by degeneracy.

From these experiments, then, we may conclude that different types of crop oats are derived from the *Avena fatua*, or wild oat; but, besides this, they open out a subject for inquiry of great practical interest and importance, which may be clearly stated as follows:—

If by cultivation the wild oat assumes the cultivated form, then by degeneracy cultivated oats may become wild ones.

Those who know what a detestable weed is the wild oat wherever it occurs, and how difficult it is to eradicate,[11] will at once see the cogency of the question involved.

[11] The author once went with a rector of a parish in Gloucestershire to examine the glebe allotments of the poor people, when, catching sight of an apparent crop of oats, the landlord threatened to dispossess the tenant, "because he had carelessly left his crop without gathering." However, the matter was explained when it was pointed out that the land was planted with wheat, which the oats had quite smothered.

Farmers in some districts, and more especially on stiff clay soils, have ever objected to the cultivation of oats, as they had always maintained that they left behind a crop of weed oats. This, which was never a favourite idea with the botanist, who is generally too much inclined to species-making, seems now to have a basis of truth, for not only is it confirmed by the experiments described, but observation of an independent kind points to the same truth.

On examining the produce of shed, or accidentally scattered oat seeds, the first crop will often present the wild tendency in a partial reversion to the hairy state, an elongation and thickening of the awn, and a lessening of the size of the kernel; and this more particularly on heavy soils. It was, indeed, an observation of this change in oats scattered on forest marble clay which induced us to try the experiments above detailed; and as the subsoil of our botanical garden is the same clay, we are, perhaps, indebted to this cause for arriving so soon at such signal results.

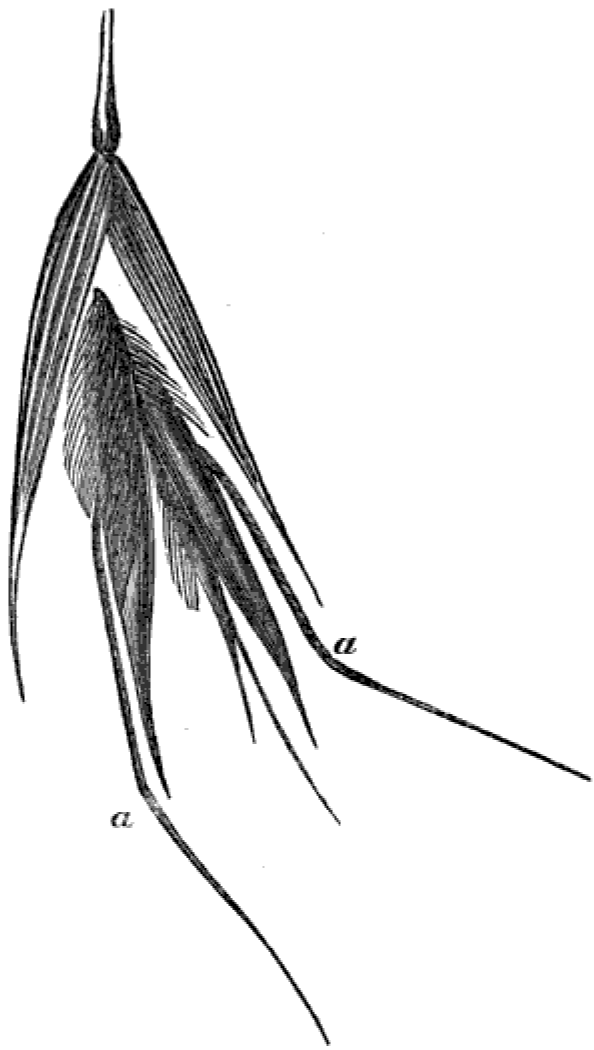
Again, it is known in farming that some clay lands will never produce heavy oats; a sample, however good, is sure to degenerate upon such soils. Hence, then, the foregoing experiments and observations lead to the following conclusions:—

1st. The wild oat is perhaps not a native of Britain, but derived through the degeneracy of the cereal crop; and hence its occurrence only as an agrarian.
2nd. The cereal oat, on the contrary, is the result of the impress of cultivative processes upon the wild form, and as such liable to lapse into the wild state with greater or less celerity, according to the circumstances of soil and situation.

These conclusions are of practical value, as they show the direction in which experiments should be conducted in order to attain to varieties, it being a well-known fact that one variety is suitable for one soil, and another for a different kind of land. And again, as some forms of plants would seem to have the tendency of wearing out by long cultivation, so we have the means of applying to the original source of their production, and thus of commencing a new generation.

They teach us, too, the necessity of avoiding the growth of the oat crop in some situations, and which in the case before us is not the result of the "pigheadedness" with which the farmer is often so thoughtlessly accused, but a conclusion founded in reason; and if we consider how robust is the growth of the wild oat, and that its support is secured by robbing the grain crop with which it occurs as a weed—the difficulty of separating it from the crop where it has gained a footing—and, above all, that its succession is secured by its seeds universally ripening a few days before that of the crop with which it is mixed, and the moment they are ripe they fall and become self-sown,[12]—we can see abundant reason for wholesome fear as to the introduction of cereal oats in districts liable to their degeneracy.

[12] The wild forms shed their seeds much more readily than the cultivated ones, and are, besides, earlier in ripening, and thus much of our wild seed had dropped before the other forms were fully ripe; and it much assists experiments in transmutation not to let the seeds with which they are to be carried on become dead ripe. This is another cultivative process.



Spikelet of the Wild Oat.[13]

[13] From *Popular Science Review*, vol. i. p. 10.

The annexed enlarged figure of a bunch of wild oat seeds will sufficiently illustrate the changes necessary to produce the cultivated form.

Under cultivation, which supposes the *selection, saving up, and sowing in a prepared* bed of our seed, the wild oat seed gradually becomes smooth externally, and its awn less coarse, while internally the grain becomes larger and heavier; so that while the seed of the wild oat would weigh about 15 lb. per bushel, that of a fine sample of white cultivated oat sown on our farm this year weighed as much as 48 lb. per bushel.

Now, the proof of this theory consists in the facts—

1st. That heavy oats degenerate by being *cultivated* in poor soil.

2nd. By *being let go wild*, they sink still lower, and gradually assume the external hairs, stiff awns, and poor grain of the wild oat.

CHAPTER XXVII.

ON THE SUPPOSED ORIGIN OF BARLEY AND RYE.

The cereal barley is found to offer three important forms, which can be best explained by the annexed diagramatic arrangement:—

Two-rowed—	*Four-rowed—*	*Six-rowed—*
by abortion of four	*by abortion of two*	*by fruition of all*

the seeds of a spikelet.

The two-rowed barley has been named *Hordeum distichum*; and as we are inclined, with Professor Lindley, to the belief that this is the original from whence the other forms have sprung, we here quote the learned Professor's remarks upon this and the probably allied forms:—

> "It is probable," he says, "that all kinds of barley grown by farmers are varieties of one species, of which, the *H. distichum* of Linnæus is the type. The spikelets of this genus always standing in threes, and the threes being placed back to back, it is evident that every ear of barley must consist of six rows of spikelets. If the middle spikelet of each set of threes is alone perfect, the side spikelets being abortive, we have *H. distichum*, the common two-rowed barley, and its many varieties; if the two-tuberal of each set is perfect, and the central spikelet imperfect, as sometimes happens, then we have four-rowed barley; if, on the other hand, all the spikelets are perfect, we have six-rowed barley, or *H. hexastichum*;[177] but the cases of four-rowed barley have been merely accidental—they may be referred to the six-rowed form; and thus we have only two principal kinds of barley—namely, *H. distichum* and *H. hexastichum*.
>
> "1. *H. distichum.*—This is the only kind of barley that has been found apparently wild. We have now before us specimens gathered in Mesopotamia during Col. Chesney's expedition

to the Euphrates, with narrow ears, a little more than an inch long, exclusive of the awn, or four and a half inches awns included; and others from the ruins of Persepolis, with ears scarcely so large as starved rye. Both are straw-colour, but that from Mesopotamia has the glumes much more hairy than the other. The plant is also said to inhabit Tartary. The report that it grows wild in Sicily seems to have arisen from the Mediterranean *Ægilops ovata* having been mistaken for it. To this species belong all the varieties, from one to sixteen, formerly mentioned under Barley; as also does No. 20, fig. 34[14]—the *H. zeocriton*, sprat or battledore barley, an undoubted result of domestication, chiefly remarkable for the ears being so much broader at the base than the point as to produce a long ovate figure.

"2. *H. hexastichum.*—We found no record of this having been found wild, and presume it and its numerous varieties to be domesticated forms of *H. distichum*. The common bere, or winter barley, may be taken as the typical form to which Nos. 18, 21, and 22, and figs. 37 and 38[15] are evidently referable, varying in size, colour, and hairiness, more than in any other circumstance deserving botanical appreciation.

"The *H. vulgare* of Linnæus is a form with the grains in four rows, the naked-eared variety of which is again the *H. cœleste* of some writers.

"Both these forms of barley vary with naked seed, the pales losing their adhesion to the grain. But this difference is attended with no other peculiarity.

"3. The *H. trifurcatum*, also known under Dr. Royle's name of *H. œgiceras*, is a very remarkable naked-seeded species, with much the appearance of wheat. It is a tall or glaucous six-rowed sort, but the rows are not placed in lines with the same exactness as in the two former kinds, so that the ears are round like wheat. The pales[178] are apparently in a monstrous form, the ends being three-lobed, and curved back in the form of horns, which sometimes extend into awns. It has been introduced from the Himalaya Mountains within a few years, but its economical qualities remain to be determined."[16]

[14] See Morton's *Cyclopædia of Agriculture*.

[15] Ibid.

[16] *Cyclopædia of Agriculture*, vol. ii. p. 68.

We have had opportunities, through the kindness of Professor Lindley, who contributed seeds, of cultivating all the forms just described; but our experiments for two years did not elicit anything new upon the subject: we therefore feel justified in quoting the above entire, especially as the different forms in our plots afforded sufficient evidence of an uniformity of origin on the one hand, with every disposition for forming varieties on the other.

Rye (*Secale cereale*).—For the little that is known of the natural history and origin of this crop-plant we again quote from the *Cyclopædia of Agriculture*, which states as follows:—

> “The common rye is a cereal grass, distinguished from wheat by its narrow glumes and constantly twin narrow florets, with a membranous abortion between them. Otherwise it is little different in structure, although the quality of its grain is so inferior. According to Karl Koch, it is found undoubtedly wild on the mountains of the Crimea, especially all around the village of Dshimil, on granite, at the elevation of from 5,000 to 6,000 feet. In such places, its ears are not more than 1 to 2½ inches long. Its native country explains the reason why it is so much hardier than any variety of wheat, the southern origin of which is now ascertained.”

We have not seen any of this so-called wild rye; it would, however, be of great service could some good experiments be made with it, with a view of noting the changes which take place on cultivation. Indeed, we have long wished for authentic examples of all our wild, or supposed wild, cereals, with a view of examining side by side the nature and amount of the changes which cultivation would most assuredly produce.

Rye, unlike either wheat or barley, is not remarkable for a long list of varieties—a fact which may, perhaps, be attributed to the more limited growth of the former than the two latter. Its less extended cultivation must be attributed to its inferior qualities as food; for, though rye is in the main a hardier plant than wheat, and therefore could withstand the evils of a colder climate and colder treatment, yet with the advanced climate—the acclimatization of a country rather than a plant—the superior plant, wheat, everywhere prevails; and this cause also gives rise to the production of finer varieties, which are thus grown where only coarser ones were possible.

CHAPTER XXVIII.

EPIPHYTICAL PARASITES (VEGETABLE BLIGHTS) OF CORN CROPS.

These forms of parasite are so numerous, that nearly every species of flowering plant may become the nidus even of several named genera, with many species, or, at least, varieties of them. We here say attacked, because the advent of many of their forms passes under the name of “blight;” a term which at once recognises their injurious tendency.

Whether these epiphytes are the causes of the so-called blighted conditions, or merely their effects, is a subject upon which no little discussion has been expended. We do not, however, mean to re-open the question here; we will only remark, that in all probability this very wide range of the lower tribes of the vegetable kingdom is very variable in these respects.

Again: it will be impossible to enter into details of the different species of epiphytes. We shall hope, therefore, to elucidate their natural history, in so far as the farmer is concerned, by pointing out the more general facts connected with the following forms:—

<table>
<tr><td>1.</td><td colspan="3">Uredo segetum—Smut or dust-brand of wheat, barley, and grasses.</td></tr>
<tr><td>2.</td><td colspan="2">Uredo caries (Tilletia)—Bunt</td><td rowspan="4">of wheat.</td></tr>
<tr><td>3.</td><td colspan="2">Uredo rubigo—Red gum or red robin</td></tr>
<tr><td>4.</td><td>Uredo linearis</td><td rowspan="2">—Straw-rust, or “mildew”</td></tr>
<tr><td>5.</td><td>Puccinia graminis</td></tr>
<tr><td>6.[181]</td><td colspan="3">Puccinia fabæ—Bean-rust.</td></tr>
<tr><td>7.</td><td colspan="3">Æcidium berberidis—Barberry-rust.</td></tr>
<tr><td>8.</td><td colspan="3">Cladosporium herbarum—Corn-ear mould.</td></tr>
<tr><td>9.</td><td colspan="3">Botrytis infestans—Potato-mould and mildew.</td></tr>
<tr><td>10.</td><td colspan="3">Botrytis—Turnip-mildew.</td></tr>
<tr><td>11.</td><td>Oïdium erysiphioides</td><td rowspan="2" colspan="2">Hop-mildew.</td></tr>
<tr><td>12.</td><td>Erysiphe macularis</td></tr>
<tr><td>13.</td><td colspan="3">Oïdium abortifaciens—Ergot of grasses.</td></tr>
</table>

1. *Uredo segetum*, Smut or Dust-brand, is common to barley, and not unfrequent in wheat; in both of which crops it is easily recognised from the affected ears of corn appearing as though they had been powdered over from the sweep’s soot-bag. On closely examining these blackened ears, we find that the whole flower has, as it were, effloresced into a black powder, which, on being placed under the microscope, is shown to be composed of myriads of granules, called by the fungologist *spores*, in which latter are contained still smaller grains, or *sporidia*.

These black spores are all washed away by the time the crop is ripe, leaving the stalks bare and grainless, so that the sample suffers no injury from this blight, which, even if present after threshing, would only tend to a slight discoloration of the sample, which is remediable by the smutter. Its chief effect, however, consists in causing the loss of much grain. We have observed it to the extent of as much as an eighth, but usually the diminution is about equal to the amount of seed sown; though it is not improbable that the whole crop may in many cases be greater when the smut is present. Sheep-folding previous to barley, special manuring for this crop, and other causes of increased fertility, are constant causes of the increase of the dust-brand.

2. *Uredo caries*—Bunt, Pepper-brand, Smut-balls.—This blight differs from the preceding in the fact that in the grain no flower is formed, but its interior becomes filled with a dark powder, which, when viewed under a high magnifying power, is found to consist of granules, with a surface which is rough, and not smooth as in the dust-brand.

In most cases, the whole grains of the ear will be so affected; in others, only a portion of them. They will be gathered in the harvest, and as the diseased grain is readily crushed, the black powder materially damages the appearance of the sample. Nor is this all: this blight has a most disagreeable odour and flavour, both of which are communicated to the sample, and so, besides diminishing the amount of produce, it greatly deteriorates it. Its specific name of *caries* of course refers to this fact, as also does that of *U. fœtida*, adopted by Baur, an author to whom we are greatly indebted for information upon these curious productions.

Before considering the remedy for this evil, it will be well to distinguish it from the "purples, ear-cockle, or peppercorn" (*vibrio tritici*)—a name expressive of its animal origin, and frequently rendered "wheat-eels." In the purples, the grain is shorter than a healthy wheat grain, irregular in shape (cockled), and purple externally; but its interior is filled with what, to the naked eye, is like very short white cotton-wool. On placing a bit of this woolly substance with the point of a needle on a slip of glass, just touching it with water and submitting it to a high magnifying power, the term "wheat-eel" will at once be seen to be justified; for, if alive, thousands of eel-like creatures will be seen writhing in the fluid.

The differences of these two affections of wheat may be expressed as follows:—

Bunt.	*Ear-cockle..*
Grain smooth externally, sometimes appearing black from blackened interior grains showing through the thin epidermis	Grain cockled and irregular in shape, purple externally, skin thickened, interior of the grains stuffed with a white cottony

(bran). These corns easily crush beneath the finger, emitting the black fungi.	substance, not compressible by the finger; but being opened, and the interior magnified, exhibits the living wheat-eels.

As regards the ear-cockle, we incline to the belief that a damp atmosphere and cold soil are chiefly concerned in its spread, if not in its production. As we have shown the difference between it and bunt, we now proceed to offer a few remarks upon the production of the latter, and its remedies.

Bunt is mainly produced by defective seed. It occurs on all kinds of soils—sands, clays, and limestones—and is not peculiar to any climate. Professor Henslow believes the disease to be wholly propagated by the spores of the fungus adhering to the wheat-seed. He says, "It has been clearly proved that wheat plants may be easily infected, and the disease thus propagated, by simply rubbing the seeds before they are sown with the black powder or spores of the fungus. It is also clearly ascertained that if seeds thus tainted be thoroughly cleansed, the plants raised from them will not be infected;" and he deduces from this a proof in favour of steeping; for he says, "This fact is now so well established, that the practice of washing or steeping seed wheat in certain solutions almost universally prevails."[17]

[17] See an essay on *Diseases of Wheat*, in the *Journal of the Royal Agricultural Society* for 1841, by the Rev. Professor Henslow.

Our own experiments, however, recorded in the "Journal of the Royal Agricultural Society" for 1856, led us to conclude that the success derived from pickling wheat in different caustic and corrosive solutions arose from the fact of diseased grain being destroyed in the process; and we extract the following record of experiments made in 1853, as explaining this view of the matter.

Four plots of wheat, all from the same sample, were sown in the following order:—

1.	2.	3.	4.
Much diseased wheat, without pickle.	Much diseased; treated with sulphate of copper.	Perfect picked seed, without pickle.	Perfect picked seed, with sulphate of copper.

The results of these were as under:—

Plot 1. Most of the seed germinated, but the crop was much blighted, both in straw and grain; in fact, scarcely a perfect ear of the latter.

Plot 2. A small quantity of the seed germinated; the few resulting ears were free from blight.

Plot 3. Germinated, with a good and clean resulting crop.

Plot 4. The same result as Plot 3.

These experiments seemed to show that the pickling of wheat destroys the seed, so as to prevent germination when the seed is diseased or ill-formed; but if perfect seed be always employed, no pickling at all is necessary, it being strictly true that a diseased progeny must result from an imperfect stock in plants no less than in animals.

We have said that bunt is not peculiar to any climate; we have, however, always observed that employing seed from a warm district on a cold one, or using the finer white wheats in cold, exposed, or ill-drained situations, is sure to produce a large quantity of this fungus. Autumn-sown wheat, too, is less liable to the infection than spring wheat, which we attribute to the fact that many of the weaker plants will succumb to the cold rain and frost.

3. *Uredo rubigo* (Red-rust, Red-rag, Red-robin) makes its appearance in the inside of the chaff-scales, and ultimately in the green epidermis of the growing grains of wheat. Its first appearance is that of oval pustules, caused by the raising of the skin, which, ultimately bursting, shows the orange-coloured spores of the epiphyte. This must not be confounded with *Cecidomyia tritici* (wheat-midge), the larvæ of which are of a bright orange-colour; in the latter, the living moving worms may be easily detected by any common pocket lens or magnifying glass. Both these pests, to which we would apply the distinctive terms of *Uredo rubigo* (red-rust) and *Cecidomyia tritici* (red-gum), are exceedingly common in some seasons, and not unfrequently in the same crop. Good deep cultivation is the best remedy for the rust; but the treatment of the fly is a different matter. We would suggest the burning of smother-heaps on calm days, just as the wheat is bursting into ear, as smoke is decidedly obnoxious to these small insects, which in some seasons may be seen in thousands about the bursting wheat.

4 and 5. *Uredo linearis*; *Puccinia graminis* (Straw-rust and Mildew).—We refer to these epiphytes under one heading, as there can be but little doubt that the latter is a more advanced state of the former. They both occur in oblong patches on the leaves and straw of wheats and other grasses: in the *uredo* stage, of a dull red colour; in the *puccinia* stage, of a blackish hue. They are both, as, indeed, are all these fungi, interesting microscopic objects; but our object now is to describe them popularly. Both will always be found in abundance in cold poor soils, and more especially if the finer wheats be grown in such situations. The application of a dressing of salt to the soil is said to be a preventive. Be this as it may, the disease is said to be rarer in Cheshire, where salt is so much used by the farmer, than in any other county, in as far as we have observed.

Here, again, we incline to think that these are morbid affections of the plant. They are, indeed, viewed as such by Unger, in his "Die Exantheme Pflanzen," in which the very title classes them with eruptive diseases of animals. Berkeley and Henslow, the two great authorities, however, do not accord with this view: the former remarks in reference to it—"Surely these plants are too distinctly, too regularly, and too beautifully organized to be the products of disease like warts or purulent matter in animals." As, however, the microscope demonstrates that warts and eruptive diseases have also their special and curiously formed organisms, such a mode of reasoning is not conclusive.

Weeds have a great influence in producing mildew, which perhaps may be accounted for from the fact that weeds are in active growth as the wheat-stalks decline in vigour; and hence the constant evaporation of moisture from the weeds to the wheat is continually re-moistening an ever-drying surface—a most fertile source of mildew and moulds of several descriptions.

6. *Puccinia fabæ* (Bean-rust).[18]—The brown pustular rust-looking spots on the foliage of beans, and, indeed, occasionally on the stems and pods of beans, are sometimes common to this crop. They are usually accompanied by a lessening both in quantity and quality of this pulse, both in the garden and in field culture, but certainly more generally in the latter. Too gross manuring without well mixing the dung with the soil would seem to be a constant source of the evil. In fact, highly nitrogenized manures appear to

favour the development of all this class of epiphytes, just as too much meat might bring about different forms of rash or eruptions in the animal. Weeds, which are too much permitted in beans, here aid in perfecting the mischief; hence, then, we may perhaps take it for granted that the mention of the causes of mischief suggests the remedy.

[18] This blight is mentioned here on account of its affinity to the former.

7. *Æcidium berberidis* (Barberry-rust) is here referred to, from the opinion prevailing that it is the cause of rust and mildew in wheat. We can no more believe that the barberry-rust would produce rust in wheat, than the rust of any other plant would do so; for nearly all plants are affected with some kind or other of rust. This epiphyte, too, is very different in structure from wheat-rust. Still, that wheat growing under a barberry hedge may be more blighted than in the rest of the field is quite true; and so it is with wheat grown under any kind of hedge. High fences are known to favour wheat blights; open, exposed, well-cultivated positions, when not too elevated, and without trees or hedges, being those in which the best wheats are grown.

8. *Cladosporium herbarum* (Corn-ear Mould) is a brown-coloured mildew, mostly occurring on the exterior of the chaff-scales of wheat, but common to many plants in a state of decadence. It consists of greenish or blackish tufts, which appear on the outside of the chaff-scales of wheat under the two following conditions:—

On wet soils, where the ears appear to have been prematurely starved.

On dry sands, where long-continued drought has caused some ears to wither and die before the seed was fully formed.

In both these cases we see that the plant has been previously injured. The decay commences under alternations of moisture and drying, and hence the fungoid attack. Here, then, the conditions necessary for preventing will be deep cultivation and a due pulverization and mixture of the soils.

9-12. *Botrytis*, *&c.* (Mildew).—Under this head we include a multitude of epiphytes, to which the terms mildew, mealdew, mehlthau (Germ.) are applicable. They appear to the naked eye as patches of white dust or meal on the leaves and stems of the affected plants. With the microscope we see that they are beautifully-organized plants, having a kind of rootlet (mycelium) or spawn entering the tissues of the living plants on which they grow, and delicate pedicels supporting spores at the externally visible portion of the plant. The botrytis of the potato and turnip, the erysiphe or oïdium of the hop, vine, and other plants, are only different forms of mildew, which in some shape or another will be found on most plants. That these attack living tissues is quite certain; but in the case of the potato, the turnip, and the vine, there is reason to believe that they result, to a very considerable extent, from diseased action in their tissues. For example: the botrytis of the potato seems to attack a crop much over-cultivated, on the approach of wet and cold nights after a prosperous growth in warm sunshine. So, the oïdium seems to us to be most abundant on renewed growth after a season of dry weather. Again: mildew in turnips is sure to follow that check which a long season of dry weather brings after a prosperous and vigorous growth. All these circumstances at least show how these attacks are favoured by the conditions which bring disease. So much, indeed, is this the case, that we found, upon experimenting with some cucumbers in a warm stove, that as long as we regularly watered the plants and gave them the requisite air, they kept healthy; but, by neglecting these conditions for a few days, we obtained mildew with the greatest certainty.

The remedies against mildew are—to obtain as healthy a growth as possible, and to maintain this with as great regularity as circumstances will permit. Of late years, both the mildew of the vine and the hop have been treated with flowers of sulphur. Dusting the affected hop-leaves with sulphur certainly arrests the mildew in an incredibly short time; and we found that by dusting sulphur from a fine sieve on our cucumber plants, the disease was immediately arrested in its progress. We therefore look upon this as an invaluable remedy in these states of mildew, whether occurring on the vine, the hop, the turnip, the cucumber, or on other plants, as we have frequently seen it in hothouses—a circumstance which shows the near affinity of all those forms of epiphytes, which, perhaps, after all, only vary with the variations in the structure and economy of the different plants on which they occur.

13. *Oïdium abortifaciens* (Ergot); *Secale cornutum* (Ergot of Rye).—The black horn-looking spur which occurs in rye and other grasses was formerly looked upon as a distinct fungus; now, however, it is known to be a diseased

or malformed condition of the grain or seed, resulting from an attack by an oïdium on the immature seed.

Most of the cereal and even the meadow grasses are liable to attacks of ergot, which is increased by cold damp fogs and a moist condition of the atmosphere, the difference of the size of the spur being in accordance with the size of the affected grass seed. Thus, in rye we have seen spurs more than an inch long, while in the cock's-foot grass it is seldom a quarter of an inch.

The ergot, as it occurs in the rye, is much used by medical men in difficult cases of parturition; and we have had evidence before us, in some cases of abortion in cows, that the constant depasturing on grasses affected with ergot (and the *Lolium perenne* in aftermaths is often especially so) has been the predisposing cause.

CHAPTER XXIX.

INSECTS (ANIMAL BLIGHTS) AFFECTING CORN CROPS.

The different families and species of insects affecting the various kinds of corn crops in all their stages of growth are so numerous, that a detailed list of them would occupy greater space than we can devote to this chapter.

In this position of affairs we have thought it wise to confine our remarks to some of the commoner and more mischievous species, choosing those more particularly which are common to the wheat crop, of which the following may be at once introduced as a summary in itself sufficient to show what the farmer may expect at each stage of growth:—

1. - [The *Slug*, The *Wire-worm*,] - Attacking the plants soon after germination.

2. - [The *Gout Fly*, The *Saw Fly*,] - That attacks the wheat stems as they begin to form.

3. The *Wheat Midge*—Commencing their injuries in the young flower.

4. The *Aphis Flea*—Which attacks the *rachis* and floral envelopes.

5. The *Ear cockle*, The *Corn Moth*, — Which destroys the growing grain.

6. The *Corn Weevil*—Which eats the flower from the grain.

7. The *Little-grain Moth*—Which attacks the grain in store.

8. The *Meal-worm Beetle*—Living upon ground corn or flour.

Now, this list may be said to have reference to eight stages in the growth and preparation of wheat, and they mostly apply to other grains also—namely, 1. The germinating plant; 2. The growing plant; 3. The growing flower; 4. The green ear of corn; 5. The young grain; 6. The perfected grain; 7. The stored grain; and 8. In the state of flour.

1. The *Slug* may be described as a houseless snail. There are several species, but the milky slug (*Limax agrestis*) and the black slug (*L. ater*) are those most common to our corn crops, and are more especially mischievous to wheat; for, as this crop usually succeeds clover or "seeds," in which they breed most rapidly, so, the older the clover lea, the more eggs will be ready to hatch in the wheat crop, and this all the more readily as the wheat is nearly always put in with a single ploughing, and with as little cultivation as possible.

The best remedy will be found in encouraging insectivorous birds—the lark, rook, starling, peewit, and others, eating them either in the egg or young state with great avidity; a good assistance to whose labours may be supplied in a few broods of ducks from the farmyard, which it will pay well to have tended by a good boy—where such can be found—as these birds are most efficient as destroyers of slugs and caterpillars.

Store pigs turned into old leas, where they can do no mischief, will get no bad living where snails and insects abound.

Wire-worms.—The several species of beetle which produce the wire-worm belong to the genus *Elater*. They are of a long oval shape: about half the length belongs to the head and thorax, and the other to the abdomen. Every schoolboy knows that when he holds the insect on its back it elevates the abdominal portion, and again lets it fall so as to make a beating sound; and hence its generic name, and also its common name of click-and-hammer beetle. If he remove his finger when in this position, the creature immediately skips up and turns on its feet, from which action it has got the name of "skipjack."

Curtis has estimated nearly seventy species of click-beetles as producing wire-worms in this country; but the three following are those generally met with—*Elater lineatus*, *E. obscurus*, and *E. ruficaudis*. These all attack corn and almost every other kind of vegetable.

The larvæ of these are very much alike, being hard, leathery, wiry caterpillars, which vary in length to about three-quarters of an inch, according to age. These are mostly smooth, and have six feet on their thoracic segments, and a false foot or *proleg* in the middle of the underpart of the terminal section of the abdomen—characters by which wire-worms may be distinguished from all others. Their length varies with age; as they live for some years in the larva state, so the different sizes mark so many broods, which in some fields are annually provided for. It should here be observed that the wire-worm does not breed; these larvæ can only be hatched from the eggs of the female click-beetle: hence, then, destroying the worms prevents the development of their parent.

Now, as we have seen whole fields of wheat destroyed by wire-worms, it becomes important to examine the nature of this attack, with a view to point out a remedy. If, then, we go into a corn field in early spring, and see the young wheat blades looking yellow and sickly, we shall seldom be long in finding the wire-worm, on carefully taking up some of the affected plants. Its position will be at the base of the plant, sometimes eating its way into its centre, and so eating out its very heart; or perhaps it may nibble away the outer coat of the young stem, and so prevent any nutriment passing into the blade. One worm will be enough to kill a single blade; but, alas! it frequently happens that he either visits all the blades, or is assisted by many individuals to each plant. This abundance we have observed more particularly on the breaking up of old pastures, old seeds, or saintfoin *lea*, in which not only have we many broods of wire-worms, but the eggs of a fresh lot, which hatch in time to eat the spring wheats. Again, this large increase we have ever observed in districts where rooks are few or much molested. The rook is a constant visitor to the clover field; but when the plant is young he is driven off, because the farmer "cannot think what else he can come for but the clover buds;" and when he sees some of these strewing the ground where the birds have been, he is confirmed in his opinion: but, if he carefully looked at the buds themselves, he would find them of a sickly hue, however recent the attack, and, if he looked deeper he might find the real enemy.

Fortified, then, with repeated observations of this kind, if asked how best to keep under wire-worms, we say most unhesitatingly, encourage the rook: he is one of the farmer's best labourers; and though, like John, and Dick, and Hodge, he will sometimes run into mischief, it is surely better to institute a judicious police than to condemn and execute without very strong evidence.

Yarrell, in his beautiful "British Birds," has the following remarks upon this highly-important subject:—

> The attempts occasionally made by man to interfere with the balance of powers as arranged and sustained by Nature, are seldom successful. An extensive experiment appears to have been made in some of the agricultural districts on the Continent, the result of which has been the opinion that farmers do wrong in destroying rooks, jays, sparrows, and, indeed, birds in general on their farms, particularly where there are orchards. In our own country, particularly on some very large farms in Devonshire, the proprietors determined, a few summers ago, to try the result of offering a great reward for heads of rooks; but the issue proved destructive to the farms, for nearly the whole of the crops failed for three successive years, and they have since been forced to import rooks and other birds to stock their farms with. A similar experiment was made a few years ago in a northern county, particularly in reference to rooks, but with no better success; the farmers were obliged to reinstate the rooks to save their crops.

But as, perhaps, the most interesting account of the value of rooks will be found in an extract from the *Magazine of Natural History*, vol. vi. p. 142, we cannot do better than transcribe it:—

> "In the neighbourhood of my native place (in the county of York)," says the writer, Mr. T. Clithero, "is a rookery belonging to W. Vavasour, Esq., of Weston, in Wharfdale, in which it is estimated that there are 10,000 rooks; that 1 lb. of food a week is a very moderate allowance for each bird, and that nine-tenths of their food consists of worms, insects, and their larvæ; for, although they do considerable damage to the fields for a few weeks in seed-time, and a few weeks in harvest, particularly in backward seasons, yet a very large proportion of their food, even at these seasons, consists of insects and worms, which (if we except a few acorns and walnuts in autumn) compose at all other times the whole of their

> subsistence. Here, then, if my data[197] be correct, there is the enormous quantity of 468,000 lb., or 209 tons, of worms, insects, and their larvæ, destroyed by the rooks of a single rookery in one year. To everyone who knows how very destructive to vegetation are the larvæ of the tribes of insects, as well as worms, fed upon by rooks, some slight idea may be formed of the devastation which rooks are the means of preventing."

Let this, then, suffice for the rooks; but starlings, wagtails, larks, and other birds, are also helpmates to the farmer; and therefore the wanton destruction of these will certainly bring, nay, has already brought, a great amount of trouble upon the cultivator of the soil.

The destruction we speak of has been committed by clubs and societies established for the purpose; but, as their members are mostly filled up with all sorts of prejudices—few being naturalists, or even accurate observers—it becomes daily a matter of more pressing importance that middle-class education, if not National-school teaching, should recognise the value of the natural sciences.

2. The *Gout-fly* (*Chlorops glabra*) and the *Saw-fly* (*Sirex pygmæus*) both lay their eggs below the first node or knot of the young plant, which, as soon as they hatch, form maggots that eat out the substance of the stems and the nodes, which thus become weakened and ultimately break off, or, if left standing, the ears of corn as they appear will be dried, whitened, and infertile.

In these, as in most cases of insect attacks, we have an occasional blight of such extent as to destroy whole crops, against which we are almost powerless, as we know so little of the economy of the creatures by whom the mischief is caused; still, there can be little doubt but that their periodical appearance, to the extent to cause them to be recognised as *blights*, is due to the thinning of their enemies; and we have always observed that a paucity of the *Hirundines*—the swallow tribe of birds, their greatest enemies—is coupled with a great increase of the smaller insects which it is the vocation of swallows, bats, and others of the hawking insectivorous creatures, to take on the wing.

3. The *Wheat-midge* (*Cecidomyia tritici*), also called the Hessian-fly, is sometimes very destructive to the wheat crop. In 1860 we observed the effects of this creature to a greater extent than we have before known, in not a few instances rendering the crop scarcely worth reaping. Upon this

creature we sent the following notice to the *Agricultural Gazette* for August 30, 1862:—

> The wheat-midge (*Cecidomyia tritici*) has been so destructive for the last two or three years, that every fact connected with its history ought to be of great interest. Curtis tells us that "in Scotland one-third of the crop was lost, and the farmers suffered severely in 1828 and the three following years;" whilst "in Suffolk the yield[19] of wheat was one-third less in some districts in 1841 than was expected."
>
> The presence or absence of this insect is so important as affecting the yield, that we now never fail to look for it in every crop upon which we would offer a judgment in this respect.
>
> It is easily detected in the larva state on opening some of the chaff-scales—pales—of affected crops, as in the interior of these will be found some minute larvæ (maggots) of a bright yellow or orange colour. In the earlier period of the blossom these larvæ will be found about the[199] stamens and pistils; later, upon the grain, which is always shrivelled and lost where the attack has been made.
>
> The colour of the maggots is so much like that of the red-rust as often to be mistaken for it; the difference, however, between the bunches of minute granular fungi and living worms will be made apparent to the most careless observer by the assistance of a common pocket lens. We find two terms in use for these yellow appearances—namely, red-rust and red-gum; and as we have so often found them employed indiscriminately, we would restrict the former to the fungus,[20] thus—*Uredo rubigo*, red-rust; and *Cecidomyia tritici*, red-gum. Our observations on the latter this year have chiefly been made in the counties of Sussex and Gloucester, in both of which we have seen this insidious enemy at work to an alarming extent. In the former county, with a very limited extent of red-rust; in the latter, the later and more delicate wheats have both red-rust and red-gum in the same crop: and the interest of the subject will be the more forcibly apprehended when we say that in some crops, which, from a first glance at the straw and ears, we should have put down as somewhere about thirty bushels per acre, we have, after a more minute inspection of the ears, estimated at less than twenty bushels; and, indeed, in one field which we have examined during the last week (August, 1862), affected by the *Cladosporium*, *Uredo*, and *Cecidomyia*, there will scarcely be a yield in good grains of the amount of the seed sown.

[19] We believe this creature to be one of the most common causes of deficient yield, so that a knowledge of its history is all-important in estimating the value of a crop, which, as a rule, we should always put lower in the seasons when this blight abounds.

[20] See *ante*, p. 185.

The fly which lays the eggs from which these yellow larvæ are derived is of about the size of a gnat, and usually takes the wing in the evening, in which case, if its enemies the bats are not numerous, smother fires lighted towards sundown on the wind side of the fields are not only destructive to large numbers, but act as an offensive notice to quit to others. Curtis says:—

> With regard to the Hessian-fly, even if its presence could be ascertained in the early stages, it does not seem possible to devise any[200] means of destroying the eggs or young larvæ, unless feeding off the blade with sheep would effect the object; and when their progress is detected by their mischievous works, at a more advanced period, nothing, I apprehend, but sacrificing the crop would arrest them. It appears, therefore, to be an evil to which we must occasionally submit; but, to guard against its immediate recurrence, it will only be necessary to collect and burn the stubble after the corn is reaped, by which means the larvæ and pupæ which are concealed at the base of the stalk will, of course, be destroyed.

Now, in reference to wheat stubbles, we would remark that the old-fashioned plan of leaving them long as a protection, and, we may add, a preserve of food for partridges, had its good effects in an agricultural point of view; but if this be done, we advocate the burning of the stubs on the soil, as they will thus act better as a manure, while the destruction of insects by the process must be enormous. All concur that modern agriculture suffers increasingly from insects; hence, then, an extended study of their habits seems daily more desirable: and we boldly assert that if our country schoolmasters would teach their pupils to observe insect life, they may be doing more good to agriculture than all our present so-called agricultural colleges and schools put together.

4. The *Aphis flea* (*Aphis granaria*) is a creature destructive to the grain by "sucking the verdure out on't." We have this year (1864) seen this insect, more especially the *apterous*—wingless—females, sticking on to the green wheat ears to such an extent as to render a walk into the crop a disgustingly dirty process. It would seem that a continuous dry and warm season favours the increase of these creatures; but, as we have always observed that the earlier sown wheats nearly always escape, from their coming into ear and advancing to ripeness before the aphis has increased its countless broods; so then we should recommend early wheat sowing, wherever and whenever practicable, as a preventive of the pest; in fact, the being in good time with all farm work has every advantage.

5. The two affections of the grain in our table are widely different in their modes of attack, but both tend to lessen the quantity of produce. The first, the Ear-

Cockle (*Vitrio tritici*) is an affection of the grain, which at starting it will be well to distinguish from smut or bunt. In the latter, the grain is filled with what appears a black powder, the grains of which the microscope shows to be a fungus;[21] whilst in the cockle the seed, which is purple externally—hence called "purples"—is filled with what appears to be white cotton wool. This, under the microscope, has the appearance of a multitude of eels. These are, indeed, minute infusorial worms, and are exceedingly curious; the smallest portion of the cottony substance taken on a pin's point and just moistened with water, often showing thousands of the eels under a good instrument; for drawings and descriptions of which and good drawings (after Bauer), we should recommend the reader to consult "Curtis's Farm Insects." A damp season favours the production of these; hence drainage and such conditions as increase the effects of damp and cold are to be guarded against.

[21] See *ante*, p. 183.

The *Corn Moth* is best known by the presence of a small, slightly hairy maggot, which is found to eat the flour from the grain; this is the larva of a small moth, probably the *Butalis cerealella*. It is easily found in the chaff scales; and during the summer of 1861 we saw as many as six in a single ear, and it was, indeed, one of the causes of the bad yield of that year. We know of no remedy for this evil; but, perhaps, if we were better acquainted with the habits of the moth itself, means might be devised for taking it before the eggs are laid in the young ear of corn.

6. The *Corn or Granary Weevil* (*Calandra granaria*) and others.—These attack corn in store, and probably differ in species according to the kind of corn. This is a small beetle, the female of which makes a hole in the grain and deposits an egg, which soon hatches into the maggot; this eats out the grain with great assiduity until its partial period of rest in the pupa state; which passed, the beetle finishes the work, and may frequently be found in the interior of wheat.

The usual structures of granaries and corn-stores contribute to the increase of this pest, as they are mostly dark and ill-ventilated chambers. The best remedy is to expose the grain to the greatest possible amount of cold, by spreading it on the floors in hard frosts, and letting in light and air. Curtis quotes the "Bulletin des Sciences Agriculture" for July, 1826, for the following plan:—"Lay fleeces of wool, which have not been scoured, on the grain; the oily matter attracts the insects amongst the wool, where they soon die, from what cause is not exactly known. M. B. C. Payrandeau related to the Philomatic Society of Paris that his father had made the discovery in 1811, and had since practised it on a large scale."

7. The moth that visits granaries (*Tinia granella*) may here be adverted to. The presence of the larvæ of the little grain moth may soon be ascertained in the granary, when one finds several grains of corn united by a web, to which will be attached bunches of small granules, which are the exuviæ of the one or two caterpillars belonging to each group of corns.

The best method of preventing this is thorough cleanliness, light, and ventilation in the granary. If, however, the moth has got possession, then we recommend sulphur to be burnt in iron pans—old saucepan lids are as good as anything—stopping up all the crevices. This will be an effectual remedy, not only for the moth, but for the weevils and other insect pests; and if a pound of sulphur be occasionally burnt in the barn, even rats must succumb to the gas which is generated.

8. The *Meal-worm Beetle* (*Tenebrio molitor*), which generates commonly in the meal-bins of this country, and the *T. obscurus*, which has been introduced in American flour, are two forms of beetle, the larvæ of which are "meal-worms." These are best prevented by not keeping too large a store of flour, always having this dry and in the best condition, and storing, as far as possible, in a clean, light, and airy position. Indeed, as Curtis remarks, "Cleanliness is the best guard against these insects;" and we cannot better conclude this chapter than by further quoting the following from this excellent author:—

> In looking back to the variety of insects that feed upon corn, and the multitudes that are often congregated in one heap, there can be no doubt that a very large portion must be occasionally ground up[204] with the corn and consumed by the public. This is not only a disagreeable fact, but it may be the source of very serious consequences, for I think it not improbable that many diseases might be traced to the insects which are converted with the infested flour into bread, amounting to such a large percentage, that if they have the slightest medicinal or deleterious qualities, it is impossible to deny the influence they must exercise upon the human system. I have known bushels of cocoa-nuts, which were every one worm-eaten and full of maggots, with their webs, excrement, cast-off skins, pupæ, and cocoons, all ground down to make chocolate, flavoured, I suppose, with vanilla!

CHAPTER XXX.

SCIENCE IN THE CULTIVATION OF CORN.

The object of the present chapter will be to point out the principles concerned in the more immediate acts connected with the cultivation of corn. In so doing in the present case, as in the discussion of the preceding subjects, it may not be out of place here to state that it has not, nor will it be, our object to enter into the every-day practical details of crop-management, but to dwell more particularly upon those points in cultivation which may be said to belong more especially to the science of the subject.

This chapter, then, will be more especially devoted to the consideration of the three following subjects:—

1st. On the uses of special manures for corn crops.
2nd. On the quality and quantity of corn to be used for seed.
3rd. On the period for harvesting corn.

1st. *On the Uses of Manures.*—It is pretty generally agreed that special manuring for corn, when grown in the ordinary shifting crop system, is positively injurious, and more truly so, if farmyard dung be employed. Still, on our own farm we were over-persuaded to give a dressing of rotted dung to some wheat. As the previous crop, turnips, had all but failed, we yielded on being told that it was a common Dorset custom, but, fortunately, only to the extent of a few acres down the middle of the field, on which part, at harvest, the main of the crop had fallen to the ground, with the affection known as knee-bent. There was plenty of straw, not at all good; but the yield of plump grains can hardly be half of those of the other parts of the field.

As a general rule, we have never observed special manuring to be useful except as top-dressings in early spring, at which time soot, or, better still, a mixture of soot and guano, may be sown on most wheat crops to advantage, and more especially where the young plant has been injured by the slug or the wire-worm, as in these cases the lower joint and the winter root are destroyed. If, then, the young plant be at this time stimulated with the mixture as advised, and the crop be afterwards rolled, we supply nutriment just in the form that it can be readily assimilated, the injured plants send out new roots from the second joint, and begin a fresh life, whilst the uninjured ones push out new buds—*stolons*—and all grow the better, because the roller has aided in firmly fixing the plants in the ground.

There have been those who would tell us that manure can be best used to wheat by subjecting the seed to various steeps; but we need hardly stop to question the folly of the assertions which from time to time re-appear, both at home and abroad, upon this point.

Thus far the subject of manures has been treated as for wheat as a shifting crop; but this crop has been grown year after year on the same soil, and, in some cases, without an apparent diminution in quantity or quality. One instance that came under our own observation was in Gloucestershire, where a cottager had grown wheat on the same plot of ground for thirteen years, and, for aught I know, it may still be continued. Hence the subsoil was *Lias shale*; but it was well drained and cultivated as a garden, the manure employed being the contents of the garden-house.

In cases of this kind, an annual application of manure is absolutely necessary; and we are happy to find that different manures and their effects have been experimented upon and duly noted, *for the same plots*, during a period of no less than twenty years, and that by such careful and reliable inquirers as J. B. Lawes, Esq., F.R.S., and Dr. Gilbert, F.R.S.; full details of the results of whose labours upon this subject will be found in Vol. XXV. of the *Journal of the Royal Agricultural Society of England*, from which we have extracted some of the following general conclusions as to average yield and weight of corn for the lengthened periods quoted:—

1. TABLE OF RESULTS OF EXPERIMENTS AT ROTHAMSHEAD, BY MESSRS. LAWES AND GILBERT.

Plots.	Manures used every year.	Average.		Average weight per bush.	Years.
		Bush.	Pecks.		
1	Unmanured every year	16	1	57·9	20 years, 1844-63.
2	Ammonia salts alone	24	1¾	57·6	19 years, 1845-63.
3	14 tons Farmyard manure	32	1¾	60·0	20 years, 1844-63.
4	Unmanured every year	15	2	56·5	12 years, 1852-63.
5	Mixed mineral manure alone	18	1¾	57·9	
6	Ammonia salts alone	22	2½	55·9	
7	Ammonia salts and mixed mineral manure	36	1½	58·4	
8	14 tons Farmyard manure	35	1½	59·3	

A glance at this table shows us the wonderful results of *continuous* manuring for the soil operated upon; we might, however, expect that, though the general conclusions would probably not greatly vary, yet that there would not be absolute uniformity in these respects in different soils and districts.

2. *On the Quality and Quantity of Seed-corn.*—It seems to be generally concluded that a thin seed, from poorer soil, should be preferred for land of a

better quality; but our own experience would lead us to look for seed from as great a change of soil as possible, and to procure therefrom not a poor, but as good a sample as we could. We should, however, look for our seed, not from a richer soil or a warmer climate, but the reverse. Oats, for example, as previously shown, degenerate, even to wild ones, if the poor seed be brought from a poor, cold soil, to be cultivated in land still poorer. We, however, on our farm, sowed oats during the past season weighing 48 lb. per bushel on a sandy soil; and, although our return was not so large in bushels as though we had sown black oats, yet their weight was but just under that of the seed. Now, these oats were from Canada, and, no doubt, the warm climate of the west of England suited them as to change.

As regards barley, we prefer a good sample for seed, if it be of home-growth; at the same time, very thin samples from Russia, or the States, often do well. Last season, we sowed some American barley of so poor a quality, that it was impossible to tell its name, but which gave for 50 acres an average yield of 40 bushels per acre, so even and plump, that only 28 sacks of "tailing" were separated, and the bulk—good Chevallier barley—was equal to any in the market.

In cultivating wheat, climate must ever be considered, as only in warm situations can the finest samples of white wheats be grown. Upland cold positions are suitable for red wheats, and so are undrained lowlands; still, good farming will render it possible to grow white wheats where, before drainage and other ameliorating processes, such was impossible.

As regards the quantity to be sown per acre, it will be seen that the margin is sufficiently wide, if we say that it lies between half a peck and half a quarter. In garden cultivation, with deep digging, and in the absence of weeds, birds, or insects, where you can choose your time for every operation, dibble in a seed in a place, the minimum quantity may suffice, as good crops have been got from a very small quantity of seed; but garden experimenters rather too positively lay down the law, when they tell the farmer that this thin seeding will do equally well on broad acres, where every operation is circumscribed by circumstances. Where there is so much to do, you cannot always get everything done at the right season, even if the soil were favourable for so doing; and the period at which you get your land ready for the seed, and the time of sowing it, makes a wide difference. But there is another point of even—if possible—greater importance; namely, the *quality* of the seed. Now, on our farm we always ascertain the germinating power of every sample of seed before sowing; and from this, as well as from the results of numerous experiments on this subject, we have arrived at the conclusion, that there are immense differences in this respect, which cannot possibly be made out at sight, but can only be ascertained experimentally. To make this matter clear, we append a table (2) of the results of experiments on this point upon no less than forty-two samples, which were tried in 1863.

Now, these experiments showed a want of germinating power, in some of the samples, of more than 50 per cent., and in the 42 samples an average of 24.5 per cent.; from which it will be seen that sometimes the thick sower is not the thick seeder, and his failure of a crop is not always due to slugs and wireworms.

These experiments were published in the *Agricultural Gazette*, and they evoked some remarks from a learned divine, so unfair and uncandid, as only to be excused by the nature of his professional education and modes of thought. Now, when this gentleman affected to believe that these things could not be so, and that with him every seed germinated, we could only conclude that the days of miracles had not quite ceased; but as, in later numbers of the *Gazette*, his opinions have been somewhat modified in this respect, we yet think him capable of riding a hobby too hard, though not until the pace has thrown him down and broken his knees will he own it.

2. TABLE OF THE GERMINATION OF WHEAT.

No.	Label. Wheats of 1862.	Weight per bushel.	Price per bushel.	Came up pr. cent.	Failed per cent.	Remarks.
			s. d.			
1	Tasmania	66·	...	46	54	These are six samples from the International Exhibition of 1862, to which they were forwarded by various colonists.
2	Ditto	60·5	...	8	92	
3	Tuscan, from Victoria	68·	...	94	6	
4	Ditto ditto	63·	...	78	22	
5	Ditto ditto	67·	...	90	10	
6	Tasmania	60·	...	30	70	
7	Ditto	59·5	...	28	72	Taken by us; probably the same as No. 6.
8	Talavera	66·	...	98	2	Four samples from Hainhault Farm—amongst the best that have come before us.
9	Spalding	63·3	...	94	6	
10	Thick-set Rough Chaff	65·	...	100	None	
11	Morton's Blood Straw	62·6	...	94	6	
12	Hallett's Pedigree	62·9	...	78	22	Communicated.
13	Creeping Wheat	66·5	...	98	2	Ditto.
14	Bland's Giant Prolific	59·	...	96	4	Ditto.
15	Fuller's Red	56·8	...	98	2	A poor grain from the Cotteswolds.
16	Red Straw Lammas	56·8	7 0	82	18	Samples taken by us from Cirencester Market. No. 21
17	Hallett's Pedigree	64·6	10 6	88	12	

18	Browick	58·5	6	6	88	12	not a seed wheat; it contains 76,800 seeds of corn cockle and 64,000 seeds of rye in the bushel.
19	Red Chaff White	59·	6	6	78	22	
20	Free-trade	59·5	6	3	88	12	
21	Russian	55·	5	7½	32	68	
22	Burwell	58·5	8	0	18	82	
23	Rough Chaff Talavera	60·5	9	0	90	10	Communicated from a well-known seedsman.
24	Talavera	63·	10	0	38	62	
25	Corner's Rough Chaff	62·	10	0	52	48	
26	Red Browick	65·	8	0	58	42	
27	Chidham	66·5	10	0	70	30	
28	Lammas	63·3	8	0	58	42	
29	Britannia, or Red Thickset	66·	8	0	54	46	These formed a most interesting series of several sorts of wheat—most of which looked remarkably well as hand samples.
30	Red Nursery	67·	9	0	92	8	
31	Col. Quentin's Giant	68·	9	0	38	62	
32	Kessingland	63·3	8	0	86	14	
33	April	60·3	12	0	84	16	
34	Golden Drop	63·3	8	0	92	8	
35	Shirreff's Bearded Red	60·5	9	0	74	26	
36	Essex Rough Chaff	66·3	9	0	96	4	
37	Hunter's White	60·	8	0	60	40	Out of condition.
38	Shirreff's Bearded White	63·2	10	0	96	4	
39	White Trump	63·3	9	0	96	4	
40	Grace's White	65·	10	0	38	62	
41	Hertfordshire White	62·2	8	0	94	6	
42	Hallett's Pedigree	66·	10	0	92	8	

3. TABLE OF THE GERMINATION OF BARLEY, 1863.

No.	Label.	Price per quarter.	Came up pr. cent.	Failed per cent.	Remarks.
		s.			
1	From Sherborne	29	98	2	All market samples.
2	,, Martock	29	98	2	
3	,, Lulworth	24	96	4	
4	,, Crewkerne	28	76	24	
5	,, Mr. Masters	28	96	4	
6	Odessa	24	96	4	
7	From Salisbury	24	100	0	Salisbury is considered one of the best places for seed barley. The samples are mostly from the Chalk Rock.
8	Ditto	24	96	4	
9	Ditto	24	90	10	
10	Ditto	24	92	8	

11	Ditto	24	100	0	
12	From Langport	28	100	0	Like most of our specimens, market samples.
13	„ Chard	27	82	18	
14	Stiff-straw	28	82	18	
15	Nottingham	32	90	10	
16	Chevallier	26	96	4	
17	From Yeovil	26	70	30	This is a low-germinating series; their uniformity of price and difference in germination is remarkable.
18	Ditto	26	70	30	
19	Ditto	26	84	16	
20	Ditto	26	94	6	
21	Ditto	26	84	16	
22	Chevallier, sown on farm	28	96	4	Two good samples, and the yield of the crop of fifty acres each about 36 bush. per acre.
23	American, ditto	28	100	0	
24	Ditto	30	92	8	
25	New from farm, 1864	30	98	2	
	Average		92	8	In round numbers.

Seeing, then, that there were such variations in the germinating powers of wheat, we determined to try a series of experiments with barley; and from the results (table 3), it will be seen that, though the margin is not so wide, yet great differences occur; still, with regard to this grain, we constantly find that in samples too thin and poor for even the farmyard poultry to pick up, yet that much of this is capable of germination.

Still, theory and practice confirm the assumption that in England very much seed is wasted by being too thickly sown; and, if a farmer can get his land well prepared and in good time, we conclude, as a matter of practical experience, that just half the seed usually sown will be better than the double quantity; but we should, as a rule, make a difference of at least half a peck for each week that we were beyond the best time of wheat-sowing in any particular district. On our own farm we sowed four and six pecks of wheat where double the quantity had been the rule before Christmas, and from six to eight pecks afterwards; six pecks of barley and oats, where a sack had previously been the rule. With the wheat and barley we were right, except in the very late-sown of the latter, when time was only sufficient to grow a single head, and not to allow of stooling. Here a sack would have given a better result. The same with our oats: thin seeding caused them to run to straw; they were on a poor sand, taller than the men who cut them;

but had we doubled our seed, we conclude we should have had shorter straw and more corn.

If, then, these things be so, the judgment of the farmer will be best shown in rightly weighing *all* the circumstances of his case; and in the matter of seeding, as with physic, he will find that homœopathy *alone* is only quackery.

CHAPTER XXXI.

ON HARVESTING CORN.

A knowledge of when corn is in the best condition to be harvested is a matter of great importance; and hence some observations upon this subject may fitly conclude this part of our work.

Not to enter too deeply into chemical matters, we may state, at least as a probable general conclusion, that there is a period in the growth of grain and pulse crops before they are ripe, in which all the feeding qualities will be found diffused in the several plants; a little later, and the feeding matters will be found more particularly concentrated in the seed. Now, if oats, peas, and beans, be cut in this "green" state, they make either a fresh food, or can be dried into hay, which, when cut into chaff, is found to be an excellent feeding material; and as such crops can be quickly cleared and cheaply employed, there is no doubt but that they will henceforward be more generally used in this way than formerly.

But, again, in ripening of wheat there would appear to be a point in its progress short of "dead ripe," in which every quality is fully stored in the seed; and, after this period, the seed-covering becomes thicker, and makes more bran in proportion to flour: facts made out from the following results of experiments of samples in three different states:—

TABLE OF THE RESULTS OF EXPERIMENTS WITH WHEAT.

Sample 1.—Wheat gathered when the grain was sweet, and almost milky. The stalks green. Date, July 25th, 1856.
Sample 2.—Wheat from the same field, gathered when in the state of hardening grain. The stalk just yellowed all the way down. August 2nd.
Sample 3.—Wheat from the same field, gathered when what is termed "dead ripe," having been, in fact, left longer than it otherwise would, for want of hands. August 18th.

4. TABLE OF RESULTS FOR TWELVE EARS OF WHEAT DRIED.

“MORTON’S RED STRAW WHITE.”

Sample.	Weight of the ears.	No. of grains of corn.	Weight of grains of corn.	
	Grains.		Grains.	
1	400	569	284	Grain shrivelled.
2	379	431	294	Grain plump.
3	468	453	377	Grain coarser.

5. TABLE OF ANALYSIS OF THE CORN FOR THE TWELVE EARS.

Sample.	Measure.	Per-centage of flour.	Per-centage of bran.	
1	7·5	70·4	29·6	Flour of a fine white quality in all the samples.
2	6·8	71·4	28·6	
3	8·8	63·7	36·3	

Now, this shows that although the medium ripe ears in sample 2 had a less number of grains, yet their per-centage of flour, as compared with bran, was greatly on the increase. Still, it will be seen that sample 3 has the advantage in measure: hence, then, unless the miller will agree to give a better price for a “gay”[22] sample, it will be to the farmer’s advantage to leave it to fully ripen, if he can make sure that it can be kept from shedding in harvesting, and the attacks of birds.

[22] The farmer’s term for early-cut corn, in both the middle and West of England.

As regards barley, if our crop is required for home use for feeding purposes, we should cut at least a week earlier than most people, and we should have as good feeding quality, without loss from winds, loss in harvesting, and from birds; but, if our land grows malting barley, the sample will be a better, and more uniform in germinating, when “dead ripe.”

During the last season (1864), our pupil, F. Witts, Esq., collected bunches of corn from a crop of fine white oats at the under-mentioned dates. From these we counted 500 seeds, and took their weights; and, though we confess that many such experiments will be required to settle the whole facts of the case, yet the results given in table 6 are so curious, that we hope in future to direct our pupils in carrying out many similar experiments.

The two samples, each of the 20th and 21st, were probably obtained from different parts of the same field, yet they lead us to conclude, as do those of the other dates, that a single day, if a hot summer, makes a great deal of difference.

Now, the crop was not cut until a week after the 21st, and yet we are persuaded that we should have gained by cutting on the 20th rather than later, and, at least, we should have prevented much loss from “shed” seeds.

6. TABLE OF RIPENING OF OATS.

Date.	No. of seeds.	Weight in grains.	Remarks.
July 9	500	110	The interiors of the grains only milky.
July 9	500	120	
July 11	500	165	The interiors just beginning to harden.
July 14	500	165	
July 16	500	207·5	Seeds ripe, but not beginning to shed.
July 18	500	230	
July 20	500	250	Ripe, and shedding more every day.
July 20	500	262·5	
July 21	500	257·5	
July 21	500	267·5	
Dec. 15	500	250	Thrashed on the named date. Weight, 47½ lb. per bushel.

Cratægus oxyacanthoides. Glabrous White-thorn.

HOW TO GROW GOOD FENCES.

CHAPTER XXXII.

ON THE NATURE OF FENCES.

Fences, as boundary lines to estates and as a means of dividing and separating land into convenient parts or fields, are worthy of greater attention than we think is paid to them either by the landlord or the tenant.

But it is perhaps the fact that the landlord on the one hand too often looks upon them as mere boundaries, or deems that he is only personally concerned in them to that extent; while the tenant on the other hand—and especially if his holding be precarious—can hardly be expected to take that care and defray those expenses which growing good fences and keeping them in order must necessarily entail. In treating this subject, then, we shall endeavour to show that the study of how to grow good fences, by putting the matter upon correct principles, will tend to the good of all parties concerned.

Fences are of two well-known types: *Dead fences*, such as the natural boundaries of streams, artificial ditches, raised mounds, walls, railings, &c.; *Live fences*, grown from living trees or shrubs. These latter, then, as forming no unimportant part of farm cultivation, will occupy our attention in the next few chapters.

With regard to dead fences, those in more general farm use may be briefly described under the heads of railings, mounds, and stone walls.

Railings are of various kinds, according to circumstances; the simplest form of these consist of piles driven into the ground at about five feet apart and secured by split larch on the top, and either larch cross pieces below or iron hoops. In making these the landlord usually finds the rough material, the tenant paying for the work, the usual cost for cutting-out being a penny for each pile. This kind of fencing is mostly employed as a protection to young live fences, or to fill up gaps in older ones.

Mounds are simply lines of raised earthworks, and are used where stone or fencing materials are expensive, or where live fences can only be grown with difficulty. Sometimes these elevations are crowned with privet or some light hedge-plant. They are occasionally employed as field boundaries by river sides, where they subserve the purpose of keeping out floods, but usually the mound is more used as a division of property than as a fence.

Stone walls are the commonest fences over miles of country in the middle of England, the Cotteswold hills being remarkable for dry stone walls—the stone for these “Oolite freestones” being well adapted for the purpose—of course they are dry, that is, built without mortar, as this would render the work too costly for field boundaries. These walls have a wild and desolate appearance, but they are commended by some as not harbouring birds or vermin; but this is a questionable good, for as regards birds, we contend that the stone wall districts would be better off if they afforded shelter for a few more; but stoats, mice, snails, beetles, and small fry of the kind of no use whatever, are absolutely protected by the stone wall.

It is said again, that the stone wall offers little chance for weeds, but to those who have been accustomed to observe about a yard on either side of a wall constantly left unploughed and uncleaned, stone walls will be considered as nurseries and protectors of weeds, and those, too, of a highly mischievous character, as couch thistles, docks, &c.

With regard to the couch grass (*Triticum repens*), we have traced it running from this source for a couple of yards into the ploughed field, with the inevitable consequence that in the furrows it is cut into convenient lengths to multiply the pest; and it has been on this account that we have ever been careful to direct dragging and harrowing to be done in the direction of the walls, before proceeding with these operations over the rest of the field, and we recommend the cutting down of weeds under these walls before a crop of corn be carried.

CHAPTER XXXIII.

ON THE PLANTS FOR “LIVE” FENCES.

The native plants which have been employed for living fences include most of our indigenous trees and shrubs, with some few which, if not native, have yet been for a long time naturalised throughout Great Britain. The most important of these will be found in the following list:—

Group 1.	Oak Beech Hornbeam Ash Elm Maple	Forest trees usually forming fences by means of undergrowth from lopping and cutting.
Group 2.	Whitethorn Blackthorn Crab Buckthorn Holly	Trees and shrubs forming fences by reason of a thick-growth and repellant thorns and spines.
Group 3.	Nut Privet Dogwood Spearwood Guelder Rose Elder	Shrubs which for the most part fill up badly-grown fences. These are really weeds in good hedges.

In the first group, it may be remarked, that oak, ash, and elm are seldom, if ever, planted for hedges; for in the first place these plants are usually too expensive, and in the next they are not esteemed as hedge plants. They mostly find their way in the fence by seeds being sown by the wind, as is often the case with ash-keys, or they may start up a bush of underwood after being cut down as hedge-row timber; in either case they are very unsightly in appearance, and far from good in hedges. Trees should not be grown in hedge-rows where the fence is to be perfect, as these overshadow the best hedge-plants, and the sides of the boles always offer weak places.

Beech and hornbeam are frequently used for garden and smaller fences, and, when well grown, are really useful as a protection, as their withered leaves are persistent, that is, they do not fall off until new ones are formed. They are grown comparatively quickly, and will flourish in poor light soils, and if strong plants be made to cross each other in planting, they may be trained to form a strong fence.

In the second group, the whitethorn (*Cratægus oxyacantha*) stands deservedly at the top of the list; in fact, it is the very best hedge-row plant we possess. It is not slow of growth in congenial soil, especially if well attended to. Its thorns render it thoroughly repellant to cattle. It bears cutting, clipping, and trimming better than any other; and though variable in its behaviour in different soils, it is, after all, capable of bearing a greater diversity in this respect than any other of our list. The whitethorn, then, is deservedly held in the highest repute for the growth of the most perfect live fence for all ordinary farm purposes; the blackthorn, crab, and buckthorn being tolerated only because they possess some of the same characteristics as the whitethorn. As regards the latter, it is exceedingly long-lived, and, if left to itself, forms trees of considerable size, which are occasionally very beautiful as forming part of park scenery; still in hedges it can be kept to any size, and cutting it in causes a new wood to spring up, which has all the characteristics of a young, quick plant.

These are merits of the greatest importance in favour of the whitethorn, which will ever make this the best hedge-row plant, as if we succeed to a whitethorn fence, which has been trimmed and kept within due bounds, there is no difficulty in continuing the process; and so if the hedge be left to grow tall and wild it may be cut out either wholly or partially, some stems cut half through—as in the process of *plashing*—laid down, and so a secure though not so tall a fence be formed, that will only grow thicker year by year.

Blackthorn—sloe (*Prunus spinosa*) is formidable enough as regards thorns, but it cannot stand the same amount of cutting as the whitethorn, and, when cut, its young shoots being almost thornless, makes a hedge of the sloe the less repellant the more vigorous are its shoots.

The crab-apple (*Pyrus malus*) and the buckthorn (*Rhamnus catharticus*) may be considered as accidental in fences; and as, to a great extent, they will grow with the quicks and suffer the same treatment without growing as upstarts on the one hand, or refusing to start again after crippling on the other, they are both tolerated in fences without quite getting a character for being hedgerow weeds.

The holly (*Ilex aquifolium*) possesses a wonderful repellant armour in its spinous, evergreen leaves, on which, account it is esteemed as a plant for fences:—

> A hedge of holly, thieves that would invade,
> Repulses like a growing palisade;
> Whose numerous leaves such orient greens invest,
> As in deep winter do the spring arrest.

This is one of our native trees, frequently attaining to a great size on even wild, stony places, with only a thin layer of soil. We have seen some fine examples, large enough to secure the holly a place among our native forest trees on the "stony Cotteswolds," as Shakespeare calls the high Gloucestershire range; it is, however, of slow growth, or it would, doubtless, be more used for fences: still in poor soils it will, after all, grow as fast as the whitethorn, Evelyn is eloquent in praise of holly. He says:—

> Is there under heaven a more glorious and refreshing object of the kind than an impregnable hedge of about four hundred feet in length, nine feet high, and five in diameter, which I can show in my now ruined gardens at Saye Court (thanks to the Czar of Muscovy[23]), at any time of the year, glittering with its armed and varnished leaves? The taller standards, at orderly distances, blushing with their natural coral; it mocks the rudest assaults of the weather, beasts, or hedge-breakers,—
>
> Et illum nemo impunè lacessit.
>
> It is with us of two eminent kinds, the prickly and smoother leaved; or, as some term it, the free holly, not unwelcome, when tender, to sheep and other cattle. There is also of the white berried, and a[224] golden and silver, variegated in six or seven differences, which proceeds from no difference in the species, but accidentally, and *naturæ lusu*, as most such variegations do, since we are taught how to effect it artificially, namely by sowing the seeds, and planting in gravelly soil mixed with store of chalk, pressing it hard down: it being certain that they return to their native colour when sown in richer mould, and that all the fibres of the roots recover their natural food.

[23] The Czar Peter the Great resided at Mr. Evelyn's house, in order that he might be near the yard at Deptford, during his stay in England; but we do not see why he should be thanked for the holly hedge.

The differences in the colour of the fruit, as of the colour and shape of the leaves, is truly a matter of variety. The red-berried holly, under the name of "Christmas," is quite an article of commerce at the festive season—so much so that a friend of ours in the neighbourhood of Stroud, who this year (1864-5) had a large tree well covered with berries, assured us that he had great difficulty in preventing it going to market with some of the marauders, who scour the country in search of anything they can sell.

In the Worcester market we for many years noticed a sprinkling of white, or, rather, yellowish-berried holly, a spray or two of which was always put with the bundle of the red-berried in effecting the many Christmas sales.

As regards the difference in the leaves, although it is true that in the gardens we have a smooth and unarmed variety, however dwarf the specimen may be, yet in wild examples the smooth leaves will, for the most part, only be found on the upper parts of tall trees; the poet, then, has been as true to Nature as graceful in art in the poem of which the following lines form a part:—

> Below, a circling fence, its leaves are seen
> Wrinkled and keen.
>
> No grazing cattle through their prickly round
> Can reach to wound;
> But as they grow where nothing is to fear,
> Smooth and unarmed, the pointless leaves appear.

Southey.

In growing hedges, the clipping to keep them within bounds helps to keep the holly spinous at any age.

Evelyn further descants upon the excellency of holly for hedges; and as the following remarks are so truly practical, we quote them in this place:—

> The holly is an excellent plant for hedges, and would claim the preference to the hawthorn, were it not for the slowness of its growth while young, and the difficulty of transplanting it when grown to a moderate size. It will grow best in cold, stony land, where, if once it takes well, the hedges may be rendered so close and thick as to keep out all sorts of animals. These hedges may be raised by sowing the berries in the place where they are designed to remain, or by plants of three or four years' growth; but as the berries continue in the ground near eighteen months before the plants appear, few persons care to wait so long; therefore, the usual and best method is to plant the hedges with plants of the before-mentioned age. But where this is practised, they should be transplanted either early in autumn, or deferred till toward the end of March; then the surface of the ground should be covered with mulch near their roots, after they are planted, to keep the earth moist; and if the season should prove dry, the plants should be watered, at least once a-week, until they have taken root, otherwise they will be in danger of miscarrying, for which reason the autumnal planting is generally preferred to the spring, especially in dry grounds. Columella's description of a good hedge is highly applicable to one made of holly, "Neu sit pecori, neu pervia furi." Of the rind of this tree birdlime is made.
>
> Alas! in vain with warmth and food
> You cheer the songsters of the wood;
> The barbarous boy from you prepares,
> On treacherous twigs, his viscous snares;
> Yes, the poor bird you nursed shall find
> Destruction in your rifled rind.

If we except the Privet, the examples of plants in our third group are quite unfit for hedge purposes, as they are entirely without offensive armature. Privet hedges are not unfrequent in gardens, where they are useful for boundaries, blinds, and to act as shelter, but as a farm hedge-plant it is quite useless.

The nut, guelder rose, and elder have none of the qualities for hedge growth that are required by the former; on the contrary, they have large leaves, and so smother the quicks if they grow with them, and when cut they shoot rapidly, especially in the case of the elder (*Sambucus niger*), and so make a hedgerow look ragged by here and there growing a yard or so above the ordinary hedge-plants; but, besides this, the lower stems get free from leaves, and hence gaps are easily made in bushes of nut, dogwood, elder, &c.

In the above description of hedgerow plants we have omitted all mention of yew, holly, laurustinas, furze, and the like, as being more properly materials for ornamental or garden hedges. The furze, however, is sometimes used on the tops of mounds, in some sandy districts, as a fence plant, but the constant dying of the old wood and the consequent exercise by the cottager of a fancied right to pull the hedge to pieces for firing render it almost impossible to employ it to any advantage.

CHAPTER XXXIV.

ON THE REARING AND PLANTING OF HEDGES.

The rearing of plants for hedges is a matter of so much importance that one can well understand how it has come to be a business of itself; and as it is better that it should be so, both landlords and tenants will do rightly to encourage its being done well. If, then, we take it for granted that the whitethorn is the best hedge-plant, it will be best to inquire—as a contribution to the science of the subject—whether there are not some important varieties of this plant; if so, we should determine which is the best, and encourage its cultivation. As the case at present stands, nurserymen take no pains in the matter; they usually employ children to collect the "haws"—the name by which the fruits are known—and it is a matter of perfect indifference where or how they obtain them.

Now, as regards the common hawthorn, experience has taught us that seeds obtained from trees in cold, wild, stony places, such as have established themselves about old quarries on the Cotteswold-hills, more quickly make good plants than those from the pampered hedge-row in the deep vale-lands.

But, in addition to this, having some years ago observed that certain whitethorn-trees came into flower a full fortnight before others, and this on the cold forest-marble clays in the exposed country of North Wilts and south of Cirencester, we were induced to examine this tree more closely; and the result of the inquiry was to induce a belief that this is a much hardier, quicker, and more certain growing plant for hedge-rows than the commoner form.

With these views established in our mind, we were not a little pleased to find that in the beautiful new edition of "English Botany," by the accomplished editor, J. T. Syme, Esq., F.L.S., &c., figures and descriptions are given of the two forms; and we here reproduce in opposite columns the descriptions referred to with a figure of the early form we have mentioned, that our readers may compare it with the common whitethorn:—

Cratægus oxyacantha.

Cratægus oxyacanthoides (*Glabrous Whitethorn*). Plate CCCCLXXIX. (E.B.) Leaves obovate or rhomboid-obovate, with 3 to 5 lobes, margins slightly convex from the base to the apex of the first lobe, usually serrated; lobes scarcely longer than broad, generally rounded. Peduncles commonly glabrous. Calyx-tube glabrous; segments glabrous, ovate-deltoid, acuminate, spreading-reflexed, with recurved points. Styles usually 2 or 3. Fruit with 2 or 3 stones.	*Cratægus monogyna* (*Common Whitethorn*). Plate CCCCLXXX. (E.B.) Leaves rhomboidal or rhomboidal-ovate, with 3 to 5 lobes, margins straight or concave from the base to the apex of the first lobe, usually entire, except at the tips of the lobes; lobes longer than broad, and acute at the apex. Peduncles generally downy. Calyx-tube more or less downy; segments slightly downy, ovate-triangular, acuminate, suddenly reflexed. Style 1. Fruit with 1 stone. (See plate.)

That the glabrous whitethorn would make the best hedge-row form we have no doubt, as its free growth and early leafing particularly recommend it; and besides, though not the commonest, we cannot help thinking it to be the hardiest variety, and one that would be likely to succeed in soils where the ordinary one would be very slow in growth.

We have occasionally met with it in nursery-plantations, as well as in hedge-rows, where it is distinguished at a glance by its more freely growing twigs and brighter coloured, quite smooth leaves; so also, but more rarely, we have met with the Glastonbury thorn in the hedge-row, which we look upon as a variety of the glabrous thorn, a specimen of which is now before us (January, 1865), with both leaves and flowers well in bud, in the midst of a deep snow and a severe frost.

This variety is fabled to have sprung from Joseph of Arimathæa's staff, which he is supposed to have planted in the soil at Glastonbury, on Christmas-day, prior to the foundation of the abbey at that interesting place; and we have found some natives, both here and in Herefordshire—whither perhaps the thorn had spread with sorts of apples,—who adduce the budding of this thorn, which is usually after our present Christmas-tide, as an evidence that Old Christmas is the right day.

But we must not be too far led away by the legendary lore, much less the poetry connected with the whitethorn.

We come now to a description of the methods to be observed in planting fences, having taken for granted that quicks be employed for the purpose, and that we encourage the production of the sort best adapted to our purpose,—an end which, we conceive, will be well attained by offering prizes to nurserymen for good and well-grown quicks.

In planting hedges, then, our first care should be to prepare the ground. This must be done according to the soil; and here it may be noted that there are two plans of doing this most commonly used, namely, raising a mound, on which the quicks are to be planted without a ditch; and the making a ditch and planting the quicks on the top of the elevated soil. Now, curiously enough, the first method is the one usually adopted in light, porous soils, as on the sands of Dorsetshire; the second, in porous stones, where ditches are not required, as in the oolitic districts; or else in clay soils, where alone the ditch is at all advisable.

We advise that in light soils, as sandy loams, where drainage is not required, the ground be well dug on the flat before the planting of the quicks; that in thin soils on brashes the brash be loosened; and then that some soil be carted on this surface, making an additional thickness of not more than six inches of soil. As regards the preparation for a fence, by previously making a ditch, we object to it on account of the loss of ground; the ditch, again, if forming part of the system of drainage, is always liable to become choked by weeds, brambles, and the like, with water-plants growing in it. Had we to begin the laying-out of ground, we should make our drainage-system independent of the fences; and so, however stiff our clays if well drained, we should as a rule only raise the soil where a fence was to be planted, by a few inches.

We speak the more strongly on this matter, because on our own farm we have fences attempted to be grown on the top of mounds five feet high, and which are made out of some of the lightest agricultural soil in England, so light, indeed, as at first to appear to be a nearly pure sand. On the same farm, again, we have yawning ditches in oolitic limestone, which never carried water; and Mr. Parkes made ditches of this kind on the College-farm at Cirencester, which have ever been equally dry. These banks and ditches are worse than useless in our own case: quicks will not grow at all; and so the bank is covered with all kinds of shrubs, mixed with weeds, neither sufficient to keep in cattle, nor prevent the workmen trespassing in every direction.

The next subject for consideration is that of the planting of the quicks. To this end we should choose our plants to be of about four or five years old; and in all cases, if possible, should personally superintend their removal from the nursery. Old bundles of quicks, that have stood it may be two or three weekly markets, will be sure to cause disappointment. They should be removed so as to secure as many of the rootlets—not merely the larger roots—as possible.

In planting, which should be done as quickly as may be after removal, avoid the dibble, or anything which would tend to combine the roots in a small compass. The best plan is to use the spade and to spread the roots carefully; then cover them up, and tread the plants firmly into the ground, taking care, if it be in a retentive soil, not to leave holes in which water could stagnate.

When so planted, at about from six to nine inches, they should annually, or twice a year if necessary, be hoed and weeded and have the surface-soil tolerably well stirred, and, usually at the end of about the third or fourth year, be carefully cut down within six or eight inches of the ground, and the soil well stirred and manured. This would appear to be a waste of time; but a single year will restore the plants to even a greater height than before, and with all the elements for a thick impervious bottom, from which time annual careful trimming—always when the leaves have performed their functions and fall off—will be sufficient to keep the hedge in an improving state.

We have here advocated planting in single lines. Some, however, prefer double rows of quicks; but the latter are more difficult to keep clean and to cultivate; and we have ever seen that it is not the quantity, but the quality and the after-treatment of the plants which result in the compact and repellant hedge.

Of course, all young hedges must be protected by a dead fence; and for this purpose we prefer posts and rails of wood, or, if to keep back sheep, mixed with a line or two of hoop-iron: this, according to the situation of the fence, will be required on only one or on both sides.

In planting young beech, or hornbeam, or any non-spinous plant, for hedges, it is advisable to cross the sets like a series of XXX's, overlapping each other at about ten or twelve inches apart; by this means the branches interlace, and a compact fence, difficult to penetrate, will be formed.

E.B. 2504.

Cratægus monogyna. Common White-thorn.

Maple may be used in the same way; but it never makes a strong fence, and it has not the advantage of the two former, as its leaves fall off at the approach of cold weather, which is not the case with either beech or hornbeam, whose leaves are eminently persistent, especially in the earlier part of their lives.

If furze hedges be required for any position, they may easily be grown, either by taking up young plants from the waste and planting them where wanted, or by sowing seed, which can readily be obtained from any seedsman.

Before sowing, the ground should be lightly dug, and the seeds, after being soaked for a few hours in water, be thinly sown, and be only just covered up by the soil. This operation may be done in February; and when the seeds come up, if they are covered over by branches of cut furze, or these be stuck here and there in, or on, either side of the rows, the young plants will be protected from cattle and sheep, which are fond of nibbling the tender furze shoots.

CHAPTER XXXV.

WEEDS OF HEDGE-ROW FENCES.

As the hawthorn is usually recognized as the best plant for living fences for farm purposes, it will be expected that this has been almost exclusively employed; but, seeing that this is so, and has been so for many years past, it is not a little interesting to trace in all hedges a predilection to grow anything else rather than that originally planted. Of course, with anything else we wished to grow, such interlopers would be eradicated as weeds; but with hedges it would seem that all kinds of rubbish are left to accumulate, until a hedge originally all hawthorn has become made up of extraneous matters, with occasional "gaps," which are sure to occur where other plants are allowed, to the prejudice of the quicks. As examples, we append the following:—

Ex. 1. ANALYSIS OF A HEDGE-ROW ON THE GREAT OOLITE COLLEGE FARM, CIRENCESTER.

	ft.	in.
Whitethorn	2	6
Maple	4	0
Elder	2	0
Maple and whitethorn confused	4	6
Elder	3	0
Maple, whitethorn, and elder, confused	12	0
Elder	5	0
Maple, whitethorn, and elder, confused	21	0
Ash twigs	3	0
Maple	2	0
Ash	3	6
Quicks	12	0
Elm twigs	3	0
Elder	3	6
Maple	3	0

Elder	3	0
Whitethorn and maple	24	0
Gap	4	0
Total	115	0

Ex. 2. ANALYSIS OF A HEDGE ON THE FOREST MARBLE, NEAR CIRENCESTER.[235]

	ft.	in.
Whitethorn	3	0
Blackthorn	4	0
Brambles and briars (Rubus and Rosa)	4	6
Ash and gap	4	0
Crab	4	0
Gap and brambles	3	0
Whitethorn	2	6
Crab	2	0
Blackthorn	2	0
Whitethorn	4	0
Blackthorn	7	0
Gap and briars (Rosa canina)	4	0
Blackthorn	4	0
Whitethorn	3	0
Rose (briars) and brambles	4	6
Whitethorn	3	0
Gap and brambles	2	6
Whitethorn	2	0
Rose (briars)	3	0
Whitethorn	2	0
Rose	2	6
Blackthorn	2	6
Total	73	0

Ex. 3. ANALYSIS OF A HEDGE ON THE INFERIOR OOLITE, BRADFORD ABBAS.

	ft.	in.
Traveller’s Joy (clematis)	3	0
Gap	12	0
Whitethorn	4	0
Ash	3	6
Whitethorn, brambles, &c.	10	0
Clematis	18	0
Sycamore stump	4	0
Brambles, &c.	8	0
Maple brambles, with occasional whitethorn bush	33	0
Nut and gaps	11	0
Blackthorn and brambles	6	6
Guelder rose	3	0

Blackthorn, &c.	5	0
Elder	3	0
Blackthorn, maple, and others, with occasional whitethorn	20	0
The same, smothered with clematis	28	0
Total	172	0

These three examples will be sufficient to show the fact that, in the lapse of years, a hedge originally planted either all or nearly all quicks, ultimately contains almost everything besides. How this comes about may be easily observed. Birds and other creatures are constantly taking fruits of various plants to the hedge-rows, the seeds of which being dropped there, soon vegetate; and if shrubs with heavier twigs and broader leaves once ascend into the hedge, they overshadow the smaller leaves of the quicks, and ultimately so discourage them that they all but die out, and it is not at all difficult to see that the success of the interlopers is only augmented by the injuries to the quicks.

A more minute inquiry into the natural history and mode of operation of hedge-row weeds will be best preceded by a list of such plants as may be considered to act as weeds in a properly planted whitethorn hedge.

In doing this we may premise that, if our object has been to plant quicks, interlopers of all kinds, whether trees or shrubs—in fact, all but the plant which we have purchased and planted—can scarcely be considered other than as weeds. To these interlopers, then, we may add the following list, as containing a series of plants that will be, perhaps, more generally recognized as weeds:—

LIST OF HEDGE-ROW WEEDS.

No.	Botanical Name.	Trivial Name.	Remarks.
1	Salix species	Willows, various	
2	Berberis vulgaris	Barberry	Spinous undershrubs.
3	Rosa species	Wild Roses (briars), various	
4	Rubus species	Brambles, various	Woody climbing plants.
5	Clematis vitalba	Traveller's Joy	
6	Hedera helix	Ivy	
7	Solanum dulcamara	Bitter-sweet Nightshade	Climbing herbs,—mostly twisting around the stems of the stronger hedge-plants.
8	Tamus communis	Black Bryony	
9	Bryonia dioica	White Bryony	
10	Humulus lupulus	Wild Hop	
11	Convolvulus sepium	Larger Bindweed	
12	Galium species	Bedstraw, various	
13	Glechoma hederacea	Ground Ivy	Weeds of the lower parts of hedges, which smother out young quicks, and
14	Geranium Robertianum	Herb, Robert Cranesbill	

15	Carduus varieties	Various Thistles	prevent the old ones from being thick at “bottom.”
16	Umbelliferæ varieties	Hedge Parsley, &c.	
17	Graminaceæ varieties	Grasses	

As regards the plants of this list, it will only be necessary to refer to a few of them, in order the more fully to impress the principles we have laid down.

The roses (briars) and brambles, though spinous, are yet short-lived; so that their old wood is continually dying out, thus causing gaps, inasmuch as such heavily-foliaged plants necessarily prevent the growth of the whitethorn or any other tolerable hedge-plant. But, besides this, the bramble has the propensity to root at the ends of its long flexile branches, and so spreads the pest in every direction, not escaping the ditch when it forms part of the fence, that the whole becomes smothered up in a tangled, inextricable mass, always out of order and unsightly, making but a poor fence, though affording shelter to hares, rabbits, and other farm pests.

The clematis and ivy are large-foliaged plants, and their pliant stems interlace on the hedge in such a manner as most surely to kill out the quicks, and so to become the usurping tenants; but, no sooner have they attained the mastery than they begin to decay, whole branches die, and the result is a gap, which must either be patched up with thorns or be newly planted, and then fenced with post and rails. As regards mending gaps with thorns, we ought to state that we view it as decidedly injurious,—as dead matter in proximity with the living only prevents the growth of the latter: at best it is only a makeshift, which soon gets rotten, and tempts the petty wood-pilferer to pull the hedge further to pieces for the sake of a few dry sticks.

With regard to those plants of which we may take the bryony and the hop as the types, it is true that their bine is annual; but each year the quantity and strength of this augments—each year the mass of foliage becomes larger and thicker. The twining arms twist around any branch strong enough to support them, and then, once at the top of the fence, they spread over its surface, making so thick a mass that the legitimate hedge-plants are no longer visible; thus sun and air are excluded from them, and they soon pine away. These are difficult to eradicate, as they have stout rhizomata (underground stems) interlaced with the very roots of the hedge-plants: still, if pains be taken to pluck away the bine as soon as it makes its appearance, it must in time be destroyed; for, like even the hawthorn tree, hardy as it is, if the leaves be kept from perfecting themselves, they soon pine away, and ultimately die altogether.

The other plants are more properly weeds of the hedge-bank than of the hedge, and as such need only be mentioned with weeds in general as pests to be periodically removed by hoeing, digging, and otherwise clearing the ground between and about the hedge-row work, more particularly necessary in the first few years of planting.

CHAPTER XXXVI.

ON HEDGE-ROW TIMBER.

Of the many sources of mischief to which the farmer may be liable, we can conceive none greater than that of being overgrown with hedge-row timber. It is scarcely, if at all, second to that of being overstocked with game—for as regards game, there is a chance of getting some compensation for palpable injury; but the mischief which trees silently but surely effect, when surrounding fields, is never allowed for, as it is not fully appreciated by the tenant, and never admitted by the landlord; and so as hedge-row timber is usually thicker in the richer parts of the country, it is somehow considered as an evidence of fertility on the one hand, while it is looked upon as a legitimate mode of increasing income on the other.

But we are quite sure that hedge-row timber is almost useless in itself, and a pest to all who must live under it. Hedges themselves are usually too many, and these too thick through them; and when it comes to be understood that the enclosures are smaller, the hedges often greater, and hedge-row timber thicker on good than on bad lands, some idea may be formed of the mischief which is inflicted by thus hemming in fine land from light and air.

The following tables, by Mr. J. Bravender, land-surveyor, of Cirencester, are the results of an "examination of the fields contained in 120 parishes:"—

TABLE OF ADMEASUREMENT OF FENCES.

Geological Formation, &c.	Average quantity of each field.	Length of fencing.	Length of fencing, per acre.	Width of fencing.	Quantity occupied by fences per acre.[24]	Quantity per hundred acres.
	Acres.	Chains.	Chains.	Links.	Perches.	Acres.
1. Red Sandstone	5½	15·58	2·83	15	9·05	5⅔
2. Lias	4	12·90	3·22	18	12·36	7¾
3. Oolite	11	20·75	1·88	12	4·81	3

4. Oxford Clay	6½	16·45	2·53	16	8·63	5⅔
5. Coralline Oolite	11	20·75	1·88	14	5·61	3½
6. Kimmeridge Clay	8	18·25	2·28	16½	8·65	5
7. Chalk	13	23·27	1·79	12	4·58	2⅘
The average of the above quantity occupied by fences is					..	4¾
A wall, 2 ft. wide, with 1 ft. 3 in. on each side, between arable fields (oolite)					2·80	1¾
A wall, 2 ft. wide, between pasture fields (oolite)					1·20	0¾

[24] Including one-third added for angular sinuosities.

The above calculations do not include the strips which are so often found alongside fences, covered by brambles, blackthorns, and other rubbish. Now we have seen what is the quantity of land occupied by fences, it will be our province to ascertain to what extent they may be reduced in size, and yet remain as useful to the agriculturist.

The following table will exhibit the saving per hundred acres, by reducing the width of fences:—

TABLE OF REDUCTION OF FENCES.

Geological Formation.	Width, as in the preceding table.	Width to which fences may be reduced.	Saving in width.	Length per hedge, per acre.	Saving in quantity per acre.	Saving per cent.
	Links.	Links.	Links.	Chains.	Perches.	
1. Red Sandstone	15	9	6	2·83	2·71	1 7/10
2. Lias	18	10½	7½	3·22	3·86	2⅖
3. Oolite, Forest Marble, and Cornbrash	12	7½	4½	1·88	1·35	0⅞
4. Oxford Clay	16	9½	6½	2·53	2·63	1⅔
5. Coralline Oolite	14	8½	5½	1·88	1·65	1
6. Kimmeridge Clay	16½	10½	6	2·28	2·18	1⅜
7. Upper & Lower Chalk	12	7	5	1·79	1·43	0 9/10

The average quantity of the above saving is 1⅖ for every 100 acres.

If this saving were effected, which is quite practicable, it would increase the cultivated land in England and Wales 490,000 acres, and would be similar in its effect to the addition of a new county, nearly equal in extent to Nottinghamshire, and somewhat larger than Berkshire."—*Morton's Cyclopædia of Agriculture*, p. 859.

The above is the evidence of a highly practical gentleman as regards the loss by bad, wide, and straggling fences; and if we add to this the additional loss and injury which the land sustains by the growth of hedge-row timber, we shall find that we have even a greater account to settle. Now, if we inquire into the nature of these evils, we shall find that they result from shade, drip, and exhaustion by roots.

There are those who speak in favour of hedge-row timber as affording shade for cattle; but we should remember that when this is so, the cattle, by being thus gathered to one spot, only aid in manuring those portions of the field where the grass is always more rank than nutritious, and this to the robbery of other portions of the field. For ourselves, we would rather have our fields exposed to the influence of sun and air, and, if required, have some contrivances for shade which could be moved about the fields at pleasure. The shade of trees keeps off those refreshing showers so important to vegetation, but in much wet the trees send down a drip which is sometimes found to be so injurious as to prevent any good growth beneath them, and then as the leaves fall off they often poison the soil for some distance, while the roots impoverish the land in every direction.

We have just visited a field, in the southern hedge of which are growing some beech trees; these not only keep off the southern sun, but their drip and fallen leaves render fully one-eighth of the field nearly useless.

Again, do we not everywhere find twice the number of hedges that are required; and, to add to the mischief, these filled with trees? In many places we see elms not more than three yards apart. Here the shade would be intolerable, but the farmer is allowed to lop them until they look not unlike the stuck-up tails of French poodle dogs—a process which certainly diminishes the evils they entail upon the farmer, but renders the timber comparatively useless.

But, say the advocates of tall hedges and hedge-row timber, “How beautiful they make the country look! Your plan would leave it all bare and desolate; no song of birds to cheer the wayfarer,” &c. But stop, good people; we love trees, but we do not care so much for straight lines of stuck-up *besoms*. Let the landlord grow his woods and his groves, and plant his parks. Let him put trees in parts which will grow nothing better, and in belts to keep off malignant winds; and even here (the best places for them), let him be content with their pleasure and profit as a rent for the ground they occupy, and not, as some do, insist upon the tenant yearly planting trees in positions which must injure so much land which he is still to pay rent for. This is about as tyrannical as to make a schoolboy carry a birch, and ask for its application.

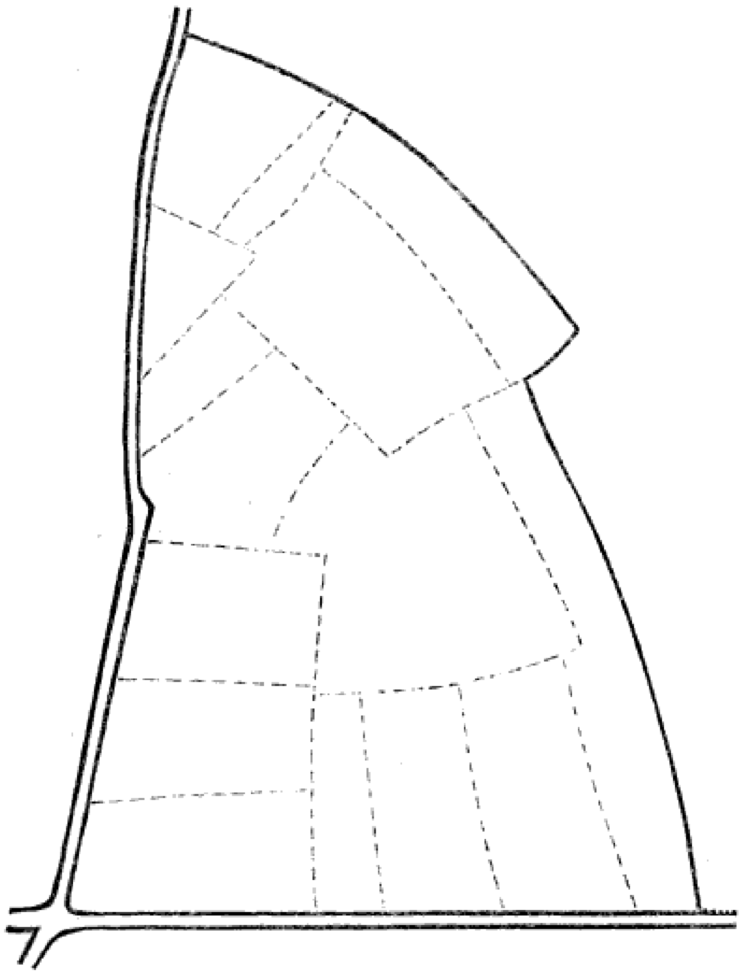


FIG. 1. *Field with its old divisions, now removed, as marked by the dotted lines.*

As regards the loss of land by the division into smaller fields, we cannot do better than copy the former outlines of an arable field on our own farm. This, which is now one field of over fifty acres, was formerly in fifteen fenced fields, each with a ragged hedge—of anything but quicks—planted upon raised mounds. Now, the gain in the removal of fences, indicated by the dotted lines (see fig. 1), may be explained by the following calculations:—

	Acr.	Rds.
Ground, 2 yards wide, occupied by the mounds and hedges, about	1	2
One foot and a half on either side of the mounds which cannot be ploughed, about	0	3
Total of gain in 50 acres	2	1

Or, per cent., 4a. 2r.

From these data, then, we may conclude that if available land equal in extent to a county may be gained by keeping fences within bounds, this may be more than doubled by grubbing up, not merely useless, but mischievous fences, and discountenancing the growth of hedge-row timber.

Now, although we reside in the county of the Dorsetshire poet, we are not of those who would curtail the privileges of the poor by closing up all footpaths, or by too rigidly curtailing the road space; but as long as the farmer has to pay rent for the ground needlessly occupied by badly-constructed hedge-rows, we think it due to him, and even to the poor themselves, that land now so occupied should in future be made food-producing; and with these sentiments we would conclude this chapter by quoting the following

DORSETSHIRE DITTY.
(*From Poems by William Barnes.*)

"They do zay that a travellin chap
Have a-put in the newspeäper now
That the bit o' green ground on the knap
Should be all a-took in vor the plough.
He do fancy 'tis easy to show
That we can be but stunpolls at best,
Vor to leäve a green spot where a flower can grow
Or a foot-weary walker mid rest.
'Tis hedge-grubbèn, Thomas, an' ledge-grubbèn
Never a done,
While a sov'rèn mwore's to be won.

"The road, he do zay, is so wide
As 'tis wanted vor travellers' wheels;
As if all that did travel did ride,
An' did never get galls on their heels.
He would leäve sich a thin strip o' groun'
That if a man's veet in his shoes
Wer a-burnèn an' zore, why he coulden zit down
But the wheels would run over his tooes.
Vor 'tis meäke money, Thomas, an' teäke money,
What's zwold an' bought
Is all that is worthy o' thought.

* * * *

"The children will soon have noo pleäce
Vor to play in, an' if they do grow,
They will have a thin musheroom feäce,
Wi' their bodies so sumple as dough.
But a man is a meäde ov a child
An' his limbs do grow worksome by play,
An' if the young child's little body's a-spweil'd,
Why, the man's wull the zooner decay.

But wealth is wo'th now mwore than health is wo'th;
Let it all goo
If 't 'ull bring but a sov'rèn or two."

CHAPTER XXXVII.

ON THE VERMIN OF FENCES.

One of the great objections urged to more hedge-row fences than are necessary, is that of harbouring *Vermin*; it therefore becomes necessary to inquire into the history of those creatures designated by a name everywhere held in reproach.

The meaning of the term vermin has not been very accurately defined. Johnson considers "any noxious animal" to belong to vermin; whilst Bailey, anxious to be more specific, defines vermin to be "any kind of hurtful creature or insect, as rats, mice, lice, fleas, bugs, &c.;" but whatever lexicographers may say upon the subject, there can be no doubt that, in country language, what are known as noxious animals are distinguished from noxious insects, the first being in most counties known as "Varment," to which belong rats, mice, stoats, &c., to which the keeper would add kites, hawks, owls, magpies, and other birds; the second term being limited to those parasitic creatures by which both man and some inferior animals may be attacked.

The farmer's notion of vermin, as applied to the hedge-row, differs from these, as it includes all beasts, birds, reptiles, insects, &c., which directly injure the hedge, together with such as choose the hedge-row or the bank on which it might be grown as a breeding-place, from which they migrate to farm crops, and so become injurious, not to the hedge alone, but to the farm in general.

Some notion of these may be inferred from the following list:—

1.	*Rabbits*—By burrowing in the hedge-bank.	
2.	*Hedge-hog*—Ignorantly included with hedge-row vermin by the farmer.	
3.	*Stoats* *Rats* *Mice*	These burrow or make the hedge-row or bank a place of refuge and concealment.
4.	*Snakes*—Erroneously supposed to be injurious.	
5.	*Slugs* *Snails*	Both breed extensively in hedge-rows, which often form these hybernacula.
6.	*Insects* injurious to the growing hedge-plants.	

Do. protected by the hedge, and migrating to the farm crops.
Do. harboured by hedge-row weeds, and thence migrating to the crops.
7. *Birds* in general, according to the dictum of the Sparrow Clubbists.

1. The rabbit is one of the greatest pests to the bank on which hedges are too often grown, and therefore is injurious to the growing hedge, to say nothing of the mischief which these creatures do to the crops. The other day we visited a field in which a hedge-bank had been undermined with no less than fifty holes in the distance of five-and-twenty yards; these ramified in every direction, not only through the raised mound, but into the fields on either side of the hedge, and out of which rabbits were dug from a depth of as much as four feet. Here the ridiculous nature of the mound was the primary cause of the mischief, and hence we here offer an illustration of the general facts which met our view:—

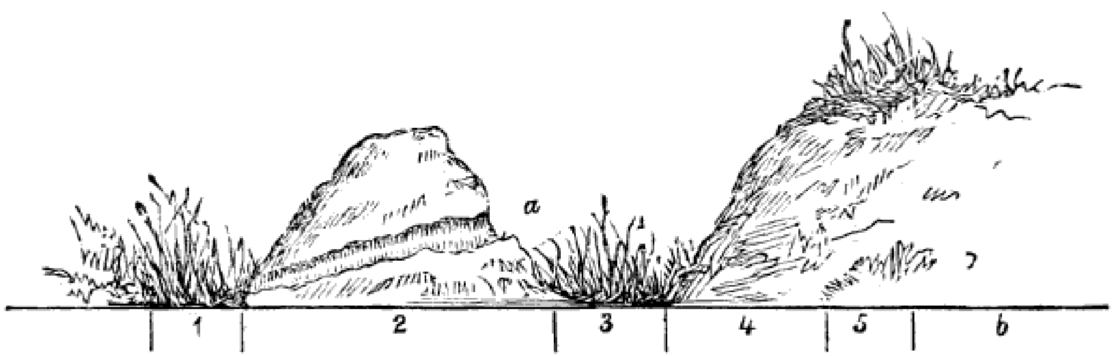


Diagram of a Mound and Ditch in Oolite Sands.

	ft.	in.
a. A rabbit hole.		
1. and 5. Grass and weeds which cannot be ploughed	5	0
2. Mound for fence	8	0
3. Bottom of ditch	3	0
4. Field side of ditch	6	0
6. Arable field	—	
Total	22	0

Here it will be seen that not only has nearly twenty feet of land been taken up with the fence, but the plan upon which it is made of itself suggests a rabbit-warren, and especially when we say that the soil is of a loose sandy nature, and the ditch has never yet been a conduit for running water, and is therefore perfectly unnecessary.

2. The hedge-hog is here only mentioned in the hope of dispelling a popular prejudice with regard to him. He is ruthlessly destroyed as vermin, on the

supposition that the hedge screens a traitor who is ever ready to suck eggs or to take a meal from the cow's udder. Now, as regards the first charge, one would have thought that, from the pertinacity displayed by those who bring it in destroying birds' eggs and birds of every kind, they would have little care upon this head. His sucking of cows has never been witnessed by any competent observer, and with such the idea was never entertained, nor can it be supposed that a cow would suffer the approach of a creature so thoroughly armed with spines as the hedge-hog. In the words of Yarrell we may conclude that "this is about as well-founded an accusation as that of Pliny, exaggerated as it is by Sperling, who assures us that it ascends trees, knocks off the apples and pears, and, throwing itself down upon them that they may stick to its spines, trots off with the prize! Ælian gives us the same story, substituting figs for apples, and omitting the climbing power of the animal."

3. This section contains creatures for which few of us entertain any affection; at the same time, it may perhaps be true that some of the greatest of farm pests, in the shapes of rats and mice, have greatly increased since the destruction of the polecat, stoat, and other of our smaller carnivorous quadrupeds.

As regards mice in general, one source of alarm connected with their former occupancy of the hedge-row has nearly vanished from among us. We allude to the supposed injury they were thought to inflict on any creature over which they might creep.

At one time, if a cow or sheep offered any symptom of paralysis or injury, more particularly of the hind-quarters, the creature was said to be "mouse-crope," for which were several popular remedies, which were used by way of direct applications, such as a liberal application of rods of wytch-hazel, drawing twigs of mountain-ash or rowan-tree over the affected parts; but the more general plan of action was to operate upon the offending creature upon the same principle as pertains to the present day in the case of a bite by a dog—namely, that the bitten subject is not safe from the direst calamities so long as the author of the mischief is alive; and acting upon this, there are few persons in rural districts who would not demand the death of a dog by whom they may have been bitten, and this not as a measure of precaution, to prevent the like occurrence happening again, but as the first thing to be done to ensure a safe cure. So with a "mouse-crope" subject: action was at once taken against the mouse, but this through the agency of the "shrew-ash," which potent remedy is thus described by Gilbert White, in his charming "Natural History of Selborne:"—

> Now, a shrew-ash is an ash whose twigs or branches, when gently applied to the limbs of cattle, will immediately relieve the pains which a beast suffers from the running of a shrew-mouse over

> the part affected; for it is supposed that a shrew-mouse is of so baneful and deleterious a nature, that wherever it creeps over a beast, be it horse, cow, or sheep, the suffering animal is afflicted with cruel anguish, and threatened with the loss of the use of the limb. Against this accident, to which they were continually liable, our provident forefathers always kept a shrew-ash at hand, which, when properly medicated, would maintain its virtue for ever. A shrew-ash was made thus:—Into the body of the tree a deep hole was bored with an augur, and a poor devoted shrew-mouse was thrust in alive, and plugged in, no doubt, with several quaint incantations, long since forgotten.

That the shrew-mouse was generally held in the greatest dread, there is no doubt; but, we find in Dorsetshire, where this notion still prevails, that the idea of mischief is not confined to the shrew, but is believed of any mouse. We had a steer in one of our feeding-pits, which, as he did not gain flesh, was said to be "moss-crop," the western vernacular for mouse-crope. Still, field mice, without regard to species, are supposed to be the most baneful in this way; at the same time, we may trace an evidence of the former generally prevailing belief in the injurious tendencies of even our common mouse, in the fact that when you have so far convinced a lady friend, who may have a "horror of a mouse," of their harmless nature, you are sure to be met with the unanswerable remark, which gains point from the manner of its utterance, "But suppose a mouse should creep over me?" We may now entirely discard every notion of the evils of mouse-crope cattle as an argument against the hedge-row as a harbour for rats and mice; still, these are vermin in the true sense of the word, and which hedge-rows, unless kept trim and clean at bottom, are sure to encourage.

4. Snakes in hedge-rows are very common, and especially on banks facing the south; of these, the common ringed snake and the slow-worm are often met with. They excite great terror in most people; but still they may be said not merely to be quite harmless, but absolutely useful, as they live upon insects and small fry in general, and so, in reality, they ought not to be classed as vermin, but take their place amongst their most decided enemies.

5. The land mollusks, to which belong the snail and the slug, are sheltered in hedges by thousands; and highly destructive they are, and more especially in small overshadowed enclosures. The quantity of vegetation which these consume is enormous, and we are sorry to think that they are on the increase—a fact which we deem to be due to the indiscriminate slaughter of small birds, more especially the blackbird, thrush, and lark, which are their most determined enemies. As farmers, we might well afford them a dessert of small fruit for the good they do in destroying slugs and snails.

6. Hedge-row shrubs are liable to be injured by many insects, more especially the caterpillars of different kinds of moths and butterflies, which sometimes eat away

all their leaves, and so greatly retard the growth of the hedge. Upon this subject we quote from "Our Woodlands, Heaths, and Hedges," for the purpose of introducing to our readers a small book by W. S. Coleman, which should be in the hands of all country readers:—

> The foliage of the hawthorn, remarkable for its elegance, is the chosen food of a great number of interesting insects, principally the caterpillars of various *lepidoptera*.
>
> Several species of these are of a gregarious nature, living together in extensive colonies under a thick net-work of silk, which serves them for a common protection while feeding on the foliage enclosed with themselves in a silken tent.
>
> Among these social net-weavers are the caterpillars of a fine insect, the black-veined white butterfly (*Pieris cratægi*), a rarity in some districts, but in certain localities, and at certain periods, abounding to such an extent as entirely to strip the hawthorn hedges of their foliage. Similar depredations are committed by the gaily-coloured progeny of the common lackey moth, and of the gold-tailed and brown-tailed moths; but the most formidable devastators, though the tiniest individually, are the little ermine moths (*Yponomenta*), small silvery-grey creatures, minutely spotted with black. The curious twig-like caterpillars of the brimstone moth (a pretty canary-coloured creature, with brown markings), and of several other geometers, are common upon hawthorn.

Last summer (1864), the hawthorn trees and hedges about the parks and squares of London were entirely defoliated by caterpillars, which progressed from tree to tree in squads of numberless individuals, only seeking a new site of action when the former one had been despoiled of every vestige of leaf and bud.

But it is not only the hawthorn which becomes attacked by insects: all other hedge-row trees and shrubs have their peculiar enemies, to describe which would take more space than we have to spare, and we therefore conclude the chapter with a few remarks upon the weeds of dirty hedge-rows. These harbour various insects, which migrate to our crops, and do an immense amount of injury. For instance, such plants as Jack by the Hedge (*Erysimum alliaria*), treacle mustard (*Sisymbrium officinale*), wild mustards, and other forms of *Cruciferæ*, in hedge-rows, afford a winter nidus for the turnip flea beetles (*Haltica concinna* and *H. nemorum*),[25] from which they take their flight to the more delicate turnip and swede crops as soon as these come up.

[25] See *How to Grow Good Roots*, pp. 43 and 44 of the present work.

Birds need only here be mentioned incidentally, as there is still a conflict of opinions as to the use of the bird family to the farmer; and those species which mostly build in and frequent our hedges are perhaps those upon which evil suspicions are most universally held. Amongst these are the hedge-sparrow, finch, linnet, and others—and that these are mischievous at times, we are not prepared to deny; but we should be sorry if the curtailment of hedges, for which we are advocates, should result in the destruction of our small birds, as we conclude most of the species to be at times eminently useful.

CHAPTER XXXVIII.

ON THE MANAGEMENT OF HEDGE-ROW FENCES.

We shall, in the first place, treat the subject of management in reference to fences composed of hawthorn. In the newly-planted hedge we shall find that the better the soil in which it is planted, the quicker and stronger the young quicks will grow. If, then, the soil be not good, or if it be thin, it will be worth while to prepare it as well as circumstances will permit. This may be done by deep digging, by bringing good soil from a distance, or some aid may be given by means of any kind of manure. It should ever be borne in mind that to start with luxuriant growth is all-important, as neglect in this matter at first can only be partially remedied afterwards.

Good quicks, selected and removed with care, carefully planted in well-prepared ground, not elevated several feet on a dry sand-bank, or carelessly grouted in a gutter of clay, will soon send out vigorous shoots. These should be well weeded and dug at least for three or four years, during which time an occasional trimming of a wild shoot here and there with the knife will rightly direct a more even growth.

In weeding, the first advent of briars and brambles should be looked to; so all seedling ash, elder, maple, and defenceless trees in general, should be *taken out by the roots*, not cut off, as this only makes a thicket of a twig.

After three or four years, if the growth be sufficiently strong, the young hedge may be trimmed to a desired shape with the shears or the hook; but if weak and straggling, we would strongly recommend that the whole be boldly cut off within a few inches of the base, the ground to be well dug and even manured about the roots, and the protecting railings to be put in order, and a new growth be waited for, which, generally speaking, will not be long—for by this means we believe that a good fence will be sooner arrived at than by allowing weak wood to go on growing still weaker.

Hawthorn fences are sometimes allowed to get several feet high before being brought into reasonable dimensions, in which case they get smooth, unarmed, and unbranched stems at the base. This state of things is too often attempted to be cured by cutting out a quantity of the wood and laying the rest, by partially dividing them near the ground—a plan which is called "plashing." This we think highly objectionable: it would be far better to cut off the whole to within a few inches of the ground, and so trim the shoots as they grow again.

The truth is, that plashing gets out of order, the layered sticks get out of place, and the whole is aided by stakes of dead wood, which soon decay, or, if not, are almost certain to be removed by the constant country claimants to dead sticks in general.

We prefer that no dead materials should be put to a living fence; for if there are gaps, it will be best to dig the ground well and put in some young quicks, fencing with posts and rails, to guard the plants as well as impound the cattle. Mending gaps with thorns only aggravates the evil, as the living part of the fence is so interfered with by the dead matter that it grows but imperfectly, and the dead materials soon rot away, leaving a greater gap to be re-mended.

We have seen gaps tried to be repaired by old quicks, but this seldom succeeds—for if they grow, they are never bushy enough to be repellant; but they often die altogether, and at best with old plants, young quicks will repair the mischief in less time.

Seeing the difficulty there is sometimes in getting quicks to grow well in hedge gaps, it is not uncommon to fill up with various kinds of hedge-row plants, such as hazel, whitebeam, spindle-tree, dogwood, maple, &c.; but the objection to these is, that they are often not repellant in any way, and they help to make weaker places broader than they found them, and, indeed, ultimately get possession of the greater part of the hedge-row. There is, then, nothing better to mend a whitethorn hedge than quicks, and they will grow if attended to for the first two or three years; but why they usually fail is, that if planted in gaps they are usually closely hemmed in by old thorns, or allowed to become smothered by weeds.

With respect to very old hedges, made up of all sorts of materials, we prefer cutting them down about three feet from the ground, leaving all the stubs to branch out, than to attempt to layer as shrubs, and then the whitethorn succeeds even less with plashing. Where, however, we have rough, but, after all, not repellant fences, we should like to see them re-planted, by which they could mostly be curtailed, and at the same time opportunity may be taken to get rid of some of them altogether, or to make them in a more convenient direction.

We are now in possession of a hedge composed of everything but hawthorn, and somewhere about twelve feet high. It is without gaps, but still pregnable at any point, by reason of the want of armature in the shrubs of which it is composed. Still, as it stands on the top of a bank five feet high, the mound and hedge together is not so bad a fence as its materials might warrant.

We here give a list of the plants of which this fence is composed, in order to the more clear explanation of what is to follow:—

PLANTS IN A HEDGE AT BRADFORD ABBAS, ON THE INFERIOR OOLITE.

	Parts.	
Ash	4	The whole intermixed with long climbing brambles and straggling briars, and the bank covered with the usual hedge-row weeds.
Hazel	20	
Cornel	10	
Spindle-tree	12	
Blackthorn	6	
Maple	20	
Mealy Guelder Rose	5	
Clematis	2	

Elder	3
Elm	3
Whitethorn	2

Now, here is a tall hedge on the north side of our field, and so capable of affording no slight amount of shelter to stock; but how much southern sun does it keep off our neighbour's field! And yet we have just succeeded to a lease which contains a clause compelling this hedge to be annually trimmed—a process which has not been performed for many years, but which we shall hereafter show should be done, especially where hedges have been properly cared for, for the due keeping of the fence itself; but further, we feel convinced that a proprietor should be able to call upon the owner of a neighbouring estate to keep his portion of the fences within such bounds as may not be injurious.

In the case before us, what is best to be done? Custom says, "Lay it; plash it." Still, the materials are not suitable for this process. "Cut it down and it will shoot up again," says the hedger, who would be ready to do the work for the wood; but mark, that in order to get as much as possible, it would be cut close to the ground. Our plan will be to cut it at about a yard from the top of the mound, and afterwards to watch the young shoots, so as carefully to trim them, in order to induce them to throw out laterals, and thus make, at least, a thick growth, though of unpromising materials.

With regard to trimming by the piece: if it be really a well-grown quick-set hedge, the keeping it to a certain standard may be easily accomplished; but if it be a weakly growth of all kinds of shrubs, the labourer slashes as close to the ground as he can with the hook, in order to "have something to cut against"—a process which only makes the hedges weaker the oftener it is performed.

CHAPTER XXXIX.

COVENANTS WITH REGARD TO FENCES, ETC.

From what has been already advanced, it will be seen that the matter of fences is most important in connection with the arrangements between landlord and tenant.

The landlord for the most part gets the same rent for the land occupied by fences as for the whole of the field, such land being calculated with the acreage; and, further, with the tenant-at-will he insists upon their being kept in order—that is, if he cares for or knows anything about order—at the expense of the tenant. In leases there are usually inserted covenants obliging annual trimming of fences and scouring of ditches; but, generally speaking, the tenant does just as much as he likes, and the landlord knows but little about it. At the same time, annual trimming of hedges would often be mischievous; and again, as some hedges would be well to be let grow tall, on account of the shelter they might afford, there will be so many circumstances to be considered in coming to a right conclusion about what should be done to fences, that it is no wonder that covenants are only insisted upon in a very partial manner, and the careless farmer, instead of repairing hedges in a permanent manner, is content to mend gaps—or "shards," as they are called in the midland counties—only when he wants to keep his beasts in any particular meadow or field.

We shall shortly discuss these views under the following heads:—

1. Fences should not be kept up to a greater extent than is required.
2. A tenant-at-will should not be expected to plant or take charge of fences.
3. Evils of bad fences.

1. The curtailment and removal of fences is, as already shown, a matter of great moment, not only as providing more available land for cultivation, but as exposing a greater surface even of the cultivated portions of fields to the influence of light and air. But on any estate where this has been deemed advisable, we have usually seen that as the work has been, as it were, divided amongst the tenants, it has either been done without judgment, or, if performed well, yet by men of different views, as having different requirements, so that it has resulted in a patchy and anything rather than an uniform improvement.

We would advise that the landlord or his agent take charge of this matter, with a view to that uniform improvement which would affect the whole estate. In this case it would be to the interest of the proprietor to make the run of the fences as straight as possible, to plant quicks, to mend gaps, and properly to fence them with rails. Were this the case, we should hardly see gaps filled up with dead materials, only to widen them as time advances by killing more of the living wood, or, what is even worse, left as roadways to tempt the trespasser. In fine, as the estate would be improved by having perfect fences, and therefore would fetch a better rent, it would appear to be the landlord's duty to see it attended to, and not to expect to charge a tenant for bad fences, and to insist upon his constantly mending them into the bargain, or it will naturally follow that they will seldom be up to a high standard of perfection.

2. A tenant-at-will, or even a leaseholder, should not be expected to plant new fences, or to cultivate those already planted, when it involves expenses from which he cannot reap the benefit. In the first place, it is not only the planting, but weeding and pruning—not merely slashing—that is required, all involving time, expense, and judgment, which no man would be justified in expending upon a precarious holding.

But take the case of a leaseholder for seven years. In our own parish, on the light oolite sands, is a quick-set hedge, which has been badly planted—now entering upon the fourth year since—upon the top of a thin mound of sandy soil, from four to five feet high. The quicks are not so good as when they were planted; it can *never* make a good hedge. Briars and brambles, and various shrubs common to oolite soils, will smother out the quicks, and altogether it will result in failure. Here the landlord should not expect his tenant to weed, and it is not worth his while to even find "rough timber" for forming a defence of such a hedge from the cattle, nor will it pay the tenant to employ a carpenter to work it. In this case the landlord should level the soil and re-plant the hedge—not on a mound of sand, but in the well-dug surface soil—efficiently fence it, and see to its annual weeding. In this way, instead of his having to find rough timber for fences for all time, one set of rails should be enough, and so he would ultimately save money for time by a present judicious expenditure; and, besides, as he would give his tenant more available land for his acreage, and this better secured, so that trespassers are kept from without and his cattle prevented straying from within, the holding would certainly be more valuable.

3. With bad fences the land is not at command. There has to be superintendence and mending whenever a field is wanted to be used. We recollect a farmer who, having bought some pigs, on being asked by his man where he was to put ’em, replied, “Oh, put ’em in the garden, for if you don’t they’ll very soon get there.”

Here was a case of bad fences about the homestead, and we may be sure everywhere else too. And here we would controvert the assertion that is too often made, that “the farmer who is a careful gardener will be a bad farmer.” We have ever seen that attention to neatness and order, at home and in the fields, will mark the good farmer, though it may not always assure us of the prosperous one. The truth is, that neatness is sometimes expensive; and as it does not always yield any greater reward than gratification to the tenant, it should at all times be encouraged by the landlord with every possible assistance, as he can never be a loser thereby, but must be the gainer.

The truth is, that there is nothing about estates or farms which so much requires remodelling as the system of fences. They want lessening, as the land is cut up into far too many awkward little pieces. They want straightening and paralleling, if we may so express it. They should, too, be kept within due compass, both as to breadth and height, so that altogether, as to material, mode of planting, position, and general supervision, the hedge-row really is in want of that kind of treatment which only a far-seeing, comprehensive overseer can direct, and which, were we to come into the possession of a large estate, would be the first process for its amelioration and improvement that we should attend to.

In fact, it may be said that this subject is daily receiving a greater share of attention, and that for a reason at first little suspected; but the truth is, steam is asserting its power on the farm as on the road, and as the engine marches into our fields, fences will be levelled before his mightiness—all sorts of crooked corners and queer-shaped angles will be removed, and the whole will assume a more regular outline.

There are moral evils connected with bad fences which we think have hardly been duly considered. We have hinted at their encouragement of trespassers and fostering of idle habits.

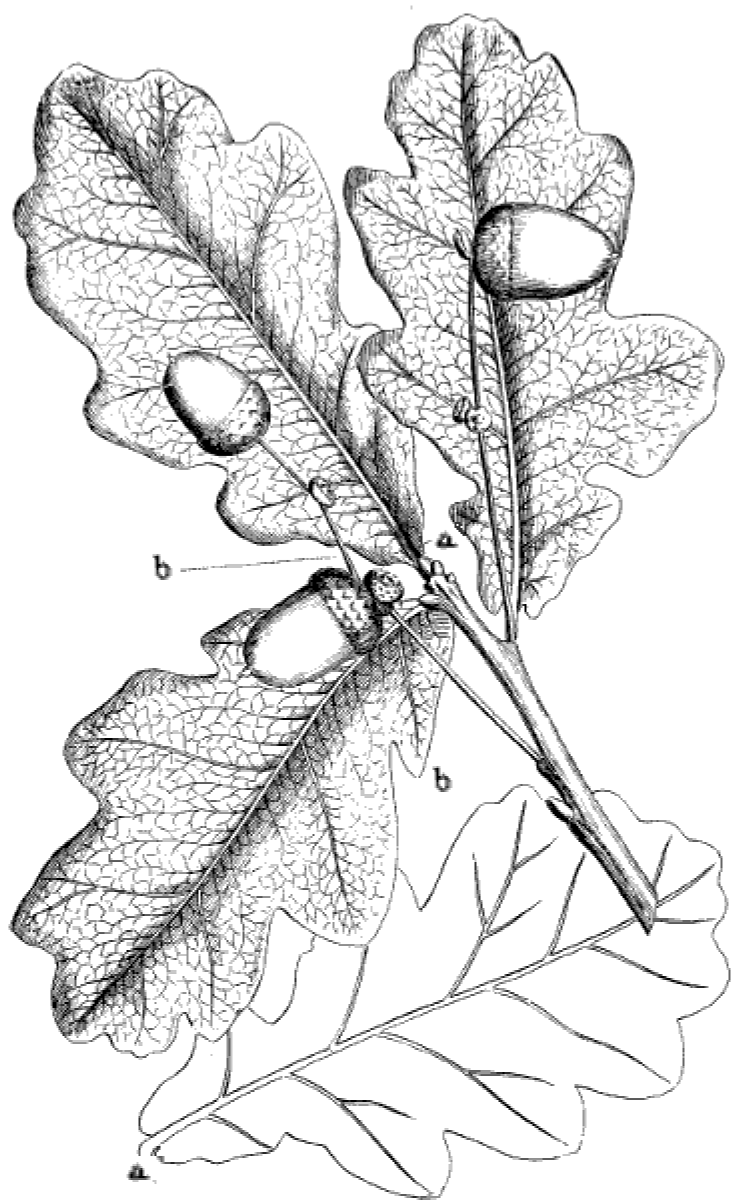
In our own parish are gaps leading from one field and from one farm to another. This encourages idle vagabonds to go anywhere—everywhere—on pretence of shooting small birds, many of which are often of more value than themselves; and if there is no gap already, how easy to push through twigs of cornel, ash, guelder rose, &c. &c.

Such hedges, again, are mended with dead thorns and stakes and rails of wood, which soon decay and become a prey to all the old women and idle children in the parish, the latter of whom hasten the period when they may claim them by climbing through and over them, and so prematurely despoil what they soon take home as of right.

In conclusion, then, we hazard the assertion that well-grown and well-kept fences are a boon to all. They benefit the landlord, by enabling him to give well-secured acres in exchange for his rent. Like good "buildings," fences benefit the farmer by affording him protection for his property. They benefit the poor, by removing a great source of lawless habits, and that commencement of petty larceny which too often leads to a complete negation of conscience.

They benefit all, inasmuch as Order, which "is Heaven's first law," is Man's best friend.

Plate I.



J.E. Sowerby, sc. W. West, imp.

Quercus Robur Pedunculata

HOW TO GROW GOOD TIMBER.

CHAPTER XL.

ON THE VALUE OF TIMBER FOR ORNAMENT AND PROFIT.

Among all the varied productions (says Strutt[26]) with which nature has adorned the surface of the earth, none awakens our sympathies, or interests our imagination, so powerfully as those venerable trees which seem to have stood the lapse of ages—silent witnesses of the successive generations of man, to whose destiny they bear so touching a resemblance, alike in their budding, their pride, and their decay.

[26] Introduction to “Sylva Britannica.”

Hence, in all ages, the earliest dawn of civilization has been marked by a reverence of woods and groves; devotion has fled to their recesses for the performance of her most solemn rites; princes have chosen the embowering shade of some wide-spreading tree, under which to receive the deputations of the neighbouring “great ones of the earth;” and angels themselves, it is recorded, have not disdained to deliver their celestial messages beneath the same verdant canopy. To sit under the shadow of his own fig-tree, and drink of the fruit of his own vine, is the reward promised, in Holy Writ, to the righteous man; and the gratification arising from the site of a favoured and long-remembered tree is one enjoyed in common by the peer, whom it reminds, as its branches wave over his head whilst wandering in his hereditary domains, of the illustrious ancestors who may have seen it planted; and by the peasant, who recalls, as he looks on it in his way to his daily labours, the sports of his infancy round its venerable trunk, and regards it at once as his chronicler and landmark.

Who indeed amongst us, in whatever position of life he may be, or in what land soever his lot may be cast, does not often find his mind's eye resting upon some favourite tree; it may be some huge elm on his village green, where, in the dim twilight, he either told or listened to the fairy tale or exciting ghost story; or the spreading oak, beneath whose shade he has picnicked; or the haunted grove, where his tale, though only whispered, yet spoke loudly to a willing listener.

> Now shift the scene to moonlight glade,
> Where dapper elves beneath the shade
> Of oak or elm their revels keep,
> What time we plodding mortals sleep.
> Next lead me to some haunted grove,
> Such as the Fauns and Dryads love;
> Or seat me by some brook, whose swell
> Makes music like a Naiad's shell;
> Then touch the tree 'neath which I lie,
> Till it unclose to ear and eye
> Whate'er it may have heard or seen
> Since spring first clothed its stems with green.
>
> *Spirit of the Woods.*

But we must not be led astray by the poetical emotions which are sure to rise up within us at the contemplation of forest trees; we shall therefore confine ourself, in this treatise, more particularly to a general description of the genera and species of trees usually grown in Great Britain for timber, with an explanation of some of the principles connected with the growth of timber.

Timber in a country where trees are almost, if not wholly, planted, affords a subject for consideration very different from that of wild aboriginal forests; in the former we have to consider our subjects as objects for cultivation, and that with a view of yielding profit or pleasure, or both, whilst the study of trees in the forest would naturally resolve itself into a botanical and physiological inquiry into specific forms. While, therefore, we would not here neglect the latter, our arrangement of trees and their history will have more particular reference to their cultivation, a subject which will probably address itself more especially to the landlord than to the tenant farmer.

In the main, then, the primary object of growing trees is that of profit, whilst a secondary—or with some even primary—consideration will be that of ornamentation; and we admit that, apart from any other consideration, a landed estate without timber would be as bare, cold, and comfortless as a house without furniture; at the same time, too many trees, and these in themselves awkwardly grown and stuck about in all sorts of awkward positions, would be like an over-furnished and ill-regulated mansion.

We would, then, have that kind of thought exercised in planting which should result, if not in profit, at least in providing ornament without loss, either to the tenant on the one hand, or the proprietor on the other. To this end we would advocate setting apart portions of the estate for the cultivation of timber in belt plantations, or even in woods, having reference to the nature of the soil and general position, and this in preference to hedge-row planting, as long lines of ash or elm can never look ornamental however well-grown; but, inasmuch as this mode of growth necessitates lopping, the timber is so long in growing and then is never good, that it seldom pays even the expenses attendant upon its utilization.

In plantations, again, you can adopt such a system of growing nurses that some return for the outlay will not be many years in commencing, and so profit by way of rent is not delayed as in hedge-row growth.[27]

> [27] We are aware that the landlord too often considers hedge-row timber as costless; but the injury which it entails upon the farm, and its nearly useless character, leads us to view the matter in a different light.

In order to understand what we would call a forest nurse, let us suppose that in a certain position our object is to grow a plantation of oak: we might in this case mix beech, elm, larch, Scotch firs, and spruce with the oak; these, by growing together, would increase an upward development; they would "pull each other up," as usually expressed. Soon this lateral growth would cause them to approach each other too closely, and then the larch would be first cut out, perhaps for hop-poles; next the spruce and Scotch firs for fencing and other purposes; then the beech and elm as they became useful; and at last, all the nurses gone, the oak would be sufficient to occupy the space, and, though many years have passed in the process, the wood has all the time yielded something towards rent and expenses.

In planting, of course, the kinds to be planted will depend upon circumstances, and so to a great extent will the methods to be adopted in planting; it may, however, be here stated that three plans of preparing the soil have been recommended:—1. *Trenching*; 2. *Pitting*; and 3. *Ploughing*.

1. *Trenching* is a very expensive process, and, upon the whole, is scarcely worth the cost. It is true that digging and turning over the soil will cause a number of weeds to die, but, on the other hand, it encourages the growth of greater numbers than it destroys, and it is doubtful whether weeding can be done so well in the loosened ground as it could before. Supposing, then, the young trees to be planted in old turf, we consider trenching to be quite unnecessary; but, as the plants will flourish best when weeds and grass are kept under, we should advise the skinning of the turf round them annually for about three years with a common mattock, and at the same time advantage to be taken of the opportunity to tread in the trees more firmly when they may have become loosened; to remove any broken or decayed matter, as in the case of conifers, to see to the training of a single leader, rather than two or more; and in all cases where young conifers show an increasing disposition to grow a great quantity of fruits (cones), we should either dig around it, and, perhaps, apply a portion of manure, or sacrifice the plant and put a fresh one in its stead.

This premature fruiting arises sometimes from the roots of the plant having been too much crippled, either by breaking or drying from being kept too long out of the ground; we may here state, then, that, if only to prevent this, in all cases of transplantation, they should be taken out of the nursery with great care, so as to injure the roots as little as possible, and further be planted in their new home with the utmost despatch. Disappointment is sure to result where trees of any kind have been kept long out of the ground, as they are when bought at market or in packets at sales. We should never purchase at the latter, unless they were left in the ground to be fetched as might be required.

As we have been led incidentally to remark upon the subject of crippling by means of injured roots, we may now point out that the same thing occurs where young trees have been topped either for mischief, or injudiciously pruned. We remember having some larches thus damaged by some vagabond boy, and in seven years they were only dwarf cone-bearing bushes, whilst others planted at the same time were 15 feet in height. In this case, then, instant removal, when discovered, and the being replaced by fresh plants, would after all be a saving of time in getting useful sticks.

2. *Pitting.*—In this process the soil is sometimes dug out so as to make holes about 2 feet square, the soil being left to weather by the sides of the holes, and returned around the trees when they are planted. This is not nearly so expensive as trenching; but it, too, is not always advisable, for trees have the tendency to confine their roots to the dug-out space for some years, and so they do not get the hold upon the ground that they otherwise would.

This plan is that of partial trenching, and we should prefer the former to the pitting process, unless where stones, such as those found in the oolite rocks, come to the surface. In such case, the removal of some of the larger stones and supplementing them with soil from some other source we have found to be of advantage.

3. *Ploughing* the soil is as expeditious a plan of preparing and clearing it as we possess; and now that steam cultivation can be brought into action for a much greater depth than could be done with horses, smashing-up the land by its means would be no bad preparation for planting where this is to be done on tolerably level ground.

While upon this subject we may here quote, as still worthy of attention, the directions in the fourth edition of the "Sylva."

> Let us now see in what manner we are to prepare the ground for their reception. The best way is by trenching, or double digging, as deep as the soil will admit of; but as this is a very expensive proceeding, and consequently can only be practised upon a small scale, I shall recommend another good method of preparing the ground. This is to be done by proper ploughing, and, if agreeable, the year before the land is planted, it may bear a crop of oats, rape, or turnips. By this means the sward will be effectually destroyed. After the crop is off, let the ground be trench-ploughed, and then harrowed with very heavy harrows, to break the clods; about the end of October let it be again ploughed crossways, and harrowed as before. This is the season for planting the sets, for the ground, by being thus cross-ploughed[272] and well harrowed, will be in proper order for their reception. The manner of planting the sets is as follows:—
>
> First, carefully take the plants out of the seed-beds, shorten the tap-root, and take off part of the side-shoots, that there may be an equal proportion of strength between the stem and the root. If the wood is designed to be but small, ten, twenty, or thirty acres, then lines may be drawn, and the trees planted in rows, four feet distant from each other, and the trees two feet asunder in the row: each line must have a man and a boy for planting. The ground being made light and pliable by cross-ploughing and harrowing, the man strikes his spade

into the earth close to the line; he then takes it out, and gives another stroke at right angles with it; then the boy, having a parcel of plants under his left arm, takes one with his right hand, and readily puts it into the crevice made by the spade at the second stroke; after this the man gently presses the mould to it with his foot, and thus the young oakling is planted. He proceeds in the same manner to the next, and so on till all is finished. An active man with his boy will plant 1,500 or 2,000 in a day; and while they are planting others should be employed in taking up fresh sets from the seed-bed, sorting them, and preparing their roots. In short, a sufficient number of hands should be set to every part of this work, that the whole may be carried on with despatch and regularity; for the ground cannot be too soon furnished with its plants after it is in readiness to receive them, neither can the plants be put too early into the ground after they are taken up from the seminary. Those plants which are nearly of the same size should be made to occupy a large quarter together, and the weakest should be left in the seminary a year longer to gain strength.

The trees, either for small or large plantations, being in the ground, the first care should be to fence them well from cattle, and even, if possible, from rabbits and hares. The next should be to keep them clear from weeds, that they may not be incommoded in their growth. In all lands weeds must be carefully watched and destroyed at their first appearance. In small plantations hoeing may do; but where the plantations are large and noble, a double-shelving plough should be provided; and when the weeds are got two or three inches high, this must be drawn exactly down the middle of each row by horses with their mouths muzzled, somebody leading the foremost horse; this plough will effectually throw a ridge each way, so that[273] the edge of it will be almost contiguous to the plants on both sides. This being done, the whole surface of the ground will be changed, and the weeds all buried, except a few about the stems of the plants, which a man following the plough should cut or pluck up. In this manner the ground may lie until a fresh crop of weeds present themselves; when these are about three inches high, a common plough should be provided to go up one side of the row and down the other, to plough the ridges made by the double-shelving plough into their former places, men following with hoes to destroy such weeds as are near the stems of the trees. Thus will the whole scene be changed again; the ground will appear as new-tilled; and in this condition it may remain until the weeds call for the double-shelving plough a second time, which must also be followed alternately with the common plough as occasion may require. By this means the ground will not only be kept clear of weeds, but the earth, by constant stirring, will be more replete with nourishing juices, the gentle showers will produce their good effects, the sun will have his influence, and all the powers of vegetation will combine to nourish and set forward the infant oak. This work must be repeated every year, until the oaks are of a height sufficient to destroy the weeds, which may be, perhaps, in three or four years, according to the goodness of the ground in which they are planted.

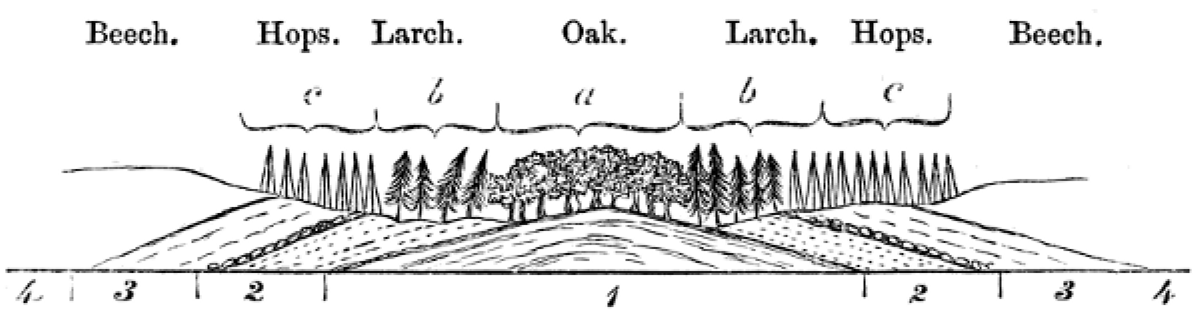
Still, notwithstanding the care sometimes taken in planting, we have often observed that the simple method of making triangular or cruciform openings with the spade, thus—**Y +**, and carefully dividing the roots in putting the plants in their places, and afterwards well pressing the turf against them, has succeeded as well as any other method. Indeed, we have known plants put in with only a single slit; but this never succeeds so well, though it is more expeditiously performed. Where, however, trees are put in at so much an acre, the plan of action must be specified, and the proceedings carefully watched, to ensure its due performance, or the work will most likely be done in the quickest, and not best, manner.

CHAPTER XLI.

ON THE KINDS OF TIMBER BEST ADAPTED FOR DIFFERENT SITUATIONS.

That the growth and quality of timber will be influenced by the nature of the soil is a matter so well understood that it would scarcely require to be treated of in this place, if we did not daily see examples of planting in which all laws of growth have been set at defiance; still, occasionally, experience has lent her aid and produced some satisfactory results; and, as an exemplification of our meaning, and as showing the influence of geological position upon planting, we would direct attention to the following section:—

ALICE HOLT FOREST.



4. Chalk. 3. Chalk Marl. 2. Upper G. S. 1. Gault Clay.

Here we have the oak—of both varieties known to planters, to be hereafter described—flourishing most luxuriantly on the stiff soil of the gault; the chalk-marl, upper green sand, and gault—the two latter only partially—being engaged in hop cultivation. The green sand surrounding the forest is mostly devoted to the growth of larch or spruce, the thinnings of which are used for hop-poles and the larger trees are left as timber-belts; whilst the beech will be found to favour the chalk. Hops and other cultivated plants flourish according to geological position.

That the geology of a district affects vegetation mainly, according to the mechanical and chemical structure of its individual rocks and the climate in which they are situate, is quite true; and yet the following table will show that different formations favour the growth of trees upon other conditions than those named.

Choosing figures to represent relative values, the annexed table is intended to show the amount of influence exercised by certain geological rocks in the growth of different fruit and forest trees met with in England.

	No.	Rocks.	Apple.	Pear.	Oak.	Elm.	Beech.	Firs.
Cretaceous Rocks.	1	Chalk	2	0	2	4	8	5
	2	Green Sands	3	1	3	7	0	3
	3	Gault	4	1	6	6	0	0
Jurassique Rocks.	4	Oxford Clay	6	0	10	8	0	1
	5	Oolite Freestone	2	0	1	4	10	5
	6	Lias	10	3	5	10	0	1
	7	New Red Sandstone	8	10	7	12	0	2
	8	Mountain Limestone	1	0	2	2	3	1
	9	Old Red Sandstone	15	8	8	10	0	1

These figures may serve to express—although roughly—the capacities of different formations for the production of fruit and forest trees, and it may be curious to note that, while the chalk and the oolite freestones, both composed of carbonate of lime, offer a remarkable agreement in point of dendrological productions, the mountain limestone, also consisting of carbonate of lime, affords very different results; here, no doubt, the different kinds of scenery presented by the rocks themselves have a decided influence on the general results.

Much, however, of any geological influence in the growth of trees must depend upon the material rather than upon the position of the rocks forming the subsoil upon which they occur, and thus it may be expected that clays, limestones, and sands, and different mixtures of these, will each favour the growth of a peculiar spontaneous or native vegetation; so that, if we looked to a larger list of trees and coupled it with lists of herbaceous plants, we might make out even a stronger case, either for the effects of geological or lithological conditions; but enough has been said to point out that various trees naturally affect one position more than another, and so they succeed as the results of planting and cultivation in one kind of soil in preference to another, and it may be laid down as a rule, that pomaceous fruits and hard-wooded trees, as oak and elm, only *flourish* in strong soils, though they may be imperfectly grown in all soils, whilst soft-wooded trees, as beech, lime, and the coniferæ, succeed best in lighter soils; hence, then, the planter who would try to grow vigorous oak on sandbeds would be disappointed, and while beech is the "weed" of the Cotteswold oolite, whoever tries to grow an orchard upon the freestone rocks is sure to meet with disappointment.

As regards forest trees we shall, for the most part, confine our remarks to those of the following list, as, although of recent years many new genera and species have been introduced, they are not yet in general cultivation even for ornamental purposes, much less as a source of profit.

LIST OF NATIVE OR NATURALIZED FOREST TREES.

Oak Chestnut Walnut Elm Ash Beech	Our more common timber trees used in buildings, furniture, cooperage, turnery, &c.
Birch Larch Spruce Scotch Fir Poplar	Employed in furniture, turnery, &c. The British Coniferæ are not used for timber, except for fencing and other common purposes.
Plane Mountain Ash Maple Lime	Employed for turnery, picture-frames, and occasional useful purposes.

CHAPTER XLII.

ON THE BRITISH OAK.

Whilst the discussion is still pending, of iron against wooden bulwarks, if only for the love we feel towards the "brave old oak," a few notes upon the forms of this truly national tree can hardly fail to be acceptable. At starting, however, we must bear in mind, that though we have ever looked upon the oak as so thoroughly British that we had almost been brought to think that it was made for the sole glory of our land, yet there are those who would wish to cast a doubt upon its true aboriginal nature, and who, according to their custom, represent everything great as borrowed from the Continent. What says, however, that pleasant discourser on forest trees, Jacob George Strutt, of imperishable sylvan fame:—"In proportion as the oak is valued above all other trees, so is the English oak esteemed above that of any other country, for its particular characteristics of hardness and toughness, qualities which so peculiarly fit it to be the 'father of ships,' and which are so admirably expressed in two epithets by that great poet, to whom the book of nature and of the human heart seemed alike laid open:—

> Thou rather with thy sharp and sulph'rous bolt
> Splitt'st the *unwedgeable* and *gnarled* oak,
> Than the soft myrtle."—SHAKESPEARE.

Selby again, in his "History of Forest Trees," a work which should be in the hands of all lovers of the beautiful natural objects of which it treats, describes the finding of some bog oaks, which would almost connect the present race with a fossilized past:—

> At the Linden, the seat of C. W. Bigge, Esq., the trunk of a magnificent oak was extracted from a peat moss that fills a small basin or hollow, evidently produced by the stagnation of a stream, which now passes through it, and which, at some distant period, had been dammed back by the fall of the trees upon its margins. This oak was covered by a layer of the peat to the depth of about three feet, and was discovered by probing the moss. The trunk, with a small portion of one of the larger limbs, was with great labour and difficulty dragged from its miry bed. The contents of the portion recovered contained 545 cubic feet, although the whole of the sap-wood had perished. The timber was perfectly sound, and the tree, by whatever accident it had been overthrown, had fallen in the vigour of its growth. When sawn up, the interior planks were found of a deep rich brown colour; those nearer the exterior darker, or approaching to black. A variety of elegant furniture has been made from the wood; but it has been found necessary, for fine cabinet-work, to have it cut into veneers, for, when worked in bulk, it is apt to crack and become warped. Remains of other huge oaks have also been met with on the banks of the Tyne, the Alne, and other rivers, as well as in various bogs and morasses; and we mention these instances to show that in a district where, at the present day, nothing but recently-planted oak or dwarfish timber from

> stock-shoots exists, in former times the monarch of the forest grew luxuriantly, and attained a splendid development; and also as an inducement to the planter not to neglect the liberal insertion of this national tree wherever soil and situation are found congenial to its growth. In other parts of England, the oak still grows in all its native magnificence of form and dimensions, and the remains of those ancient forests, which are chronicled by our earliest writers, and which, in the time of our Saxon ancestors, spread over the greater portion of the country, are still to be traced in the venerable but living relics of enormous oaks, many of which are supposed to number more than a thousand years.

Not to neglect to plant the national tree! We hope indeed that there is no possessor of broad acres who does not esteem it a duty, regardless of profit, to provide for a succession of forest kings, if only to beautify the face of the country, and to leave the people of the present, some grand living object to connect them with the history of the past. In fact, planting of the "British oak" has not only been considered a duty, but followed out with the keenest pleasure by the country gentleman. In so doing, the question has scarcely until lately occurred, is the British oak always the same? or, are there not different species, or at least varieties of the genus *quercus* which have been confounded by the planter? To this question we now propose to address our inquiries.

On referring to different authors, we shall find mention of the following names as applied to the British oak:—

1. Quercus robur, *Linn*.
2. „ sessiliflora, *Salisbury*.
3. „ intermedia, *Don*.

This method of nomenclature would, however, be only tenable on the supposition that we considered the trees so named *specifically* distinct; but as we incline to believe them to be only varieties—though highly important as such—we intend to treat of them as follows:—

1st. QUERCUS ROBUR PEDUNCULATA.
2nd. „ „ SESSILIFLORA.
3rd. „ „ INTERMEDIA.

Plate II.

J. E. Sowerby, sc W. West imp.

Quercus Robur Sessiliflora.

1st. *Quercus Robur pedunculata* is readily distinguished in trees separate from others by its robust habits, thick, gnarled, twisted, and more or less horizontally inclined branches. The leaves have comparatively few broad, wavy indentations, and are set on a short leaf-stalk (petiole) (Plate I. fig. *a*), the fruit being situate on long footstalks (peduncles), varying from two to upwards of four inches (fig. *b*).

This is the typical British oak, the pride of our sailors, when men fought bravely and did not care to vie with each other as to who should make the most secure skulking-places. The tree—

Whose roots descend
As low towards Pluto's realms, as high in air
Its massive branches rise. The utmost rage
Of wintry storms howls o'er its strength in vain.
Successive generations of mankind,
Revolving ages flourish and decay,
Yet still immovable it stands, and throws
Its vigorous limbs around, and proudly bears
With firm and solid trunk its stately form,
A mighty canopy of thickest shade.

VIRGIL, *Georg.* ii. 291.

This is the tree that seems to be longer lived than any other in Britain, and though it would appear to be the prey of nearly, if not quite, two hundred species of insects, it has still had vigour of constitution to survive them all; and in many instances we might point to brave old trees which must have been veterans at the time of the Norman Conquest. Now, however, they are old and staggy, with hollow trunks truly—but what trunks!—from forty to fifty feet in circumference, presenting the following picture to us as it did to Spenser:—

There grew an aged tree on the green,
A goodly oak some time had it been,
[282]
With arms full long, and largely displayed,
But of their leaves they were disarrayed;
The body big, and mightily pight,
Thoroughly rooted, and of wond'rous height:
Whilom had been the king of the field,
And mockel mast to the husband did yield;
And with his nuts larded many a swine,
But now the grey moss marred his rine;
His bared boughs were beaten with storms,
His top was bald and wasted with worms,
His honour decay'd, his branches sere.

Shepherd's Calendar.

This, indeed, is a melancholy sight, like the Stag's Horn Oak by the roadside between Farnham and Woolmer, in the ancient boundary of Alice Holt Forest; yet this has a young tree growing by its side, perhaps one of his own children, which gracefully conceals much of his gaunt nakedness. In the same forest are many old staggy trees, their contorted horn-like branches sticking out in a most picturesque manner from the top and sides of a still leafy head. In these the white owls may yet be seen peering out of dark cavernous hollows as they did in Gilbert White’s day; and during the summer of 1861 we with pleasure watched their motions, which so minutely agreed with those described by the father of observing naturalists, that we cannot forbear quoting his remarks thereon in his “Natural History of Selborne,” a not very distant parish from the Holt, and to which he indeed often refers:—

> As I have paid particular attention to the manner of life of these birds (the White Owl), during their season of breeding, which lasts the summer through, the following remarks may not be unacceptable. About an hour before sunset (for then the mice begin to run), they[283] sally forth in quest of prey, and hunt all round the hedges of meadows and small enclosures for them, which seem to be their only food. In this irregular country we can stand on an eminence and see them beat the fields over like a setting-dog, and often drop down in the grass or corn. I have minuted these birds with my watch for an hour together, and have found that they return to their nest, the one or the other of them, about once in five minutes; reflecting at the same time on the adroitness that every animal is possessed of as far as regards the well-being of itself and offspring.

Notwithstanding the good done by these birds in keeping under mice, all our eloquence could scarcely preserve them from the onslaught of the keeper; they were, however, protected during our pleasant sojourn at the Holt; but we much fear only, after all, to gratify the taste for stuffed birds, a *love* which is equally fatal to the feathered race (and especially the finest examples thereof) as the *hate* of the keeper.

But we are digressing sadly, and must return to *Quercus Robur pedunculata*, and complete our observations thereon with the statement that most, if not all, the nobler examples of oaks in England belong to this form. Selby directs attention to the “Flitton Oak, in Devonshire, of the *Sessiliflora* variety, supposed to be one thousand years old, and which is thirty-three feet in circumference at one foot from the ground.” However, nearly every historical oak is of the pedunculate variety. In the Holt forest are still left some huge examples; the same in the Dean forest; and Braydon, near Swindon, Wilts, though disafforested, can yet show noble trees of this form. Indeed, throughout England it is difficult to meet with many examples of any other form, except in Wyre forest, Worcestershire, where the tree next to be described is perhaps the more general, and it would also appear that in the New Forest the *Q. sessiliflora* is also frequently met with.

Quercus Robur sessiliflora may be generally described as of a more upright and formal habit. Limbs straighter and less gnarled. Bark usually smoother than the former. The leaf has many sinuosities, and is set on a comparatively long leaf-stalk (petiole) (Plate II. fig. *a*).

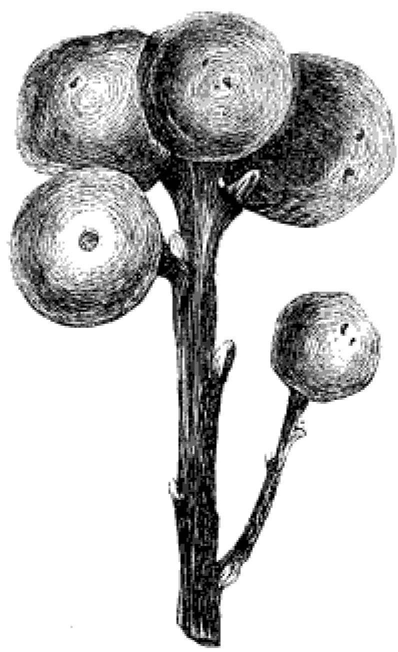
The fruit, on the contrary, is so nearly sessile that it may be said to have little more than the indication of a peduncle (fig. *b*).

We have already stated our opinion that the sessile-fruited oak does not usually attain the huge dimensions of the pedunculate form; but on the other hand we incline to the belief that it grows more rapidly, and is best adapted for a lighter soil than the latter. There are conditions which might to a greater or less extent affect the quality of its timber, but we do not think that there is much difference in this respect. We believe that their wood has been used indifferently, and the quality is influenced by surrounding circumstances. Selby, in his "History of Forest Trees," states on this head:—"The result, perhaps, of some original constitutional defect, or arising from the nature of the soil, situation, or other local peculiarities of the ground upon which the timber has been raised; such at least is the result of our own experience, as we have met with oak of the *peduncled* kind, its timber possessing all the inferior qualities attributed to, and supposed to be possessed exclusively by, *Q. sessiliflora*." The longer, straighter spars of the Sessiliflora, in days when oak was so uniformly used for roofs, seem to have pointed out this variety for roof-timbering; and hence some of the finest ancient timbered roofs of this country have been ascertained to have been formed from its wood. With respect to these the opinion long prevailed that they were formed of the wood of the Spanish chestnut. This, however, is but a poor timber tree, as, long before it could afford so large a scantling as would be required by the roof of the Parliament House at Edinburgh or of Westminster Abbey (both of which were supposed to be of chestnut), the chestnut would begin to decay at the heart; in fact, just at the period when the heart-wood of oak begins to harden, that of the chestnut would appear to deteriorate.

Quercus Robur intermedia, having a petiole intermediate in length between the other two varieties described, and a peduncle varying from a quarter to one inch in length, may with propriety be deemed a variety intermediate between "Sessiliflora" and "Pedunculata," and a comparison of the three will substantiate its claim to this title.

As a tree it is impossible to make out any specific character from its mode of growth, and, indeed, without the fruit, it is extremely difficult even to distinguish it as a variety.

It occurs—only occasionally—in the Cotteswold district, and we suppose the same elsewhere. One meets with it here and there in the hedge-rows, and in Oakley Park, the seat of Earl Bathurst, we can point out a few specimens.



Galls of the *Cynips Quercus petiolata*.
(Natural size.)

Passing from the subject of the varieties of our British oak, it now remains to mention a most formidable enemy by which it has of late years been attacked, and so exclusively, that in plantations where may be found the American oaks, the Ilex oak, and Turkey oak trees, it has been the only one subjected to the operations of the new gall pest. It has long been known that our native oaks were subject to excrescences of different forms and sizes, such, for example, as oak-apples, oakleaf galls, oak spangles, &c., all of which were ascertained to be caused by several species of *cynips*; but lately we have to lament the introduction of a new species of the same insect, forming a new kind of gall, which, instead of attacking the backs of the leaves, as does the oakleaf gall, occupies the stem that belongs to the leaf; in fact, the attacked leaves seem to be converted into bunches of galls, as represented in the adjoining figure, which presents an illustration of the new pest. They are hard galls, more or less like the "nut-gall" from Aleppo, of which ink is made, and it will be seen that the little twig supports no less than five galls, in the interior of each of which may be found the maggot or *larva* of an insect; and, as this is affected at the expense of the buds and leaves, the mode of injury must be obvious, as the new twigs which would have been formed, had there been no galls, would in their turn have produced branches and leaves. Trees thus infested are crippled as though they had been subjected to constant pruning.

As much of the natural history of the *cynips*, by which these gall-nuts are formed, as is necessary for our purpose, may be gathered from a paper by Mr. Parfitt, who seems to have well studied the gall insect in Devon, its head-quarters. We quote it from the Journal of the Bath and West of England Agricultural Society for 1861:—

> The eggs deposited by the females in the oak buds in September remain there in a state of apparent quiescence till the following spring; then, as soon as the sap begins to flow, the irritant injected into the wound at the same time the *egg* was deposited, or possibly the combined action of the egg and irritant, causes the sap to diverge; that portion of the bud which should have formed a young shoot is converted into a spherical ball; the outer scales of the bud fall away, and it is the woody secretion which entirely forms the gall. The cells in the gall are not elongated and regular, as in the young shoot, but confused and irregular; and in the centre of each gall lies a young grub of the *cynips*, forming a living nucleus, around which is deposited a thin, hard, woody envelope, much more compact in substance than the sponge-like tissue which fills up the interstice between it and the shining outer coat of the gall. This compactness of structure is a necessary and all-wise provision of nature for protecting the delicate insect which lies within from destruction; for if the gall were composed entirely of large spongy cells, the rapid flow of sap in the early spring would be more than the creature could consume, and it would consequently be drowned. I am aware that some naturalists incline to the opinion that the *larvæ* of the *cynips* feed on the gall. From this view, however, I venture to dissent; for not only is it inconsistent with the structure of the creature's mouth, and the position in which the young *larvæ* are invariably found, with the head tucked under the apex of the abdomen, but if they fed on the substance or crude material of the gall, the undigested parts would certainly be[288] found in the interior of its cell: in other words, the excrement would be there, for there is

no outlet, and the lacteals or absorbent vessels of the gall could not take it up. I therefore think that the creature feeds entirely on the sap of the tree—an elaborate food fit for it without the need of mastication. This explains how it happens that the galls of commerce, with the insects in them, are so much better and dearer than those from which the *cynips* has escaped; in a word, the tannic acid is more abundant.

It has been before observed, that there are two broods of the insect in a season; thus, those which do not emerge from the gall in September remain on till the following April or May. This is a wise provision of nature for continuing the species, should anything befall the autumn brood; and it is the more deserving of notice, because the gall-producing *cynips* has a deadly enemy which accompanies or follows it in its flight from bud to bud, and deposits an egg wherever it finds the egg of the *cynips*. Here, as soon as the *cynips* larva is hatched, the larva of the parasite is hatched also; forthwith the latter proceeds to eat a hole in the skin of the rightful occupant of the nidus, and the two larvæ go on growing together till the *cynips* is ready to assume the pupal state; then the parasite cuts the vital thread of the *cynips*, and uses its skin for a pupal envelope for itself; and thus, instead of the gall-fly emerging into day, a beautiful green insect makes its appearance on the stage of life. I had the pleasure of first discovering this parasite while engaged in studying the *cynips*; it belongs to the genus *Callimone*, and from the fact of having discovered it in Devonshire, I gave it the name of *Callimone Devoniensis*. It is one of the handsomest of our British insects; its costume a brilliant green, shot with gold; the abdominal segments green, gold, and purple; legs yellow; tarsi reddish; and it has four beautiful transparent and iridescent wings.

It has been stated that oak-galls are produced at the expense of acorns. From this view my experience leads me to dissent. In exceptional instances it may have been the case; but as a rule the *cynips* confines its attacks to young trees and young growths in hedges, within a range of ten or twelve feet from the ground, and the nearer the ground the more numerous the galls. Young trees which have not attained a greater height than that I have indicated suffer so much that many of them can scarcely make headway against their foe; and in several nurseries I have visited, where it might be expected that[289] greater care would be paid than in the case of ordinary plantations, the young stock of oaks has been rendered quite unsaleable by the pest. This year I have noticed the progress of the insect on two groups of young English and Turkey oaks growing side by side; and although there are hundreds of galls on the English oaks, there are none on the Turkey oaks. From this I am led to infer that the species of *cynips* now under notice is confined in its depredations to the English oak; and as it invariably selects trees of younger or restricted growth—probably because the temperature at a higher elevation than ten or twelve feet from the earth is unfavourable to it—it would seem that children might be advantageously employed in young plantations in collecting the galls by means of cutting-hooks, such as are used for thistles. The galls, when once collected, might either be crushed for tanning purposes, or consumed by fire, and if the process were repeated for two or three seasons, it is more than probable that the plantation would be altogether free from the pest.

These able remarks not only well describe the nature of the attack, but also point to a cure—a matter to which we would direct the most serious attention of the planter; for we may state that, in 1853, we saw some very small oak trees, in the neighbourhood of Dawlish, Devon, from which some hundreds of these galls might have been gathered. This was the first time we had noticed this pest, though it appears that it had been under Mr. Parfitt's notice as long as a dozen years. Since then (1853) we have traced it in its progress as follows:—

Having observed the galls in Devon in 1853, we were yearly on the look-out in the Midland and Eastern counties for its appearance, and the following dates will show that its spread, though gradual, was sufficiently rapid:—

The galls were gathered in Devon in	1853
The same kind in Somerset, in	1854
In Gloucester, on the west side of the river Severn, Forest of Dean, in	1855
In Gloucester, east side of the Severn, and as far as Oakley Park, Cirencester, in[290]	1856
In Worcestershire, in	1857
In North Wales, Beddgelert (pointed out to us by John Savory, Esq.), in	1859
In Sussex, very sparingly, in	1860
In Alice Holt Forest, and far from abundant, in	1861
About Hastings, very plentifully, in	1862

We have this season observed a lot of the young galls; but last year, for the first time, we discovered that, in many cases, the maggot had been extracted by some small bird, one of the titmice (*Parus cæruleus*); and, if so, wherever young oaks may be growing, it should afford an additional reason for the protection of these useful birds. The magnitude of the evil, unless checked by some means, may be estimated from the fact that, in 1856, we could scarcely find half a dozen galls within a wide district, and now all around may be found trees, not more than 10 feet high, upon which are no less than from one to five hundred distinct galls.

We conclude these remarks upon our native oaks with the fervent hope that in "Merry England" it may ever be as described by dear old Chaucer:—

A pleasant grove

* * * * *

In which were okes grete, streight as a line,
Undir the which the grass so fresh of hew
Was newly sprong, and an eight fote, or nine,
Every tree well from his fellow grew,
With branches brode, laden with levis new,
That, sprongin out agen, the sonnè shene.
Some very rede; and some a glad light grene.

CHAPTER XLIII.

ON THE CHESTNUT AND WALNUT.

The Chestnut and Walnut are here brought together, not only as producing two useful kinds of hard-wooded timber, but from the fact of both being bearers of esteemed kinds of fruit. They are neither grown to the same extent in England as on the Continent, and probably neither of them is indigenous to this country, although it is stated by Sir W. Hooker to grow in woods apparently wild, in the south and south-west of England. As regards the fruit of the former, it may be said that in parts of Spain "Spanish Chestnuts" are a staple article of food. In England they are sometimes brought to table as a stuffing for turkeys, or roasted for dessert; but their greatest consumption among us is with the poor, who, in winter, with a halfpenny-worth of roasted chestnuts enjoy the double luxury of warm fingers and a sweet nutritious diet. Walnuts, as a fruit, are highly esteemed by all classes: as much by those who crack and peel them in a second or third class railway carriage, as by the squire who takes them as a concomitant with his glass of port. With us they are only cared for while they can be peeled, but abroad they are carefully dried, in which state they form an important article of commerce. In the Portuguese court of the International Exhibition of 1861, in our capacity of juryman, we had brought before us specimens of dried walnuts from as many as fifty exhibitors.

The Spanish chestnut (*Castanea vulgaris*) has no relationship with the so-called horse-chestnut, which latter, we might just mention, is solely employed as an ornamental tree, if we except its occasional use in cabinet-work. Evelyn, sixty years ago, speaks of it as being "all the mode for the avenues to their country palaces in France." It has been much used for this purpose with us, and its magnificent flowers and fine foliage will ever recommend it as an ornament about country residences.

But to return to the Spanish chestnut. This tree is planted with us both for the growth of timber or as underwood for poles; for the latter purpose it answers well, as it soon grows up again after cutting, and in its young state it goes so soon to heart-wood that the poles are remarkably strong and tough.

As a timber tree, the chestnut has been very extensively extolled both in this country and on the Continent; it may, however, be concluded that although its wood is exceedingly useful, it has never been put to the important uses which have been claimed for it.

Evelyn, speaking of chestnut-wood, says:—"I had once a very large barn near the city, framed entirely of this timber."

Sir T. D. Lauder tells us that the roof of the Parliament House in Edinburgh is constructed of chestnut, and we have often seen it stated that the magnificent roof of Westminster Hall has been framed of this timber;[28] but to quote from Selby's admirable "History of British Forest Trees":—

> The fact is, as Buffon first observed, the wood of the oak, more particularly that of the sessile-fruited variety, assumes, in course of time, a near resemblance in colour to that of the chestnut in its best condition, or when young and untainted at heart; and as few chestnuts could have acquired the scantling frequently observed in the timbers of these ancient buildings at the age dialling or decay almost invariably commences, this in itself furnishes a strong argument against the use of chestnut timbers and beams by our ancestors, inasmuch as the trees must become unfit for the purpose long before they had attained the necessary dimensions.—P. 326.

[28] Many of the most ancient houses in London were built of its (chestnut) wood, as is the roof of Westminster Hall, built by William Rufus, in the year 1099, still free from any appearance of decay.—*Sylva Britannica*, p. 81.

But although we may safely dismiss the notion that chestnut is of the value formerly supposed, yet its timber is not without its uses; it is employed for smaller beams, gate-posts, piles, and other purposes where large timber is not required. Its best use is for poles, for which purpose chestnut may be employed as nurses to oak, thinning out the former as growth advances.

Dismissing, however, the subject of the economic value of the chestnut, whether for timber or fruit, as an ornamental tree it has few equals. There are many fine chestnut-trees in our country, but perhaps the finest, as it is supposed to be the oldest, sylvan veteran in England is the one at Tortworth, in Gloucestershire, of which Strutt says:—

> In the reign of Stephen, who ascended the throne in 1135, it was deemed so remarkable for its size, that, as appears upon record, it[294] was well known as a signal boundary to the Manor of Tortworth. At the time that it was thus conspicuous for its magnitude and vigour, we may reasonably suppose it to have been in its prime; if, therefore, we pay any regard to the received opinion which is applied to the chestnut, equally with the oak, that it is three hundred years in coming to perfection, this calculation takes us back to the beginning of the reign of Egbert, in the year 800, for the commencement of the existence of the Tortworth Chestnut.

Well then may we exclaim with the poet—

> Hail, old patrician trees, so great and good!

The Walnut (*Juglans regia*) is supposed to have been introduced from Persia by the Romans; but although we can have no claim to it as a native, yet it has thriven so remarkably well, as for many years since to have furnished us with a large quantity of a highly valuable timber. So much indeed is its wood esteemed, as to have caused its use only in the better kinds of cabinet-work, such as drawing-room furniture, internal fittings, and where mahogany would now be considered as somewhat common; it has, too, been ever esteemed as a wood for gun-stocks, as it combines hardness, toughness, and an agreeable colour with a great degree of lightness—being of a less specific gravity than that of any other kind of hard wood.

Fowling-pieces, gentlemen’s rifles, pistols, and all the finer kinds of small arms, usually have stocks of walnut, as its texture, colour, and the sharpness with which fancy carvings can be worked, peculiarly adapt it for the purpose.

During the continental war, English walnut fetched an enormous price. Selby tells us that a single tree was sold for £600, owing to which many of the noblest specimens were sacrificed; and Loudon tells us that, about 1806, no less than 12,000 trees were annually required for these uses in France.

In England this tree is principally grown for its fruit, which is a great favourite when ripe as an adjunct to the social glass. Still enormous quantities are never allowed to attain to ripeness, from their being used in a green state for the purposes of pickling, sauces, and the like; indeed, so much is the green part of the walnut esteemed for its flavouring properties, that the very "hulls," or coverings to the ripened fruits, are employed as an ingredient in the preparation of sauces and flavourings.

Another use of the fruit, especially on the Continent, is that of making oil, which is considered to be little, if at all, inferior to fine olive-oil.

The walnut-tree, then, may be considered as offering many claims for its more extensive cultivation, for although native growths of timber have been of late years in a measure superseded by American walnut and hickory wood, still it offers no mean inducements to the planter upon this score alone, at the same time it must be allowed that with us the chief inducement to the culture of this tree is the value of its fruit and the handsome tree which it makes.

In the growth of this and the preceding, it is always best to procure good, healthy, young trees from the nurseryman; indeed, in planting all forest trees this may be considered as not only the best, but usually the cheapest mode of proceeding.

CHAPTER XLIV.

ON THE ELM.

To the critical botanist the study of the different kinds of Elm is one of the most perplexing subjects he has to cope with, the fact being, that if the seed of any one form be cultivated, the results will seldom or never be uniform, for not only may several well-known varieties be produced from the seed of a single tree, but even new forms may thus be obtained.

On this account have arisen the great discrepancies one meets with in authors as regards nomenclature; some making many species of the Elms commonly met with in Great Britain, while others reduce them to two; viz.—

Ulmus campestris—Small-leaved, Common Upright or English Elm.
Ulmus montana—Large-leaved, Spreading Scotch or Wych Elm.

But though these are the names used by most authors to distinguish these two well-recognized forms, yet they have been reversed in Dr. Arnott’s edition of Hooker’s “Flora,” thus:—

> *Ulmus suberosa* (Ehrh.)—Common or English Elm.
> *Ulmus campestris* (L.)—Broad-leaved or Wych Hazel.

Now it is not our object to enter into a discussion on the much-vexed question of species, and therefore, without even determining whether the English and Scotch Elms be absolutely distinct, we shall yet describe as two well-established forms of forest trees, and endeavour to put them in their proper position among profitable and ornamental timber trees, to which end we would distinguish them as follows:—

1. Ulmus campestris. (*English Elm.*)	2. Ulmus Montana. (*Scotch Elm.*)
Leaves small, doubly-notched at the margin, with an alternation of larger and smaller teeth (alternately serrate).	Leaves larger, divided into segments at the margin, which segments are notched with fine serrated teeth.
Fruit small and flat, with a deep notch at the apex; bunches somewhat small and inconspicuous.	Fruit large and flat, with a slight notch at the apex; bunches large and having the general appearance of bunches of hops.
Branches more or less spreading, inclining to be rough or even corky (*suberose*). Twigs more orless hairy.	Branches more or less upright, smooth, and even. Twigs sometimes clothed with a short down.
Bole more or less towering upwards, its divisions having the same tendency. Arms more like those of the beech.	Bole shorter, branching at a moderate elevation into large spreading arms, more like those of the oak.
Roots throwing up suckers often at a great distance from the tree.	Roots not stoloniferous.

1. *Ulmus campestris.*—The English Elm, though not the producer of the most valuable timber, or of a kind for more refined purposes, is still one of the most extensively useful of any kind whatsoever. The long straight balks of this Elm caused it at one time to be employed for water-pipes; these can be readily cut into boards of great length and width, which are useful for a variety of purposes. Selby sums up an account of its character as follows:—

> The wood when matured is of a deep-brown colour, compact and fine-grained; according to Loudon, it loses nearly two-thirds of its weight in drying, as when cut it weighs nearly seventy pounds the cubic foot, and when seasoned not more than twenty-eight pounds and a half. In the lateral adhesion of its fibre it surpasses the *U. montana*, though perhaps inferior to it in longitudinal toughness, and therefore not capable of supporting so severe a

cross strain. The former property, however, eminently qualifies it for every purpose where a strong wood that will not split or crack, either from concussion or the action of sun and wet, is required; on this account, Matthew, in his able treatise on naval timber, strongly recommends it for the "blocks, dead-eyes, and other wooden furniture of rigging." In country carpentry it is very extensively used in all the Southern parts of England; but the purposes to which it is applied it is unnecessary to enumerate, these having already been described by Evelyn and subsequent authors. Its durability under water, as well as the straightness and great length of its stem, qualifies it for making the keels of large ships, for which purpose it sells at a very high price.

As an ornamental tree for general purposes, few can surpass the elm, as when well-grown and not too much interfered with by the forester, it has a gracefully aspiring form without a disposition to lankiness: its foliage is thick enough to afford any amount of shade, and yet is never of a heavy appearance.

It flourishes best in good deep soil, in which the most solid balks are grown: when planted on poor land or on gravel-beds it decays at the heart at a very early age. Some of the English elms in Hyde Park have thus decayed, whilst others have attained a respectable size and age, having been injured by storms:—

> The wintry winds had passed
>   And swept an arm away,
> And winter found a wound at last,
>   In which to work decay.

In good soil the English elm grows to an enormous size, remaining perfectly solid to a good old age. We remember the felling of a tree called "Piff's Elm," on the high-road between Cheltenham and Tewkesbury, in which the hole measured 28 feet in circumference at 4 feet from the ground, and we counted 198 rings of annual growth. Still, when grown in poor gravelly soils and in the usual hedge mode, in which they are periodically shrouded and crippled, they often begin to decay in the centre at less than twenty years of age.

There are varieties of the *U. campestris*, which, as they are not of any particular importance as timber trees, need only be lightly touched upon in this place. They are as follows:—

1. *Ulmus suberosa*—Cork Elm, bark of the limbs exceedingly corky.
2. *Ulmus carpinifolia*—Hornbeam-leaved Elm, leaves strongly-veined, serratures blunt; branches nearly smooth.
3. *Ulmus stricta*—Cornish Elm, leaves smooth and shining above, doubly serrated, with

obtuse teeth; branches bright-brown, smooth, erect.

4. *Ulmus glabra*—Small-leaved Elm, leaves small and smooth; branches pendulous.

2. *Ulmus montana.*—The Scotch Elm, the broad-leaved elm (wych hazel) of most parts of England and Scotland, is well distinguished by its large broad leaves, hop-like fruits, large limbs diverging from a less towering trunk at an obtuse angle, branches more or less lax and pendulous, bark of the twigs dark brown, smooth and not corky; of stem when rough, not *suberose*.

This tree is reputed wild, but there seems reason to think that this form, and certainly the *U. campestris*, has been introduced. One reason for this conclusion is that although the *U. montana* produces such an enormous amount of seed, yet, in as far as we know, none of this produces young trees, or, in other words, this elm does not appear to increase sporadically. Even in cultivation it is found to be exceedingly difficult to replenish our nursery stock from seed, and hence the cost of young plants, as they have to be produced from suckers, or otherwise layered, and occasionally grown from cuttings. Evelyn says:—

> It seems to be so much more addicted to some places than to others, that I have frequently doubted whether it be a pure indigene or translatitious; and not only because I have hardly ever known any considerable woods of them (besides some few nurseries near Cambridge, planted, I suppose, for store), but most continually in tufts, hedge-rows, and mounds; and that Shropshire, and several other counties, have rarely any growing in many miles together.—*Sylva*, vol. i. p. 127.

To this may be added the fact that the most notable elm trees will usually be found at cross-roads—as Maul's Elm at Cheltenham, nearly 40 feet in circumference, or about dwellings; the fine old trunk at the Slade Farm, near Stroud, Gloucestershire, as much as 50 feet, for some time hollow, and once used as a cider-mill; the fine elms in our parks, as at Hyde Park, Kensington Gardens, and others; and such avenues of elms as seen at Christchurch.

As a timber tree the Scotch elm is not esteemed so highly as is the English sort. To begin with, it does not grow such straight even balks; it is more gnarled and knotty in sawing, and more difficult to work. Selby says that Scottish writers have arrived at a different conclusion, which he conceives to have arisen from the fact that "their estimate has been drawn from a comparison of the wood of *U. montana* with that of *U. suberosa* (considered by them to be the English elm), which produces a soft, spongy wood, greatly inferior to most other trees of the genus.”

It is used for flooring and rough country work. The peculiar wen-like excrescences that one sometimes meets with on the sides of wych elms are carefully preserved and cut into veneers for fine loo-tables, work-boxes, and other purposes, when a peculiar mottled fine-coloured wood is required for fancy-work.

Some of the finest elms we have examined have been Maul’s elm, Piff’s elm, the Slade elm, before mentioned, and the following, measured at one and three feet from the ground.

		Circum. at 1 foot.		Circum. at 3 feet.	
Ulmus montana,	Oakley Park, Cirencester	38	0	33	6
Ditto,	Hyde Park	—		20	6
Ditto,	Hyde Park	—		20	0
Ditto,	group of twelve in Kensington Gardens, varying to	—		20	0
Ulmus campestris,	Hyde Park, several varying from 20 ft. to	—		30	0
Ditto,	in Oakley Park, from 15 ft. to	—		22	0

CHAPTER XLV.

ON THE ASH, BEECH, AND OTHER WHITE-WOODED TREES.

The Ash (*Fraxinus excelsior*), when well-grown and in good foliage, is one of our most charming trees; its light, graceful, and agreeably-coloured leaves, united with a graceful disposition of lithe, smoothly-formed limbs, altogether fully entitle it to be considered as the “Venus of the Forest.”

The leaves of the common ash are pinnate, with from three to four pairs of leaflets and one terminal leaflet. This latter is sometimes absent when the apex is bifoliate, and a form called the double-leaf is produced, which even at this day is reputed by the rustics to be capable of working various charms.

It is this pinnate pendent leaf which, loosely hanging on the flexile, more or less pendent branches, gives so much grace to the tree.

We have been much pleased with some groups of ash trees in Earl Bathurst's park (Oakley Park) at Cirencester; but, as Strutt well observes,—

> It is in mountain scenery that the ash appears to peculiar advantage; waving its slender branches over some precipice which just affords it soil sufficient for its footing, or springing between crevices of rock, a happy emblem of the hardy spirit which will not be subdued by fortune's scantiness. It is likewise a lovely object by the side of some crystal stream, in which it views its elegant pendent foliage, bending, Narcissus-like, over its own charms.

But charming as is the ash when in its most perfect foliage, yet as its æstivation is usually so late, and the fall of its leaves so early and rapid, it often displays all but naked limbs, even amidst the freshness of spring, as well as during the autumnal tinting of almost all other trees. It would seem that its buds cannot expand in spring frosts, whilst the first frost of autumn will frequently make the whole foliage drop in one mass beneath the influence of the succeeding sunshine. This susceptibility to spring cold is doubtless at the base of the country weather predictions which are made to depend upon the behaviour of the ash in respect to its time of displaying its leaves:—

> When the oak's before the ash,
> You may then expect a dash.

Generally held to mean, that if the leaves of the oak are seen before those of the ash, a fine dry summer may be expected; but, on the contrary,—

> With the ash before the oak,
> You may then expect a soak.

The truth of all this may be that a cold wet spring, which would retard the bursting of the buds of the ash, may be expected to be followed by a fine summer; whilst, on the contrary, a genial forward spring is often succeeded by a wet summer.

Selby remarks on the early fall of the leaf, which, as he says, is "after the first autumnal frost, however early that may happen; and this, in general, without undergoing any change of colour, or contributing by the 'sear and yellow leaf' to the waning beauty of autumnal foliage." On this account, Sir

T. D. Lauder recommends that “ash trees should be sparingly planted around a gentleman’s residence, to avoid the risk of their giving to it a cold, late appearance, at a season when all nature should smile.”

It should be noted that although the ash seems to be so susceptible of cold, it nevertheless ripens its seeds most perfectly in any part of Great Britain; and besides this, these seeds, or “keys,” when naturally sown, come up with the greatest certainty, so that young ash may be removed from the wood and used for planting.

This renders it easy to cultivate young plants from seed; to which end, when the ripened keys are gathered in the autumn, they should be well examined to see that the seed has not been eaten out by the ash-weevil, as it will most certainly be if a small orifice be observable on one side of the key or samara, just over the seed.

In growing ash with a view to profit, it is recommended to plant it by itself in belts or plantations, which are called ash-holts, as it usually, when well started, grows upwards too fast to be a good nurse to other trees, which latter would suffer from the whipping of the longer heavy flexile stems of the ash.[29]

[29] Selby says, “The pitting system should always be adopted in planting the ash, for the roots, even in young plants, are too numerous, large, and spreading, to be properly inserted by the splitting or **T** method.” We would also add, that they should be planted as soon upon removal as possible.

It is too often planted in hedge-rows, where it is exceedingly objectionable, not only from the ill effects on the scene of interminable rows of one kind of tree, but the drip and the peculiar growth of the roots render it most destructive to the growth of crops planted beneath its shade.

The uses to which the wood of this tree is turned are multifarious in the extreme. Walking-sticks are made from ash saplings; and as, from youth to age, it is so tough and elastic, it is used for handles and other parts of farm implements and machinery of all kinds. The wheelwright and coachmaker employ the wood extensively; so also the cooper. As a firewood its “offal” is always welcome, as it burns with a clear, bright flame, and that nearly as well in the green as in the dry state; and the whole tree is so rich in potash that this alkali is often made from its trimmings and loppings.

We had already mentioned some of the superstitions connected with the ash, and at p. 250 will be found directions for making a shrew-ash; we shall now, therefore, only direct attention to another practice which this tree was employed for, even to a somewhat recent period, as it will account for some curious growths of ash which will sometimes be met with. Evelyn says:—

> I have heard it affirmed with great confidence, and upon experience, that the rupture to which many children are obnoxious, is healed, by passing the infant through a wide cleft made in the bole or stem of the growing ash-tree; it is then carried a second time round the ash, and caused to repass the same aperture as before. The rupture of the child being bound up, it is supposed to heal as the cleft of the tree closes and coalesces.

As, then, the healing of the child would seem to depend upon that of the tree, this potent charm is not always successful, as may be gathered from the fact that young trees have been met with which never healed at all, and we recollect one of these, of which the accompanying wood-cut is a copy, having been presented at a Conversazione of the Worcestershire Natural History Society. The tree from whence it was taken was of about ten years of age. Selby says that an instance of this use of the ash is "related by the Rev. T. Bree, in the *Magazine of Natural History*, where a ruptured child was made to pass through the chasm of a young ash-tree, split for the purpose, in Warwickshire."

These facts seem to point to the acting upon such superstitions to within a comparatively recent period, though doubtless the drawing a child beneath the stolon or shoot of a bramble that has rooted at its extremity, and which we have known to be gravely recommended by a wise (!) woman, would be equally efficacious, and, upon the whole, easier to perform.

Evelyn further says that “the chemists exceedingly commend the seed of the ash to be an admirable remedy for the stone.” “But,” he adds, “whether by the power of magic or nature, I determine not.” We would suggest that it was by the power its roots possess of riving the natural rock. So stone-crop, from decomposing the stones on which it grows, was held to have the like effect. How strange, then, it is that with such evidences of the truth of the motto,—

Similia similibus curantur,

physicians of the present day should refuse to listen to this still (and very small) voice of nature, and not all become homœopaths! Such may well be the reasoning of many an old woman who still pretends to cures either by magic spells or infinitesimal globules.

Two interesting varieties of ash are met with: the pendulous or weeping-ash, which, Sir W. Hooker informs us, is said to have been first discovered in a field at Gamlingay, and the *Fraxinus heterophylla*, in which the leaf is simple, that is, it is in one piece, more the form of a laurel-leaf than the usual pinnated ash-leaf. These variations are easily perpetuated by grafting, and are here only mentioned on account of their peculiar habits.

The Beech (*Fagus sylvatica*) is admitted by all authors to be a native of Great Britain, and if the many magnificent giants one here and there meets with be admitted as proofs of indigenous origin, few trees can put in a more imposing claim. The celebrated Burnham beeches, so well known to artists and lovers of nature in general, and the many fine examples of this tree in the Cotteswolds, upon which range it is said to grow as a weed, testify to the age and size to which the beech may attain.

The plantations of beeches in Oakley Park are well worthy of note in speaking of the Cotteswolds, for although they have been planted here, yet the fine, tall, clean balks, lofty tops, and the "twilight shades" beneath, will not soon be forgotten by the author, who, beneath their boughs, through the liberality of Earl Bathurst, "has felt them all his own," as says the poet Gray of the Burnham beeches. Here, too, has he mused, though not, like Pope, in "thoughts that burn," yet much wondering at the curious plants which choose such seclusion for their dwelling. Of these the following may be here enumerated, as they really form part of the natural history of the beech wood:—

Listera Nidus-avis—Birds'-nest Orchis.
Habenaria chlorantha—Butterfly Orchis.
Epipactis grandiflora—Large White Helleborine.
Epipactis ensifolia—Narrow-leaved White Helleborine.
Epipactis latifolia—Broad-leaved Helleborine.

Monotropa Hypopithys—Yellow Birds'-nest.
Pyrola minor—Lesser Winter Green.

Such a list of plants found in the beech woods is sufficient to make their locality remarkable, and if we add to them the

Tuber cibarium—Truffle,
Morchella esculenta—Morell,
Elaphomyces muricatus—Sharp-warted *Elaphomyces*,

—these, with various other curious fungi, will be sufficient to make Oakley Park and its beeches a botanical habitat of no mean pretension.

As regards the truffle, we may mention that we have heard that a former Earl Bathurst kept dogs for the purpose of hunting them. We have partaken of the morells from this park several times, and always found them delicious, and can recommend them stuffed with sausage-meat and fried, as a dish for an epicure: we have seen them exposed for sale in the greengrocers' shops of the good old town of Cirencester.

But we are sadly digressing from the subject of the beech tree in his history as a forest and ornamental tree. Under the latter aspect, then, most authors, except Gilpin, view the beech to hold a very high place. Coleman, in his "Woodlands," considers that,—

> Among our truly indigenous forest-trees, the beech must certainly rank as second only to the oak for majesty and picturesqueness; while, for the union of grace and nobility, it may claim precedence over every other member of our sylva.
>
> Having said this, we must, as a matter of course, dissent from the opinion of Gilpin, the highly-gifted author of "Forest Scenery," who has, as we think, unjustly impugned the ornamental character of this generally favourite tree, and this because he had some crotchets of his own about landscape composition, and the shape that trees ought to take to make them good subjects for the pencil. The beech did not happen to fit itself to his theory, and so he quarrelled with it, and called it hard names.

Any one who has ever seen a well-grown beech tree, such as was once our delight to visit at Hartley Bottom, near the source of the Thames, or who has seen such masses of beech glowing with autumnal tints as may be witnessed in a journey on the Great Western Railway between Swindon and Cheltenham, will never speak disparagingly of the beech, which we think noble, alike by itself as in masses, or as a sylvan denizen with other trees.

But it has other claims besides that of ornament; it is a highly useful wood, much employed in carpentry, cabinet-work, and turnery; in the making of charcoal; and increasingly so in the manufacture of wood-spirit.

As a firewood it excels most others, as it burns with a clear flame, even when wet, and leaves behind only a small quantity of ash. How, indeed, could it possess much ash when it flourishes in positions where scarcely four inches of soil covers up the oolitic stone, its roots spreading over the rock and occasionally dipping into its fissures in a manner most aptly illustrative of the fact that this tree really derives but little nutrition from the soil, the rocks upon which it grows, for the most part, serving to moor the giant in position that it may spread forth its leaves to feed upon the atmosphere?

The beech is easily propagated from its fruit—“mast”—which, indeed, so readily grows beneath the trees that thousands might be obtained for the purpose of pricking out in nursery lines, if looked after. The usual method of cultivation is to gather the mast in the autumn, to keep it well in sand, and sow in the spring. After two years it is pricked out in nursery rows, and is fit for planting in three years more.

Where once established it will soon spread, as the mast grows sporadically with great readiness, and this tree has a faculty for extending undisputed possession; thus, in America will be found wide-extended forests of scarcely anything but beech, which, though perhaps a little varied from our own, is yet doubtless of the same species.

There are several ornamental varieties of beech to be obtained from the nurserymen, some of which are more curious than useful; but we must not omit to mention the Copper Beech (*Fagus sylvatica*, var. *purpurea*). This, judiciously disposed, is capable of affording a great charm to the wood, and more especially in plantations near the homestead. They are fast-growing trees, and at present are here and there to be met with of considerable size. We once possessed a couple on our lawn, the largest of which must have been nearly six feet in circumference; and what from its colour, the thickness of its foliage, and the fine sweep of its branches, it was capable of yielding shade and shelter of a most perfect and agreeable kind.

The drip of the beech is prejudicial to cultivation, we think, from the circumstance that the hard, though thin, leaves are so difficult of decomposition that where they fall they leave a thick carpet covering up the ground. If, then, these trees are in such a position as to do mischief from this cause, the leaves should be removed, and they will, if stored, be found very useful in making hotbeds, linings to pots, and other gardening work.

Beech is less liable to insect attacks than almost any other tree; the most annoying is that of the *Aphis*, especially when near the house, as this harbours insects of all kinds, and the exuding honey-dew much injures the aspect of the tree.

Beech timber would be more valuable than it is were it not for its liability, when in panels, tables, and furniture, to be attacked and bored by weevils. We once had our house so infested with these little beetles, derived from some furniture of this wood, as to cause considerable alarm; but fortunately our domestic's knowledge of natural history in the matter of bugs was somewhat defective, as she had mistaken the nature of the weevil. This pest can be removed by boiling in oil; but it is a great drawback to the use of a wood which otherwise might be applied to various domestic purposes.

CHAPTER XLVI.

ON SOFT-WOODED FOREST TREES.

In this chapter we shall shortly direct attention to such soft-wooded trees as the sycamore, plane, horse-chestnut, lime, willow, poplar, and others, which, though commonly grown, are yet more so for ornament than profit; for though their woods are found to be more or less useful, as a general rule they must take a comparatively low rank as timber trees.

Both the Sycamore and the Plane are introduced trees; both attain to a large size; and when judiciously mixed with other trees form a very pleasing contrast. The plane has the property of withstanding the effects of smoke in towns better than any other tree, and therefore it is recommended for planting in public parks and town enclosures.

The Horse-Chestnut has much of the character of the above; it grows tall and large, and its fine foliage and handsome bunches of flowers are very attractive. It is an excellent tree for shade, and has the merit of quick growth; but its wood is so brittle as to cause great limbs to be too readily blown off with a high wind.

The Lime (*Tilia Europæa*) is one of our most charming native trees, for so it has been pretty clearly proved to be by E. Lees, Esq., F.L.S., who says "that at Shrawley, eight miles north from Worcester, there is a wood, remote from any dwelling or public road, of about five hundred acres in extent, the greater part of the undergrowth of which is composed of *Tilia Europæa*, var. *Microphylla*;" and the same gentleman, in a communication to the Botanical Society of London, mentioned several places, in Worcestershire, Herefordshire, Gloucestershire, Monmouthshire, and South Wales, where he considers the lime to be indigenous, and where he met with many remarkable and aged trees.

We shall not here enter into a discussion about species, but, from what we saw in Shrawley wood and its district, we incline to the belief that several names made to depend mainly upon the leaves, might well be omitted, seeing that from Shrawley itself the leaves on the newly-sprung underwood are fully five times larger than those on an old tree.

Putting such questions aside, we may well consider the lime as a truly ornamental tree, *whose varieties* give great charm to the forest or the more limited plantation about the homestead, where its shade, its perfume when in flower, and patience under lopping and training, must ever recommend it.

The Willow, though usually cultivated in the shape of twigs for basket-making and the like purposes, for which many species are employed, is nevertheless grown upon the margins of streams and in damp places about estates and farms for its lop, which is much used for hurdle-bonds, thatching-spars, &c.

Amongst implements from this tree, the willow-wand of the cricketer has now a fame in the New as well as in the Old world, and long may its magic continue to develope the muscle and sharpen the faculties of the youth of Old England; whilst well-developed muscle cannot better maintain its tone than by a well-contested game of cricket.

In good situations the White Willow (*Salix alba*) attains to very magnificent proportions. One at Siddington, near Cirencester, measures 22 feet in girth, at one foot from the ground; 18 ft. 6 in. at three feet; and 20 ft. 6 in. at six feet. The principal limb measured 12 ft. 6 in., and the circumference of its fine top is as much as 72 feet. And four trees by the Roman Amphitheatre at Cirencester, average somewhere about 12 feet round at six feet from the ground. Trees of this size, from their light, silvery foliage, give great character to the surrounding scenery.

These soft-wooded trees, with some poplar and other ornamental trees, furnish a more or less light, soft, spongy wood, very inferior for timber, but yet capable of being put to various uses in turnery, internal work, &c., in which white wood is employed.

The *Coniferæ* (Cone-bearers).—The Fir tribe may well form a subject even for a separate volume, for not only are some of them employed as timber trees, but many are grown for their curious and interesting structure.

The *Pinetum* has become to be a matter of amusement to many a country gentleman throughout the country; and in these are collected such new forms as may in time become useful to the planter, as well as such minute species as may illustrate the natural history of a subject well worthy of extended study.

Amongst our giants of this natural order may be placed the yew (which has been made a separate order under the name of *Taxaceæ*) and the cedar; the spruce-fir, Scotch-pine, and larch being the more useful members as timber trees.

The Yew (*Taxus baccata*) is generally considered as an indigenous tree, and as we can certainly point to individuals that must have weathered nearly, if not quite a thousand years, we are not disposed to quarrel with the conclusion. Its former use in the construction of the English long-bow is now obsolete, and so too has almost died out the taste for growing this tree to torture into grotesque shapes. Still, as a picturesque tree in woodland and home scenery, and even as an attendant upon the parish church, we should like to see the yew more extensively grown. It is also a most useful tree for close hedges and blinds in the garden, as it will bear being clipped within due bounds with a great amount of patience.

The Cedar (*Cedrus Libani*), which was probably introduced to this country towards the end of the seventeenth century, has yet made such progress as to rival in size and importance many of our more stately native timber trees of far greater age.

Amongst the more stately examples of this tree, we may mention those at the Chelsea Botanical Garden. There are some fine groups in Oakley Park, Cirencester, growing on almost a bare rock of the Great or Bath Oolite, and in the bleak Cotteswold country, attaining the circumference of from 10 to 12 feet, at three feet from the ground. Long may the cedar be cultivated for the size and beauty to which it can attain, in which, perhaps, it may yet be excelled by the *Cedrus deodara*, not many years since introduced from the Himalayas. We rejoice to see such noble specimens of vegetation grown, independent of profit, which, indeed, is scarcely needed by a princely possessor of a fine estate handed down, perhaps, from generation to generation, in which each tree may have a history of its own.

The Spruce-Fir (*Abies excelsa*) is an elegant tree in composition, and grows well on the thinnest and poorest soils. Its upright, tapering mode of growth renders it a good nurse, with beech, larch, and other *Coniferæ*. It may be planted thickly; the first thinning being used for hop-poles, the next for spars, masts, &c.; and ultimately a few may be left to attain size and height as shelter and for effect.

The Scotch Pine (*Pinus sylvestris*) is a native of North Britain, where its fine trees in large forests or in great clumps, form a peculiar and at times magnificent appearance. It is much used in planting in this country, principally as a nurse; but its young sticks are not so durable as those of the spruce, and much inferior to the larch. Its larger wood forms the red deal—a timber so much used in all kinds of carpentry as to give this tree a high value among timber trees.

The Larch (*Larix Europæa*) is a deciduous tree of the order, and though it has not been introduced into general use for very many years, yet its value is daily becoming more fully developed; and as a tree for general plantation, either as a nurse or in belts, it has few, if any, equals. As a curious tree, it appears to have been grown early in the eighteenth century, and some fine trees are noticed by Selby at Dalwick in Peeblesshire, and at Monzie in

Argyleshire. The largest larch which we have noticed was one which was felled in Oakley Park.

It had previously been injured by being struck with lightning, by which large pieces of the bark had been torn away. We examined it at Lord Bathurst’s desire, when it was found to be bored into from the base of the trunk to as high as we could see, by that curious insect the *Sirex gigas*, whose hornet-like appearance causes so much consternation in the pine forests in Germany, from which it is often introduced into the dwellings of the peasant with fir logs. It is quite as large as the hornet, and much of the same bright colours, but its apparent sting of more than half an inch in length is only an ovipositor, so that that formidable-looking creature is perfectly harmless after all. This tree was nearly twelve feet in circumference, at three feet from the ground, in which condition its lower drooping branches give the larch a fine picturesque appearance.

Larches, and, indeed, the whole of the *Coniferæ*, are best procured for planting from the nursery, and much time will ultimately be saved by planting them as soon after removal as possible, and that by the pit method; and so done, larch, unlike most other young trees, shoots away at once, and soon allows of thinning to profit.

We now bring this subject to an end, for the want of space; but we cannot part with friends we love so much without a benediction; in the words of Cowley then we say,—

> Hail, old patrician trees!

DESCRIPTION OF THE PLATES.

Plate I. QUERCUS ROBUR PEDUNCULATA, nat. size, from Oakley Park, Cirencester. Fig. *a. Petiole*, or leaf-stalk. Fig. *b. Peduncle*, or fruit-stalk.

Plate II. QUERCUS ROBUR SESSILIFLORA, from Wyre Forest, near Kidderminster. Fig. *a. Petiole*. Fig. *b. Peduncle*.

NOTE.—The leaf of *Quercus Robur sessiliflora* has a greater number of divisions than that of *Q. Robur pedunculata*. These lobes are somewhat more acute at the apex. This and its longer petiole, and general brighter colour of the whole leaf, gives the former tree, when in foliage, a lighter aspect than the latter.

HOW TO GROW GOOD ORCHARDS

CHAPTER XLVII.

ON THE APPLE AND PEAR AS ORCHARD FRUITS.

In discussing the subject of fruit in relation to the farm, we shall find that the number of species is exceedingly limited, being, indeed, confined to two: the apple and the pear. This paucity of species, however, is amply compensated for in an extended and constantly extending list of *sorts*, or varieties, which, in both species, amount to several hundreds.

The apple, which we shall first describe, is admitted on all hands to be derived from the wild crab-apple (*Pyrus malus*), which is considered to be a native tree, to which position its general appearance in woods and hedges all over the island would seem to give it no small claim.

The fruit of the crab is exceedingly austere, and hence sour-tempered people are said to be "crabbed." The expressed juice makes a strong vinegar, called "Verjuice"—in the vulgar, "Varjes"—and hence Akerman, in his "Wiltshire Tales," has given a cross-grained woman the name of "Mistress Varjes." Verjuice is a very popular remedy for sprains and bruises, and hence on most farms having trees of crab-apples, the fruit is made into vinegar, and kept separately for medicinal or domestic use.

The wild crab is very various in the size, colour, and flavour of its fruit, varying in the latter point from an austerity that, on biting an apple, would make one wince again, to that of an agreeable acid flavour, almost equal to some of our domestic apples.

Taking into consideration this disposition to run into varieties, even in a wild state, we shall not be surprised that, in cultivation, the sorts of apples should be endless, so much so, indeed, that Don, in his "General System of Gardening and Botany," has copied a list[30] in which are described no less than one thousand four hundred sorts, and in a nurseryman's list now before us, "Descriptive Catalogue of Fruit Trees, by John Scott, of Merriott Nurseries, Crewkerne, Somerset," are described as many as one hundred and sixty-six sorts, which he is prepared to supply to purchasers.

[30] This list was made out by the Horticultural Society in 1832, and may now be considerably augmented.

As an evidence of the facility with which new sorts can be obtained, there is scarcely a country town or place in orchard districts but has given its name to some apple. Thus we have Canadian Pippin, Newtown Pippin, Carlisle and Keswick Codlin, Hawthenden, &c.; and the names of fruit-growers and others attached to apples is almost endless; as thus: Ashmead's Kernel, Nelson's Codlin, Lucombe's Seedling, Lord Nelson, Lord Raglan, &c., &c.

The subject of "sorts," as applied to fruit, is one of great interest, as the facility with which these can be obtained renders it possible to procure fruit possessing very different properties and capabilities, adapted, not only to a great variety of uses, but with powers of adaptation to different soils, and a wide range of climatic differences.

These powers of adaptation have, indeed, resulted in the preservation of many sorts, but it also causes the neglect of some others; for as fashion takes up with new favourites old ones are neglected until they die out, and, if not become entirely lost, their stocks are lessened, so that the chance of a good choice for their continuance becomes more difficult year by year. We believe this to have more to do with the decline of old favourites than any inherent principle of decay with which grafts are said to be endowed.

The many sorts of apples differing so much in flavour and keeping powers, enable this fruit to be employed for a variety of purposes, such as—

Culinary Apples, used for tarts, puddings, &c., &c.;
Dessert Apples, usually of a sweet sub-acid flavour and crisp texture, eaten raw;
Cider Apples, the expressed juice of which forms English Cider (*Cidre*, French).

The same distinctions apply to pears, with the difference that their juice is termed Perry.

Now, with regard to the two first, we need here only mention them incidentally, as their description belongs more properly to the horticulturist, or pomologist, than to the farmer; at the same time it must be confessed that both culinary and dessert apples may be made a source of profit by the farmer, as they would always find ready purchasers; but the difficulty a farmer meets with in their cultivation results from the circumstance that it is not easy to exert that watchfulness over broad acres necessary to protect sweet apples from the predatory urchins with which every country parish abounds, a propensity, indeed, not sufficiently checked by the elders, whose plea that "it is only a few apples, and that children will be children," affords just that amount of encouragement which too often ends in more serious acts of larceny.

As regards cider fruit, we would here dissent from the common belief that sour apples are the best for cider-making. We believe that the sweeter the apple, and the higher the specific gravity of the juice, the better the cider. Many, then, of our culinary and dessert apples would make most excellent drink; at the same time there are many sorts that will not "cook," whose flesh cannot be got to become soft and pulpy, but rather hard and tough by the processes either of boiling or baking. Many sorts whose flavour is not sufficiently agreeable to be eaten raw, and yet these may yield on expression a sweet juice, resulting in a strong and agreeable cider.

Now, although there can be little doubt but that the quality of cider is much influenced by the sort of fruit from which it is made, we are inclined to the belief that the nature of the soil has, if possible, a still more decided influence upon the result. We therefore now direct attention to some of the best cider districts in England, which may be classed as follows:—

Devonshire, Cider of the sweetest and richest kind;
Somersetshire, Cider rich and not so sweet;
[323]Dorsetshire, Cider somewhat poor;
Herefordshire, Cider and Perry, very strong, but somewhat harsh;
Worcestershire, Perry and Cider, rich and not too harsh;
Gloucestershire, Cider and Perry, strong but not sweet.

The prevailing geological formations of these cider-producing counties may be arranged as follows:—

1. Oolite Sands—Dorset, and parts of Somerset.
2. Lias—Gloucester, Somerset, and Dorset.

3. New Red Sandstone—Worcester, Devon and Hereford, in part.
4. Old Red Sandstone—Hereford and Devon.
5. Silurian System—Hereford, in part.

Hence, then, cider and perry are grown on the sub-soils of five geological substrata, if, indeed, No. 1 should not here be classed with No. 2, for the extent of orcharding upon the inferior oolite sands of Somerset and Dorset is rather due to its extension from the contiguous lias, and this on account of an occasional depth and tenacity of soil. Its produce, however, is usually inferior.

In Gloucestershire orchards always stop when the top of the lias is reached, and it is curious to see the sides of the Cotteswolds occupied with well-to-do orchards until the oolite is reached, and then they cease altogether, except in some few instances, which are here referred to by way of warning.

Gloucestershire, for our present purpose, may be said to rest on liassic valleys and oolitic hills. In the valleys are small farms with small enclosures, much of which is in orchard and meadow, whilst on the hills are large farms with fields of from 30 to 100 acres devoted to arable cultivation. Hence, then, this has brought about two sets of farms: the vale, with its fruits and dairy stock, producing good cider, perry, butter, and cheese; the hills, mutton, wool, roots, barley, &c. Now, it happens as a rule that the hill farmer stands higher in his profession than he of the vale, for on the hills he can say—

> "Ay, marry, now my soul hath elbow-room."

The skill and enterprise in breeding the magnificent Cotteswold sheep, for which there is each year such a spirited competition, attest to this fact.

No sooner, then, does a vale farmer become possessed of sufficient capital than he moves to the hills, and as in his former residence he had imbibed a love for cider, his first act will be to plant an orchard at his new home; but, alas! the most successful farmer cannot command crops in an uncongenial soil, and so it is not surprising that we should know of instances where not even enough fruit for an annual apple pudding has been produced from a Cotteswold orchard which had been planted thirty years.

Apples only attain to perfection on deep tenacious soils, and in a genial climate; the moment the roots get down to stones, the ends of the branches begin to decay, and they become covered over with lichens as thickly as in wet ill-drained clays; besides this the trees look old and knotty, even in youth, a sure sign that they are not sufficiently nourished. These facts are so well known that in planting in our gardens we prepare the soil, if not sufficiently deep and good, and make the climate more genial by fencing and planting in sheltered situations; but this is not possible on a large scale.

Pears prefer a lighter soil than apples, the new red sandstone deposit, especially, the marls of this rock and the lias clays, when covered up, as in parts of the valley of the Severn, with sand drifts, suit pears admirably.

Like the apple, the pear is rich in sorts. It is said to be derived from the *Pyrus communis*, which is referred to as a native tree; but though it is really wild in the temperate regions of the European continent, and in parts of Asia, there seems reason to conclude that our occasional hedge-row denizen has, after all, been derived from pear cultivation.

Pears for dessert are very numerous, and each year adds to the list. Scott, of Crewkerne and Yeovil Nurseries, gives a list of two hundred and thirty sorts cultivated by himself, as Standards, Pyramids, and Dwarf-trained for walls and espaliers. This list abounds in French names given by both French and Dutch horticulturists, with whom the pear is a great favourite.

Lindley, in his "Guide to the Orchard and Kitchen Garden," describes but six sorts of perry pears, of which there are doubtless several varieties. They are as follows:—

ORIGIN OF NAMES.

Barland, from Barland, in the parish of Bosbury, Herefordshire.
Holmore, from the parish of Holmore, between Hereford and Leominster.
Huffcap.
Longland, from the field in which the tree grew.
Oldfield, from Oldfield, near Ledbury.
Teinton Squash, from Teinton, in Gloucestershire.

Besides these are Blakeney Red Trump Pear, Honey Pear, Moorcroft, Malvern Hill, &c. Pears, like apples, being named from places and people, &c., each district having its own favourite sorts; but perhaps those in the previous list are the favourite.

This subject of variety in both apple and pear is interesting, as it has given rise to innumerable names upon this head. My old pupil, Mr. Clement Cadle, says:—

> It is almost impossible to give satisfactory information on the sorts of fruit, because the same sort is not only known by different names in different localities, but it also assumes a widely different character under the influence of broad distinctions of soil and climate, and this is more frequently the case with pears than apples. In a tour I made last autumn in the south of Devonshire, I visited several farms in the neighbourhood of Totnes and Paignton, and amongst a great number of sorts that I there saw, I could in no instance recognize either an apple or tree as being like those I had seen before in Herefordshire, Gloucestershire, or Worcestershire.
>
> In selecting for producing cider or perry it is very important, not only to get those kinds which suit the district, but to get a variety in their character, especially for making good cider. Thus, some of the apples should be sour, others sweet, bitter-sweet, tart, and harsh, as much of the keeping character of the cider depends upon this mixture, which also makes it fine down well. It may be remarked that sweet or eating sorts of pears seldom make perry that will keep any length of time, or that fines well.
>
> There is another peculiar feature in regard to sorts of fruit, namely, that each variety has its day, then gradually dies out. The trees become non-bearers, and their places are filled with new sorts. This is especially the case with the Hagloe crab, Fox whelp, and Skryme's kernel, which seldom bear or grow well now, and are nearly gone.
>
> *R. A. S. Journal S.S.*, vol. I. pp. 18, 19.

As regards pears, it should be stated that, while in Worcester, Gloucester, and Hereford much perry is made, and it is highly esteemed, especially for bottling, in Dorset this drink is almost unknown, and we were last year greatly surprised that a farmer who had an immense crop of pears of a sort that were not fit for dessert or culinary purposes, could not divine what to do with them, though he made excellent cider.

We conclude this portion of our subject with a quotation from the Botanical Looker-out, by our old friend and fellow worker, E. Lees, Esq.:—

> A pear orchard in exuberant flower is a vegetable spectacle not easily matched, for the bending branches of the pear tree give a gracefulness to its outline far exceeding the stiff formality of the apple tree, and oppressed with a multitudinous crowd of blossoms its branches almost trail the ground, a bending load of beauty that seems by moonlight a mass of silvery ingots. The Barland Orchard, between Worcester and Malvern, containing more than seventy trees, lofty as oaks, cannot be seen by a traveller without admiration, and is the finest in the kingdom, though the trees are now getting old.

CHAPTER XLVIII.

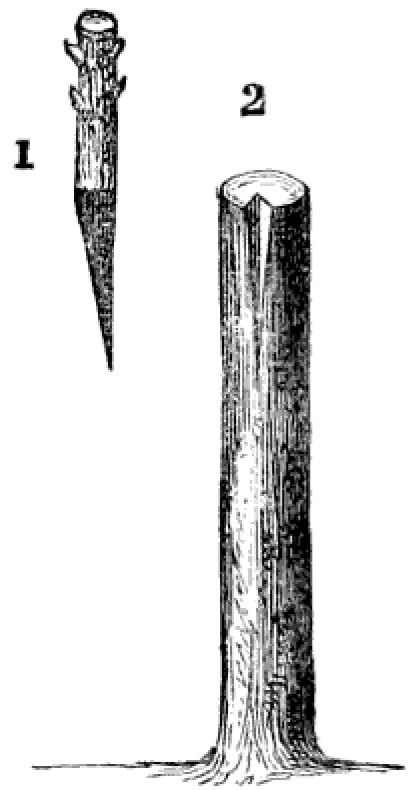
ON THE PRODUCTION AND CHOICE OF FRUIT TREES.

Although new sorts of fruits are easily obtainable from seeds, yet this method of production is much too slow for general purposes, and when kernel trees—that is those raised from seed—are in the slow progress of such events brought to produce fruit, it is ten to one if it be of any value; so that even seedling trees, when they have attained sufficient size, are best used for stocks upon which to graft any desired sort.

In reproducing a constant supply of well-known sorts of fruit, three plans are usually practised, namely, *Budding*, *Grafting*, and *Cutting*.

Budding is usually employed in the case of smaller fruit or flower trees, and but seldom with apples and pears; this well-known process, however, is frequently had recourse to in the nursery; it is performed for fruit trees in the same way as for roses, and therefore needs no description in this place, as we can scarcely conceive the farmer doing much in this direction, except as a matter of amusement and experiment.

Grafting is a common process on most farms with orcharding; a sort of fruit may be wished to be changed or a promising tree may be broken, and in either case the farmer should know enough of the process of grafting to be able to do it himself or else to properly direct others.



1. The Graft.
2. The Stock.

In grafting, the first thing to be done is to secure good shoots from a healthy tree of the sort you wish to grow—these are called the “grafts.” The stem to receive the graft is called the stock. Now a stock may be single, in which case one graft will be sufficient, as in the accompanying diagram, or if an old tree has to be grafted, a graft may be inserted on as many branches as may seem desirable. Our diagram represents the common practice of side grafting, but different plans are adopted according to the difference in size of the stock on the one hand, and the graft on the other, the principle to be aimed at in the process being to get *as complete an apposition of as much of the wood and bark of the graft, with that of the stock, as is possible by careful cutting and fitting*, and the tact and delicacy in manipulating this matter make that successful result which marks the good grafter. In this as in other matters, practice and experience ensure success; and hence it is usually found expedient to employ a person who makes it his profession, and such are always to be obtained in cider countries.

Graft protected by a
Wicker basket.

When the grafts have been fitted, they must be kept in place by some plastic material, and that most commonly used is a compost of cow-dung and clay, well kneaded together, or merely chopped hay and clay; this is pressed round the united parts in the form of a ball, and in cases where every care is taken the graft may be further protected by a wicker basket, as in the diagram.

Cutting.—The ease with which apple trees can be multiplied by cuttings was forcibly impressed upon our attention at a very early age. When a boy, having seen a most promising branch cut from a favourite apple tree in the process of pruning, the thought struck us that we might get a tree of our own, and so, seizing the branch in question, we planted it in another part of the garden, only—sad to relate—to have it pulled up the first time the gardener passed that way. With a boy's perseverance or obstinacy—which the reader pleases—again and again did we replant this same branch with a like result, until finding a quiet corner, we once more planted our cutting, and this time, no evil chance overtaking it, it took root; and in two years from that time we enjoyed the taste of apples from what, we hope not undeservedly, was allowed to be considered our own tree. This was a matter for frequent reflection in after-life, for, besides viewing the result as a reward for perseverance, it is just possible that our first disappointment may have tended after all to our success, for doubtless the unexposed sheltered corner was just the place for ensuring this in rooting cuttings. Here, however, the cutting was a large branch, but for general purposes we should recommend cuttings to be made of small unbranched shoots; these may be planted in rows in a somewhat shaded situation, and when they have become rooted and fit for independent trees, they may be removed to their permanent places, and so be either pruned for tall orchard trees, or, as they are well adapted to the purpose, be trained for dwarf orchards.

Pruning, in the cultivation and due keeping of an orchard, is one of the most important operations connected with the subject. Its objects are:—

1st. To circumscribe the growth in any given direction, to train the tree on the one hand, and to let in light and air by thinning on the other.

2nd. By pruning fruit trees we operate so as to check undue growth of wood and leaf, and thus, by what the botanist calls the "arrestation of development," cause flower and fruit to be formed instead of leaves. In the western counties, if a tree or plant of any kind grows leaves too freely, it is said to be too "frum," probably derived from the Saxon *from*, strong, stout.

Pruning, then, hastens the fruiting season in fruit trees, but at the same time it brings on premature age, and hence the operation should be performed with judgment, or else premature decay will be the consequence. In pruning of large trees care should be taken to cut out, as smoothly as possible, all awkward or crossing branches, so as to expose the whole of the fruiting limbs to light, warmth, and air. This again is an operation requiring an experienced hand, and when such an one is known, it is far better to employ him than to trust the matter to those who know little or nothing of the subject.

Much has been said and written upon the subject of rearing fruit trees, and when matter of this kind is addressed to the nurseryman, it is to be welcomed if based upon sound botanical principles, but we cannot recommend the farmer to grow his own fruit trees, as he rarely pays sufficient attention to their youthful training, and we therefore recommend the purchase of fruit trees from the best growers, to get the best sorts, and to get well-grown and healthy examples. These should be carefully lifted and planted as soon as possible after leaving the nursery, always avoiding trees that have hawked the market week after week, even if procurable for nothing.

Some people insist upon the propriety of planting poor trees grown in poor soil, but our experience has shown that nothing could be a greater mistake. It is true that these often fruit soon; but getting crops of fruit from trees only a quarter grown, though sometimes welcome to a tenant with no sure holding, is a matter which should always be looked to by the landlord, who, indeed, should pay greater attention to his orchards than is usually the case, if his desire be to hand them down to his successors in anything like a good bearing condition. That fruit trees must in time get old is quite true; at the same time it may be stated as an important fact, that poor stunted trees on the one hand, or those too prodigal of their youth on the other, will too surely result in decrepitude ere half the span of a healthy tree be attained.

Feeling so strongly as we do the importance of healthy young trees from a good soil and climate to plant even in an unfavourable district, instead of, as is generally sought after, trees from a poor soil, we are glad to have our opinion fortified by a successful practical grower of fruit trees, whose samples of young stock in apple trees, as we have seen them exhibited in Yeovil market, are patterns of healthiness in bark and models of form. The cultivator to whom we refer is Mr. J. Scott, whose name and place we have before mentioned. He says, in his Descriptive Catalogue of Fruit Trees:—

> There remains *one thing* the writer would especially guard intending planters against; that is, be careful *never to purchase* trees off a poor soil. I know this is heterodox; but many years' experience has taught me the fallacy of the popular dogma, *i.e.*, "Get your trees off poor soils, as they will be hardier, and endure the storms better." I could show examples, in numbers, in my nursery, where the trees came from one of the so-called poor soils, that never will be anything like healthy trees. They were hide-bound and checked in their natures when I received them, and I believe will ever remain so, less or more. A genial, moderately rich, and naturally good soil is the soil I would choose my trees from.

Experience and observation, both in the garden and the orchard, fully confirm us in this view of the case, and we would therefore only add to the direction, “Get your trees from moderately rich soil,” that of, “Plant them in a soil of the like kind;” for if trees be brought from a poor soil, not fit for them, to a poorer, they will certainly not succeed, and indeed the choice of poor land for orchard growth will be seen to end in disappointment.

In planting apples we should choose a mixture of several of the best sorts, and it is recommended that some should be sour; but we prefer to have those that produce a juice of high specific gravity, though with all cider and perry fruit there will be great diversities in this respect, depending upon soil, climate, and season.

The following list of apples contains such as are met with principally in the counties of Worcester, Hereford, and Gloucester; all may be used for cider, but some are more especially adapted for house purposes:—

I.—LIST OF APPLES.

Those marked with (A) are good for hoarding, and those with † are good for boiling.

Skyrme’s Kernel—Tart; good for cider.
Royal Wilding—Bitter sweet; good for cider.
Black Foxwhelp—Moderately tart; good for cider.
† Red Foxwhelp (A)—Moderately tart; good for cider.
Cowan Red—Sweet; good for cider.
† Dymock Red (A)—Very sweet; good for cider.
White Norman—Bitter sweet; good for cider.
Red Norman—Bitter sweet; good for cider.
Hagloe Crab—Tart; good for cider.
Pawson—Tart; good for cider.
† Redstreak—Sweet; good for cider.
Yellow Styre—Sweet; good for cider.
† Hooper’s Kernel (A)—Moderately sweet; good for cider.
† Hill Barn Kernel (A)—Sweet; good for cider.
† Ribston Pippin (A)—Sweet; good for table and keeping.
Golden Harvey (A)—Sweet; good for table and for cider.
Siberian Harvey—Sweet; good for cider.
Farewell Blossom—Tart and bitter; large bearer.
Upright French—Bitter sweet; large bearer.
Black or Red French—Bitter sweet.
Knotted Kernel—Tart.
Leather Apple—Hardly any taste.
Ironsides (A)—Hardly any taste; good for keeping.
† Cats’-heads (A)—Sweet; good for cider.
Pigs’-eyes—Sweet.

Downton Pippin (A)—Sweet; table and eating.
† [335]Codlings (A)—Sweet; good as boilers and for cider.
† May Blooms (A)—Sweet; good for cider, boiling, and keeping.
Rough Coat (A)—Dry and sweet; good keepers.
Brandy Apple (A)—Very sweet; makes strong cider.
† Cowarne Quinin (A) Sweet; good for cider.
† Blenheim Orange (A)—Very sweet; good for table.
† Golden Pippin (A)—Very sweet; good for table.
Old Pearmain (A)—Very sweet; good for table.
Brown Crests—Very sweet.
Under Leaves—Sweet; large bearer.
Red Kernel—Sweet; good for cider.
† Reynolds's Kernel (A)—Sweet; large pot-fruit.
Newland Kernel—Bitter sweet; good for cider.
Jackson's Kernel—Tart.
† Sam's Crab—Tart.
† Bridgewater Pippin (A)—Sweet.
† Spice Apple (A)—Sweet.
White Beach—Bitter sweet; good for cider.
Handsome Mandy—Bitter sweet; good for cider.
Golden Rennet (A)—Sweet.
Pine Apple—Moderately tart; wood cankers.
Stoke Pippin (A)—Sweet; good bearers; pot-fruit and for cider; and numerous others.

From Prize Essay on Orchards, by Clement Cadle, from the Journal of the Royal Society.

The next list is taken from Scott's Descriptive Catalogue, by way of contrast and comparison with the above, as it is more particularly adapted to Devon, Somerset, and Dorset.

LIST II. CIDER APPLES.

The following is a list of some of the best Cider fruit,
cultivated in the best Cider counties throughout England.

167. Best Bache, spec. grav. 1073. A Herefordshire fruit of great excellence.
168. Bringewood, a good cider fruit.
169. Bovey Redstreak.
170. Cadbury, supposed to be the same as Royal Somerset.[336]
171. Coccagee, a splendid cider fruit of first-rate excellence.
172. Cowrane, red, spec. grav. 1069; an excellent sort.
173. Devonshire Redstreak.
37. Devonshire Quarrenden, a valuable hardy fruit; well known.
35. Downton Pippin, a most prolific and valuable cider fruit.
174. Forest Styre, spec. grav. 1076 to 1081, esteemed fruit.
175. Foxley, spec. grav. 1080, hardy and a great bearer, excellent cider fruit.

176. Fox Whelp, spec. grav. 1076 to 1080, a celebrated cider fruit of the richest kind.
54. Golden Harvey, spec. grav. 1085, a first-rate cider fruit. No orchard should be without this.
177. Haglo Crab, spec. grav. 1081.
178. Jersey, early, very fine cider fruit.
179. Jersey, late, a great bearer, and excellent; one of the best.
77. Isle of Wight Pippin, spec. gray. 1074, a fine cider fruit of great excellence.
180. Kingston Black, first-rate cider fruit of first-rate excellence.
97. Minchal Crab, a very fine fruit.
181. Red Must, very large, yielding a fine cider from heavy soils.
182. Red Streak, spec. grav. 1079, one of the best cider apples.
183. Siberian Bitter Sweet, spec. grav. 1091.
184. Sops in Wine.
185. Tom Potter or Tom Put, a fine fruit.

Besides the above, many other choice sorts make splendid Cider.

Pears for perry differ in one respect from apples, in that, though the best and purest perry is made from only one sort of fruit, and that generally from fruit utterly unfit for any other purpose. Pears, as has been stated, delight in a lighter soil than that which is suitable for apples, and the trees have the advantage of growing so tall that even cereal cultivation is possible under them. It is, therefore, curious to note how scarcely any perry pears are grown in the west of England, unless we view Gloucester as a western county. Though Somerset and Dorset are particularly adapted for the pear, there are many places where its culture is never attempted; we would mention the district of sandy loam around Sherborne, Dorset, as one well adapted for the growth of perry, but where it is nevertheless almost unknown.

It may be noted that although good cider—even the best—can be made from dessert and culinary fruit, yet dessert pears are not well adapted for perry, as their produce is usually watery, and does not fine well.

CHAPTER XLIX.

ON FRUIT-GATHERING, ETC.

In making cider and perry there are several important matters to be taken into consideration, as upon the due observance of these success will mainly depend. These are—

The selection, gathering, and storing of the fruit.
The grinding of the fruit, and storage of the drink.
The after-management, keeping, fining, &c. &c.

Orchard fruit is economized chiefly in the three following methods:—

1. Cooking Apples—used for culinary purposes.
2. Dessert Apples—some of the fine-flavoured varieties.
3. Cider Fruit—which includes all the others.

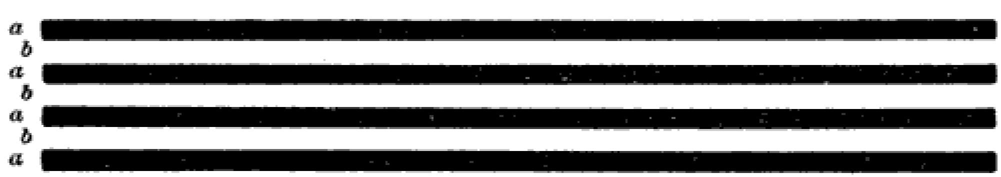
1. Cooking apples may be hand-picked as they become ripe, and those that will not keep long, as the various codlins, may be disposed of in the lump to the fruiterer, or sent to market in smaller quantities. The good keeping apples may be sold in the lot when ripe, or kept in store to be retailed at market.

Both these sets of apples require to be gathered with some care; in short, to be what are called "hand-picked," as, when bruised, they not only are injured for present use, but their keeping qualities are greatly affected.

For store apples the fruit should be gathered before being what is called "dead ripe," that is, when they are quite crisp and juicy; one of the best indications of fitness being a bright light-brown kernel as opposed to a dull dark-brown.

The fruit should be kept in a dry room, from which frost is entirely excluded, and where air can freely ventilate whenever required. The best plan is to fit up such a room with shelves made up of laths three inches wide, and placed an inch and a half or two inches apart.

PLAN OF SHELF FOR KEEPING FRUIT.



In this way *a* represents the laths, of which there may be many or few to each shelf according to the breadth required; *b*, the interspaces. Here, then, the fruit is placed in lines over the interspaces, the object being thus to secure a free passage for the air all around the fruit; if placed in a single layer, faulty ones can be seen at a glance, and these should be removed as soon as detected.

If this plan be found too onerous, and fruit must be put together in larger quantity, we would advise that they be so placed as that air can get to them from below. Keeping fruit in heaps in corners, or even spreading them between layers of straw, tends to their destruction rather than preservation. If, then, it be borne in mind that the end to aim at, in order to keep fruit, is that of exposing sound examples to the free access of the air, it will be seen that the nearer we can secure this the better will be our result.

We say *sound* fruit, for it is useless to put spotted and worm-eaten apples or pears in the keeping-room. These had better be put by and used as soon as possible for whatever purpose they may be fit, for whenever the air can get into the interior of fruit by reason of abrasions, borings, &c., decay soon sets in; and now, while we are writing, we have a quantity of apples with the plague-spot of rottenness proceeding from their being "worm-eaten."

2. In storing dessert apples these directions are even more important. If, then, the farm should produce one or several sorts in quantity, if they are to be disposed of, we would advise their sale to the fruiterer with the onus of gathering and managing them. Small farmers sometimes make no bad addition to their income by thus disposing of fine fruits, and we always advise that such should be planted to a greater extent than is usually done about farm homesteads. It is not a heavy matter for the landlord to find a few sorts of choice fruit-trees for his smaller or even larger holdings, and, by thus adding to the comfort or even luxuries of his tenants, he will be benefiting not only himself but the country at large. We believe it to be a duty incumbent upon the landed proprietor thus to foster a love of fruits, and we honour the names of Knight, of Downton, and Williams, of Pitmaston, in that they loved to propagate new fruits, and to encourage their dissemination. It is said by Mr. Benjamin Maund, the author of "The Fruitist":—

> A propagator of apple and pear trees from seeds may be supposed to possess not only patience, but a desire to benefit posterity. Twelve or fourteen years cast a long shadow before them; and when, after waiting this length of time, the uncertain value of the substance is considered, it must be confessed that men deserve more than praise, who originate new fruits. Apple trees rarely show the real quality of their fruit in less than fourteen years. All, however, who have the convenience of doing so, should raise seedling trees; for it is to these only that we can look with any degree of confidence for permanently furnishing our orchards, and not to old or cankering varieties.

It is true that it is not within the province of all, even of the permanent owners of the soil, thus to add to the number of Pomona's gifts, but all can inquire for and purchase esteemed sorts; and no tenant that is worth having will grudge them care and attention, be his tenure ever so precarious.

We would assign to the lords of the soil the duty of improving fruit-trees, while the gentleman who resides in the country, it may be for only a short season, should make the best use of it to encourage a love for the garden, and to increase its various attractions to charm the eye, and to increase and vary the vegetable food of the people.

3. Fruit for cider-making will consist of "wind-falls," that is, such as has fallen prematurely ripe, or been shaken off by the wind; and gathered fruit. As regards wind-falls, it is only necessary to state that, although these can only be employed for an inferior kind of drink, yet even this may be improved by care, as thus:—Instead of picking up the apples while they are still wet with dew, they should be gathered in as dry a state as possible, and then not, as is too often the case, huddled together in a heap in the orchard, exposed to alternations of frost, and wet, and dry.

Such fruit will often require to be kept for some time waiting temperate weather, which is best for cider-making. It should be kept then under cover, and in such a manner that the air can get beneath it; and for this purpose we have found a few wattled hurdles well adapted for keeping fruit on that is waiting to be ground.

In gathering cider-fruit we should consider it ripe at that period when a not rude shake of a limb would cause most of it to fall pretty well at one and the same time. We dislike beating off fruit with sticks, as it damages the bearing shoots. In fine, in gathering fruit all undue violence should be carefully avoided, as it is unwise to use that amount of hurry, which will only secure a large present crop, unless it can be done in such a manner as not to injure our hopes of the future. It is a curious circumstance that in the garden there is usually something like a crop, even in a bad season; but in the orchard we seldom meet with anything like a crop the year following what is called a "hit of fruit," and only the finer sorts of apples which are hand-gathered with care are often found to be most constant bearers, while the rougher cider-fruits seldom afford a good crop oftener than once in from three to five years. Surely, then, much of this must be the result of the rougher treatment to which cider-fruit is so carelessly subjected.

When the fruit is collected, it should be put in a dry airy place, to await the process of grinding. For this we adopt the plan of spreading it in sheds or outhouses on wattled hurdles. This keeps it from the rain, by which it becomes sodden when in exposed heaps: then the wind will only partially dry it, and the result will be a general heating of the mass, which results, if not in quick decay amounting to absolute rottenness, yet in that state, technically called "moisey,"[31] or dead, in which the juices are nearly dried up and the fruit flavourless.

[31] Apple moise, or apple moce, was an old dish made of pressed apples. In cider counties apples are called moisey when they are juiceless, dry, and without flavour—dead. (See Archaic Dictionaries.)

We have seen heaps of apples, consisting of many waggon-loads, in the orchard at Christmas, when wet and frost had so preyed upon them that none of their proper juices remained. This is certain to make a cider which will be of inferior quality; and though some of our friends boast of the good quality of their cider which has been made in the roughest manner, yet one cannot help thinking how much better it might have been with the fruit carefully collected, and kept until it could be ground. Still, with all our care in this matter, disappointment is sometimes the result; for it is with cider as with wine, the season will have a great deal to do with it, though with both, the manner of making and storing will be all-important matters, to which we shall advert in the next chapter.

We much object to the gathering of fruit for any purpose in the wet. Were it not for the expense, it would be better to take advantage of dry weather, and to collect even cider-fruit by hand-picking before it has become dead ripe, and so let the ripening process be completed in some dry storing-place. In our own experience of cider-making, the two or three casks made for home consumption from carefully picked and well-kept fruit are usually of the best quality, and so made we believe cider to be a most agreeable and very wholesome beverage,—to paraphrase Isaac Walton, only fit for farmers or very honest men. As long, however, as rough people are about who never know when they have had enough, the rougher cider made by a ruder process is quite good enough.

It must be obvious to all that if a man can drink as much as four gallons of good cider in a day's mowing, he would be better off with a less quantity of an inferior sort, supplemented with tea or coffee.

CHAPTER L.

ON CIDER-MAKING AND ITS MANAGEMENT.

In making cider or perry it is well not to begin unless the weather be moderately cool, as in hot weather the changes in the fluid become too rapid, and it consequently does not keep well.

The first process will be to grind the fruit into as perfect a state of pulp as possible. This will be effected when the kernels are decidedly crushed. Such a state of pulp usually ensures the best results, not only from the fact that the whole juice of the fruit is not only set free, but it is all exposed to the action of the air, by which both the colour and quality are greatly improved; and, besides this, every good quality is decidedly increased by having the principles and flavour of the kernels mixed with the other juices.

The method by which this is best effected is by grinding in the usual circular stone horse-mill. This is confessedly a slow process, but notwithstanding the newer methods, to be presently described, we still prefer it to all others, and that from the great completeness with which the grinding is effected.

Of late years cider-mills have been brought out which essentially consist of a combination of gribbling teeth, by which the fruit is first torn to pieces, and two cylindrical rollers, between which it is afterwards crushed with greater or less completeness.

In some cases the rollers are of iron, in others of hard stone: the latter is preferable, as contact with iron, even where but slight, causes the drink to assume a degree of blackness, especially on exposure.

Portable mills of this kind are now very general, but we so fully agree with the remarks of Mr. Cadle, that we here quote his description of some portable cider-mills, with his comments upon their action.

> About twenty-six years ago, Mr. Coleman, of Chaxhill, Westbury-on-Severn, commenced making an improved cider-mill and press, which could act either as a fixture or a portable mill. It was found that the cider thus made fined better, and the process was also more expeditious. These advantages, together with the cost of keeping the old kind of mills in repair, which landlords were unwilling to undertake, led to their being superseded, as they wore out, by Coleman's, or a similar mill.
>
> Coleman's mill consists of two pairs of rollers fixed in a strong wooden frame; it is fed from a hopper, the apples passing through the first pair of rollers, which are made of hard wood, with iron teeth, so as to break the apples, which fall next between a pair of stone rollers set close enough to break the kernels, and from these the pulp drops into a trough placed beneath to receive it.
>
> Mr. Latchem, of Hereford, has also paid considerable attention to the construction of these mills, and has taken out a patent for doing away with the iron in the feed-rollers, and substituting steel teeth fitted into one roller, and working through other steel teeth on a fixed plate, partly on the same principle as a curd-mill. The fruit, after passing this "chewer," is ground between a pair of stone rollers, as before described.
>
> Until the portable apple-mills became general, we had a mill to almost every farm, and even to many of the cottages; but in Devonshire one mill or pound-house serves for a number of makers, and sometimes for a parish, each person paying so much per hogshead for the making.
>
> [347]Most of the travelling portable machines in Herefordshire have two presses with each mill, and are worked by two horses, making 1,000 to 1,500 gallons in a day; sometimes they are worked by a small portable steam-engine. They are very expeditious, and do very well for a second-class cider, but if you would have the best, they are very objectionable, because the different sorts of fruit very rarely get ripe at once in sufficient quantities to enable you to make much at a time. Much cider is therefore spoiled, the fruit being ground when too green, by those who are impatient to finish the process. I think that each farm or holding should have a mill of its own, even if it be only a small hand-mill.
>
> There are several other rude plans of grinding, such as nut-mills, graters, scratchers, &c., but they are so objectionable that they hardly deserve notice.
>
> All metallic substances should be kept from contact with the pulp, as chemical combinations immediately take place on contact; for instance, if you take a clean knife and cut an apple through, the knife quickly becomes black, as well as the apple. For this reason

> I think the iron teeth and cast-iron in the rollers are objectionable; as also the steel ones, although perhaps not to the same extent. I should recommend that this iron be removed, and fluted rollers of larger diameter be made of some hard wood, such as yew-tree, or American iron-wood. No doubt more power would then be required to work the mills, but this would be of little consequence if the produce was first-class cider.
>
> When this new mode of grinding was first tried, there was great complaint amongst the labourers that the cider did not agree with them, and this was generally attributed to the iron; but in my opinion, the green state of the fruit when ground made the juice harsh, and caused irritation in the system.—*Journal R. A. S.*, vol. XXV. page 1.

The next point for consideration is the pressing out of the juice. This has been done with screw-presses of various kinds, either wood or iron, with single or double screws.

Hydraulic presses are now coming into fashion, and one advantage which they possess is, that of easily and expeditiously getting *all* the juice from the pulp.

In Dorsetshire the ground pulp or "pummy" is usually put upon a flat stage between layers of straw, which are deftly turned up at the edges so as to keep the "cheese" together. Upon the top of the cheese is placed another flat board, which is acted upon by the press.

In Worcestershire and Hereford the pulp is pressed in hair cloths, which plan is much more perfect than with straw.

In pressing it is well to observe that the pulp be ground on one day and pressed the next, as not only colour but general richness in quality results from exposure. The dark colour which an apple assumes on being cut is due to this cause, not as supposed to the steel knife, for the change mentioned is equally certain with a silver one. In the now almost exploded plan of scooping apples, the pulp of even sour apples becomes sweet by the process.

As the juice is exuded from the press it falls into a trough beneath, which is divided into two parts by a grating with small holes, by which the particles of pulp are separated, and from this the clearer fluid is conveyed to the cask.

As regards straining, we have seen some of the finer sorts of perry made by a more complete straining than the above; in fact, a rough kind of filtering in flannel bags. This would take too long a time for general purposes. It is, however, a good way of making drink for bottling.

The after-management of cider and perry is a subject upon which much has been both said and written. We, however, join in the country opinion, that "if it be made well the less it is messed with the better."

We prefer putting cider in large casks in a cool cellar—say of from one to two hundred gallons or more,—to each of which should be two tap-holes, one in the middle and one towards the bottom; the first tapping from the middle hole insures a clear fluid without disturbing the lower part, which thus goes on "settling down."

If cider from good fruit be made well, it will have an agreeable sub-acid flavour, derived from the malic acid, which is the principle which gives the refreshing juice of most fruits.

Fermentation is necessary to make good cider, as by it the sugar of the fruit is converted into alcohol or spirit; and if, when this process is complete, the fermentation ceases, we shall have a refreshing, exciting, and generous fluid; if, however, it passes from vinous to acetous fermentation, we get acetic acid, and the product is sour.

Cider made from good and well-ordered fruit in temperate weather, and put in casks in a cool cellar, will be likely to ferment equably, and to stop at the right time; if so, the product will be of the best; if, however, these conditions have not been complied with, the cider will be more or less harsh or "hard," and no means will avail to improve it. Sulphur may be burnt in the casks to check fermentation; but we would after all prefer acetic to sulphurous acid. Chalk and lime will decompose the acid, but to little purpose. The London method of adding sugar or sugar-candy and water to sour cider—and to them all mature cider is sour—is in itself innocent enough.

There is, then, this consolation: if the cider be harsh, farm labourers will drink it; and as they will not, as a rule, drink half so much of the inferior as of the best, they will after all be the gainers.

CHAPTER LI.

ON THE USES AND ECONOMY OF CIDER AND PERRY.

If we canvass the opinions of the mass of the people in cider-producing and non-cider-producing counties as to the relative merits of cider and beer, we shall find opinions wider apart than even the counties themselves. The "Beer-drinking Briton" cannot at all understand how the lover of cider can skin his throat with such sour stuff as cider, whilst the agricultural labourer in cider districts infinitely prefers harsh cider to the finest ale. We recollect, in one of our geological trips in to Herefordshire, in company with an esteemed clerical friend, that a quarryman, working in Wenlock limestone, tendered us a few shells, on which we offered him sixpence, remarking, "Here's a quart of beer for your trouble." This same man then gave our companion a couple of trilobites, who presented him with a coin of like value to our own, but with the remark, "Here, my friend, is a *gallon of cider* for you." The effect upon the man's whole being will never be forgotten. He was the slave of the Church for the whole day, and ever thereafter for all we can tell.

In cider districts the farmer, his family and friends, all relish cider, and with all, its proper use seems to agree in a most remarkable manner; but it would be fun to a country cousin who could cease to look at the matter in a serious light to see what a face his London relative would make at a draught of his "own peculiar;" and yet he of the town professes to like sweet cider; but as his knowledge of sweet cider is obtained from the summer drink of the London houses, called "Prime Devonshire Cider," the following recipe will explain it:—

Take of Vinegar (or sweeter still, cider)	1 pint.
Brown sugar (or treacle)	1 pound.
Water	7 quarts.

The following will be found in Cooley's "Cyclopædia of Practical Receipts:"—

> Cider, Made.—An article under this name is made in Devonshire for the supply of the London market, it having been found that the ordinary cider will not stand a voyage to the metropolis without some preparation. The finest quality of made cider is only ordinary cider racked into a clean cask, and well sulphured; but the mass of that which is sent to

London is mixed with water, treacle, and alum, and then fined down, after which it is racked into well-matched casks (*i.e.*, a burnt-sulphur match). The larger portion of the cider sold in London, professing to be Devonshire cider, would be rejected even by the farmers' servants in that county.

No wonder, then, that cider is not a favourite beverage when it is only used as a summer drink in some sophisticated form; but, when understood and obtained at all good, we believe it to be wholesome and palatable, and, indeed, we know it to be preferred before even the best ales in cider districts.

There is a common error amongst town-folk who prefer the above mixture that cider is not intoxicating, that it has no strength in it; but we regret to say that it is not only intoxicating, but we believe more exciting than beer: it is true that its effects pass off sooner.

Drunkenness with cider would seem to be so far different than in the case of beer, in that while the latter makes its victim heavy and stupid, the former incites to motion, and leads to quarrelling, fighting, and foolhardiness.

Hence, then, cider so exhilarates the farm labourer that he will do any amount of work if he is constantly plied with it, and all the while that it is but stimulating him, he fancies he is getting strength and vigour from it; but, alas! he is only thus drawing upon his capital; exhaustion follows a hard day's work got over amid hard drinking, which requires the following day to be spent on the same high-pressure system, or else little will be done. Hence one of our own labourers, during barley mowing at so much *per acre*, was fain to confess that he "wanted a pint of cider at four o'clock in the morning worse nor any other time of day."

It happens, then, that as harvest work is wanted to be done expeditiously, it is let out by the piece, by which the labourer gets more money and more cider. But consider, my masters, that, when not under these stimulants, you can only expect from the workman a languid day's work when the excitement is over; and too often, indeed, the poor man gets a long illness as the result of his forced, that is, stimulated labour, and, if not, such a system of drawing upon his capital—strength—is certain to end in premature old age.

Seeing, however, that the labourer has got to believe that drink keeps up his strength, it too often follows that he concludes that the more he gets of it the better; and hence, as a rule, there is no satisfying him upon this head, and the result is, that the labourer too often keeps himself in that state of thirst and muzziness during his work that almost compels him to seek the public-house when work is done. Here quarrels ensue, and it is a wonder that manslaughter is not more frequently the result. Expelled from the scene of his debauch, he finds his way home, unless, as is not unfrequent, he is "found drowned" in the river by which he may have to pass.

This is no fancied sketch, as it is derived from the sad experience of the author and the result of events in his own parish. On one melancholy occasion it was indeed sad to hear the Coroner, among other remarks, observe that full four-fifths of the inquests in a cider county were the result of drink.

Is there not, then, a heavy responsibility resting upon the farmer in especial connection with cider, while his men are partially paid in this fluid? It is different in the beer-drinking counties, as beer costs more money, and is never allowed in such quantity as cider. Put it down as true that the farmer *at times* gets more work out of his men by plying them with cider, yet we feel sure he thereby hastens the time when such men can no longer work, and they have then to be chargeable to the parish, if in the mean time nothing worse should happen.

Mechanics are not paid in drink; they purchase what they require out of regular wages, and thus they have the option, which many of them take advantage of, of leaving off strong drink altogether; and though they too are sometimes hard pressed to get a piece of work done, yet, by over-hours, for which they are rightly paid, not, as in the country, wholly by cider, but in money, the business is managed, and the workman can afford extra meat and bread, by which his worn muscles are truly renovated, and not merely stimulated to frantic action as by drink. The great rise in the price of meat, even before cattle disease became rife, is due to the cause that so much more meat has, within the last five years, been eaten by the British workman. In this advance, however, the farm labourer has had no part; he rarely gets meat twice a week, while all this time his wages have advanced so much as 25 *per cent.*, which rise, in nine cases out of ten, is only looked upon as a boon, inasmuch as it enables the recipient to "enjoy himself," which simply means he has more to spend at the public-house.

We conclude, as the result of experience, that each sack of corn that finds its way to market from a cider county costs 1s. (or 3d. per bushel) in drink, which, though it is produced on the farm, might yet have been sold to produce that amount.

Would it then not be better to sell such farm produce, and, by giving extra money instead of drink to the labourers, and so, by allowing him the option of taking less drink but more meat, gradually to withdraw him from the temptations to get drunk, which beset him under the present system? For, while we feel quite sure that the morbid craving for the public-house has commenced with drinking on the farm, we may be certain that if by any means we can check this system, it will ultimately be a great gain to both master and man.

Where are farm labourers best off? We say in the non-cider counties. In these he has learnt the use of skim-milk and the value of meat. In cider counties the farm labourer despises skim-milk as "poor weak tack, only fit for pigs." He cannot get meat, as he takes part of his wage in a stimulant which excites him to spend some of his money in falsely "*keeping up his strength*."

Now what are the results? We unhesitatingly assert, muscle, longevity, more robust, honest, well-to-do families, healthier bodies and minds, beyond the cider limits.

If, then, these things be so, some change in the use and economy of this wholesome drink is an object worthy of the deepest and most earnest consideration. One man alone can do no good. Beneficial results can only follow upon calm discussion and combined action by the masters, upon well ascertained facts. We would not stint the labourer of that which is to do him good; and if we find that he is really willing and capable of taking the whole responsibility connected with his drinking requirements upon his own shoulders, we cannot help thinking that it would be for the good of all parties to pay increased wages in full rather than any portion in kind, and more especially of the kind we have thus animadverted upon.

POSTSCRIPT.

In bringing these Papers to a conclusion, we would, among other matters, make a few remarks upon the title under which they have been issued, namely, *Science and Practice of Farm Cultivation*.

Now it will be seen that our object has not been to enter into the minutiæ of practical farming, but rather to point out some of the more important scientific principles by which much of practice is regulated. Hence, then, we would beg the reader to amend the title as follows:—"Science *of* Practice *in* Farm Cultivation." This will more fully explain the aim and object we have had in view in the series of Papers now concluded.

It is now time to tender our best acknowledgements for the aid we have received in the many drawings with which this small work has been so liberally illustrated. We owe especial thanks to Mr. Hardwicke for several fine plates of interesting agricultural as well as botanical specimens; to the Royal Agricultural Society of England for the loan of the woodcuts of roots; and to our friend Mr. Wheeler, of Gloucester, for the use of the woodcut illustrations of grasses; and as both the drawings of roots and grasses were made by us direct on the wood, rough though they may be, we yet hope they may be deemed more faithful than any second-hand copy.

Our labours being ended, it only remains to add that we hope our little work may have the effect of inducing some of our agricultural friends to look into the principles connected with the various operations which they daily superintend, as by so doing agriculture will be really elevated to a science; whereas, by merely copying what has been done before, we shall only be empirics, practising rational empiricism it is true, but still coming short of that light and knowledge which is the life,—*the science* of our profession.

J. B.

Bradford Abbas, Dorset,
Sept. 25, 1865.

COX AND WYMAN, PRINTERS, GREAT QUEEN STREET, LONDON, W.C.

TRANSCRIBER'S NOTES

- The text of the original work has been maintained, including all inconsistencies in spelling, lay-out, hyphenation, capitalisation etc. These have not been changed, except as indicated below. Notable inconsistencies include Hagloe/Haglo, bird's foot/birdsfoot/birds-foot, codlin/codling, Cotteswold-hills/Cotteswold Hills, wire-worm/wireworm, sainfoin/saintfoin, per cent./percent./per-cent./pr-cent. Achillæa millefolia (yarrow) and Achillea millefolium (milfoil) are both used for the same plant.
- Multi-page tables have been re-combined into single tables.
- Footnotes have been moved to directly under the text to which they refer. Illustrations and tables have been moved to before or after the paragraph in which they were printed in the original work.
- The differences in wording between the table of contents and the text have been left as in the original work because the meaning is clear.
- Changes made to the text:

Page	Original	Changed to
vi	epipitical	epiphytical
	(page number) 218	217
vii	(page number) 266	265
	chesnut	chestnut
	(page number) 320	319
9	be utterly failed	he utterly failed
10	that be has tried	that he has tried
24	Skirvings swede	Skirving's swede
41	(see Chap. VII.)	(see Chap. VI.)

112	fænum-græcum	fœnum-græcum
127	Bird’s-food Trefoil	Bird’s-foot Trefoil
136	*single*-seeded	*single-seeded*
146	indentical	identical
151	in August 31	on August 31
276	geologial	geological
318	first letter missing from “gives the former tree”, “g” inserted	

For improved readability, the reference letters and numbers in the drawings on pages 160, 264 and 280 have been enlarged.

Some obvious punctuation errors have been corrected silently.

Braces have been added to or removed from some tables for the sake of consistency.

Decimal points have been standardised to mid-dots.

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