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# Pasture Grasses

AND FORAGE PLANTS,

*Their Seeds, Weeds, and Parasites.*

By Samuel H. Preston.



(CLOVER PLANT ATTACKED BY LOCUSTS.)

LONDON :

THOMAS C. JACK, 45 LUDGATE HILL.

EDINBURGH : GRANGE PUBLISHING WORKS.

1887.

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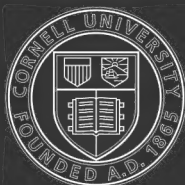
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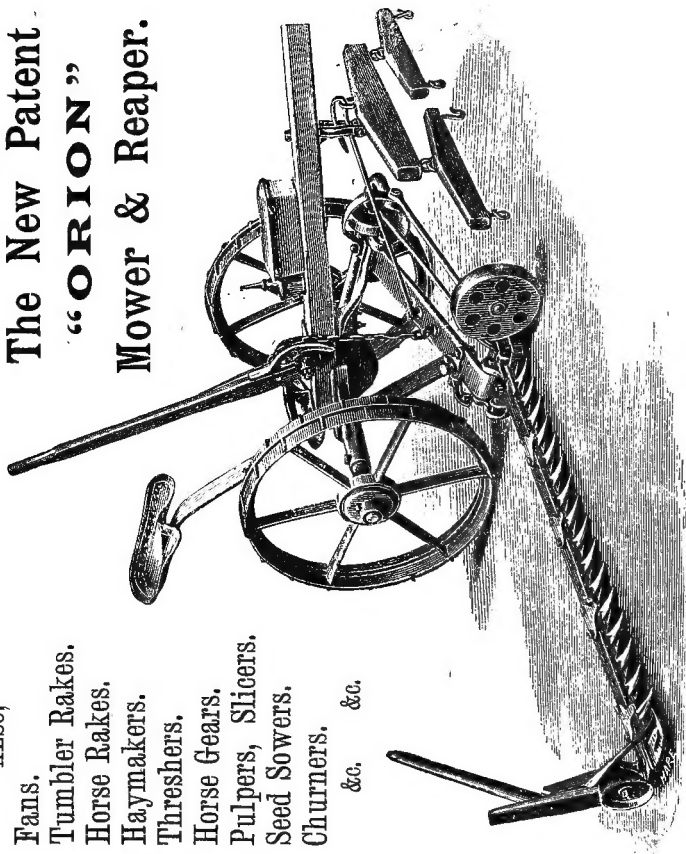
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# PASTURE GRASSES

AND FORAGE PLANTS,

AND

*THEIR SEEDS, WEEDS, AND PARASITES.*

BY

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LONDON:

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*Ballantyne Press*  
BALLANTYNE, HANSON AND CO.  
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## P R E F A C E.



LATTERLY there has been much discussion and divergence of opinion regarding the comparative merits of the different cultivated grasses. Some authorities praising beyond measure certain varieties and depreciating others; while other authorities as strenuously advocate the opposite.

Others again advocate the use of forage plants and grasses hitherto unknown to our agriculture, and so far has all this gone that a large section of the agricultural public is puzzled what guide to follow. Again it may be noted—if one may draw inferences from the queries addressed to the agricultural press, and from the results of many conversations held by the writer with farmers, and with people who sell seeds in different parts of the United Kingdom—that there is a surprising lack of information on the subject of the *parasites* that injure or destroy the forage plants and the *weeds* that rob or stifle them.

Under those circumstances it appears to the writer that there is room for a work, *the plain and practical object* of which is to bring within handy reach the essence of the opinions of the best British, Continental, and American authorities, many of whom are of

world-wide celebrity and acceptance, and all of whom have devoted the best part of their lives to the study of this and kindred subjects.

In the part devoted to the grasses the writer has set himself the task of sifting out those passages which most directly illustrate the points that have practical importance to those connected with agriculture, summarising and arranging same by the aid, on the one hand, of an experience derived from a long connection with the Home and Foreign seed trade, and on the other hand, of an enthusiasm developed by long application to a particular line of study.

The aim also has been to avoid elaborate statements of matters with which most intelligent agriculturists are already acquainted; and to abstain from cumbering the work with botanical descriptions, or with historical accounts of the derivation of species and varieties—matters which, whatever interest they may have for the curious student of botany, are of small importance to the farmers and seedsmen for whose use this work is intended.

*The contents of the work* comprise the following:—

1. The opinions in brief of the best authorities up to date on the comparative merits and values of the principal pasture and forage plants used in the agriculture of Europe and North America, with notes on suitable soils and situations.

2. Analyses of the leading natural and artificial grasses, notes on their comparative values as regards produce and nutritive matter, deduced from the celebrated Woburn experiments.

3. Notes on the weeds and parasitic plants that infest our pastures and forage crops (a large proportion

of which objectionable vegetation finds its way there through the medium of the seed).

4. Revised standards of purity and germinating faculty of agricultural seeds as recognised or used in the Home and Foreign seed trade.

5. Remarks on the impurities and adulterations of seeds, with extracts from the Act of Parliament known as, but miscalled, "The Adulteration of Seeds Act."

6. Detailed instructions as to how the quality (purity, genuineness, &c.) of a parcel of seed may be judged; accompanied by illustrations giving enlarged sketches of those seeds that are somewhat difficult of recognition.

7. Notes on the manures that suit, or are unsuitable to, the various pasture and forage plants.

THE INFORMATION contained in this little book has been collected from works that are in many cases bulky and rare and expensive, insomuch that but few men could spare the time for, or care to go to the trouble of, collecting them, and plodding through their contents. On those grounds the compiler of this work ventures to hope that his labours, in collecting and arranging, will be appreciated by a large number to whom the information presented in this handy form will be useful.

. . . . .

OF ORIGINAL INVESTIGATION into the subject of pasture and forage plants there has been a surprising dearth in the United Kingdom; which is all the more to be wondered at when one remembers that in such a humid and uncertain climate as ours there is no tribe of plants so important as the natural and artificial grasses.

Since the time of Sinclair little or nothing has been done in the same line in the British Islands. The only

break in the clouds is that afforded by the investigations of Sir John B. Lawes, but those, while highly valuable, are only directed to one branch of the subject, viz., to the question of the effects and value of manures in different combinations on the growth and character of the grasses, &c.

*On the Continent of Europe* and in North America, on the other hand, there has been a great activity of inquiry into those subjects. Dr. Stebler, of the Swiss Governmental Seed Control Station, in his wonderfully complete work on "The Best Forage Plants," makes reference to an astounding number of works, published in Germany alone, on the subject of the grasses; and Dr. Vasey, of the United States Department of Agriculture, quotes a long list of works on the grasses of the United States, some of which are treatises on the grasses of a single State. The reports issued by the United States Department of Agriculture afford evidence of much valuable leading and assistance given to the cause of agriculture (in particular to the subject of the grasses) in the great Republic of the West; and in Denmark the agricultural schools and the Copenhagen seed-testing station (subsidised by the Government) are centres of activity and investigation. The various German states pay special attention to agriculture and forestry—some of their seed-testing stations have been in operation for almost half a century. The Swiss seed-testing station and its superintendent, Dr. Stebler, are of more than European reputation; and Dr. Stebler's book on "The Best Forage Plants," in the publication of which he was assisted by his Government, is a monument as well of scientific arrangement and accuracy as of profundity and completeness of information.

As the great bulk of our seed supply is drawn from the Continents of Europe and North America, and as particular attention has been paid to the *seeds* of the agricultural grasses in Dr. Stebler's book, I have given his opinions a special prominence.

There are signs that this subject is about to receive more attention than it has hitherto received in those kingdoms. Our situation and our climate point to the fact that the cultivation of grass and other forage plants is one of those things our country is best suited for, and now that the introduction of the silo promises to make us, so far as those plants are concerned, to a considerable extent independent of the weather, it cannot be doubted that the careful selection and growth of the pasture grasses and forage plants suitable to locality, soil, rotation of cropping, and other circumstances, will form a very prominent feature in the farming of the future.

The following is a list of the authorities whose works have been consulted and quoted from in this present volume:—

*Dr. Stebler*, Superintendent and Director of the Swiss Seed Testing Station (Station Fédérale de Contrôle des Semences).

*Dr. Parnell*, author of the "Grasses of Scotland," a standard work.

*Dr. Vasey*, of the United States Agricultural Department.

*Chas. Johnson*, author of the "Grasses of Great Britain."

*Sinclair*, author of the celebrated "Hortus Gramineus Woburnensis," and Director of the renowned Woburn experiments.

*Mr. M. J. Sutton*, author of "Temporary and Permanent Pastures," and member of well-known firm of Sutton & Sons of Reading.

*Mr. Hunter*, of Chester (to whose kindness the compiler is under

obligations for loan of the major portion of the illustrations contained in this work).

*Lawson's "Agrostographia,"* which still remains second to none as a standard of careful arrangement and accuracy.

*Mr. Carruthers*, Botanist to the Royal Agricultural Society of England.

*Sir John B. Lawes, Bart.*, whose Rothamsted experiments are known and appreciated in every quarter of the globe where improved agriculture has obtained a footing, and whose name is a household word at the fireside of every intelligent farmer in the United Kingdom.

*Mr. Faunce De Laune*, of Sharstead Court, Kent, whose spirited exposure of the erroneous processes by which land has been laid down to grass has had wonderful effects in bringing about desirable improvements in the said processes.

*Curtis and Stillingfleet*, early and honourable pioneers in this field of investigation.

*Morton's "Encyclopædia,"* a surprising monument of industry, careful research, and intelligent classification.

And other authorities too numerous to particularise.



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## *PRELIMINARY REMARKS ON THE GRASSES.*



It has been remarked of the grasses that they are the true plebeians of the vegetable kingdom, constituting, as they do, the broad understratum of its vast society of flowering plants. They form a group of vast extent and of universal distribution, occupying every range of temperature, from the most extreme of polar lands to those under the equator, and from the low ocean shores of the tropics to the alpine limits of perpetual frost.

The grasses have found a name in every tongue and time, from the earliest periods of human record or tradition; and the application of the seeds of many of them to the support of mankind is of such remote origin as to be not only beyond the earliest annals of the human race, but even to figure as a myth in the traditions which preceded them, and to occasion the practice of agriculture amongst all nations of antiquity to be deduced from the teachings of a god. We can understand how the attention of people would be attracted to certain of the larger fruits as articles of

food; but it seems extraordinary that the various races of mankind should have adopted grass-seeds as their principal support, and pursued the cultivation of same till it has become a science involving the subsistence of millions, and engrossing the paramount consideration of kings and governments. Equally singular, in connection with some of the cereal grasses, is the fact that neither change of climate nor treatment under cultivation during thousands of years has brought any important alteration in general character, so that the cereal grasses grown under the rainless and burning skies of Egypt and those of the same species grown in Northern Europe differ no more than varieties which may be reared on the same field.

Every grass has its stem cylindrical and jointed at intervals throughout,—the erect or ascending portion (the culm or straw) being almost universally hollow between the joints; and this applies irrespective of stature—equally in the little *Poa annua*, which finds a living, and even thrives, in the chinks between the paving-stones of an unfrequented street, and in, for instance, the *Panicum arborescens*, which contends for elevation with the loftiest trees of the forests of Hindustan, through the branches of which its slender stems, scarcely thicker than a goose-quill, penetrate till they reach the upper air.

We may make a rough division of the grasses in the following way:—

*First.* Those which are cultivated for the purpose of using their seeds in the manufacture of food for man-

kind. This would include the cereal grasses (wheat, barley, rye, oat, maize, &c.), and of those two prominent facts are worthy of notice: 1st, They are annuals; and 2d, They are never found in a wild state, unless where met with as solitary and temporary productions from seeds of chance distribution. Also it would include rice, millet, and other grasses which have acquired local or occasional value in cultivation. Such, for instance, are some species of *Panicum*, also *Setaria*, *Zizania aquatica*, *Stipa pennata*, *Poa fluitans*, &c.

*Second.* Those grasses that are cultivated for their foliage, and used for pasture or forage purposes. It is with this very important section we deal in detail in the following pages.

*Third.* Grasses such as those of the *Saccharum* or sugar-cane family, from the expressed juice of which sugar is manufactured.

*Fourth.* Those grasses considered by the agriculturist as weeds, but which, while of little or no value as producers of food for man or beast, are yet extremely useful in the economy of nature as colonisers and pioneers to vegetation of a higher grade. The grasses which come under this section fulfil most useful functions,—some as land-formers, slowly changing marsh or morass into land that will bear ameliorative processes, or contributing largely towards fixing and rendering solid the mud-flats that accumulate about the mouths of rivers on low coasts. Others act as land-protectors — sand-binders — spreading a dense and rapidly-formed network over the surface of the loose

material, as well as fixing it below by an interlaced root-system.

We may be sure that in nature there is a place and a use for everything, if we only knew, and would confine it to, its right place and purpose; and in no tribe of plants is this better exemplified than in the Grasses.

# PASTURE GRASSES

AND

## FORAGE PLANTS,

AND THEIR SEEDS, WEEDS, AND PARASITES.

---

### CHAPTER I.

#### WEEDS.

RUSKIN defines a weed to be a plant out of place, and furthermore a plant that has an invincible tendency to get out of its place. In Morton's *Encyclopædia* we find a weed defined as any plant, different from the crop, found growing with the crop to its hindrance. This will hold as a general definition, but still there are certain wild plants which are more specifically known as weeds. Weeds may be roughly classified as follows:—

1. *Flat or Prostrate Weeds*.—Such as Ribgrass and some of the Thistle tribe. In addition to their other objectionable characteristics, these weeds are obnoxious, inasmuch as they cover the ground and shade it, taking up considerable space.

2. *Creeping Weeds*.—Such as Crowfoot (Buttercup) and certain of the inferior grasses. These do not attract much attention at first; but as each plant—

by sending out side-shoots, which root and form distinct plants—is able to create a large colony of weed tufts, they would, if allowed, soon take entire possession of the field.

3. *Running Weeds*.—Such as Coltsfoot, Stinging Nettle, Brake Fern, Couch-grass, &c. These not only increase by seeds, but almost each joint or division of the creeping root (rhizome) is capable of producing a separate plant. They are amongst the most troublesome in the whole list, and they are very exhaustive to the soil. Again, the ordinary processes of agriculture only result in propagating them by subdivision—the patches get broken up only to be spread over a large area. Removing the underground stems is the only effectual way of dealing with this class of weed,—a special attack with a three-prong fork, for instance, would be found detrimental to their existence.

4. *Deep Rooted Weeds*.—Such as the Dock, Burdock, Marsh Mallow, Ragwort, and Wild Carrot. They are for the most part biennial, and seed the second year. Some of them can be easily pulled up by hand when the ground is soft after rain, or they can be mastered by hoeing if cut below the crown. The foregoing operations should be performed before the seeds of the weeds are perfected, otherwise the ground may be stocked with fresh seed, and the weeding process have to be repeated all over again on a future occasion. After having pulled or cut the weeds they should be burned, as their fleshy taproots possess great vitality—and they have the capacity of perfecting their seed even after being pulled up.

Most of the common species of weeds will be found to complete their growth and ripen their seeds



in a single year. The best known specimens of this class (the annual weeds) are the Common Groundsel, Chickweed, Wild Mustard (Charlock), Cleavers, &c.

Nothing is more surprising than the length of time the seeds of some of the above will remain dormant in the soil, until, in the course of events, they are turned up and exposed to the influence of light and air, when they start into growth and produce a luxuriant vegetation, to the astonishment of the farmer. The latter in his perplexity to understand how such a crop of weeds came there, usually takes a short cut out of the difficulty by trying to connect the seedsman with it in some way or other. Almost every seedsman can furnish from his experience instances of this nature; some of the instances being of an extraordinary and almost unaccountable character.

Professor Buckman, in his Prize Essay "On the Extirpation of Weeds," mentions how Charlock will often make its appearance in great quantities after the breaking up of pasture or old sanfoin lea; how quantities of wild plants will spring up quickly and abundantly in woods after trees and underwood have been removed; and how newly-formed earthworks frequently caused the sudden growth of wild plants which had never before been observed in the district.

Sir John Sinclair has given us some observations to the effect that though it is impracticable to extirpate annual weeds altogether, yet the number of them may be so much lessened as to prevent them from materially injuring corn crops. Two measures, he says, are necessary for that purpose—first, to bring the seeds within the limit of vegetation; and, secondly, to destroy every weed that vegetates—thus regularly lessen-

ing the original stock. By the operations of ploughing, harrowing, and rolling—first to cause the weed-seeds to start into growth, and afterwards to kill the young weeds—many farms which formerly were a nest of seed-weeds have been brought into such order that the weeds are kept under subjection, and are easily managed.

Certain weeds in meadows betray a want of drainage—such, for instance, are the Sedge grasses, Hassock-grass or Bull-Snouts (*Aira cœspitosa*), Water Dock, Wild Forget-me-not, &c. Others show poverty in the soil, such as Ox-eyed Daisy, Sorrel, Ribgrass, Cowslip and Common Daisy when in quantity.

Plants coming under the head of weeds, whether growing in poor or rich soil, not alone take up space we should rather have occupied by the crop, but they appropriate the most valuable part of its food: they impede the due growth of the crop by cramping and confining it; they clog the ground mechanically; they keep air and light from the young seed; they delay the processes of harvesting and stacking, and make the work more expensive.

It will in some measure illustrate the loss caused by weeds to quote the results of an experiment which demonstrated that the difference in produce of an acre of wheat that had been weeded over that of an acre of wheat that had not been weeded was  $4\frac{1}{2}$  bushels; and that the same process applied to oats showed a gain of 10 bushels on the weeded acre, and applied to barley showed a gain of 15 bushels.

Bearing in mind the immense loss caused to the country at large by the prevalence of weeds, it is not

going too far to say that their suppression is a matter of national importance. Relentless and continuous war should be waged against weeds,—and there should be official direction and supervision to insure that systematic efforts shall and must be made towards the destruction of those impoverishing pests of the plant world. There can be no greater nuisance, and none calling more loudly for the interference of the authorities, than a field or dyke or common covered with weeds which are allowed to seed and spread themselves all round; and those who attempt to estimate the national loss caused by weeds will yearn for a revival of that statute of King Alexander II. of Scotland, which denounced that man to be a traitor “who poisons the king’s lands with weeds, and introduces into them a host of enemies.”

Professor Buckman remarks that one of the most fertile sources of the continuation of weeds is that of constantly allowing them to seed on the land.

In addition to the weed-seeds produced on the land, there are other agencies at work to increase the weed colony. The seeds of weeds are brought on land, for instance, by (1) the wind, (2) by floods in the case of low-lying lands, (3) in farmyard dung that has not been sufficiently decomposed, (4) in the excrement of fowl, and (5) through the medium of impure seeds.

### **The Sale of Impure Seeds.**

However difficult it might be to prevent the introduction of weeds by the first four of the processes alluded to above, there should be no important difficulty in preventing the sale of impure seeds.

If we include bad grasses as weeds, which we are certainly bound to do, those of us whose connection with the seed trade supply a means of knowing can easily understand how largely the weed family may be, and is, recruited from this source. Yorkshire fog, Hassock-grass, useless Brome grasses, Couch or Scutch, &c. &c., find their way in immense quantities into land (where they should not be) through the medium of dirty or badly-cleaned seeds. It is not alone the bad grasses that are thus introduced, but many other weeds more or less injurious, as may be seen from a study of the details of this work. In the proper place the reader can note how, for instance, we may—through the medium of badly-cleaned Ryegrasses—get Oxeyed Daisy, Buttercup, Trefoil, Large Dock, Sorrel Dock, Ribgrass, Dragon-grass, &c. &c. Through impure samples of the clovers we get Sorrel Dock and Ribgrass in large quantities, Corn Chamomile, Haresfoot Trefoil, and sometimes that worst pest of all, the Clover Dodder. Along with the natural grasses we may get Large Dock, Sorrel Dock, Brome grasses, Hassock-grass, Self-heal, and sometimes Ergot. So if we begin with perfectly clean land, and if there were no other source from which weeds could be introduced, we could soon accumulate a good stock by the use of unclean seed alone.

Writing on this subject, Mr. Carruthers, botanist to the Royal Agricultural Society of England, says: "It would be difficult to calculate the injury done to a meadow by the introduction of Yorkshire fog, and of the two *Airas* (Haddock-grass, &c.), which form so large a portion of some of the mixtures" (that had been sent in to him for examination). In mixtures for

laying down land examined by him, he found samples showing as much as 25, 26, and as high as 41 per cent. of Yorkshire fog, which—in some cases, at any rate—must have been added as a substitute for Meadow Foxtail. In other mixtures Mr. Carruthers found 27 per cent. of *Aira flexuosa* added as a substitute for Yellow Oat-grass. He has had samples of a seed sold as Meadow Fescue that contained scarcely a single grain of the seed of that grass; while samples of it containing 20 and 10 per cent. of Ryegrass were quite commonly met with. He has seen samples of Dogstail containing up to 50 per cent. of Blue Melick grass (a grass found on all moors in Great Britain and Ireland, but possessing no agricultural value).

This is not the place to multiply instances of natural impurities or of substitutions, which will be found detailed under the proper head in the body of the work, but one observation made by Mr. Carruthers may be quoted, viz.: “I have no reason for supposing it (substitution or adulteration) is done by any one connected with the trade in Britain, and I have little doubt that the worthless seeds are introduced before the goods reach England. It is greatly to be desired, then, that the buyers employed by the trade should be able to detect the presence of adulteration in samples offered to them.”

### Is Legislation Wanted?

Many people think that there should be a law putting a penalty on the sale of seeds that contain a conspicuous quantity of the seeds of weeds or inferior plants. It certainly does seem strange that a grocer may be fined for selling as coffee a harmless compound

of coffee and chicory—while the same grocer may with impunity sell, as Ryegrass seed, a most hurtful compound, in which it is quite possible there may be as much as (let us say) 50 per cent. of the seeds of bad grasses and other weeds. Those who buy the adulterated coffee suffer only to a most insignificant extent in comparison with those who buy and sow the adulterated or impure seed. In the latter case, not alone is the purchase money wasted, but the crop is deteriorated, the land poisoned, and much expense incurred in getting rid of the weeds thus introduced.

Many who have heard of the “Seeds Adulteration Act,” but who have not read it, may think that it deals fully with the adulteration of seeds, as its name implies; but the fact is that it is a “Seed Adulteration Act” in name only, and would be more properly entitled “The Dyeing and Killing of Seeds Act,” as it deals only with the killing and colouring of seeds—a practice never very general, and, in any case, one not a tenth part so damaging to the farmer, or so hurtful to the commonwealth, as the practice of selling weed-seeds, be they present as natural impurities or introduced as adulterants. (A copy of the Seeds Adulteration Act will be found on page 13.)

In view of the evil consequences resulting from the sale of impure seeds, there are many who think that, in addition to imposing penalties on the sale of such by Act of Parliament, the sale of seeds—as of drugs—should only be entrusted to the hands of those holding a certificate of qualification. That certain steps, on some such lines as those, will be taken sooner or later, there can be no doubt; but it is very necessary to remark here, that measures of

such a character would be incomplete and barren of good result unless accompanied by a regulation placing a liability to prosecution on such landowners or farmers as allow weeds to grow and seed on their land. It is obvious that there is not much use in my going to the trouble of cleaning my land, or taking pains to procure seeds of high purity, if there is a weed nursery on a neighbouring farm, or on some contiguous railway embankment or piece of common.

### The Case of Ireland.

Those remarks apply with much force to the sister kingdom of Ireland; of which it has been said with perfect truth that, as far as weeds are concerned, she is the richest country in the world.

Dr. Macauley, in his "Tour of Observation in Ireland in 1872," says: "The amount of weeds is a national disgrace. It is not uncommon to see a ton of weeds in a dozen tons of hay. Many a field has more weeds than a whole parish in England. Fields and roadsides are alike neglected, and weeds help to keep Ireland green but poor. I never saw such a country for weeds. I am sure it is no exaggeration to say that the direct loss to Ireland from weeds is above a million and a half sterling per annum, and I have heard the loss estimated at nearly double that amount." Those remarks, written fourteen years ago, are equally true to-day. From observations made during a recent and extensive tour in Ireland, the writer can indorse every word of the above; indeed, it is a question whether matters are not now in a worse condition—as fourteen years of unchecked re-

production would naturally increase and extend the evil. The fertility of the soil, combined with the humidity of the climate, produces Thistles, Nettles, Ragworts, &c., as large as bushes, and as profusely as if they had been sown for a crop. Whatever little is done, and it is only a little, to remove weeds from the fields, there is no attempt made, apparently, to remove them from the waste corners, the roadsides, the wide fences (known as "double ditches"), the railway embankments, and such like; and in the latter end of the autumn the gigantic Nettles, luxuriant Ragworts, and great flaunting Thistles sending their down forth into the breeze, are conspicuous objects of the landscape. Registrar-General Donnelly, in his Irish Agricultural Abstract of 1874, stated his opinion that "until legislation affords some remedy to those who keep their land free from weeds against such parties as allow weeds to grow and seed, the practice of clean agriculture in Ireland cannot be hoped for."

Most people have noticed the beautiful parachute-like apparatus attached to the seeds of the Thistle, Dandelion, and other weeds, by which they are capable of being wafted miles away from where the parent plant grew. Again, the seeds of Yorkshire fog and those of the Aira family (Haddock-grass or Bull-Snouts) are so light that they can be blown by the wind to a considerable distance. Bearing those things in mind, one can realise to some extent what damage can be done by *even one foul field* in a district, or by neglected waste spots, railway or canal embankments, on which weeds are allowed to grow.



The enormous increase which may result from allowing weeds to seed may be conceived from a study of the following list, which shows the number of seeds each of the weeds named is capable of producing in a single season :—

Name of Weed.	Number of Seeds on a Single Plant.	Name of Weed.	Number of Seeds on a Single Plant.
Groundsel . . .	6,500	Shepherd's Purse . . .	4,500
Corn Cockle . . .	2,590	Cow Parsnip . . .	5,000
Red Poppy . . .	50,000	Stinking Chamomile	40,650
Charlock . . .	4,000	Oxeye Daisy . . .	13,500
Corn Sow-thistle . . .	19,000	Burdock . . .	24,520
Musk Thistle . . .	3,750	Common Dock . . .	13,000
Blackhead . . .	3,000	Dandelion . . .	2,040

From the above may be gathered the significant fact, that—after allowing a wide margin for the casualties to which seeds are constantly liable—yet plenty would be left, even where seeding is allowed but for a single year, to give trouble for many years after.

### What Should be Done.

It is apparent to all who have studied the matter, that if farming in Great Britain and Ireland is to continue to afford a living to those connected with land, it can only be done by allowing none of the resources of the soil to go to waste, or to be diverted from the use and benefit of mankind. We must consider weeds as the persistent and implacable enemy of the farmer, and, through him, of all mankind. If *we* are to flourish *they* must go to the wall, and *vice versa*. Whatever way the problem of weed extirpation is

solved—it must be faced ; and, impelled by a sense of responsibility, but with great diffidence, the writer ventures to put forward a few suggestions, which, if put in practice, would, he considers, go a long way in coping with this evil.

1st. Steps must be taken to prevent by law the sale of impure seeds ; and to effect—

2d. The establishment of governmental seed-testing institutions in each of the three kingdoms.

3d. Grand juries should be obliged to compel those who contract for the care and repair of roads to remove and destroy all weeds found on, or growing on, the roadsides.

4th. The police or other local authority should be empowered to prosecute owners of fields or railway embankments, and overseers of commons, on which weeds were allowed to seed to the detriment and injury of the neighbourhood.

[It will not do to throw the onus on the aggrieved neighbour (as the law does in some countries) of prosecuting the offending party. People will suffer a great deal of this kind of loss and annoyance sooner than go to law with their neighbours and arouse bad feeling.]

In concluding this chapter the writer desires to state his belief that this subject would long ago have been dealt with on some such lines as suggested above if we had had, what most other civilised governments have, viz., a Minister and Department of Agriculture, under the auspices of which might be diverted to the rescue and development of agriculture some portion of that public attention which the extent and importance of such an industry merits.

32 &amp; 33 VICT.]



[CH. 112.]

## SEEDS ADULTERATION.

## CHAP. 112.

## An Act to Prevent the Adulteration of Seeds.

[11th August 1869.]

*Whereas* the practice of adulterating seeds, in fraud of Her Majesty's subjects, and to the great detriment of agriculture, requires to be repressed by more effectual laws than those which are now in force for that purpose :

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this Parliament assembled, and by the authority of the same, as follows :—

1. This Act may be cited as "The Adulteration of Seeds Act, 1869."
2. In this Act—

The term "to kill seeds" means to destroy by artificial means the vitality or germinating power of such seeds :

The term "to dye seeds" means to give to seeds by any process of colouring, dyeing, sulphur-smoking, or other artificial means, the appearance of seeds of another kind.

3. Every person who, with intent to defraud or to enable another person to defraud, does any of the following things ; that is to say,
  - (1.) Kills or causes to be killed any seeds ; or,
  - (2.) Dyes or causes to be dyed any seeds ; or,
  - (3.) Sells or causes to be sold any killed or dyed seeds, shall be punished as follows ; that is to say,

- (1.) For the first offence he shall be liable to a penalty not exceeding five pounds ;
- (2.) For the second and any subsequent offence he shall be liable to pay a penalty not exceeding fifty pounds :

Moreover, in every case of a second or subsequent offence against this Act, it shall be lawful for the Court, besides inflicting upon the person guilty of such offence the punishment directed by this Act, to order the offender's name, occupation, place of abode, and place of business, and particulars of his punishment under this Act, to be published, at the expense of such offenders, in such newspaper or newspapers, or in such other manner as the Court may think fit to prescribe.

(The other sections of the Act deal with summary proceedings for offences. Recovery of penalties. Intent to defraud particular person need not be alleged. Appeal from summary conviction. Limiting time for proceedings. Court may order prosecutor to pay costs of unreasonable prosecution, and so on.)

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In 1878 the above Act was amended by a short Act of two sections—the second section of which is the only important one, and alters section two of the first Act as follows:—

Section 2 of the Adulteration of Seeds Act 1869 shall be read as if instead of the words, “The term ‘to dye seeds’ means to give to seeds by any process of colouring, dyeing, sulphur-smoking, or other artificial means the appearance of seeds of another kind,” there were therein inserted the words, “The term ‘to dye seeds’ means to apply to seeds any process of colouring, dyeing, or sulphur-smoking.”

## CHAPTER II.

## PARASITES.

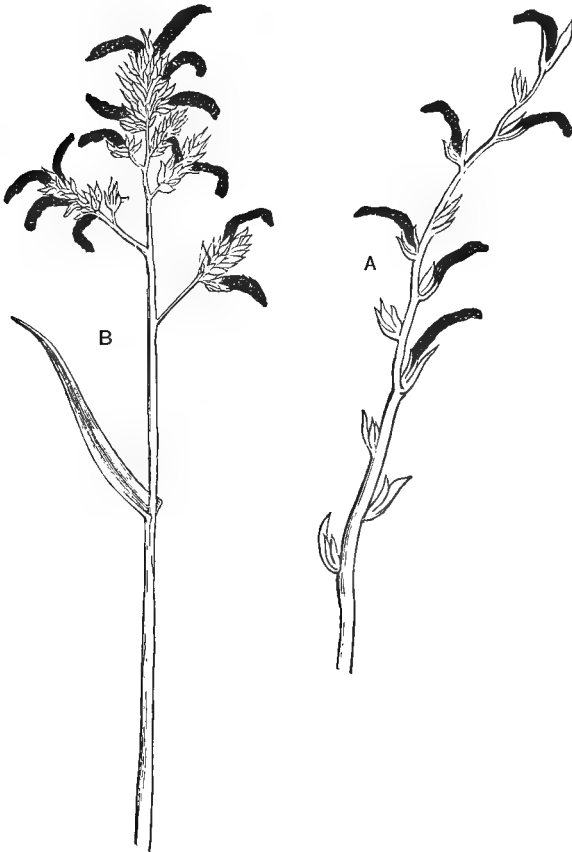
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**Ergot and Ergotism.**

ERGOT has been described as a monstrous condition of the grain, in which the enlarged and diseased ovary protrudes from the floret in a curved form resembling a cock's spur (hence the name "ergot"—from the French—meaning a spur). This spur is of a blackish brown shade outside, while internally it is whitish, and contains much oil. In this condition it is taken by animals in grass and hay; causing, when taken in sufficient quantities, abortion in the case of in-calf cows that have arrived at a certain stage of pregnancy, and disease of a more or less acute character in other animals.

Ergot spurs ripen with the grasses in the autumn; and, falling to the ground, remain there during winter and spring—unchanged and unaffected by frost or rain. About the beginning of May the ergot commences to develop minute fungi, which ripen in June, and discharge spores in every direction. Such of the spores as alight on the grasses when in flower attach themselves to the seed-case, cast the embryo seed from its position, and commence at once to grow as

parasites. When the ergot reaches its full growth in August, it has a second stage of reproductiveness,



A, a spike of Ryegrass (*Lolium perenne*) showing Ergot spurs."

B, a head of Cocksfoot grass (*Dactylis glomerata*) thickly studded with Ergot spurs.

giving off spores from its tip or snout in greater numbers than those which were developed from the

fungi. Misty, foggy weather and light rains assist the propagation of the spores, but heavy rains are apt to wash them away. Dry, hilly pastures—without trees or hedges to prevent free currents of air—are not favourable to the growth of this parasite. In medicine, ergot is employed in modern practice to stimulate the motor nerve-centres which are connected with the uterus, in order to cause active contraction when that organ has lost its muscular force. In large doses ergot is an acrid poison—causing dulness, vertigo, dilated pupils, intoxication, muscular tremblings, and tetanic spasm, especially of the hind extremities, which afterwards become paralysed. Dry gangrene is a final result of the action of the poison; and by degrees the extremities, and even portions of the trunk, are rotted and fall off.

“The action of the ergot,” says Mr. Walker, in his book on “The Cow and Calf,” “taken in such quantities as it is found in our grasses, acts as an excitant upon the womb of the pregnant cow, whereby the parts contract, and give the animal a desire to abort the calf. Its malignant influences are little dreamt of by the majority of graziers. Thousands of cows annually abort during wet seasons from eating the ergot grains amongst the grass and fodder. It is no imaginary evil, but has been proved by direct experiments instituted by men of undoubted veracity. It has been given to the mare, the cow, the ewe, and the cat, and has never failed to cause untimely birth when given in proper quantities, and when the animal had arrived at a certain stage in pregnancy.”

In many cases it has been noticed that when a cow aborts in a herd many others follow suit. This is

commonly ascribed to some infection or sympathy, but it is quite clear that many cases assigned to sympathy are really caused by the poisonous ergot. A case is mentioned in the *Field* where ergotism appeared amongst eighteen cows in a dairy. The animals' legs began to swell as high as the hock joint, and in about a week the hoofs began to slough off. Some cases assumed a more severe form—the appetite failed, scab formed from the top of the hoof to above the fetlocks, and the parts below the line of the scab rotted off.

This subject is worthy of the most serious attention, for losses, one year with another, from abortion and other animal ailments incurred by ergot in Britain may be estimated at as much as is caused by foot and mouth disease.

*Treatment of ergotism*, as a matter of course, includes the removal of the animals from the place where ergot is found; or, in the case of ergotised fodder having been supplied, a change of food at once. Medical treatment, including the use of antiseptics and restoratives, will prove in some instances beneficial; but it is obvious that in this disease prevention is far more important than cure, and what is wanted is a determined effort to stamp out the pest. Meadow grasses should be cut before the period when the ergot spurs develop on the flower-head. Special attention should be paid to the corners of fields, to places under the shade of trees, and to the banks of streams and ditches. It is in such situations, where coarse grasses grow, that ergot is most likely to be found, and care should be taken to cut down such grasses in good time to prevent the pest being propagated.

Farmers might offer a small reward per dozen for



flower-heads of grasses showing ergot spurs—thus stimulating the boys and unemployed persons of the locality to search for same. A few shillings spent in that way might save many pounds; and if a sufficient quantity of the spurs could be collected, there might be a market for them in the drug trade. Tall Meadow Fescue grass seems to be particularly liable to attack of ergot, and on that account should not be allowed to go to seed.

As in the majority of cases it would not be worth while collecting the ergots, the next best course to pursue is to cut and collect the ergotted grasses and burn them; taking care that they are shaken and tossed about as little as possible, as the grains of ergot have only a slight hold on the seed stalk, therefore are easily detached, and if allowed to drop off and remain on land each grain will serve as a centre for the propagation of the pest at a future time.

A writer in a recent number of the *Agricultural Gazette* reports that he has found the disease this year on almost every grass on his farm. Also that his hay and silage was ergotted last year, and that of a herd of forty-five cows, half of them had dead calves. This writer suggests that experiments should be made with ergot on in-calf cows, with the view of getting answers to the following questions, viz., How much ergot is required to produce abortion? Is the effect of ergot greater or less as the time of pregnancy advances? Does ergot affect a cow when given on a full stomach? Does it act immediately on the cow, or must she consume it for a length of time to make her abort? This is a subject on which further investigation is very urgently required.

## Clover Dodder.

(*Cuscuta trifolii*.)

This is a genus of leafless annual plants allied to the bind-weeds, and like them strangling the plants they lay hold of.

A Dodder plant maintains its existence by twining round other plants, into whose stems it inserts its suckers and destroys the plants by appropriating to itself the sap. The seed of the Dodder on being



A Clover Plant attacked by Dodder.

sown with the crop comes up at first an independent plant; but, when it seizes a plant and sends its suckers into the stem thereof, it lets go its hold of the ground and lives thenceforth as a parasite. In appearance it resembles a number of fleshy threads twisted round a branch. One writer describes it as appearing like a large mass of yellow horse-hair

shooting up through the clover and twining itself round every stalk of it. It commences in small patches all over the field, and gradually extends itself—destroying in its progress all vegetation, and leaving the whole area as black as if a fire had existed on the spot. The seed of Clover Dodder is of a pale grey colour, and looks so like fragments of greyish clay that it takes a keen sight and a close inspection to detect it amongst



Seeds of the Clover Dodder . 1  
(enlarged and natural size). 4

the seed. As it is not much more than half the size of any clover seed it is easy to get rid of it by sifting. When Dodder appears the only remedy is to dig up the crop on, and for a considerable distance around, the spots where the Dodder appeared, and then to burn all the plants along with the pared soil. If the Dodder is allowed to mature and shed its seeds those may lie dormant in the soil for many years.

### Lesser and Greater Broom-Rape.

(*Orobanche minor* and *O. elatior*.)

Those also attack clover, attaching themselves to the roots of the seedling clover, and drawing nourishment therefrom. The tall Broom-Rape sometimes has a stem as much as an inch and a half thick and a foot and a half high, and looks as much out of place growing on the clover stump as does the young cuckoo in the hedge-sparrow's nest. The qualities of this parasitic plant are powerfully astringent. When it has once established itself it can only be removed by hand-picking.

## CHAPTER III.

### THE GRASSES.

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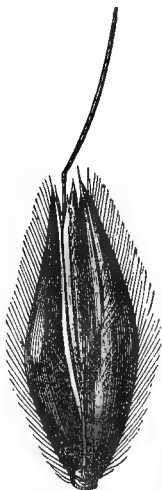
#### Meadow Foxtail.

(*Alopecurus pratensis.*)

Seed of ordinary quality weighs 5 lbs. to 9 lbs.

Best quality, 12 lbs. per bushel.

Standard of germinating power, of H.M.'s Office of Works, 60 per cent.



Seed of the Meadow Foxtail.

Dr. PARNELL says that this is one of the most valuable grasses to the farmer. One of the earliest and best for permanent pastures, and most grateful of all grasses to every kind of cattle. Its produce is nearly three-fourths greater on a clayey loam than on a sandy soil, and the quantity of nutritive matter is also greater in the proportion of three to two.

MARTYN says:—It possesses the three great qualities of quality, quantity, and earliness in a degree superior to any other.

CHARLES JOHNSON reports that its strong fibrous roots take a firm hold of the soil, but

the plants have little or no tendency to extend themselves laterally. It has been affirmed to yield more bulk and weight of hay than any other grass hitherto subjected to experiment. The first crop may be cut about middle of May, and the lattermath is unusually productive.

SINCLAIR'S opinion was that it should never form a less proportion than one-eighth of any mixture prepared for permanent pasture.

Dr. J. A. VÆLCKER (who made a series of analyses of the grasses for Mr. Sutton's recent work) says that in Meadow Foxtail, Perennial Ryegrass, and Timothy, the amounts of nitrogen and true albuminoids are considerably higher than in the other grasses. Meadow Foxtail, indeed, shows a marked superiority in almost every respect; for, besides being so rich in nitrogen, it has also the highest amount of digestible matters.

J. S. GOULD (an American authority) says that pastures well covered with this grass will afford a full bite at least one week earlier than those which do not have it. No grass bears a hot sun better, and it is not injured by frequent mowings—on which account, as well as for its early verdure, it is valuable for lawns.

Dr. STEBLER counts this and Sweet Vernal as the earliest of the good grasses of our meadows. It puts forth its long succulent leaves already in commencement of April, and its flower-spikes begin to appear about middle of same month. It reproduces itself by means of short stolons from the stump, and consequently does not grow in thick tufts. It does not acquire its full development till the third year.

Mr. HUNTER says that it thrives best on a rich,

moderately stiff, moist soil, and does well under irrigation, but it is of little value on poor dry soils.

Mr. SUTTON thinks it is only suitable for alternate husbandry when the ley is to remain at least three or four years. There is scarcely a forage plant known which endures cold so well as this, and spring frosts do it little harm. Also it is one of the few grasses that thrive well under trees. By the third week of May it is in full flower, and should be cut if there is sufficient of it in the meadow to warrant early mowing. This necessity for early cutting should influence the proportion of Foxtail in a permanent prescription. The aftermath frequently exceeds the early growth in bulk.

*Manuring.*—Experiments at Rothamsted proved that both nitrate of soda and ammonia salts did equally well with the Foxtail plant.

*The Seed.*—True seed of Foxtail, as Mr. Sutton says, is always expensive, and so light and delicate as to require exceedingly well prepared land to insure vegetation. It has been pointed out by Dr. Stebler that in the ordinary seed of commerce the germinating power stands at a low figure, which is due to the fact that the seed is often gathered while unripe. They used to consider it fair seed that grew 30 per cent., and called it *excellent* when it grew over 40 per cent. From seventy-nine trials he found an average of only 19 per cent. of germinating faculty. Since the above was written, however, the quality of this seed has been improving year by year. The collectors, more particularly in the North of Europe, are becoming more awake to the necessity of allowing it to ripen properly. The sorting and cleaning of the seed is also receiving

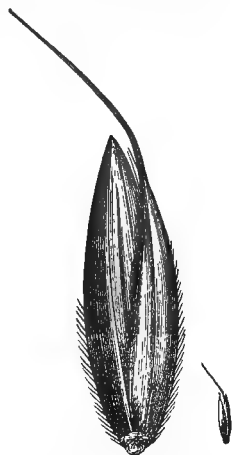
much more attention, so that at the present time seed may be obtained with a guaranteed germinating power of as high as 70 per cent. This notable improvement has been brought about in a great measure by the investigations and reports of the Botanist to the Royal Agricultural Society of England. Also some credit for this change for the better is due to Mr. Faunce De Laune in calling public attention to the low germinating power of the Foxtail seed at that time usually supplied. According to Mr. De Laune one could formerly meet with samples of Foxtail seed, of which not a single grain would germinate, and in other cases the germinating power would run to such figures as 5 per cent., 8 per cent., and so on.

It would not be a difficult thing to collect the seed of the Meadow Foxtail. The best plan is to cut the flower-spikes with a portion of the stem attached, bind them in little bundles, and let the seed come to perfect maturity. By this plan seed of a much higher germinating faculty will be obtained than by the plan of stripping the seed from the standing stem.

A few years ago it was not an uncommon thing to meet with a good many samples of Foxtail containing a considerable proportion of York-



Seed of Yorkshire  
Fog.



Seed of the Black Grass.

shire Fog, and, it may be presumed, samples of that class are not yet quite extinct. Such impurities, however, can be easily recognised, as the seed of the Yorkshire Fog is usually whiter in colour, and not so hairy as that of the Foxtail. Furthermore, the kernel of the latter is of a yellow hue, while the kernel of the Yorkshire Fog is of a silvery white colour.

We have it on the authority of Mr. Hunter that the seeds of *Alopecurus agrestis* (Black grass) were also much used to adulterate Meadow Foxtail; and the same authority adds that "this Black grass is one of the most execrable of weeds, and not a seed of it should be permitted to enter into the composition of any permanent pasture, yet tons of this seed are annually used to adulterate the true *Alopecurus pratensis*."

### Sweet Vernal.

(*Anthoxanthum odoratum*.)

The best seed weighs from 10 to 12 lbs. per bushel.

Standard of germination, of H.M.'s Office of Works, 60 per cent.

W. CARRUTHERS, F.R.S., thinks that this is a Perennial grass deserving of a place, though not an important one, in permanent pastures. It is one of the earliest grasses, showing flowering heads even at the end of April. The foliage is at the best but scanty, and it is never a favourite food with stock.

Mr. M. J. SUTTON says it is one of the earliest grasses, coming into full flower at the beginning of May, and therefore no surprise will be felt that it yields only a small hay crop. It is a true Perennial, and continues



growing until late in autumn, this fact clearly indicating that it is even better for grazing than for cutting. It grows luxuriantly on deep, rich, moist soils; and in wet peaty land it becomes so large and reed-like as to deceive any but the most experienced botanist. Strange to say, it is equally at home on thin moors and exposed sandy dunes, and will live in soil which will not feed any other grass.

Dr. STEBLER'S opinion is that, as it starts to grow so early in spring, it has the advantage of the moisture remaining in the soil from the winter, and thus is enabled to thrive even on the driest soils. After being sown it starts growing more quickly than any of the other grasses, and gives, even in the first year, a fair return. In warm situations it comes so rapidly forward that it has ripened and shed a portion of its seeds before the hay-cutting season, by which means the quantity of it in the land is increased (perhaps out of proportion to its value.—Ed.). At the time of hay-making the flowering stems and heads are almost as hard as straw, and not much more nutritious. It is on account of its aromatic aroma that the culture of it has been so strongly recommended, but it is not by any means certain that the odours which are pleasant to mankind are equally agreeable or in any way of advantage to the beasts of the field. The latter will judge their food by the tongue and palate; and as Sweet Vernal grass, notwithstanding its name and smell, has a bitter taste, it is probable, and more than probable, that, instead of being liked by cattle, it is avoided by them, and only eaten when they are almost famished.

Mr. HUNTER says its yield is somewhat scanty, and its early produce not nutritive. The latter-growth is

more nutritious; and, as the peculiar aroma of this grass gives a relish to and improves the flavour of other grasses, the addition of a moderate quantity of seed to mixtures for permanent pasture is recommended.

Dr. PARNELL found that it constituted a part of the herbage of pastures on almost every kind of soil, though it only attains to perfection in those that are deep and moist. It is said that the flavour of mutton is greatly improved when sheep are fed on pastures where this grass abounds.

*The Seed* as imported contains a good deal of sorrel and other weed seeds that are collected with it. It is also very necessary to bear in mind that the seeds of a worthless annual variety (*Anthoxanthum Puelli*) are in a great many cases substituted for the true Sweet Vernal. It requires a very close examination to distinguish the seeds of the one from the other. In the true kind the apex of the palea is evenly rounded, and the edge uniformly and finely serrate. The hairs are scattered irregularly over the surface. In the false kind the apex of the palea is roughly serrated, and the hairs are arranged along the midrib and veins and along the edges. Those distinguishing characteristics are not, however, always to be depended on, and would not by themselves be a safe guide. The smell of the seed furnishes some help towards arriving at a correct opinion, but the most reliable test is an examination of the kernel. Rub some of the seed between the palms and blow away the chaff. The kernels of the false kind will be found pale coloured and short, while those of the true kind are dark brown (or almost black) and are more elongated than those of the *Puelli*. The seed of the true Sweet Vernal (*A. odoratum*) is, and

must always be, costly. It is gathered by hand from plants growing wild in the woods and clearings of Central Germany, and only a very small quantity is sent to this country.

### Tall Oat-Grass.

(*Avena elatior*, Linn. *Arrhenatherum avenaceum*, &c., &c.  
*Holcus avenaceus*.)

Standard of germination, per Dr. Stebler, 70 per cent.

This grass is known under a variety of botanical names; in France it is called Fromental, and in other parts of the Continent is known as French Ryegrass.

Dr. PARNELL says this grass produces a plentiful and early supply of foliage, and is valuable either for hay or pasture. On the Continent it is highly prized. All kinds of cattle eat it with avidity, although it is said to be unpalatable to horses.

Dr. STEBLER'S opinion is that it is certainly one of our best forage grasses. In mixture with other grasses it is an excellent plant, which should not be omitted from any mixture, provided it is not sown on too moist a soil. It is most valuable as a grass for meadowing purposes. On account of its deep-rooting propensities it succeeds well on dry soils that have depth and are not too compact, but if the soil is too poor the plant becomes sickly, and gives but a mediocre produce. It is a quick-growing grass, and flowers at beginning of June. Gives considerable produce the first year, but the second year's cutting is the most important. Having a bitter taste, it should not be given by itself to cattle in a green state. For hay it is especially

suited, as it is easy to save and keeps well. In dry warm situations it might be used in mixtures to the extent of 20 per cent. If only for one year's cutting Italian Ryegrass is of more value, but if for two or three years' meadowing the Tall Oat-grass should get the preference.

SINCLAIR'S remarks upon it are rather contradictory, but certainly very little in favour of its agricultural value. After mentioning the properties it possesses, which would entitle it to a high rank amongst the grasses adapted for alternate husbandry, he adds that it contains too large a proportion of bitter extractive and saline matters to warrant its cultivation without a considerable admixture of other kinds.

CHAS. JOHNSON, quoted above, adds his own opinion that:—So long as it has to struggle for existence with other self-established tenants of the soil, it is harmless, and probably beneficial to the animals feeding upon the mingled herbage amongst which it is an admitted but never a prominent associate.

Mr. MARTIN J. SUTTON says that its roots penetrate so deeply as to enable the plant to withstand the effects of both cold and drought. It is almost indifferent to soil, and may be grown pretty nearly everywhere. It cannot be called strictly perennial, but is twice as long-lived as Italian Ryegrass, and grows as much herbage in its first year, while in its second and subsequent years it is far superior to its better known rival. When sown in autumn a much larger produce is obtained in the following year than from a spring sowing. For a three years' ley one-fifth of entire sowing would not be an unreasonable quantity on good deep soil.

Dr. VASEY (of the Agricultural Department of United States of America) says the cultivated grass best adapted for winter pasture in the South is the tall Meadow Oat-grass, which will thrive on a more sandy soil than most of the cultivated grasses (though it prefers a rich upland), and will yield more green food in winter than any other grass. It and Cocksfoot are thought to endure the heat and drought better than any other cultivated grasses.

Professor PHARES (of Mississippi) says it may be sown in March or April and mown the same season, but for a heavier yield it is better to sow in September or October. Not less than two bushels per acre should be sown.

*The Seed.*—According to Professor Phares it is a little difficult to save the seed. In about ten days after blooming the seeds begin to ripen and fall off, the upper ones first; therefore, as soon as the top seeds are sufficiently ripe, the panicle or flower head should be cut off and dried, when the seed will all thresh out readily.

For an acre of arable land 20 lb. of seed is sufficient; but, as it is seldom desirable to cultivate it except along with other sorts, from one-fourth to one-half of that quantity will be found sufficient.

There is a variety of this grass (*Arrhenatherum bulbosum*) of which the base of the stem forms small bulbs. This is rightly looked upon as a weed—or, as a writer puts it in Morton's *Encyclopædia*, "the cultivation of it under any circumstances would not fail to create suspicions of lunacy against the owner."

As there is no way of distinguishing the seed of the one variety from that of the other, it would

perhaps be as well not to sow either of them unless there is the clearest proof that what is about to be sown is beyond question free from any admixture of the bulbous-rooted kind. It is owing to the latter being so commonly mistaken for the true variety that Tall Oat-grass is so little used in those kingdoms. One is no better than a Couch or Squitch grass, while the other—used with judgment—is capable of filling a very useful place in our agriculture.

### Golden or Yellow Oat-Grass.

(*Avena flavescens.* *Trisetum flavescens.*)

The best seed weighs up to 10 lbs. per bushel.

Standard of germination, of H.M's Office of Works, 60 per cent. Flowers end of July.

W. CARRUTHERS, F.R.S., reports that it is found in dry meadows and pastures, and may be grown in any kind of soil or situation. Produces a considerable quantity of foliage, and is a favourite food of sheep. Is important as a late grass in pastures.

Dr. STEBLER quotes Langethal's remark to the effect that this grass is always an indication of the superior quality of the fields in which it is found; and observes further that it thrives in almost all soils except those that are extremely strong or extremely light. Its produce is sure as well in wet seasons as in dry, though excess of either moisture or drought will hinder its development. It is entirely unsuited to meadows that are liable to be flooded but are not provided with suitable drainage. It is very advantageous in meadows and pastures, gives a grass of

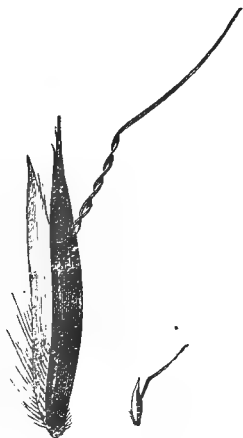
good quality which beasts eat greedily, and should never be omitted from mixtures unless they are destined for places quite unsuited to it.

CURTIS says that in excellence it comes near to Meadow Foxtail, for which it may prove no bad substitute.

Dr. PARNELL says it grows naturally in almost every kind of soil, from the limestone rock to the irrigated meadow, and is always present in the richest natural pastures. Thrives best in dry calcareous soil, and does well only when combined with other grasses. It is to be noted that sheep prefer it to most grasses.

**The Seed.**—The supply of the seed of this grass is exceedingly small, as it is very difficult to collect. In fact, so scarce is the real article, that a totally different thing, viz., *Aira flexuosa*, has been quite openly offered and sold for it (see page 35).

There is a very strong resemblance between the seeds of the two grasses—that is, to the naked eye—so buyers should be on their guard in this matter. Indeed, when we consider the scarcity and dearness of the seed of Yellow Oat-grass, and the danger of getting instead the seed of a perfectly useless grass such as *Aira flexuosa*, it is a question whether it would not be better to omit Yellow Oat-grass altogether from prescriptions for laying down land. At the same time,



Yellow Oat-grass.

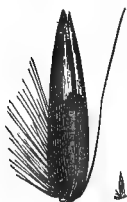
true seed of it, with good germinating faculty, can be had if one goes to the right source and pays the price. The enlarged illustrations given herein will enable the reader to notice the distinguishing features of the seeds of the two grasses.

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### Haddock Grass or Tufted Hair-Grass.

(*Aira cæspitosa*.)

Dr. PARNELL says this grass has a most unsightly appearance in meadows, pastures, and parks. It forms large tufts (termed by farmers Haddock) very hard to get rid of. The leaves are extremely rough and coarse, therefore cattle seldom touch it; and, as it possesses little nutritive properties, it does not merit the attention of agriculturists.



Haddock Grass.

MORTON'S *Encyclopædia* says it forms unsightly rigid tufts, which should invariably be eradicated by grubbing them out with a mattock or strong hoe, at the same time dropping amongst the loose soil a few seeds of Cocksfoot, Timothy, or some other strong and rapid-growing grasses.

The Seeds of this grass are found as impurities or adulterants amongst the seed of the Poas (Rough-stalked and Smooth-stalked Meadow grasses), and amongst the seeds of others of the natural grasses. Wherever met with it is most objectionable.



**Wavy Mountain Hair-Grass.**

(*Aira flexuosa*.)

W. CARRUTHERS, F.R.S., reports that it is common on sandy heaths, moors, and hilly pastures, and is no doubt of value as an ingredient in such exposed native pastures, but is otherwise a *worthless weed*.

Dr. PARNELL says that sheep eat it, but it is not recommended for cultivation.



*Aira flexuosa*.

## THE BROME GRASSES.

MORTON'S *Encyclopædia* says that amongst modern agriculturists there are not wanting some who question the propriety of so rigidly excluding the Brome grasses from field culture, seeing that they yield a weighty produce in stems and seed, and do this, especially in the case of *Bromus mollis* (soft Brome-grass or Goose-grass) on very poor dry soils.

## Meadow Brome Grass.

(*Bromus arvensis*.)

Grown at Woburn on a sandy loam.

Gave of Green food per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	10	12	2	2
Affording of nutritive matter . . . . .	0	13	1	4
But at time of ripening the seed gave only per acre . . . . .	3	0	3	0
Yielding of nutritive matter . . . . .	0	1	1	7

*Bromus erectus*.

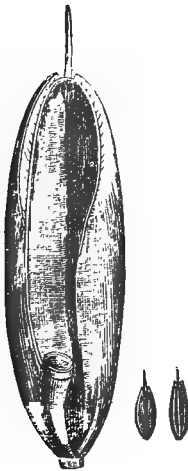
(Sometimes called *Bromus pratensis* and *montana*, also *Festuca erecta* and *montana*).

Dr. STEBLER reports that this grass has been for a long time in cultivation in South of France. Is fibrous rooted, and grows in compact tufts forming a level turf. It can be sown in autumn or spring. Is not usually sown by itself, but generally with a mixture of Sanfoin or Lucerne. Is not remunerative on good land, but is a useful and lasting grass on dry warm chalky soils. Suits dry hillsides that are exposed to the sun. In favourable situations it begins to grow early in spring, and flowers at end of May or early in June, and should be cut before the flowering stage. After cutting it grows more leaf foliage, which is eaten with relish by cattle.

**Bromus inermis.**

Dr. STEBLER reports this as a perennial stoloniferous grass, useful for binding the soil of embankments of railways or canals because of its property of pushing out a large number of long twisted underground stolons. It is capable of resisting a drought that would kill any other grass, and is equally insensible to cold. It has only a small nutritive value.

The Seeds of the Brome grasses are found in very large quantities as natural impurities in badly cleaned Ryegrass. *Bromus secalinus* will be found in large

*Bromus secalinus.*Soft Brome Grass  
(*Bromus mollis.*)

proportion in some samples of Perennial Ryegrass, and as it is rolled together in such manner as to be of about

same thickness as the seed of the Perennial Ryegrass, it is impossible to separate the one from the other. The great flat white seeds of *Bromus mollis*, and occasionally the slender, long-awned seeds of *Bromus sterilis* and *Bromus asper*, may be easily recognised in impure samples of Home and Foreign Italian. Agriculturists should carefully avoid sowing seeds that contain admixture of the seeds of any of those Brome grasses. In any land except the very worst they are out of place, and come under the head of weeds.

### Schröder's Brome Grass.

Mr. MARTIN J. SUTTON says that this grass has not been sufficiently cultivated in England, and strongly urges its inclusion in mixtures for two or three years' ley which are mainly to be fed off. There is a prejudice against it because of the harshness of its foliage, yet it is a valuable forage plant. It is one of the earliest grasses to start in a temporary pasture; it grows so strong as to crowd out weeds; it feeds on the surface, and will thrive on the thinnest soil. In warm moist seasons especially its usefulness will be manifested. Mr. Sutton once saw a field of this grass keeping an extraordinary flock of sheep, which were penned on it during a hot summer. The crop was ready at one end of the field as soon as the sheep had finished at the other.

Professor PHARES (of Mississippi) says it varies in the time of starting growth; but, when once started, its growth after the successive cuttings or grazings is very rapid. It is tender, very sweet, and stock eat it greedily. It makes also a good hay, and produces an immense quantity of leaves.

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## Crested Dogstail.

(*Cynosurus cristatus.*)

Extra good seed will sometimes weigh up to 36 lbs. per bushel.

Standard of germination, of H.M.'s Office of Works, 90 per cent. Some seedsmen guarantee 95 per cent.

CHAS. JOHNSON reports that this grass frequently forms the principal part of the sward in situations natural to it, viz., high and dry pastures or sheep downs. In such situations no species is more valuable. Owing to the depth to which its roots penetrate, it remains green long after most other species have withered. It is not at all, however, adapted for general cultivation—the stems being too harsh and wiry, and the herbage unproductive where a crop of hay is required.



CURTIS (who bases his qualifications to pronounce opinions regarding the grasses on “twenty years culture and observation of them”) says that—finding this grass produces but little foliage; that its stems are wiry and constantly refused by cattle; that, on account of its roots being fibrous and penetrating to no great depth, it becomes in dry summers little better than an annual—he is induced to think less favourably of its intrinsic merits.

Dr. STEBLER considers it one of the best grasses—not valuable so much in respect of its produce as in regard of its high nutritive qualities. Prospers best in a humid climate, and forms an essential part of the best pastures in England, Holland, Schleswig-Holstein, and

Switzerland. It begins to throw up foliage early, and flowers from middle to end of June.

Dr. PARNELL pronounces it to be a most valuable grass for permanent pasture, but not recommended for hay. Thrives better in tenacious elevated soils than in those of a drier or sandy nature, and in irrigated meadows attains an unusual size.

Mr. HUNTER says it should be included in all mixtures for permanent pasture, but the quantity of seed should be very moderate, as when once established it will increase from year to year by self-sowing. The leaves are fine and form a dense turf.

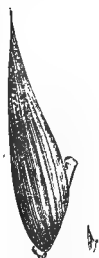
MORTON'S *Encyclopædia*: a writer in this work says of the Crested Dogstail, that from a more intimate knowledge of its actual merits, it is not now generally considered worthy of field cultivation. Few grasses, however, are better adapted than it for bleaching greens and scythe-kept lawns.

*Manuring*.—At Rothamsted it appeared to thrive equally well on unmanured plots and on plots that had been dressed with mineral manures only. It showed a dislike for ammonia salts and a preference for nitrate of soda.

The Seed varies in quality very much owing to carelessness in collection, and in handling by those who save it. A difference in price of as much as 100s. per cwt. between a superfine and a poor sample is not an unusual occurrence. Through bad handling (during the process of drying the seed) many samples get heated and become discoloured. Many inferior samples will be found to contain various weed-seeds—sometimes ergot in addition; and again the shelled seeds of Yorkshire Fog are prominent in many samples.

Considering the price of good pure Dogstail seed, and the adverse opinions of the grass expressed by some of the authorities quoted above, it is a question for the farmer—especially in districts where it abounds naturally—whether it would not be as well to exclude it entirely from the mixtures for laying down his land. Certainly, as a general rule, considering how copiously it resows itself, it is well to diminish the quantity of this seed in specifications to the lowest point.

It is stated that Crested Dogstail is frequently adulterated with the seed of the Blue Melick grass (*Molinia cœrulea*)—a grass of no agricultural value which grows on heathy and moory land. The seeds of *Molinia* may be distinguished by their larger size and darker colour, and can be recognised by the naked eye on a close scrutiny.



Blue Melick  
Grass.

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## Fiorin or Creeping Bent.

(*Agrostis alba var stolonifera*.)

As there are a number of varieties of *Agrostis*, all of which are next to useless except this one; and as the seeds of the other varieties are usually sent out instead of the true Fiorin, it is as well to give here a short botanical description of the plant, viz.:—*This is a variety with the branches of the panicle (flower-head) densely tufted; sheaths roughish; stems long, smooth, and procumbent, putting out roots from the nodes or joints. It differs from Agrostis vulgaris in having broad leaves;*

*a much closer and larger panicle, with green or pale flowers; the large glume minutely toothed all along its back; the ligule long, narrow, and sharp.*

Dr. STEBLER'S view of it is that, if it has been grown on a suitable soil, it will produce herbage of a succulent nature which cattle eat with pleasure; but if grown on poor or dry ground, it will be avoided, as it becomes hard and without flavour. It suits best on a light moist soil; also on peaty soils that have not been drained; also on wet clayey soils; but does not succeed on dry soils, especially if composed of compact clay, into which its fine roots cannot penetrate.

Professor BALDWIN (Ireland) writes as follows:—  
“Fiorin grass is extensively grown in Donegal. On reclaimed moor and other deep land there it makes most valuable permanent meadow. I speak of the true *Agrostis stolonifera*, with which worthless and even noxious plants are confounded.”

CHARLES JOHNSON says that the value of all the varieties of *Agrostis alba* depends upon the creeping stems—which afford a heavy crop of hay late in the year, and also supply leaves for early feeding. The Fiorin of Nature's own planting flourishes in a rich well-watered soil, and produces an almost miraculous quantity of fodder; but it is unreasonable to suppose that, in the absence of such conditions, any parallel success can attend its cultivation. The Creeping Bent may be a useless weed—wiry, nearly leafless, and unpalatable to cattle—or it may be succulent, abundant in foliage, and as grateful to them as it is productive—according to the soil and situation in which it finds itself. The creeping runners, stems or stolons of this and other grasses of similar habit, are highly nutritive.



Mr. MARTIN J. SUTTON says it affords very early feed in spring, but its power of yielding late keep in autumn is its most remarkable feature. It has been pastured as late as the middle of December, and the herbage, if allowed to remain till following spring, not deteriorated. In wet seasons it overpowers other grasses, and its creeping roots become almost as objectionable as Couch. It is also very exhausting to the soil.

Mr. HUNTER says this grass is suitable for affording a supply of herbage during winter and early spring months when other grasses are dormant. The habit of growth resembles the strawberry—long trailing shoots or stolons being produced during the autumn and winter months. It thrives on all good soils, particularly those that are wet; also does well on peaty soils, but is not suited to dry pastures.

NOTE.—As the Fiorin grass came at first prominently into notice through the writings of Dr. Richardson, who had experience of it in the north-east of Ireland, I thought it well to make some inquiries about it in Ireland, and was referred by Professor Baldwin of Dublin to a gentleman in Donegal, who farms some reclaimed bog there on which a plantation of Fiorin had been made by sowing pieces of the creeping stems and covering lightly with soil. This gentleman reports as follows:—"I believe it is an excellent grass for our soil; in fact, we could not raise anything like the same quantity of any other kind of grass. My experience is that newly-broken bog is the most suitable land for it. I believe we have had as much as ten tons of hay per acre (Irish), but this I consider an extra good crop, and you will not have that quantity except for one or two years on good land well manured." Wishing to see a

specimen of this exceptional crop, I procured a bundle of the grass and found amongst it a fair proportion of large plants of Rough-stalked Meadow grass, which no doubt helped to make up the heavy yield. This instance corresponds with certain facts connected with the celebrated Orcheston Meadows near Salisbury, the grass of which was found by Curtis to be principally made up of Rough-stalked Meadow grass, and a species he calls *Agrostis palustris*, which, from the description given, appears to be the Fiorin.

I have had also a report on this grass from another Irish correspondent of experience, who says: "Fiorin grass—the kind with the creeping stem—should be cultivated by itself on moist ground for hay, of which it gives several cuttings in the year of enormous produce and excellent quality. Cattle are extravagantly fond of it, and the farmer by its use may convert almost unprofitable swamps into the most valuable land on his holding."

**The Seed.**—As has been pointed out by Johnson, the Fiorin, as is the case with plants generally which propagate themselves by lateral extension, produces very little seed. Hence those who are desirous of cultivating it will succeed best by planting cuttings of the creeping stems in drills an inch deep and slightly covering them with soil. The seed of commerce is almost invariably *not* that of the true Fiorin, but is the seed of some of the other worthless varieties—such as *Agrostis dispar*, *Agrostis vulgaris*, *Agrostis canina*, &c. Some of the leading seedsmen, having discovered this, and having ascertained by experiment the impossibility of getting seed of the true Fiorin, have struck it out of their lists altogether—which is a much better plan than

to send out seeds of grasses that are no better than noxious weeds. Even when the seed of the *bondâ fide* Fiorin grass has been procured it is very difficult to get it to grow. My Donegal correspondent writes: "I have no faith in the *seed* of Fiorin, as I have seen it sown and it never came to anything, but we plant the stems and cover them lightly with earth."

Again another correspondent writes: "I have tried to raise it from seed, but have entirely failed to do so."

*According to the Woburn experiments*, the Fiorin grass grown on an active peat soil, produced—

	T.	cwts.	qrs.	lbs.
A. At time of flowering, per acre . . . . .	7	18	0	0
Which yielded of hay, per acre . . . . .	3	9	0	14
B. Yield at time of ripening its seed, per acre . . . . .	8	10	0	17
C. Further produce of Green Aftermath, per acre . . . . .	1	4	1	6
D. Portion left uncut till December produced at rate of, per acre . . . . .	9	2	1	6

So as to give the reader an idea of the merits of the other varieties of *Agrostis*, which are so commonly sold as the true Fiorin, the following is appended:—

### Herd's Grass, or Redtop of America.

(*Agrostis dispar.*)

MORTON'S *Encyclopædia* says that, however suitable it may be in comparatively warm climates for dry soils, yet to the British grower it can only, like *Agrostis vulgaris*, be recommended for the most barren and worthless land.

### Fine Bent Grass.

(*Agrostis vulgaris.*)

Dr. PARNELL says it grows on dry heaths and pastures. Is said to be disliked by cattle generally, and is not of sufficient importance to merit the attention of agriculturists.

### Cocksfoot.

(*Dactylis glomerata.*)

Seed weighs 18 lbs. per bushel.

Standard of germination, of H.M.'s Office of Works, 90 per cent.



Cocksfoot.

Dr. PARNELL says it succeeds best when the subsoil is porous and not stagnant, so that the fibrous roots can penetrate deep. It is less impoverishing to the soil than Rye-grass; and, though it is as a pasture grass that it possesses most value, yet even for hay it is superior to Ryegrass and many other grasses. In pastures it should not be allowed to grow coarse, but should be kept closely cropped either by cattle or by the scythe.

CHARLES JOHNSON says for an alternate crop it is by far the best grass that can be employed alone. Rooting deeply, it is less liable to suffer from excess of drought than most others on dry sandy soils. As moist retentive land is more favourable to its luxuriance, and induces an overgrowth destructive of

those of weaker habit but equally productive, it may be advisable as a general rule in laying down land to grass to exclude Cocksfoot where other species of a fine quality are found to flourish. This grass, Johnson thinks, is more valuable for pasture than for hay.

Mr. HUNTER says, for permanent pasture, for alternate husbandry, or for hay, there is not a more valuable grass. It is one of the earliest, most productive, nutritious, and valuable of the cultivated grasses, and no grass comes sooner to perfection. If kept closely cropped its produce is enormous, and it is relished and greedily eaten by all kinds of stock.

Dr. STEBLER'S opinion is that it is an excellent grass, growing quickly and ripening early. It constitutes in his country (Switzerland) the principal part of the best pastures. It should be cut before the flowering stage, as at and after that period it contracts a toughness. After each cutting it produces less stems and a large proportion of root leaves, which give excellent forage whether in a green state or as hay. Of all grasses this one furnishes the most substantial aftermath. It reaches full development the second year after sowing. It is not advisable to sow it alone, or in too large proportion for forage purposes, as it forms large clumps with bare spaces between. It is best to use it in mixture with Clover, Ryegrass, Foxtail, and Timothy—the proportion of Cocksfoot not to exceed (unless in exceptional cases) 15 per cent. A good rolling in the spring serves Cocksfoot, the operation reducing the projecting clumps to the level of the sward. In irrigated meadows it does very well, attaining in such situations a very large size.

SINCLAIR recommends a mixture of three parts Cocks-

foot, with one part each of Hard Fescue, Rough-stalked Meadow grass, Tall Oat-grass, Timothy, Perennial Rye-grass, and White Clover—to secure the most productive and nutritive pastures in alternation with grain crops on soils of the best quality; and even on soils of an inferior nature, under the circumstances of unfavourable seasons, this mixture will afford nutritive herbage when the land would have been comparatively devoid of it if one species of grass only had been employed. It is further stated, on the authority of Sinclair, that when Cocksfoot is suffered to grow rank or old for want of sufficient stocking, it contains nearly one-half less nourishment than that which is of recent growth.

Professor PHARES (of Mississippi) says it may be mowed from two to four times a year, according to latitude, season, and treatment. It will grow well on any soil containing sufficient clay, and not holding too much water. Cocksfoot grass is easily cured and handled; also it is readily seeded and catches with certainty. I know but one objection to it, *i.e.*, like Tall Oat-grass it is disposed to grow in clumps and leave much of the ground uncovered. This may be remedied by thick seeding, using  $2\frac{1}{2}$ , or better, 3 bushels of seed per acre. In common with others I prefer Red Clover with Cocksfoot—it fills the gaps and matures at the same time. One peck of Red Clover seed and six pecks of Cocksfoot is a good proportion per acre. Sheep leave all other grasses if they can find this—and, acre for acre, it will sustain twice as many sheep or other stock as Timothy. Cut at the proper stage it makes a much better hay than Timothy, and is greatly preferred by animals—being easier to masticate, digest, and assimilate, in fact more like green grass in flavour, tenderness, and solubility.

Mr. M. J. SUTTON says that its proper place is on good, strong, damp soils on low-lying districts, where it produces an enormous quantity of leafy herbage. It is entirely out of place in upland meadows. Its valuable qualities are better realised in a three or four years' ley than in a permanent pasture. With Ryegrass and Clover it forms a superior feeding ley. Its quality is always higher before flowering.

Mr. ELLIOTT (of the Border Union Agricultural Association) gives a contrary opinion to that of Mr. Sutton with reference to suitability of Cocksfoot for inferior lands. He says he saw it growing luxuriantly at Sharstead Court (Mr. De Laune's place) on poor land at the head of a steep bank. Also he has grown it himself successfully on poor and high land.

Mr. STANTON GOULD of New York says it affords a good bite earlier in spring than any other grass except the Meadow Foxtail. It gives a very large amount of aftermath, and continues to send out root-leaves until very late in the autumn.

*Manures.*—We have it stated that when not liberally fed Cocksfoot almost disappears. Ammonia salts and mineral manures are conducive to its growth, but it does not take kindly to nitrate of soda.

*The Seed.*—We draw our supplies of Cocksfoot seed from a wide area, viz., from North America, from New Zealand, from France, and Germany. The New Zealand seed would be almost perfect if it were free from the seeds of Yorkshire Fog, which is present in large proportion in many samples. American seed, on the



Yorkshire Fog.

other hand, is free from Fog, but sometimes contains seeds of Dock, &c. French seed is worst of any in the matter of impurities, containing, it might almost be said, a little of all sorts.

*At Woburn* Cocksfoot produced green food per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . .	12	9	0	17
Which gave of hay . . . .	5	6	0	0

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### THE SHEEP'S FESCUES.

Some Continental authorities comprise under the heading of Sheep's Fescues all those sub-species and varieties that grow in compact tufts, and increase by lateral intra-vaginal shoots. Of those sub-species and varieties as many as eight are specified; while of the creeping-rooted Fescues (such as *F. rubra* and its sub-species and varieties) six are specified.

Of the Sheep's Fescues there are only two that have importance from an agricultural point of view, viz., *F. ovina var vulgaris*, and *F. ovina var duriuscula*. In commerce, with the exception of fine-leaved Sheep's Fescue, we cannot tell by ordinary examination of the seed which sub-species or variety that particular sample of seed belongs to. It may belong to one of the Sheep's Fescues, or it may be seed of Red Fescue or of *F. fallax*, or *F. heterophylla*. The latter seed is the longest and largest of the lot—but the size of the seed is no certain guide. Seeds as well as plants vary in size according to soil and situation, and, for that matter, each plant of



each variety will have some seeds larger or smaller than the normal size, and so a process of sifting will easily equalise the sizes all round.

How unsatisfactory this is from the farmer's point of view will appear when we discover that each of the various kinds which are liable to be sold as Sheep's Fescue requires a special soil and situation in order to attain its maximum development.

Some of the kinds, for instance, are only suited for dry soils, while others are served by irrigation. Some creep at the root and exhaust the surface soil, while others are fibrous-rooted and go deep. Some do best under shade, while others prefer the open. It would clearly, therefore, be of great advantage to get the kind that suits the circumstances of our land; but the seed is little or no guide, and the farmer has no remedy except to deal with seedsmen of skill, experience, and integrity.

### Hard Fescue.

(*Festuca duriuscula.*)

Seed weighs 20 lbs. per bushel.

Standard of germination, of H.M.'s Office of Works, 75 per cent. Some seedsmen guarantee from 10 to 15 per cent. higher than this.

Dr. STEBLER'S opinion is, that the variety known as Hard Fescue is only distinguishable from the other Sheep's Fescues by its somewhat more robust growth. For good land, or even for poor land that can be irrigated, grasses of more value can be found; and it is only on dry and thin soils, where the better grasses

will not do well, that the Sheep's Fescues become of much importance to agriculture. On good soils it is useful as a bottom-grass in mixture with other grasses, and may be mixed with the clovers for soiling; but by itself, or in large proportion, it can only be used to advantage on land that is dry, poor, and thin, of a sandy or silicious nature. On such it is truly a god-send, as it supports extreme drought, and is absolutely insensible to temperature and to climatic influences. It should never be sown alone even in the worst land, as it grows in thick close tufts and does not cover the ground. To fill up the blank spaces it is necessary to mix it with other grasses or forage plants. With *Anthyllis vulneraria*, for instance, on soils of the poorer class—and with White Clover, Smooth Meadow grass, or perhaps Timothy, on soils of a somewhat better kind. The year it is sown it develops slowly and gives but a poor yield. It is the second or third year that it reaches its maximum, after which it begins to decline. Cattle will not eat it except under pressure of extreme hunger. Sheep like it well enough, but not so well as they like some other grasses.

SINCLAIR remarks that it withstands the effects of severe dry weather better than many other grasses, and recommends its use to a small extent in laying down new pastures. He adds that it attains greatest perfection when combined with Meadow Fescue and Rough-stalked Meadow grass.

Dr. VASEY, of U.S.A. Agricultural Department, says it is indigenous in the mountainous parts of New England, in the Rocky Mountains, and in various Northern localities. It is without doubt the very best of the grasses growing on sandy soils. It is only as a pasture

grass on such soils that it is valuable, and in these when highly manured it is driven out by the more succulent species. It roots deeply, and forms a dense, short turf, which adapts it admirably for lawns and pleasure-grounds where the soil is sandy.

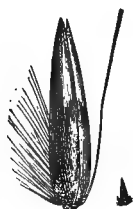
Mr. M. J. SUTTON says it is the most robust of all the small fescues. The herbage is tender, succulent, and much liked by all kinds of cattle. On moist and rich soils it affords an immense amount of herbage. It is of importance in forming a close bottom to the turf amongst stronger-growing varieties, and in this respect is of especial service for upland pastures. It may properly be considered one of the least expensive and most desirable of bases or bottom-herbage grass of a permanent mixture for all soils that are not very wet.

CHAS. JOHNSON says that it is generally regarded as one of our most valuable grasses, being very productive considering the slender character of its foliage, and thriving in most soils and situations. Few grasses retain their verdure during the severest winter to an extent so remarkable. The spring produce, however, is but trifling, the foliage not attaining much length until the approach of the flowering season. Meadows in which it abounds should be mown when it is in flower, as both bulk of produce and proportion of nutritive matter are greater at that time.

**The Seed.**—The great bulk of what is offered in commerce is collected (we may presume for the most part in a hasty and careless fashion) from plants growing wild in the woods and clearings, consequently it contains a great many seeds of weeds in its natural state. The most noticeable of weeds to be found

in it are Sorrel, Tufted Hair-grass, and soft Brome grass.

The writer remembers meeting with a sample of Hard Fescue a few years ago. It was offered by a Continental house, and looked so bad that he analysed it with the following result:—A hundred grains contained



Tufted Hair-Grass.

58 of Hard or Red Fescue, 27 of Tufted Hair-grass, 4 of Meadow grasses, 4 of Sorrell, 1 of Chickweed, 2 doubtful seeds, and 4 bits of quartz. This, of course, was a very bad case, and there are not many like it (let us hope), but still a sufficient number of impure parcels of the smaller fescues may be met with to warrant the statement that almost all the

seed of this species that is imported would be the better of a special cleaning and recleaning before being sown. There are wholesale and retail seedsmen who devote themselves to the cleaning of the natural grasses, and the buyer can purchase perfectly pure seed if he will go to the trouble to look for it.

*Stimulating manures* do little or nothing for Hard Fescue, they only encourage other grasses at its expense.

At *Woburn*, Hard Fescue, grown on a hard clayey loam, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	8	4	0	0
Which yielded of hay per acre . . . . .	3	13	3	9

At the seed ripening period it increases its weight of grass, but loses nutritive matter.

## Fine-Leaved Sheep's Fescue.

(*Festuca ovina tenuifolia.*)

Extra good seed weighs 24 lbs. per bushel.

Some seedsmen guarantee a germination of 80 per cent.

CURTIS says that it appeared to him applicable only to the purpose of making a fine-leaved grass-plot that shall require little or no mowing.

Dr. STEBLER describes it as a dwarf variety, with the leaves very fine and almost hair-like. Seeds not awned. Has no agricultural value, but is useful in lawns and ornamental grounds, particularly in shady places.



CHARLES JOHNSON says also that in the practice of agriculture it is almost useless, being entirely unproductive as hay; while for grazing purposes, on temporary pasture, grasses of larger growth are proportionately far more profitable. Nature in her distribution of it on poor, rocky, sandy soils, where other species would dwindle and die, points out the only situation to which it is properly adapted. He shares the opinion of the other authorities as to its suitability for lawns, bowling-greens, and pleasure-grounds.

The Seed is of a tawny orange colour, something less than half the size of Hard Fescue, and differs also from the other Sheep's Fescues in being awnless.

It is stated on good authority that only a small quantity of the true seed comes into those kingdoms, and that a small-seeded sample of Hard Fescue is

usually sold for it. However, there is no difficulty whatever in procuring the true *F. ovina tenuifolia* if people will go to the price of it, which is usually about thrice the price of Hard Fescue. It is also stated that it is sometimes adulterated with the seeds of the Blue Melic grass, which is a most objectionable adulteration in this instance, as it is a most obnoxious grass to introduce into lawns, in the formation of which Fine-Leaved Fescue is much used.



' Blue Melic grass.  
(*Molinia caerulea*).

At *Woburn*, grown on a light sandy soil, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	2	8	2	13

At time of seed ripening did not increase in weight, but nutritive matter had decreased very much.

## Various-Leaved Fescue.

(*Festuca heterophylla*.)

Dr. STEBLER's opinion of it is, that it is a first-rate grass, and that he has obtained very satisfactory results from it. It succeeds better in the shade than in the open. It requires strong rich land and a warm situation, as it belongs naturally to the south of Europe. Most of the seed sold as *F. heterophylla* and *F. rubra* is really the seed of *F. fallax*.

Mr. MARTIN J. SUTTON says it is a most valuable Fescue grass, and indeed one of the best of the finer grasses. The earliness of its growth makes it exceedingly useful in a pasture. For hay it is comparatively

unimportant and the aftermath is small. It will not make a continuous turf alone, but in company with Red Fescue and Smooth Meadow grass will fully occupy the soil.

MORTON'S *Encyclopædia* says it is suited for a strong class of dry soils, and for permanent pasture on such it is recommended to sow 1 lb. or 2 lb. of it per acre.

The Seed.—See remarks on the seeds of the small fescues under the head of Sheep's Fescue. Considering the uncertainty whether one gets the true seed, it is little use going to any pains to particularise this fescue or *F. rubra* in our specifications.

At *Woburn*, grown on a sandy soil with manure, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	6	1	2	4
Yielding hay . . . . .	1	16	1	23

At the time of seed ripening the yield of grass was about one-fourth less, but the yield of hay did not suffer much diminution.

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## Red or Creeping-rooted Fescue.

(*Festuca rubra*.)

Dr. STEBLER'S opinion is, that the only essential difference between this and the Sheep's Fescues is to be found in the roots. The root-systems of the latter being fibrous and deep, while that of the Red Fescue is creeping, having underground stolons with extra-vaginal shoots or scions. It succeeds best on soils of a porous or somewhat peaty character, as in such it can freely

develop its stolons. It can be cultivated with success even on shallow soils if same are fairly good and not too dry. In the mountains of Switzerland, where it has but a thin layer of earth, it forms the principal part of the vegetation. It flourishes on the dry sandy banks of rivers, and will exist even on the sandy dunes by the sea. As its roots extend themselves principally through the upper spit of the soil, it is that section is exhausted by it. In point of nutrition it is not up to meadow hay of average quality.

Mr. MARTIN J. SUTTON says this grass derives its name from the reddish-brown colour of the lower leaves. He is quite of opinion that Hard Fescue is infinitely superior, except for poor, dry, harsh soils, and on uplands where Red Fescue may fairly be considered essential, especially for its great power of withstanding drought. This quality fits it for use on railway slopes, and for all burning soils and hot climates. It must be regarded as exclusively a pasture grass. All cattle like it, but for hay it is of small utility, and the lattermath is inconsiderable.

MORTON'S *Encyclopædia* says that it and its varieties, like all creeping-rooted grasses, exhaust the fertility of the soil and extirpate the more valuable fibrous-rooted sorts—hence they should never be sown on ground suited for the growth of Hard Fescue and its varieties.

At *Woburn*, grown on a light sandy soil, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	4	11	0	17
Yielding hay . . . . .	1	18	3	0

At time of seed ripening the quantities of grass and hay had increased to a small extent.



## THE MEADOW FESCUES.

The German botanist, Hæckel, whose ruling in the matter is also adopted by Dr. Stebler, places *Festuca pratensis* and *F. arundinacea* as sub-species of *F. elatior*, and divides those again into varieties and sub-varieties. States further that *F. loliacea* (Darnel or Slender Fescue grass) is a hybrid between *F. pratensis* and Perennial Ryegrass, and adds that there are also in existence hybrids between Meadow Fescue, Italian Ryegrass and *F. gigantea* (Giant Wood Brome, or Fescue grass). Dr. Parnell also thinks it is very probable that *F. pratensis* is only a variety of *F. elatior*.

## Tall Meadow Fescue.

(*Festuca elatior*.)

Seed weighing 20 lbs. per bushel.

Standard of germination, per H.M.'s Office of Works, 75 per cent.

MAUKE, a German botanist, so far back as 1818 wrote that this was one of the best and most useful of grasses.

Dr. PARNELL describes it as growing from three to five feet high, the root being perennial, fibrous, somewhat creeping, and forming large tufts. It is a nutritive and very productive grass, grows naturally in rich, moist soils of a clayey nature, and, notwithstanding its coarse appearance, cattle appear fond of it, especially cows.

Professor PHARES, of Mississippi, says it grows well in nearly all situations, wet or dry, on hill or bottom-land, even though subject to overflow, and matures an extraordinary quantity of seed. The seeds germinate readily, and it is easy to set a piece of land with this grass. On account of remaining green throughout the winter, it is sometimes called "evergreen grass." Mowed and dried it makes good hay, much relished by stock.

Dr. STEBLER reports that it flowers at the end of May or beginning of June, some days later than Tall Oat-grass and Cocksfoot, and ripens its seed about end of July. It gives abundant produce of good quality, and, being a true perennial, should never be omitted on land that is suitable to it, viz., good loam or clay soils where a sufficiency of moisture can be had. It will also do fairly well on a cool sandy soil that can be irrigated; in fact, there is scarcely any grass that profits so much by irrigation as this one. It takes rather longer to develop than some of the grasses, and it is only in the second or third year that it reaches its complete development. When established it commences to vegetate early in spring, and grows quickly, so that on good ground one can get three good cuttings in a favourable season. In point of earliness it comes immediately after Meadow Foxtail.

Mr. FAUNCE DE LAUNE.—Although Tall Fescue is usually represented as doing well only on damp soils—moist clay, and so forth—it is reported by Mr. De Laune that plants of it during the exceptionally dry summer of 1884 retained their fresh green colour, and continued to grow, when all other grasses in the same pasture were suffering from the excessive and long-continued

drought. From this it would appear that it might be used with advantage on light soils as well as on those that are heavy and wet.

Mr. M. J. SUTTON would exclude this grass entirely from prescriptions for meadows which are generally cut for hay, not only because of the tendency of the grass to become ergotted, but because of the extreme coarseness of the hay produced. This authority adds further that the plant when indigenous to this country is practically sterile, yet on the Continent of Europe, where it is known as *Festuca arundinacea*, it is fertile, and seed of it is saved and exported to England annually. The plant, whether produced from the divided roots of the indigenous variety or from seed of the Continental *F. arundinacea*, equally maintains the characteristic creeping habit of the root, which is a distinctive feature as compared with *F. pratensis*.

The Seed of the true Tall Fescue is larger, flatter, and more pointed than that of the common Meadow Fescue. Formerly it used to be difficult to get seed of Tall Fescue free from admixture of Perennial Ryegrass, and in some cases even yet such samples may be met with. Mr. Hunter says that "absolutely pure seed of *F. elatior* cannot be obtained, the purest samples usually containing from two to five per cent. of Ryegrass, about the same proportion of Cocksfoot, and some Meadow Fescue."

In addition to a natural sterility, a good deal of the seed of the Tall Fescue grass is rendered useless by the attacks of an insect which penetrates the ovary and destroys the germ. Therefore, from one cause or another, as much of the Tall Fescue seed of commerce is of low germinating power, it follows that if a proportion

of Perennial Ryegrass (which germinates well) be present in it, either as a natural impurity or as an adulterant, the produce may perhaps show little else but Ryegrass plants, leading the experimenter to suppose that there was a larger proportion of Ryegrass seed in the sample than in reality was present.

*At Woburn*, grown on a black rich loam, it gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . .	22	15	3	3
Yielding dried hay . . . .	7	19	2	2

## Meadow Fescue.

(*Festuca pratensis.*)

Seed weighs 26 lbs. per bushel.

Standard of germination, per H.M.'s Office of Works, 90 per cent.

Dr. STEBLER's opinion of the Meadow Fescues generally will be found under the head of Tall Fescue.

SINCLAIR states that it constitutes a very considerable portion of the herbage of all rich natural pastures and irrigated meadows, and makes excellent hay. The leaves are succulent and tender, and they never form rank tufts. It is of greater value at time of flowering than at time the seeds are ripe in proportion of three to one.

MORTON'S *Encyclopædia* states that it possesses high merits both as a spring and autumn pasture grass, and

is surpassed by few as a hay grass when cut at the time of flowering.

The *Agrostographia* of LAWSON pronounces it to be an excellent grass, either for alternate husbandry or permanent pasture (particularly the latter), combining as it does most of the properties without the defects of Common Ryegrass.

Mr. HUNTER reminds us that this is one of the six grasses recommended by Curtis for laying down moist or moderately dry soils to permanent pasture, and adds that no grass has a stronger claim to that position, and that it should be a large constituent of all mixtures of seeds for permanent pastures. Although it loses much of its nutritive value if not cut at the time of flowering, yet, as the seed is not ripe till about the first of August, the sowing of this valuable grass along with Ryegrass, Cocksfoot, &c., for hay crops or alternate husbandry need not be restricted, as the seeds of these grasses ripen two or three weeks earlier than those of the Meadow Fescue, so that such crops would be ready for mowing at the time the Meadow Fescue was in flower, and in its most nutritious state.

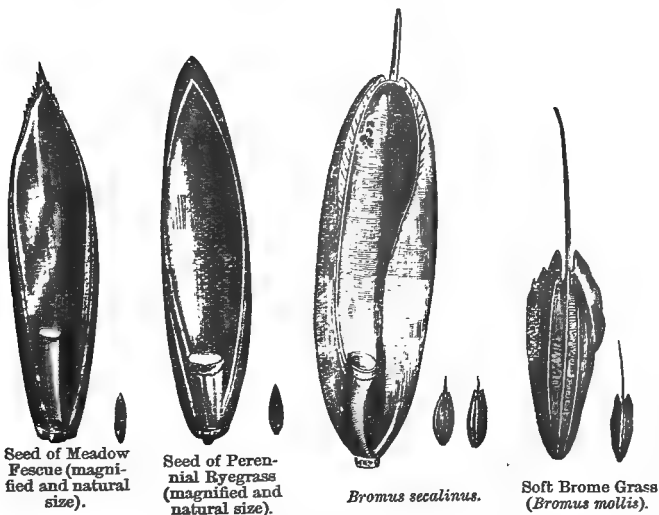
Mr. MARTIN J. SUTTON'S opinion is, that Meadow Fescue may properly be regarded as one of the most valuable, perhaps the *most* valuable, grass that can be sown. Its presence is a pretty certain indication of good land. It flourishes in strong deep land, especially in low-lying meadows and valleys where a moist atmosphere prevails. Scarcely any grass equals this for land under irrigation, though entirely unsuited to a water-logged soil. As it requires three years to attain maturity, Mr. Sutton looks upon it as a landlord's grass, to be used principally for permanent

pasture. With cattle the plant is ever a favourite, and, if possible, is even more relished than Foxtail. The early growth of Meadow Fescue is not large by comparison, but before the end of June it leaves Foxtail far behind.

**The Seed.**—A few years ago complaints of the difficulty of getting genuine seed of Meadow Fescue were numerous and emphatic. The adulteration of it by means of Perennial Ryegrass must have been carried on to a very large extent, *vide* the reports of the Botanist to the Royal Agricultural Society of England. Taking the report for 1883, for instance, we find that of the samples of Meadow Fescue examined by him *only 29 per cent. were free from Ryegrass.* Of the balance 12 per cent. contained Ryegrass to the extent of *one-half!* Twenty-two per cent. contained Ryegrass to the extent of over one-fourth, but under one-half; and 37 per cent. contained Ryegrass to the extent of less than one-fourth.

The great difficulty of distinguishing by the naked eye (and sometimes even by the magnifying glass) the seed of the one species from the other smoothed the way for such malpractices. Of late years, however, there is no difficulty in getting the seed perfectly pure. From America especially we get some splendid seed of this grass, and most seedsmen are now prepared to supply seed which they can guarantee perfectly pure, allowing a small margin for seeds of Ryegrass that may get into it during the collection. It should never be bought unless specified as "re-cleaned," as in the rough state it contains often a considerable proportion of seeds of bad grasses and weeds—notably seeds of the Brome grasses. The illustrations appended will give an idea of the

characteristics of the different seeds as they appear under a magnifying glass. It is easy enough to distinguish the seeds of the Brome grasses by the naked eye, but not so easy to find distinguishing marks between the seeds of Meadow Fescue and Perennial Ryegrass without the aid of a good magnifier.



Seed of Meadow Fescue (magnified and natural size).

Seed of Perennial Ryegrass (magnified and natural size).

*Bromus secalinus.*

Soft Brome Grass (*Bromus mollis*).

At Woburn, Meadow Fescue gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . .	6	1	2	4
Yielding in hay . . . .	2	17	2	26

At the time of seed-ripening the weight of crop per acre had increased considerably, but the quantity of nutritive matter had fallen off to less than one-half.

### Squirrel-Tailed Fescue Grass.

(*Festuca bromoides*, Linn. *Festuca sciuroides*, Koch.)

The seed is known in the trade as Hairgrass, being long and slender, with a long hair-like awn. The plant is of no agricultural value, being rigid, dry, and innutritious. It is mentioned here in detail only because its seed is so often found as an impurity in Italian and Perennial Ryegrass.

### Spiked Fescue Grass.

(*Festuca loliacea*.)

Mr. CARRUTHERS, F.R.S., says it is a hybrid between Meadow Fescue and Ryegrass, is occasionally met with, but nowhere has been able to keep its place as a permanent variety. Like other hybrids, it does not perfect its seeds, the flowers being generally abortive. It has no special merits.

*The seed* generally offered for it is *Glyceria fluitans*, or Manna grass.

Professor BUCKMAN, author of "Natural History of British Meadow and Pasture Grasses," holds it is a variety of Meadow Fescue, and says—"It is not only found, but is constant, and a most valuable grass for hay or pasture in meadows by the side of rivers—especially where subject to floods."

Mr. BAKER, of Royal Herbarium, Kew, reports that *F. loliacea* is a mere variety of *F. pratensis*. A friend of his experimented with it on garden soil, and it simply grew into *pratensis*.

Mr. M. J. SUTTON (from whose book the above two



opinions are taken) says that he does not recommend the sowing of *F. loliacea*, and does not consider the high cost of its seed a necessary outlay, although the plant is admirable on those soils where it will remain constant.

### Yorkshire Fog, or Meadow Soft Grass.

(*Holcus lanatus*.)

Average germination, according to Dr. Stebler, is 50 per cent.

There seems to be a wonderful divergence of opinion about this grass. Some authorities dismiss it as a noxious weed, or denounce it in most vigorous language, while others seem to take a more appreciative view of it. The reading of the contradictory opinions given below will cause one some bewilderment.

Dr. PARNELL says the only advantages this grass possesses are its being productive and easy of cultivation. It has no merits either for pasture or hay, as cattle of every kind, especially horses, seem to dislike it. It attains its greatest degree of luxuriance on light moist soils of a peaty nature.

E. F. HANSEN (Plön, 1827) says it is a sweet and succulent grass, much sought after when in a green state by cows and sheep. If cut and saved before the opening out of the flower stalk, it gives a hay which cannot be excelled in quality, and which is much liked, especially by horses.

CURTIS thinks that, if not disliked by cattle on



Yorkshire Fog.!

account of its woolliness, it may rank with some of the best grasses.

SINCLAIR states that in consequence of the soft down which covers the surface of this grass, it is not willingly eaten either by horses or horned beasts.

Dr. STEBLER, though his written opinion of it is not very flattering, yet gives it a place in his book on "The Best Forage Plants." He describes it as an early perennial grass, but of little value in agriculture. He alleges that the most competent contemporary writers are unanimous in recognising in it a plant not deserving of a place on land capable of growing the better grasses; but on peaty ground, or on poor sandy places where other grasses will not succeed, it has a certain value. In humid climates or situations it shows less of the woolliness which is so objectionable to cattle. To neutralise this woolliness it is recommended to sprinkle salt on it, which renders the small hairs moist and soft. It should always be cut up and mixed with other food.

Professor PHARES, of Mississippi, quotes the case of the Hon. Mr. Lewis of Louisiana, who has cultivated this grass many years with great satisfaction, and adds—"It is by no means the best of our grasses; but best for some lands, and on such lands more profitable than other grasses."

Sir HUMPHREY DAVY, in accounting for the dislike of cattle to this grass, puts it that its nutritive matter consists entirely of mucilage and sugar, whilst the nutritive matter of the grasses most liked by cattle have either a sub-acid or saline taste.

An IRISH AGRICULTURIST, who is one of the largest stock-breeders and butter-producers of the county

Limerick, writes—"We like Ryegrass and *Yorkshire Fog* in our pastures, and stock here appear to relish them."

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### Italian Ryegrass.

(*Lolium italicum*.)

Seed weighs up to 22 lbs. per bushel.

Standard of germination, 80 per cent.

CHARLES JOHNSON says the great value of this grass consists in its being of more rapid growth from seed than any of the other kinds, and in the quantity of fine close herbage it produces under favourable circumstances. The water-meadow seems to afford the widest scope for its capabilities, as being the nearest approach to its natural habitat, and most accordant with the circumstances under which it originated.

LAWSON'S *Agrostographia* says that it is an invaluable grass for alternate husbandry, yielding as it does an early, bulky, and quickly succeeding herbage. General experience, since the first introduction by Messrs. Lawson of this grass to Britain, has demonstrated that two seasons of Italian Ryegrass are all that can be depended upon with certainty; and in very wet, cold, spongy soils, it will often exhibit a thin stock the second season. Instances have, however, occurred in which as many as five or six successive years' produce have been reaped from the same field—yielding annually, on an average, about  $7\frac{1}{2}$  tons of dry hay per acre; but this has arisen more from the ground having been resown in the course of reaping the seed, than from the actual duration of the original plants.

Mr. JAMES HUNTER says that no agricultural plant of greater value has been brought into notice during the present century. It is indispensable for alternate husbandry; but, as it does not last for more than two years, it is of no use in permanent pastures. It is indeed a mistake to include it in mixtures for permanent pasture, as the spaces left bare at the end of the first or second year will most likely be occupied by worthless grasses, such as Yorkshire Fog, Brome grass, Annual Meadow grass, &c. The produce of one year's growth of Italian Ryegrass compared with one year's growth of Perennial is as 23 to 14. The nutritive value of Italian compared with Perennial is as 35 to 28.

Dr. STEBLER's opinion is, that as a grass for cutting or soiling purposes the Italian Ryegrass is that which occupies the first rank. On light warm soils it suits well to sow it in August in association with Crimson Clover (*Trifolium incarnatum*), which will give an abundant cutting in the month of May following. It is with clovers other than the above that it is usually associated, but in sowing it in mixture with ordinary clover there is this drawback, that the Italian grows more rapidly, and is already over-ripe and past its best when the clover is only commencing to develop. This is why that latterly the custom is becoming more general to decrease the proportion of Italian Ryegrass and substitute an equivalent of other grasses (such as Timothy, Tall Oat grass, and Cocksfoot) when sowing down land for alternate cropping.\* There is no other grass shows such a return for manure as this does, especially when treated with the liquid manure of the farm. By the use of liquid

\* Dr. Stebler's remarks have reference to the Continent, and more especially to his own part of it, viz., Switzerland.

manure as many as eight or nine cuttings have been got from it in certain years. It succeeds best on warm, moist soils, particularly on loams rich in vegetable matter. It also does well on clay soils of which the subsoil is permeable. In warm situations and on light land it is much benefited by irrigation. Its quality of rapid, vigorous, and luxuriant growth has caused it to be occasionally used for the extirpation of weeds which are difficult to get rid of in the ordinary way, and the same qualities make it suitable for filling up the blanks in meadows of clover, Lucerne or Sainfoin. [For this purpose the soil is stirred with a harrow, the Italian sown, and the ground then rolled.]

Mr. M. J. SUTTON says, given the desire of obtaining from an acre of liberally fed land the largest possible produce within twelve months, and Italian Ryegrass has no equal. The most profitable way of growing it is alone, because the crop can then be cut before any of the stalks become hard and lose their nutritious qualities. Many farmers make it a rule to sow in October, and crops have sometimes been cut on warm, moist soils at Christmas, and again in the following April. Valuable as it is for alternate husbandry in company of other grasses, such as Cocksfoot, Perennial Ryegrass, and Timothy, yet in a permanent pasture it is distinctly harmful, and should never be included in a prescription for that purpose. It is so gross a feeder as actually to choke and smother the Poas (Meadow grasses) and finer Fescues, and—when its own ephemeral course is run—it leaves the land destitute both of plants and nourishment. It is objected that Twitch is produced by Italian Ryegrass. With pure seed this is impossible, but plenty of Italian Ryegrass with Twitch in it is freely bought and sold every season.

*The Seed.*—That portion of the seed which is imported from the Continent yields a very heavy crop, but is so infested with pernicious weeds as to need most careful cleaning before it is fit to sow. The writer lately took an ordinary sample of average French Italian, weighing  $3\frac{1}{4}$  ounces, and out of it picked 253 seeds of Ox-eyed Daisy alone. That is equivalent to 1157 seeds of the weed to each pound weight of Ryegrass, or over 250,000 to each bale of 2 cwt. Besides the above-named weed it also contains Trefoil (in the husk), Wild Forget-me-not (Dragon grass), Buttercup, Bromus, &c.; and, as there can be no doubt that the great bulk of the imported seed is sold without being cleaned, the consequences of sowing such a quantity of weed seeds may be guessed at. The impurities found in home-grown Italian are generally the same as those mentioned in connection with Perennial Ryegrass. It may be interesting to note that the seed of this grass when first introduced in 1831 was sold at 42s. per bushel.

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### Perennial Ryegrass.

(*Lolium perenne.*)

Seed weighs up to 30 lbs. per bushel.

Seed weighing 22 lbs. per bushel will germinate as well as, or even better than, the very heavy weights; and the 22-lb. or 24-lb. seed, *if equally pure*, is the best value for the money. Dr. Stebler's trials gave an average germinating faculty of 70 per cent.; but his standard for good seed is 75 per cent. Some seedsmen guarantee 80 per cent.

There has been more controversy over this grass

than over any other in the list;—that is to say, over its qualities, its duration, its feeding value, and so forth. We must only let the various authorities speak, and draw our own conclusions.

LAWSON'S *Agrostographia* says it possesses several good qualities to recommend it to the attention of cultivators, the principal of which are—

1. Its suitableness to a great variety of soils.

2. The facility with which it is propagated by reason of its seed being produced in abundance, and their uniformity in ripening.

3. The fibrous structure of its roots, which fits it in an eminent degree for alternate husbandry.

In respect to duration the most permanent varieties of it have no claim to any title beyond that of sub-perennial.

STILLINGFLEET, writing more than a century ago, says that many are tempted by the facility of procuring the seeds of this grass to lay down grounds near their houses (where they want a fine turf) with it, for which purpose, unless the soil is very rich, a worse grass cannot be sown, as it will certainly die off entirely in a very few years.

CURTIS, alluding to the many varieties of this grass he had met with, reports that he had seen a double-flowered variety; also one with awns (Curtis's work was published thirty-five years before *Lolium italicum* was introduced by the Lawsons). Again, he had seen a variety with viviparous florets, and another with branching panicle.

CHARLES JOHNSON says it is exclusively in the successional system of cultivation, and, in a few isolated instances apart from it, and dependent upon peculiarity

of soil and situation, that the importance of this grass is chiefly manifested. As an uncultured pasture grass, it holds perhaps a very subordinate rank, but admitting this to be the case is not denying its utility in other respects. It readily vegetates on almost every kind of soil, and produces a plentiful supply of early herbage before the young plants come into flower. In the spring it is highly valuable—being greatly relished by cattle, by which, however, the rigid flowering stems are left untouched; and, unless the latter are removed by timely mowing, the after-crop is nearly worthless. No grass so rapidly impoverishes the soil—or, rather, takes from it that which is necessary to its own support to an extent equally prejudicial to its future growth. As a pasture grass it is of much lower rank than several other very common species; but, considered in its proper place, or merely as an artificial grass adapted only to peculiar circumstances, its worth cannot be reasonably disputed. Other species of grass may be more extensively applicable, but this is one that—of small account in its original state—culture has modified, has indeed forced into unnatural productiveness. Ought we to be surprised that a plant so conditioned should fail when the stimulus that first wrought the change is exhausted or withheld?

SINCLAIR comments upon the differences of opinion respecting the merits and comparative value of Ryegrass. He notes that it produces an abundance of seed, readily vegetates on most kinds of soil, soon arrives at perfection, produces in its first years of growth a good supply of early herbage, which is much liked by cattle. On the other hand, the after-crop is very inconsiderable, and the plant impoverishes the soil in a high degree if the culms, which are invariably left untouched by cattle,



are not cut before the seed advances towards perfection. When this is neglected the field, after midsummer, exhibits only a brown surface of withered straws.

Dr. PARNELL endorses the statement that, for permanent pasture, the produce and nutritive powers of the Ryegrass compared with those of the Cocksfoot grass are inferior nearly in the proportion of 5 to 18, and inferior to Meadow Foxtail in the proportion of 5 to 12, and inferior to Meadow Fescue in the proportion of 5 to 17.

Mr. FAUNCE DE LAUNE, in vol. xviii. of the *Journal of the Royal Agricultural Society of England*, says that this is a short-lived grass; and that, owing to the shortness of its roots, it exhausts the surface of the soil, so that, when it dies out, the bare space is so impoverished that though grasses may germinate upon it they will fail to live unless highly manured by accident or on purpose. Besides, the feeding qualities as determined by chemical analysis do not encourage its cultivation. In his own experience it has proved at some seasons injurious to stock. The grasses most pernicious to newly formed pastures are, first and principally, Ryegrass in all its varieties, and Yorkshire Fog. Both those grasses are rapid in growth and make a great show; they produce an abundance of seed and are very cheap, hence their popularity with superficial observers.

Mr. MARTIN J. SUTTON says that, while other grasses are dependent on season and weather, Ryegrass is able to hold its own under all circumstances, enduring winter frost and summer heat. Another great advantage is that it is so little injured by being allowed to grow old before it is cut. It deserves to be widely known that Ryegrass straw cut into chaff is a very substantial food for cattle. Even on land where it is certain to die out,

excellent service will be rendered while it lasts; and, by yielding up its place when other kinds are sufficiently established to occupy the land, weeds are kept in check, and crops of valuable herbage are secured meanwhile. On all those grounds Mr. Sutton advocates the use of Perennial Ryegrass in prescriptions for permanent pastures; and adds that for alternate husbandry it may be regarded as indispensable for all soils. Even on land where it certainly would not be permanent, it should be liberally sown for a short term of years.

A burning sand or thin gravel is least suited to it, but it answers on a gravelly clay, is at home on all loams, and positively revels on tenacious land. The poorer and drier the soil the shorter will be its duration. The roots are very shallow; and, as a poor soil speedily becomes exhausted by the rapid growth, of necessity the plant dies. Pastures which are stimulated by the dropping of cattle, or are dressed at proper intervals with farmyard manure, continue to grow Ryegrass year after year without the sowing of seed.

*The objections* which have been urged against the use of Perennial Ryegrass for pastures are largely owing to the improper employment of Annual Ryegrass in its place. The latter is only adapted for one year's ley, and its use in a permanent prescription is no better than a fraud.

Dr. STEBLER'S views on Perennial Ryegrass read to the effect that while sometimes highly praised and at other times denounced, still it is, in spite of all, one of the best of our forage plants, and should never be omitted when laying down good land. It will not suit moory or dry light land, but for heavy clay soils its place could not be filled by any other grass. It

furnishes a rapid and dense growth; is not injured by trampling, and has other high merits as a pasture grass. For mowing purposes, however, it is notably inferior to other grasses, and chemical analyses of Ryegrass hay shows that its nutritive value is a little inferior to that of Meadow hay of average quality. On light soils, and with a dry atmosphere, it will be scarcely more than biennial; while on good heavy land, with a humid atmosphere, it should last seven years or more.

Professor WALLACE'S, of Edinburgh University, opinion is, that it cannot be said to be a permanent grass unless when grown on rich old pastures where there is an abundance of humus or decaying vegetable matter. He adheres to what may be termed a modified view of Mr. De Laune's opinion of Ryegrass, viz., that it is not necessary to exclude it altogether, provided we do not allow of or encourage the adulteration of other seeds by its admixture.\*

Ryegrass is vigorous and has some very good qualities, especially when grown on good soil. Its disadvantages are—

1. A tendency to run to seed and take ergot when in that condition;
2. The small amount of aftermath; and
3. Its liability to disappear in a few years.

The better the after-treatment, the better will be the results got from Ryegrass.

Mr. JAMES HUNTER says that the use of a large proportion of Ryegrass cannot be justified now that it

\* This allusion is to the adulteration of Meadow Fescue seed by admixture of Perennial Ryegrass seed, a practice on which some comments will be found under the head of Meadow Fescue.

is possible to obtain most of the true permanent grasses equal in germinating power to Perennial Ryegrass, and in some cases surpassing it. It is a grass that quickly exhausts the soil, and becomes year by year less productive. Although the plants are short-lived they do not disappear from the pasture, but are reproduced from the seeds which are freely ripened and shed, the flower-stems being invariably left untouched by cattle. Again, as regards cheapness, when the *number* of seeds in a pound of each of the leading kinds is ascertained, it will be seen that Ryegrass seed is really dearer than the seed of some of the permanent grasses.

*The Seed.*—Perennial Ryegrass seed of less weight per bushel than 24 lbs. cannot be thoroughly cleaned, so that lighter samples should always be avoided. On the other hand, there is no advantage, except perhaps on the score of extra purity, in the use of seed of very heavy weight, as it has been proved that seed of 22 lbs. or 24 lbs. per bushel will yield a greater bulk of produce than seed of 28 lbs. per bushel.

*The weed seeds* usually met with in Ryegrass (both Perennial and Italian) are those of the Buttercup (called "Crawtae" or Crowtoe in Scotland), Ribgrass, Large Dock, Sorrel Dock, Hairgrass (*Festuca sciuroides*), Wild Forget-me-not (sometimes called Scorpion grass), Goose grass (*Bromus mollis* and *secalinus*), and "last but not least," Yorkshire Fog.

The grass-seed merchants of Scotland and the North of Ireland take great pains to remove all weed seeds from the Ryegrass; and, by the aid of expensive and elaborate machinery, succeed in producing samples of a very high degree of purity. The total quantity of weed seeds thus removed annually in the cleaning pro-

cess would astonish most people. The labours of the merchants to produce pure seed are, however, in many cases rendered useless by the foolish and short-sighted practice of many farmers, who throw into this pure seed a mixture of some cheap rubbish, perhaps hayloft sweepings or rough uncleaned seed got from a neighbour, and thus restore a considerable proportion of the bad grasses and weed seeds which the grass-seed cleaners have been at such pains to remove.

The presence of Annual Ryegrass seed amongst Perennial must likewise be looked upon as an impurity. As has been pointed out by Mr. Sutton, the selling of the Annual for the Perennial variety is "no better than a fraud." The seed of Annual Ryegrass is large, flat, and can be easily distinguished from the seed of Perennial or Italian varieties. It is almost as broad as the Goose grass, but is more chaffy, and has no awn. It is impossible to remove the seeds of *Bromus secalinus* from Perennial, as they are rolled up tight, and will slip through any mesh that will let Ryegrass through. A sharp scrutiny is required to detect the presence of this impurity, but it may be recognised by its rolled-up appearance, and by the short awn that is attached.

*Weight per Bushel.*—On this point Dr. Stebler gives a table, showing results of an examination of four qualities of Ryegrass seed, and demonstrates that, while No. 4 quality was only one-third the price of No. 1, yet by making a calculation, founded on the purity and germinating power of each, the No. 4, or worst quality, was actually *eight times dearer* than the No. 1, or best. Something similar could be demonstrated of the seeds of almost all species of plants used in agriculture.

At Woburn, Pacey's Perennial, grown on a brown rich loam, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
At time of flowering . . . . .	3	9	3	15
Yielding hay . . . . .	1	10	1	1

A variety, called Russell's Perennial, gave of grass per acre—

	T.	cwts.	qrs.	lbs.
Under same conditions . . . . .	6	19	3	2

### Blue Melick Grass.

(*Melica cœrulea*, or *Molinia cœrulea*.)

As mention has been made of the seed of this grass being found as an impurity or adulterant in the seeds of other species, it becomes necessary to briefly allude to its leading characteristics.



Blue Melick  
Grass.

It is a perennial grass, frequent on moors and wet heaths; has a conspicuous purple flower, somewhat resembling a sprig of lavender. The roots are extraordinarily long and numerous.

JOHNSON says that it is eaten by sheep, but that cattle generally refuse it, or crop it only when compelled by hunger, or early in the spring before the flower stems shoot up. Its slender rigid stems have considerable elasticity, and in places where this grass is abundant they are employed to make brooms, mats, baskets, and even ropes.

SINCLAIR remarks upon the presence of this grass as indicating those deep peat soils which are adapted for the production of ash, alder, and willow.

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## Timothy Grass.

(*Phleum pratense.*)

Seed weighs 50 lbs. per bushel.

Standard of germination—some seedsmen guarantee 95 per cent.

Flowers third week in June, and ripens its seed end of July.

SINCLAIR says it is a most valuable grass for hay, but as the aftermath is inconsiderable, it should be combined with other species, whose produce consists chiefly of lattermath. It is remarkable for its weighty produce of culms, which are more nutritive than those of any other grass. It should always form a part of mixtures for permanent pasture or alternate husbandry.

Dr. PARNELL says it is a hard, coarse grass, not much liked either by horses, cows, goats, or sheep. It has been highly recommended for hay, as the stems—during the time the seeds are ripe—contain more nutritive matter than the stems of most other grasses.

CURTIS says it affects wet soils, and is very productive, but coarse and late. It has no excellence, that he could see, which Meadow Foxtail does not possess in an equal degree.

CHARLES JOHNSON says that where quantity rather than quality is an object in making hay, the Timothy is fully equal, if not indeed superior, in yield to Meadow Foxtail, but the hay is harsh and wiry. All of its better qualities are dependent on the depth and retentive character of the soil. On a moderately rich and tenacious soil it is a durable and nutritious grass, though too coarse to be generally liked by cattle, unless in the spring, when the early and abundant

foliage is often remarkable in those pastures in which it is plentifully distributed amongst the scanty verdure of the later grasses. Unless in very dry soils, it has a tendency to creep at the root and interfere with the growth of other grasses.

Mr. JAMES HUNTER says that, notwithstanding its coarse appearance, it is a grass of the highest nutritive value, and for productiveness stands in the very first rank. It produces an abundance of early herbage which may be cropped till a late period of the spring without injury to the haycrop. It attains greatest perfection on deep, moist, retentive soils—on dry soils it is of less value.

Dr. STEBLER reports that in Schleswig-Holstein, Mecklenburgh, and over large districts of the Northern States of America, it constitutes the chief part of the pastures, and from year to year its cultivation is becoming more general in Northern and Central Europe. It takes a high place for nutritive qualities, but to secure these in largest proportion it should be cut just as the flowers begin to make their appearance (about the end of June), as later on it develops woody fibre, and gives a coarse hard hay. Being deficient in albumen, it is advisable to use it in conjunction with other grasses in which that substance is prominent. It associates best with Red Clover and Alsike. When grown by itself, or in large proportion with clover, it is better to use it for soiling than to save it for hay, as it becomes hard in the saving. For permanent pasture mixtures the quantity used should never exceed 10 per cent. as it is not a lasting grass, and its herbage thins out after the third or fourth year. It resists the rigours of winter better than most other grasses, and it

is said that it suffocates and destroys moss. Another advantage about it is that its seed is easily saved, and is very cheap. Taking it all round it is an excellent grass.

Dr. VASEY in his Report on Grasses of the United States of America, says, "As a hay grass Timothy has no superior; for a pasture grass it gives out too early in July."

Mr. MARTIN J. SUTTON says that a substantial advantage about it is that it reaches the height of its produce the first year after being sown; but, unless properly fed, there is a tendency to weakness the third or fourth year. No other grass will bear extremes of heat and cold better than Timothy: all cattle eat it greedily, and horses manifest especial fondness for it. It produces a heavy hay crop, is exceedingly nutritious when young, and becomes still more so when old and the seed is formed. Still, *its hard wiry stems when dried can scarcely be called hay*; they may be very nutritious, but they will have to be cut into chaff before being given to the cattle. The crop is really mown to greatest advantage before the ears are out of their sheaths, having regard to the fineness of the hay and the aftermath.

Timothy should form a principal constituent for heavy soils, but mischief may be done by using it in excess. The herbage is coarse; the stalks soon become hard, and their increased feeding value in that state is of no avail if cattle refuse to graze them (as they undoubtedly do), or if the presence of this grass in abundance lowers the price of the hay. When seed is freely shed there is a danger that the plant will take almost exclusive possession of the land, especially on those formations that favour its growth; and once sown it is a very difficult grass to eradicate. Timothy is

not so suitable for sowing with clovers for alternate husbandry as other grasses on account of its late flowering; but with Cowgrass,\* which flowers considerably later than Broad-leaved Red, this difficulty does not arise, and perhaps it would be impossible to find two plants which could more suitably be sown together.

*Manures.*—Those of a nitrogeous nature appear to have a very marked effect in promoting the growth of this grass.

The Seed being cheap, there is little temptation to adulterate it. Besides, it is easy to detect adulteration or impurity, as there is no other seed which resembles it to any extent. Samples from which the silvery husk or covering has been separated should not be discarded or undervalued on that account, as it does not affect the germination. Some samples of Continental seed may be occasionally met with containing a very large proportion of weed seeds.

It is impossible not to notice these weed seeds, they are so different from the Timothy seed; so that people who buy such seed must do so either through most culpable carelessness, or actuated by a desire for a little extra gain in the retailing of it, as such samples, being discarded at once by the better class of merchants, can only find buyers by being offered at a price that will induce some people to take them up.

*At Woburn,* Timothy grass, grown on a clay loam, gave of grass—

	Tons.	cwts.	qrs.	lbs.
Cut when flowering . . . .	18	4	2	13
Which yielded hay . . . .	7	14	3	24

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\* What Mr. Sutton refers to is what is known in the trade as Single-cut Cow, or Late-flowering Red.

Further experiments showed that, in the grass cut when the seed was ripe, the loss in drying was smaller, and the nutritive matter was more than doubled; but this was fully counterbalanced by the deficiency of the aftermath.

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## THE MEADOW GRASSES.

### Rough-Stalked Meadow Grass.

(*Poa trivialis*.)

Extra good seed weighs up to 26 lb. per bushel.

Standard of germination, of H.M.'s Office of Works, 75 per cent.

Flowers third week in June, and ripens seed in the middle of July.

The roots fibrous, not stoloniferous; flowers acute, and connected by a web. Lower palea five-veined—the middle vein, only, having silky hairs, the marginal veins smooth.

SINCLAIR states that the superiority of this grass over others of its species—its high nutritive qualities, and the marked partiality which oxen, horses, and sheep have for it—distinguish it as one of the most valuable of those grasses which affect moist rich soils and sheltered situations. He further adds, that it is unprofitable for any purpose on dry, exposed situations, and advises its use exclusively for permanent pastures on rich soils and in sheltered positions. When combined with other grasses it gives almost double the produce that it would give if grown on the same soil by itself, which shows how beneficial shelter is to it.

CHARLES JOHNSON says it is certain that not any among our indigenous species are more generally liked by sheep and by cattle of all kinds. Its merits, however, have their limits, and a moist rich soil is essential to its development. On such soils no grass is better adapted for constituting a leading portion of both permanent and alternate pasture.

STILLINGFLEET makes mention of a meadow at Orcheston, near Salisbury, which produced enormous crops. CURTIS got pieces of its turf sent to him (cut from five different parts of the field) and planted same in his garden, when he found they contained the following grasses:—Rough-stalked Meadow grass in all five, Twitch grass in four, Meadow Foxtail in two, *Agrostis palustris* (Fiorin?) in two, and *Avena elatior* in one.

Dr. STEBLER reports that a humid climate and a strong rich soil suit it best, and that it is not absent from any good grass land of Central and Northern Europe. The first year it makes only lateral growth, pushing out stolons which lie along the ground, strike root, and—branching off in all directions—form a thick interlaced growth, which gives, however, only a spare yield. In the second year it makes a dense upright growth, so close and compact that the scythe has difficulty in cutting its way through it. Notwithstanding this vigorous growth, it gives, however, but a feeble second cutting. It is a very suitable grass for irrigation meadows. Being a shallow-rooting grass, it takes its principal supply of nutriment from the soil nearest the surface. It should be cut before the flowering season.

Mr. JAMES HUNTER says that Rough-stalked Meadow grass, compared with the Smooth-stalked ditto (*Poa pratensis*), is 25 per cent. more nutritious.

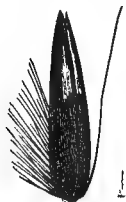
LAWSON'S *Agrostographia* says it is a valuable grass in a mixture for pasture land, particularly on damp soils, and where partly shaded by trees. It is well suited for irrigated meadows. Its creeping shoots begin to grow pretty early in spring, and, by lying prostrate on the ground, form a beautiful verdant sward. As the season becomes more advanced, however, these shoots are apt to get dried up by the effects of the sun, but they shoot out again towards the end of the season, and continue green during the greater part of winter.

MR. MARTIN J. SUTTON says that, valuable as this grass is for rich soils in very moist and sheltered situations, he does not consider that, for any other land, it is worth while to incur the cost of the seed, which, if true, is always extremely expensive. On strong moist soils it is now generally considered to be superior to *Poa pratensis*, but the favourable comparison does not extend to light land liable to burn. It is liable to injury by spring and autumn frosts, and by severe winters.

*Manures.*—It takes from the soil, according to Dr. Stebler, a large proportion of phosphoric acid and potash, and a heavy manuring in the autumn promotes the development of this grass. The Rothamsted experiments established that nitrate of soda, combined with mineral manures, has a marked effect on the development of this grass, while on the contrary ammonia salts diminished its growth. In this respect it differs altogether from Smooth-stalked Meadow grass.

*The Seed.*—The pure seed of this grass is very scarce in commerce, because it is seldom or never grown by itself for seed. Thus the bulk of what is offered and sold as Rough Meadow grass is in reality the seed of some of the other species of the *Poa* tribe, with, in the worst

cases, a fair sprinkling of the seeds of bad grasses and weeds (*Aira cœspitosa*, for instance). It takes a very close examination with a magnifying glass in most cases to distinguish the Rough-stalked Meadow grass from the



*Aira cœspitosa.*

seeds of the other *Poas*, some of the distinguishing features being obliterated in the process of cleaning. This is a serious difficulty in the path of the seedsman and farmer, for we can easily comprehend that to substitute one seed for another is to

defeat the ends of the agriculturist, and to impose on him not alone loss of time and of money, but the greater loss of that increase and return which the use of plants rightly suited to his soil and to the circumstances of his land would have brought him.

The following descriptions afford a few indications by which the seeds of the different meadow grasses may be distinguished from each other:—

*The seeds of Rough Meadow grass* incline to a bluish colour, are more deeply grooved in the interior than any of the others, is only slightly woolly at the base, and has hairs on the keel only. “It has a neat, slender, and tapering appearance” (*Hunter*).

*Smooth Meadow grass.*—The seeds of this are a little thicker than those of the other, are more of a brown colour, much more woolly, and have hairs, not alone on the keel, but on the marginal ribs also.

*Annual Meadow grass.*—The seeds of this are a little longer, more pointed, thinner, and of a lighter colour.



## Wood Meadow Grass.

(*Poa nemoralis*.)

Extra good seed weighs up to 23 lb. per bushel.

Standard of germination, of H.M.'s Office of Works, 75 per cent.

Root fibrous and not stoloniferous. Florets more or less webbed at the base. Lower palea 5-veined; the central and marginal veins silky; the web sometimes wanting.

Dr. PARNELL says it ranks amongst the superior permanent pasture grasses, producing a considerable deal of fine succulent and nutritious herbage, which horses, cows, and sheep are remarkably fond of. It will grow freely in exposed situations, but in its natural state is found only in shady places, or in woods on rich soil.

CHARLES JOHNSON says that this is a grass of variable habit, and that for agricultural purposes its value seems doubtful. In mountainous districts he never saw it eaten down by sheep, and deer generally leave it untouched in parks. Hares and rabbits devour the herbage, and game birds are fond of the seeds; hence it may be worth introduction in preserves where it does not grow spontaneously.

Mr. JAMES HUNTER says that its pleasant green colour and fine herbage adapt it for sowing in mixture with other fine-leaved grasses for lawns and pleasure-grounds; and when these are much shaded by trees, no other grass is so well suited to the purpose.

The Seed is often adulterated with the seeds of Hassock grass (*Aira cæspitosa*), a small shiny seed frequently figured in these pages.

## Smooth-Stalked Meadow Grass.

(*Poa pratensis.*)

(Known in America as *Blue Grass.*)

*Germination.*—According to Dr. Stebler, good seed should have 95 per cent. of pure seeds, and 50 per cent. of those should germinate.

The root is creeping; flowers acute, and more or less copiously webbed; the lower palea 5-veined; the intermediate veins, and sometimes the marginal ones, are liable to be obscure and inconspicuous; the middle and marginal veins are hairy.

CURTIS says it has a root which creeps like the Couch grass, and is almost as difficult to extirpate. It ought therefore to be cautiously introduced where the pasturage is not intended to be permanent. As it only throws up flower-stems once in a season (in May), it should be suitable for lawns and grass plots.

Dr. PARNELL says that, although it is called *Smooth-stalked Meadow grass*, this characteristic cannot always be depended on, as in some varieties of *Poa pratensis* the sheaths are occasionally roughish, while in *Poa trivialis* they are sometimes nearly smooth. It is an early grass, producing a large quantity of herbage which is liked by all cattle; but its creeping root is said to impoverish the soil, and it is therefore not recommended for cultivation.

SINCLAIR says it cannot justify its claim to a place in the composition of the best natural pastures, and on this account it should be carefully avoided as an unprofitable plant.

CHARLES JOHNSON says it produces abundant foliage, and at an earlier season than most of our other common meadow and pasture grasses, and—being a favourite food with cattle generally—might be considered one of the most valuable did not its creeping habit interfere with the growth of others equally luxuriant and better adapted for the promiscuous crop of the hayfield. Its habit of early flowering has this disadvantage—that its seeds are ripening while the other grasses are only in blossom, and if it is not cut before the seeds are ripe, a loss of more than one-fourth of its produce is sustained.

LAWSON'S *Agrostographia* says it is liable to be injured by the disease called "rust," and, from its growing in large patches, all the other grasses within its reach are destroyed.

Dr. STEBLER says it does not succeed on heavy stiff soils or on those that are very light and poor in vegetable matter. Gives but a small produce the first year, and only reaches its full development in the second or third season: *It does not agree well with clover in a mixture.* Is extensively cultivated in North America, notably in the State of Kentucky; and as it succeeds best in soils that are friable, mellow, and rich in humus, its presence is taken as an indication of good agricultural land. It will succeed fairly well on bog or fen land that has been well drained. Possessing a dense and spreading root, and having its underground stolons protected by the soil, it is able to withstand a considerable degree of heat or cold. It is an early grass and flowers from end of May to middle of June, according to situation of the ground. The produce of the aftermath is small. The plant may be distinguished from

*Poa trivialis* by its deeper colour, and by its sending out *underground* stolons; while those of the *Poa trivialis* creep along and root *on* the soil.

Dr. VASEY (of the U.S.A. Department of Agriculture) says that it forms, in all the middle portions of the United States, the principal constituent of pastures, though its excellence is said to be rather depreciated in the Eastern States. As illustrating the different estimates formed about this grass, Dr. Vasey mentions that it is very much in favour in southern Ohio, whilst in the north and north-eastern portions of that State it is considered a very unwelcome guest in the grass-lands. He adds that this difference of estimate is probably due to varieties, or to difference of soil and to treatment.

### Water Meadow Grass.

(*Poa aquatica*, Linn. *Glyceria aquatica*, Smith and others.)

Grows from 3 to 6 feet high. Root perennial, creeping. Leaves long, broad, and flat. Florets not webbed. From its large size and broad leaves cannot be mistaken for any of the other Poas.

CURTIS says that in flat countries which do not admit of being sufficiently drained, it is almost the only grass for hay and pasture.

Dr. PARNELL says that, grown in suitable places, it affords abundant crops of valuable winter fodder which cows and horses are fond of. Its nutritive matter is greatest at time of flowering. It flowers second week of July and ripens its seed about middle of August.

LAWSON'S *Agrostographia* describes it as growing naturally by the side of muddy pools, fresh-water lakes, and sluggish rivers; also on rich alluvial soils where

occasionally flooded. It is apt, by its rapid growth and creeping roots, to choke up ditches and small streams. It is one of the tallest and at same time most productive in herbage of all the British grasses.

CHARLES JOHNSON also refers to its tendency to choke up streams (and even slow rivers) by its roots, and thus to constitute a formidable obstacle to the improvement of the land by drainage.

Mr. MARTIN J. SUTTON says it is nutritious, and generally liked by cattle. In the Fen districts it forms a large part of the herbage, and yields abundant crops of hay. It may be included in permanent mixtures for undrained clay.

MORTON'S *Encyclopædia* says that this is *the most productive in herbage* of any of the British grasses, and it is astonishing that its cultivation should hitherto have been so little practised, seeing that it might be used advantageously both for the summer and winter feed of cattle. On the banks and small islands of the Thames, as well as in the fens of Cambridge, Lincolnshire, &c., it is generally mown twice in the year and dried in sheaves for hay (which improves by undergoing a slight heat in the rick). On lands intended for irrigation it may be sown at the rate of 4 to 6 lbs. per acre either in autumn or in spring.

*At Woburn*, grown on a strong tenacious clay, it gave at time of flowering—

	Tons.	cwts.	qrs.	lbs.
Grass, per acre . . . .	56	10	1	8
Yielding hay . . . .	33	18	0	21
Cut at the time of seed ripening, it				
gave of grass . . . .	54	13	3	12
Yielding hay . . . .	27	6	3	20

### Flat-Stemmed Meadow Grass.

(*Poa compressa*.)

Creeping-rooted; florets obtuse, the lower ones webbed. Lower palea with three hairy or silky veins.

CHARLES JOHNSON is inclined to believe that this is only a variety of *Poa pratensis*. Indeed, he believes the latter to be not alone the type but the origin of all the stoloniferous forms of the genus. He adds that it is said to be liked by cattle, and produces its foliage early in spring; but the yield is too scanty to prove of much service.

Dr. PARNELL says that, were it not for the small quantity of foliage this grass produces, it would rank as one of the most valuable, as it shoots its leaves early in spring, and possesses a large share of nutritive properties.

Dr. VASEY (of the U.S.A. Agricultural Department) says, "This grass has been sometimes confounded with *Poa pratensis*, from which it differs in its flattened, decumbent, wiry stems—its shorter leaves, and shorter, narrower, and more scanty panicle. Very contradictory accounts have been given as to its agricultural value—some denouncing it as worthless, and others entertaining a good opinion of it. It thrives well on clay, or hard-trodden and poor soils." One report says: "It is certain that cows fed upon it both in pasture and in hay give more milk and keep in better condition than when fed on any other grass. Horses fed on this hay will do as well as when fed on Timothy hay and oats combined."

These discrepant opinions may be due in part to having mistaken the *Poa pratensis* for this grass. It is probably a nutritious grass; but, from its spare yield, can hardly attain much favour for a hay crop.

### Annual Meadow Grass.

(*Poa annua.*)

Dr. PARNELL says it is one of the commonest of all our grasses—flowering throughout the whole summer, and growing on any kind of soil and in every situation. Produces an early herbage, which cattle are fond of, especially cows; but being an annual, and often destroyed by a continuance of dry weather, it is unprofitable to the farmer for cultivation.

The Seeds do not possess wool at base of the floret, and are never to be found suspended from the calyx, as may be observed with some of the other meadow grasses.

### Wood-Reed Meadow Grass.

(*Poa sylvatica*, or *Festuca calamaria.*)

Root perennial, creeping, tufted. Leaves broad, flat, and of a light green colour—roughish on both surfaces. Grows in damp shady woods of rich soil.

Dr. PARNELL says that its broad, tender leaves, which are produced in great abundance, and are much sought after by cows and horses, render this grass worthy of agricultural attention.

### Reflexed Meadow Grass.

(*Poa distans*, or *Glyceria distans.*)

This is only mentioned here because its seeds are sometimes used to adulterate the other meadow grasses. As a grass it is said to rank amongst the most inferior of the British grasses for agricultural purposes.

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### Millet.

(*Panicum miliaceum.*)

The Brown and Yellow Millet of Southern Europe and the *Cheena* of the Hindus.

Dr. VASEY says it has been cultivated in the United States to a limited extent for forage, and will thrive and ripen in the Northern as well as the Southern States.

CHARLES L. FLINT (another American authority) says: "Millet is one of the best crops we have for cutting and feeding green for soiling purposes, since its yield is large, its luxuriant leaves juicy and tender, and much relished by milch cows and other stock. For feeding to cattle it should be cut in the blossom, as, if allowed to ripen its seed, the stalk is no more nutritious than, probably, oat straw."

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### Reed Canary Grass.

(*Phalaris arundinacea.*)

Flowers second week of July, and ripens its seed about middle of August. Flower stems vary in height from 2 to 5 feet.

CHARLES JOHNSON reports that it creeps widely at the root, but, unlike many grasses of similar habit, tends to form dense tufts, which contribute greatly to the consolidation and support of the banks on which it grows. It is one of nature's pioneers; and, though exceedingly valuable in habitats of its own selection, is of small economical importance elsewhere. The herbage is too coarse and rigid to be liked by cattle generally.



Dr. PARNELL says it produces a large and early crop, and will bear cutting three times during the summer. From the coarseness of the foliage cattle are said not to be fond of it. It is best suited for tenacious clay soils, and grows naturally by the sides of rivers and standing pools.

Dr. STEBLER's opinion is that it is not at all suitable for pastures, but on wet soils it has considerable agricultural value, considering that in such situations it gives a large yield of vegetation which, if cut before the flowering period, is freely eaten by cattle, and is especially useful as forage for horses. It is not affected by extremes of temperature, nor by inundations; and, though growing to a considerable height, does not lodge. It receives no injury from the overshadowing of trees, &c., and when once established it never dies out. Its chemical composition is somewhat similar to that of maize. When young it has a sweetish taste, due to the sugar in its composition, but if not cut till after the flowering period its produce is only fit for litter. Owing to its extensive root-system, and numerous and vigorous underground stems, it is useful for consolidating the borders of rivers and lakes, and for rendering marshes and mosses more firm and accessible. It is sometimes used in mixture with Fiorin for moist land.

CURTIS says that where great quantity of produce is the object, he would recommend planting this and Tall Fescue in marshy ground.

SINCLAIR says that the superior nutritive matter which the striped Reed Canary Grass possesses recommend it to the notice of occupiers of tenacious clayey soils. The foliage cannot be considered coarse when compared with other grasses which afford a produce

equal in quantity. Dry straw is a much coarser food than the hay made from this.

MORTON'S *Encyclopædia* mentions the case of a Mr. Black, who cultivated it on the Home Farm of the Duke of Buccleuch at Dalkeith, and who had a high opinion of its merits, having invariably cut it earlier than Clover or Ryegrass in the spring, for feeding horses as well as shorthorns and Ayrshire dairy stock.

**The Seed.**—From 20 to 25 lbs. of its seed will be sufficient for an acre, but even half that quantity may be made to do, as the rapidly-spreading roots of the young plants will soon fill up all the interstices.

At *Woburn*, the variegated variety, grown on a strong tenacious clay, gave of grass per acre—

	Tons.	cwts.	qrs.	lbs.
Cut at the flowering period . . . . .	15	3	3	11
Yielding hay . . . . .	7	11	3	19

### Green Bristle Grass.

(*Setaria viridis*, or *Panicum viride*.)

An annual, flowering in July and until end of autumn.

CHARLES JOHNSON says it would be a valuable grass to sow in game-preserves and warrens, hares and rabbits feeding upon it with eagerness. It will flourish in the poorest and driest of light soils—indeed, in almost any medium (water and shifting sand excepted).

## CHAPTER IV.

## THE CLOVERS.

## Red Clover.

Seed weighs 64 lbs. per bushel.

Standard of germination, 90 per cent. (Some seedsmen guarantee 95 per cent.)

Dr. STEBLER says very justly that this plant has had a considerable influence on, and is of general interest in connection with, European civilisation. By greatly augmenting the supply of meat necessary for the support of human life it, indirectly, has been a source of energy by which science, industry, and commerce have received an immense development. For forage and house-feeding during the summer it is of more importance than any other forage plant,—although it does not succeed everywhere, and requires more attention and more skill than the majority of other forage plants. It can be depended to prosper only in well-prepared fertile soils, on which clover has not been grown for several years.

Of Red Clover there are two principal varieties, viz. :  
 (a) *Trifolium pratense* (Linn.), var. *perenne* :—otherwise (and perhaps more correctly) *Trifolium pratense*, var. *pratense* ;—(this variety is sometimes erroneously

confounded with one known commonly in Great Britain and Ireland under the name of Cowgrass)—and (b) *Trifolium pratense* (Linn.), var. *sativum*.

Though of the two varieties the latter is capable of the greatest development, yet the former is most durable; and, being endowed in a larger degree with capacity to adapt itself to variations of climate and of soil, a crop from it can be depended upon under conditions where the success of the latter would be doubtful. Nevertheless it is not always easy to distinguish one of those varieties from the other; and, if the two varieties are cultivated together in the same field for some years, they do not in the end present any points of difference, and become of equal value.

The values of Red Clovers derived from different countries vary a good deal.

*American Red*, which is largely imported of late years, gives a yield about equal to that of the average of European Reds, but is less robust than they, and consequently offers less resistance to the variations of temperature and of humidity. Some interesting observations made at Copenhagen showed that the severe winter of 1878-79 killed three plants of the American Clover for one of European parentage. In milder winters the American Clover does not appear to suffer in any greater degree than the others.

*English* and *Swiss Red* excel all others in regard to durability, size, and robustness of plant.

*Styrian* and *Silesian Red* rank next after English and Swiss in respect to the qualities mentioned.

*French Red* has neither the size nor robustness of the preceding, and is more delicate every way.

*Italian Red* is very early, and germinates well, but

exhausts itself quickly, and stands frost so badly that it often disappears the first winter.

Red Clover in a green state, and while in full flower, contains 80 per cent. of water, which is 10 per cent. more than what the grasses contain; and when the clover plant is made into hay the proportion of water is 16 per cent. During the process of haymaking (by the ordinary process of saving) clover loses a quantity of its leaves. Now the leaves constitute at least a fifth of the total produce; and, as they are at the same time the richest in nutritive matter of any part of the plant, it follows that the loss in question is very serious, amounting, as it sometimes does, to one-third of the feeding value.

The experience of all agriculturists goes to show that, in feeding with a view to the production of milk, clover in a green state has a decided advantage over an equivalent quantity of clover hay.

*Common Red or Broad Clover.*—Writing of this plant, Mr. Martin J. Sutton says that it is quite unsuited for permanent pastures, but should form a large proportion of an alternate mixture. The prejudice against foreign clover, especially that imported from America and France, is well founded.

*Soils.*—The Red Clover plant succeeds best in rich, deep soil, also on good clays, and on soils of an alluvial nature. Bog or marsh land does not suit it any more than soils of a dry, sandy, or arid, chalky class. Peaty soil is also unsuitable, unless it has been dressed with marl or lime. It especially delights in a well-mixed soil, rich in vegetable matter, and containing a moderate proportion of marl or chalk.

*Trifolium pratensis perenne*.—Under this head Mr. JAMES HUNTER says:—It is the variety of Red Clover usually found in old pastures; is more durable than the common Broad-leaved Red, and suits medium and heavy soils better than light ditto. Is of greater value for permanent pastures than the true Cowgrass (except on light soils) being more productive and nutritious.

Mr. MARTIN J. SUTTON states his belief that Perennial Red Clover originated in a cross between Common Red and the Zigzag Clover. The root of Perennial Red Clover reaches down into the subsoil, thus enabling it to obtain moisture and nourishment in the hottest weather, when Common Red gives up from drought. This penetrating habit also affords a means of sustenance to the plant on land which is too poor to grow the Common or Broad Red, and makes it desirable to increase the proportion of this seed for pastures on thin uplands. It does not begin to flower until at least ten days later than Broad Clover, and its more robust and solid stems remain succulent and eatable by stock long after Broad Clover has become pithy and withered. It fills up the gap between the first and second cuttings of Broad Clover, coming into use at a time when there is no other available green food for the horses of the farm; but it rarely gives a second crop of any consequence. It produces comparatively little seed from its single crop (it is sometimes called "Single-cut Cowgrass"), and the seed of it is consequently high in price, and is rarely obtainable except from those who make its culture a study. *It is an invaluable plant for permanent pasture.* Its presence in a pasture at mid-summer, when Alsike is giving up, is of greatest service, and, although it does not produce a good crop

for the scythe, it yields a quantity of excellent feed.

*Cowgrass, in Berks, Oxon, Hants, and a few other Counties,* means a Perennial variety giving only one cutting per annum, coming into bloom fourteen or twenty-one days after other Red and having a solid stem (though this peculiarity is not invariable). Grown for seed it gives on an average three cwts. per acre.

*Single-cut Cowgrass.*—One grower says it produces very large crop on good land. He has had it so luxurious as to measure five feet long, but in such cases it exhausts itself in one season.

Dr. MASTERS, F.R.S., thinks English Red and Single-cut Cowgrass are same species, *i.e.*, both might have been developed from the same stock,—but, as to *Trifolium medium* he does not believe it could have sprung from the same stock. (See “Improvements of the Plants of the Farm,” *Journal of Royal Agricultural Society of England*, vol. xx.)

Mr. JAMES HUNTER thinks Single-cut Cowgrass only a variety of Red Clover, which flowers about three weeks later than the common species, and would be more correctly named Late-flowering Red Clover.

### **Trifolium medium.**

(*Marl-Clover* or *Cowgrass*, sometimes called *Zigzag Clover*.)

This is the true Cowgrass of Botany, but does not exist in the trade. It is not cultivated, and only found in a wild state and in botanical collections. Has zigzag stems, and the flower-heads are usually two inches distant from the uppermost set of leaves. As pointed

out above, Dr. Masters thinks it could not have been developed from same stock as Red Clover.

Mr. CARRUTHERS, F.R.S., says it is not in commerce. Its roots are creeping, and the stem takes a fresh turn at every leaf, which gives it a zigzag appearance. Its produce is said to be less than that of Red Clover; and though it may not be equal value in alternate husbandry, yet it is perhaps a more important ingredient in permanent pasture than Common Red.

*For the production of Seed* it is best to cultivate clover in a light and dry soil than in one that is moist or strong. In the latter the plant is liable to shed its seed, and carries, besides, a larger number of barren flowers. The seed is usually taken from the second crop, as the luxuriance of the first crop renders it more likely to shed its seed. Also a number of objectionable plants usually grow up with the first crop, and their seeds get mixed with the clover seed.

*The Weed Seeds* most commonly found in Red Clover seeds are those of the Ribgrass, but this is quite easily distinguished. Sometimes Dock seeds are found, also those of the Clover Dodder. The latter is a most destructive parasitical plant, the seeds of which are very difficult to detect, being so small and of an earthy brown colour, resembling minute pieces of soil. In season 1877-78 the seed-testing station in Switzerland found that 46 per cent. of the samples of Red Clover submitted to them had more or less of Dodder. Year by year, however, the percentage of samples containing Dodder is growing smaller; still it must be remembered that it is only the better class of seeds that finds its way to the seed-testing station. Those who have



inferior samples to vend take care to keep them out of the reach of testing stations. The Clover Dodder (*Cuscuta trifolii*) is the most terrible enemy of the clover plant. It is sown with the seed, and develops simultaneously; it winds its hair-like stems round the clover plant (as explained in an earlier chapter of this work), and fixes itself on to it by means of suckers, which extract the sap from the clover plant. The roots, which the Dodder possesses in the early stages of its growth, wither after a while, and then the parasite is altogether dependent on the sap it draws from the clover plant, in consequence of which the latter wastes and perishes.

*Clover Sickness.*—The phenomenon called Clover Sickness arises, according to Liebig, from the deficiency of mineral matter in the subsoil, which opinion is sustained by Kutzleb, whose experiments have demonstrated that it is brought about by the want of a sufficient proportion of potash in a soluble state in the subsoil. On soils which, by their composition, are not suitable to the culture of this plant, it should not be planted at shorter intervals than from nine to twelve years—if a satisfactory crop is to be expected. Experience has also proved that Red Clover is more likely to fail when it succeeds a plant of the same family, such as the Pea, Bean, Vetch, *Trifolium incarnatum*, &c. &c.

*Manuring.*—At Rothamsted ammonia salts had the effect of eliminating this plant from the various plots to which they were applied, whether in conjunction with mineral manures or alone. Nitrate of soda also diminished the growth.

### Alsike Clover.

(*Trifolium hybridum.*)

Weight per bushel, 65 lbs.

Standard of germination, 95 per cent.

Mr. M. J. SUTTON says of this clover that it flourishes on the same deep moist soil as Timothy, and makes an excellent companion to that grass; but it is equally suitable with Tall Oatgrass, Italian Ryegrass, and Cocksfoot. For meadows it is far superior to White Clover, as it produces a crop tall enough for the scythe, and materially adds to the total weight of hay. It also produces more keep, and is better relished than White Clover.

Mr. HUNTER sums it up as follows:—It grows as tall as Red, and produces abundant crops. Nutritive value almost equal to Red, and grows on some soils where Red will not succeed.

Dr. STEBLER'S opinion is that Alsike lasts longer than Red Clover. Its average duration is three years, but it has been known to give a fair return for five years, and in meadows—where sown with other grasses—endures even longer. It can be cultivated on soils where other Clovers do not succeed, and gives an abundant produce of such chemical composition as shows it to be a forage plant of first-class quality. The fact of its having been for a long time cultivated in the north of Europe shows that it is capable of resisting cold well. It suffers little from late frosts; and humidity—instead of being injurious—is, on the contrary, advantageous to it. It is the only species of Clover that succeeds

under irrigation, and it will grow on clover-sick land—if same has been well manured and is in good condition. On the other hand, it is not well qualified to resist long drought, as its roots do not go deep. It is more leafy than Red Clover; and also, as it contains a little more water in its composition, it is more difficult to make into hay. It is at the flowering season that it presents the largest proportion of nutritive elements, and that period is therefore the most suitable for cropping it.

On account of the slightly bitter taste of Alsike, it is not eaten so readily as White Clover is; but its feeding value, according to chemical analysis, is fully equal to that of White. Its yield is larger and of better quality when sown in mixture with other plants than when used alone, as the other grasses support the clover plant and prevent it shedding its leaves. The best grasses for mixing with Alsike, named in the order of their merit, are Timothy, Cocksfoot, English Ryegrass, Tall Oatgrass, and Italian Ryegrass. Those who have been in the habit of sowing Red Clover by itself should try instead a mixture of 50 per cent. Red, 25 per cent. Alsike, and 25 per cent. Timothy.

*Soils.*—Alsike can be cultivated on the strongest clay soils—even where the subsoil is impermeable—as well as on peaty soil, and on ground so moist that other clovers will not grow there—provided always that such soils do not retain too much water.

*The Seed.*—In the Alsike seed of commerce many samples contain a number of weed seeds of different varieties, and sometimes an admixture of Trefoil seed. Of the weed seeds, the worst are Clover Dodder and Ribgrass.

Alsike Clover seed is sometimes uncertain as regards germination. The appearance of the seed is very little guide towards enabling us to guess what faculty of germination resides in it. It may have a beautiful fresh colour, yet be under-ripe; or be of a dark glossy green, and yet be over-ripe and hard. In both cases the germinating power would be feeble. It follows from this that retail seed-merchants should make a point of ascertaining the percentage of growth of samples of Alsike submitted to them.

[There is a species of clover, very similar to Alsike, called *Trifolium elegans*, which, according to Dr. Stebler, sometimes grows amongst Alsike, and has been known to produce a peculiar disorder in horses that have eaten of it. Whether it produces the same, or any, injurious effect on horned cattle has not been as yet ascertained.]

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### White or Dutch Clover.

(*Trifolium repens*.)

Weight per bushel, 65 lbs.

Standard of germination, 95 per cent.

Dr. STEBLER gives it as his opinion that this species is indispensable for low-lying pastures. Compared with Red Clover its produce is not so large, but it is richer in nutritive matter. It will succeed in land of inferior value; it is not injured by grazing, and is less sensitive to atmospheric influences. It is regarded as a valuable bottom plant in pastures, but in certain soils it becomes excessively luxuriant and smothers the other plants with its creeping stems and thick foliage; in such cases

it is so hurtful as to almost deserve to be characterised as a weed. Although its fibrous roots extend but little below the surface, yet it is enabled to stand drought well by the aid of the principal root of the parent stem, which penetrates deeply and keeps up the supply of sap in times of drought.

Wet seasons favour the development of this plant; and, in general, a climate that is warm and humid is best suited to its nature. It succeeds well even on drained bog or marsh land.

Mr. M. J. SUTTON says it does better in poor land than Red Clover; all cattle eat it with relish, but it is less useful for the production of milk than of flesh—and is of special service in fattening sheep. In early spring it produces very little food, and the plant is so dwarf that it is practically useless for cutting—so that Alsike should take its place for a crop of hay.

*Manuring.*—In the list of mineral matter, which White Clover extracts from the soil, potash and lime are the most prominent. The application of ammonia salts alone reduces the plant to insignificant proportions, and nitrate of soda is little better in its effects. Both these result in a smaller growth of White Clover than when the land is left unmanured. Mineral manures—potash especially, with a small quantity of nitrate—considerably augment its growth; so also do dressings of marl or vegetable ash.

It has often been observed that, when land has been suitably top-dressed, a vigorous growth of White Clover has made its appearance where none had been previously perceived. In such cases its roots and creeping stems have lain almost dormant in the soil, and escaped notice until re-invigorated by the manurial stimulus.

The application of *liquid manure* is especially effective in increasing the growth of White Clover. Not only does it yield to the plants already in existence such nourishing properties as are exactly suitable, but it also conveys to the land a considerable number of White Clover *seeds* which have passed uninjured through the digestive organs of the cattle. An examination of the dry residue taken from the bottom of a liquid-manure tank showed that about 2 lbs. of such residue contained no fewer than 11,816 seeds (or about one-fourth of an ounce) of White Clover seeds, of which 62 per cent. were capable of germinating.<sup>1</sup>

**The Seed.**—There is a great deal of inferior White Clover seed in the market. Buyers do not appear generally to take so much interest in the appearance and quality of White Clover as they do with Reds, consequently the quantity of old, brown, withered seed that finds a market somewhere is far larger than one would wish who had the interests of agriculture at heart. Very few samples are entirely free from sorrel, while a good proportion of samples contain the seeds of that weed in strong proportion. Sorrel in the husk is of a brown, earthy colour; and, shelled, it is a small triangular seed that glistens: in either state it is easily recognised, and samples containing it should be promptly rejected. Another weed-seed that appears prominently in many samples of White Clover is Ribgrass. This is not quite so objectionable. Yet one does not want to pay the price of White Clover for Ribgrass seed—the latter being worth commercially only about one-tenth the price of White Clover. The seeds of Corn Chamomile are also found in many samples of White Clover; but it is stated that a little of this plant may be of advantage

in a pasture or meadow on account of its aromatic properties. Amongst the other impurities, which are objectionable in a minor degree only, may be enumerated the seeds of Suckling Clover, Haresfoot Clover, Trefoil, and Yellow Clover.

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### Common Yellow Clover or Trefoil.

(*Medicago Lupulina.*)

Weight per bushel, 64 lbs.

Standard of germination, 95 per cent.

The *Agrostographia* of LAWSON says that this is a fibrous-rooted biennial or sub-perennial. Grows in dry pastures. Although its produce is bulky, cattle are not generally fond of it either in a green or dry state.

Mr. M. J. SUTTON says Trefoil starts so early in spring as to give a bite before any other clover, and it flowers ten or fifteen days in advance of the Red variety. Chemical analysis shows the herbage to be nutritious. It grows compactly and helps to make a good bottom to a pasture, but its procumbent habit of growth prevents it from having much value for the scythe, and there is no aftermath worth speaking of.

Trefoil is seldom sown alone, but frequently in company with White Clover. The following combine well with Trefoil in affording early and valuable herbage, viz., Foxtail, Sweet-Vernal,—and *Poa pratensis*.

Dr. STEBLER'S opinion is that Trefoil should never be sown by itself, and only in mixture intended for a period not longer than two years. Whilst it is not very productive nor very durable, it is nevertheless very

useful for certain soils in which Red Clover would not succeed. It should, however, be confined to such soils, even though it is true that in regard to nutritive matter it takes a higher place than Red Clover. It is more adapted for grazing purposes than Red Clover is, but is not so well suited for madowing, as its stems lie close to the ground and escape the scythe. Its roots do not go deep, but confine themselves to the top spit of the soil, therefore the nature of the subsoil is not of much importance where this plant is concerned. Although possessing a slightly bitter taste, it seems to be eaten with relish by cattle, and it is said that it imparts a nutty flavour and a rich yellow colour to the butter. Nevertheless the balance of evidence is against employing it in pastures on good land, particularly as—owing to its overshadowing and partly creeping habit—it stifles better plants than itself.

*Manures.*—A dressing of fresh manure does not serve Trefoil, but an application of certain artificial fertilisers, particularly those with a large proportion of potash or of phosphoric acid, causes a surprising development, even in cases where the plant was previously struggling for existence.

The Seed comes to hand generally more free from impurities than that of any other sort. This can be accounted for partly on the ground that the Trefoil plant smothers all other vegetation, and its seeds can therefore be gathered pure,—and partly because it is so cheap that it is not worth while adulterating it. Trefoil seed possesses great vitality, and will grow a fair percentage even though several years old.



## CHAPTER V.

### OTHER FORAGE PLANTS.

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#### Lucern.

(*Medicago sativa.*)

Weight per bushel, 64 lbs.

STANDARD of germination—a good average seed should have 98 per cent. of pure seeds, of which 90 per cent. should be capable of germinating.

Height about three feet. Flowers in June or July. Root perennial, thick, branching, and penetrates very deep into the subsoil—sometimes ten or twelve feet.

A writer in a recent number of the *Agricultural Gazette* says that Lucern will grow almost anywhere if there is a depth of soil; but it requires a fine tilth and a very gentle covering. Once successful, it may be maintained for years with fair manuring and with very little labour in hoeing. It is one of the most advantageous grasses that we have. It yielded an immense crop at the beginning of the summer, and might have been cut a second time three weeks ago (letter dated 30th July), when it was fully ready and almost three feet high, but is being given to cattle, thus maintaining their milk and their condition at same time.

MORTON'S *Encyclopædia* says that nothing is so fatal

to Lucern as to allow sheep to graze it, as they mutilate the crowns of the plant to such extent as to render the plantation useless. Ten lbs. of seed is enough when sown in drills with the rows, as they ought to be, at least twelve inches apart. The quantity must differ essentially according to the distance of the drills, and it must be the highest where the broadcast system is adopted. This writer says that between May and November he mowed over the entire breadth four times at least, and found no subsequent treatment required beyond hoeing or pecking between the rows to keep under the grass and weeds. Roots thirteen feet long have been measured by the side of a sand-pit.

*American authorities* say that in California (especially in the southern part of the state) Lucern—under the name of Alfalfa—is cultivated largely for hay, and large crops are made by irrigation. It succeeds well in Montana. In some parts of Utah scarcely anything else in the way of forage plant is cultivated. Same may be said of New Mexico. Also is cultivated largely in Texas, and does very well.

Dr. STEBLER'S opinion is, that when green, and cut before the flowering stage, Lucern gives a forage of the best quality—in fact, more nutritious than Red Clover of average quality. It is first-rate for milch cows; and is so rich in albumen or flesh-forming materials that it answers well for mixing with fodder which is poorer in that substance—for instance, with chopped straw, &c. It does well only on a free, deep, mellow soil which has been cleared of weeds, and suits to follow after a potato or root crop. It is sown at end of April or early in May, when no further fear of damage from late frosts. Some people mix Red Clover with the Lucern,

but Dr. Stebler does not approve of that, as the clover hinders the development of the Lucern, and after two or three years—when the clover disappears—a large number of blank spaces are left in the field. In good land it comes to its full development in the second year. It commences to make growth at end of April, and gives good cuttings before, during, and after the Red Clover. At the end of from five to seven years the yield begins to diminish, and it then becomes advisable to break up the plantation at any time from thenceforward—although in some favourable situations it may be found growing on same soil from ten to twenty years, and even longer. As its roots go very deep, it can stand drought better than any other of the leguminous plants, but *it is not suitable for climates of excessive humidity*. Owing to its deep-rooting habit, it is the nature of the subsoil that has the most importance for this plant. It wants a subsoil that its roots can permeate. Those of a calcareous or marly nature suit it best, but clay land with a compact subsoil does not suit it at all; neither does land that contains an excess of moisture. The deeper the subsoil the better does Lucern succeed.

*Manuring.*—It is not recommended to dress the land with farm-yard manure just before sowing Lucern, as this favours the growth of weeds, which become very injurious to the young plants. If the latter are slow in developing, it will be found advantageous to apply a dressing of nitrate of soda. The ash of Lucern contains large proportions of potash, lime, and magnesia.

The Seed of commerce is found sometimes to contain grains of Dodder. In view of the great injury this vile parasite causes the crops of Lucern (and of clover), it

is of the utmost importance that buyers should always look for a guarantee that the seed they buy is free from Dodder. It is also stated that the seeds of Trefoil (Common Yellow Clover), as well as the seeds of two or three other more or less useless annual varieties of the *Medicago* family, are used for adulterating *M. sativa*.

According to M. VILLE, Lucern takes from between 250 lbs. to 350 lbs. of nitrogen per acre from the air, which would be a sufficient supply for four times as large an area under wheat.

Sir JOHN B. LAWES, however, in commenting on this point, is not sure that this nitrogen is not derived *from the subsoil*. There is (July 1886) a field of Lucern at Rothamsted which is seven years old, and yields from 250 lbs. to 350 lbs. of nitrogen per annum; but the roots of the Lucern have been followed into the chalk, some eight or nine feet below the surface. [The land had received mineral manure, but none of nitrogenous for thirty years.]

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### Goat's Rue.

(*Galega officinalis*.)

A leguminous plant, growing from two to five feet high, well furnished with foliage.

Messrs. CARTER & Co., who took an interest in recommending the culture of this as a forage plant, say of it, that its perennial habit and robust growth are points worth attention, as seeming to imply abundance of forage with little labour. It is also useful for green-manuring, as it contains much nitrogen. It stands drought re-

markably well. It has been successfully used as a forage plant in the South of France, where its only drawback, viz., a certain peculiarity of flavour, has been overcome by perseverance in the tuition of the stock.

From April till June is the time to sow, at the rate of 24 lbs. to 30 lbs. per acre, broadcast.

*Another authority* says it is an excellent forage plant for warm sheltered situations, and succeeds in such places on dry and even poor soil, provided it has depth, and that the subsoil is free from moisture. Its long root enables it to resist drought well, and as it draws its support mostly from the subsoil, it can be grown on the warmest soil. It possesses a similar temperament to that of the Lucern, but does not require the same manurial dressings, and, on that account, is found on the Continent a very useful and durable plant in sheltered places amongst mountains, to which manure could not be carried. It is most generally used as a green forage, as it is difficult to dry and save. It gives two cuttings even in the first year, if sown in the spring. [A sowing made the 4th of May was in flower the 21st of July.] The second cutting is almost as large as the first, and it makes its second growth quicker than Sanfoin, but not so quickly as Lucern. It should be cut when the leading branches are beginning to flower, as, up to the flowering period, the plant remains soft and succulent, but afterwards becomes hard, and is not voluntarily eaten by cattle.

It should be sown in spring without a crop, and without mixture with any other seed. It is best to plant it in lines, so that the ground around the plants can be kept clear of weeds.

*Analysis* shows that the Galega furnishes a very nutritious forage. It is rich in albumen, showing 3 per cent. more of it than either Sanfoin or Red Clover.

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## Prickly Comfrey.

(*Symphytum asperrimum.*)

Caucasian Prickly Comfrey is a distinct plant from the Common Comfrey (*S. officinale*). Sutton's *Farmer's Year-Book* says:—This forage plant is rapidly increasing in favour, and although we do not agree with all that has been said in its praise, yet we believe the plant to be valuable for giving a supply of green food in hot and dry seasons. The long roots, which penetrate a great distance into the ground, enable it to obtain moisture which lies beyond the reach of ordinary plants. Prickly Comfrey will succeed in almost any soil, but is especially valuable on soils of a dry or sandy nature. It is very hardy, gives an early cutting, supplies a constant succession of green food, and is permanent. The plant is cultivated by dividing the roots, and spring and autumn are the best seasons for the operation. Instead of 24 or 30 inches each way, we recommend from 16 to 18 inches only as the most profitable distance. The roots should be covered with about  $1\frac{1}{2}$  or 2 inches of soil. It is very important to keep the ground clean and free from weeds. The cutting should commence early, and be frequently repeated, that the plant may not run very much. It must certainly be done before the bloom appears, for the leaves are most relished when in a young state. As many as five heavy cuttings, each 20 tons per acre, or 100 tons per acre, in one season have

been obtained by good management. We recommend Prickly Comfrey especially for small occupations, as few crops can be more easily grown or prove so useful to those whose live stock consists of a horse, cow, and a few pigs.

Mr. PHILLIPS, a recognised authority on Comfrey, says:—It may be planted all the year round, excepting when the ground is frost-bound. The sets planted early in autumn almost save a season, as they become somewhat established before winter, and form crowns for the next season; those planted in spring and summer rush into immediate productiveness. All kinds of land suit Comfrey, but it thrives best in rich moist loam, with plenty of manure, especially liquid manure; it loves warmth and moisture. Dig or plough the land to a fair depth (if double-dug or subsoiled all the better), working in a heavy dressing of manure. If you give Comfrey a double dressing of manure you will have a double crop, and only one rent to pay; on poor land, where manure is scarce, you will get a greater crop of Comfrey than of anything else you can grow; and when once planted it is there for ever, only requiring a heavy dressing of manure to be dug in every season. As one or two Comfrey-growers seem to have had a little difficulty in getting their stock to eat it, it may be well to state that, in feeding it to stock for the first time, only a little should be given, and not that till it has been allowed to stand for a few hours after cutting, so as to allow the prickles on the under surface of the leaves and along the stalks to wither slightly; or the young leaves only may be given at first.

Sets can be obtained for 10s. per thousand. About 5000 sets will plant an acre if planted a yard apart each way.

Mr. ROCHFORD, of Nenagh, Ireland, says :—It has now been planted in about twenty places in the Nenagh district, and there is sufficient evidence to prove beyond a shadow of doubt its great value as food for dairy cows and stores, for horses, sheep, and pigs. It can be used early in May, thus saving other expensive food, and the last crop of the season comes in during September, and is available up to the middle of October. There is no difficulty in preventing it from spreading beyond the area on which it is planted if proper means are taken, but it is very difficult to get it out of land in which it has been planted.

The two English varieties of Comfrey may be distinguished from the Caucasian by the colour of the blossoms. The English varieties have flowers of a yellowish white tinged with green, and occasionally pale purple flowers will be found on the same stalk with the greenish ones. The Caucasian flowers, on the other hand, are all purple.

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### Serradella.

(*Ornithorpus sativa.*)

An annual plant frequently cultivated in Northern Germany. It is there considered one of the most important plants for good light soils. Its nutritive value is considered equal to that of Red Clover, while its produce is larger. It gives good results, except on land that is too heavy or too poor. On very light land it is considered best to sow it with Hard Fescue. Cattle like its produce either as hay or green fodder. It is usually sown in spring—from middle of March



to middle of April—sometimes alone and sometimes in a corn crop (Oats or Rye), and furnishes after the removal of the corn crop a good cutting or pasturage. The quantity of seed required is about equivalent to 30 lbs. per English acre.

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### **Anthyllis Vulneraria.**

A forage plant much used in Northern Germany for soils too light for Red Clover. It is cultivated both for mowing and grazing—does not stand more than one year's mowing, but in a pasture will continue for three or four seasons. In summer it fills the gap in the fodder-supply between the first and second cutting of Red Clover. As a resister of drought it will compare even with Sheep's Fescue, but on arid soils its leaves become somewhat woolly. It is a very hardy plant, resisting the heat of summer as well as the cold of winter. As it is almost insensible to atmospheric influences, it is of very rare occurrence for it to fail, and then it gives a sure, though not a large, return. It is not recommended for land that will grow clover, but is very useful for soils on which clover does not succeed, and where Serradella or Yellow Lupins give but a feeble and uncertain return. Horses do not care for it; but sheep, goats, and horned cattle eat it greedily. If one wishes to have two cuttings in the season, it is necessary to take the first before the flowering stage; but if only one cutting is wanted, and the second crop to be fed off, it is best to cut it when in full flower, so that the second growth

may consist of leaves without flower-stems. The proportion of nutritive matter in cured Anthyllis is larger than in clover hay of average quality.

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### Gorse, Whin or Furze.

(*Ulex Europæus.*)

Standard of germination, 70 per cent.

MORTON'S *Cyclopædia* says it is a nuisance or weed in our hilly pastures when allowed to attain the size of a bush; but considered most valuable forage, and extensively collected or cultivated as such, in Brittany and other provinces of the West of France, and well worthy of attention in our own western counties.

From dry sandy soils, where Turnip husbandry is unadvisable, a large quantity of useful fodder may be procured by the cultivation of this plant; but, excepting where climate, or the steepness of the land, or the expense of any attempt to improve the soil, forbid the adoption of the alternate husbandry, its cultivation does not offer any advantages sufficient to warrant its adoption. In North Wales and in many parts of Ireland the horses of the farm are maintained upon it almost wholly during the winter months, receiving about 40 lbs. daily each of the crushed two-year-old shoots. It has also been found useful for dairy cows, along with hay, during the winter and spring months; and as for sheep, the experience of many a northern flockmaster can testify to the merits of Gorse as food.

It may be sown from February to May, in drills

1 foot apart, with or without a light corn crop. Sow 20 lbs. of seed per acre for cover, or 25 lbs. for forage. It is better to sow in drills than broadcast, as the weeds can be got at more easily under the drill husbandry. In the second autumn after the sowing—having been cleaned at intervals during both summers—the crop will have attained a growth rendering it worth cutting.

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### Mustard.

(*Sinapis.*)

This is one of those coarse, quick-growing plants with wide-spreading leaves which obtain a very considerable portion of their nourishment from the atmosphere; hence it may be considered an ameliorating crop, giving back to the soil more than it takes from it. Ordinarily it is of trifling value as forage; but the failure of other plants may make it valuable for this purpose, and at anyrate it assists in the preparation for grain crops. It may be sown with some advantage for autumn feed, or it may be taken as a second crop after Vetches, early Pease, &c., when—from the season being too far advanced—it is impossible to grow anything of greater value.

The White Mustard (*Sinapis alba*) is the variety grown for the purpose of forage or green-manuring. If sown or drilled at rate of one to two pecks per acre in last week of July or in August in a tolerably favourable season, it will be fit for ploughing-in or folding-off in two months from time of sowing. Sheep are generally

healthy when feeding upon it, but make little progress if kept to it alone. The experience of heavy-land farmers in Suffolk is in favour of sowing about a peck of White Mustard on the long fallows in August or early in September, and ploughing-in the herbage about six or eight weeks from time of sowing. The effect upon the Barley crop is considered by practical farmers as equal to half a coat of farm-yard dung. (Abridged from Morton's *Encyclopædia*.)

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### Crimson Clover.

(*Trifolium incarnatum*.)

This extremely useful forage plant is pretty extensively grown in England, particularly in the southern counties, where it is sown on stubbles immediately after removal of the corn crop. Is also sometimes sown on bare patches of spring-sown clover. May be sown up to the middle of September, or might even do well up to October; but that would in a great measure depend on the kind of winter following the sowing.

*Treatment*.—According to a writer in Morton's *Encyclopædia*, the only requisite preparation of the land is a course of harrowing; just sufficient to stir the surface soil so as merely to facilitate the covering of the seed. On very stiff soils shallow ploughing is sometimes resorted to; but as a general rule the young plants stand the winter, and thrive best, when the soil is left in an unloosened state. When so treated the Crimson Clover forms excellent feeding for horses and cattle in

the early part of the following season; or it may be finally cut in June for hay, in time for late Turnip-sowing, or for fallowing the land preparatory to Wheat or other crop.

*Soils.*—It does well on a variety of soils; but a moderately stiff deep soil suits it admirably, and if at all disposed to be loamy all the better.

*Seed required.*—If sown broadcast and alone, an acre will require from 18 lbs. to 24 lbs. of seed; sown in mixture with Italian Rye-grass, the allowance is 16 lbs. clover to one bushel Italian. If sown in drills, at from eight inches to a foot apart, about 12 lbs. seed will be required.

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### Common Vetch or Tare.

(*Vicia sativa.*)

Is a well-known forage plant of the leguminous family, and is universally cultivated over Europe and a great part of Asia. There are several varieties known, the most important of which are the winter Vetch and the spring Vetch, differing more in their physical constitution adapting them to these different seasons, than by any tangible external characters. They are supposed to have acquired their different habits of growth and ripening simply by having been sown respectively in spring and autumn.

Tares form a most valuable green crop, and will grow in almost any soil; but the best soils for their growth (according to Morton) are clayey loams. On poor clays it is customary to sow considerable breadths, either

feeding them off with sheep, or mowing for summer-soiling in foldyards; this course being an admirable preparation of the land for wheat. Green Tares, according to chemical analysis, are about equal in nutritive value to the better sorts of clover. As live stock of all sorts are very fond of this green food, there is a danger of colic being produced from overloaded stomachs; consequently, when Tares have grown too succulent or are overcharged with moisture, they should be mown some hours before being given to the animals—or mixed with straw and hay, or passed with these dry foods through the chaff-cutter.

*When intended for hay*, Tares should be left standing until the flowers have for the most part given way to the pods, and some of the seeds become well formed. The crop is then ready for the scythe. When well saved it forms excellent fodder, surpassing meadow hay in nutritive power; but, if saturated with rain, becomes injured more than other grasses. The produce may yield about three tons of hay per acre, but is commonly coarse in quality.

*Time of sowing*—for winter Tares is from the beginning of October to middle of November; for summer Tares, from the beginning of March to the end of June, according to the purposes for which they are intended. For spring sowing use three bushels Tares and one bushel Oats, and for winter sowing three bushels Tares and one bushel Rye.

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## Common Rye.

(*Secale cereale.*)

MORTON'S *Encyclopædia* says that Rye is extensively and increasingly cultivated as a forage crop for early spring feeding. Cultivated as a grain crop it is an exhauster of the soil, but when fed off green the crop improves and ameliorates. As a green crop it follows wheat, and is itself succeeded by a late crop of turnips. For a green crop, the rule is to sow as thickly as possible—namely, from three to four bushels—sometimes drilled, but more generally broadcast.

The chief use of Rye as a forage crop is to supply food for sheep and lambs in the spring, in the interval that elapses after the turnips are consumed. This Rye is sown on the root-fallow, and is followed by white turnips. Rye is peculiarly suited for animals giving milk, as ewes and milch cows; to the latter it may be given with the addition of straw chaff. As a soiling crop its chief advantage is its earliness. When in a forward state it is mown for horses; but the best method of applying it is by being cut into chaff with a mixture of straw and hay, increasing the proportion of green to dry fodder as the season advances. Green Rye, from its laxative nature, requires this addition; and this application is useful as supplying a gradual change from the dry food of winter to the green food of summer.

From the toughness and pithy nature of Rye straw it is little liked by cattle, and is of slight use as fodder. It is probably, however, the most nutritious of any, as

containing a less proportion of silica and more organic matter. Cut into chaff, steamed, and given with a proportion of linseed, it would perhaps become more palatable to stock.

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### Common Sanfoin.

(*Onobrychis sativa.*)

Standard of purity, according to Dr. Stebler, should be 98 per cent., and of germinating faculty 80 per cent.

The root is perennial, somewhat woody, and penetrates to a considerable depth. The stems nearly upright, and height two to three feet; flowers from June to August. Is considered the most important leguminous herbage and forage plant in the calcareous districts of France and England, and particularly on the poor, dry, thin chalky hills and downs in the South of England. The usual period of duration of Sanfoin in a profitable state is from eight to ten years in chalky soils, and seven or eight in those of a sandy or gravelly nature. The duration of the crop may, however, be increased by judicious top-dressing. A very judicious method of raising this plant, which is practised in some parts, is to sow it with about half the quantity of Barley or other grain used for a full crop, which gives it the advantage of being shaded and kept moist during the first summer without weakening the Sanfoin plant.

Mr. M. J. SUTTON strongly urges that, instead of sowing Sanfoin alone, it should be used as a predominant constituent in a mixture of grasses and clovers fo



three or four years' ley. The sowing of Sanfoin alone, he says, is an expensive and more or less a precarious proceeding. It is by no means certain to produce a plant, but combined with strong-growing grasses there is less risk. Again, the grasses keep down weeds and prevent the growth of couch and other pests which almost invariably overrun a pure Sanfoin ley after the first two years. In Norfolk and some other of the Eastern counties, Sanfoin takes the place of Red Clover, and is rarely allowed to remain down more than two years—generally only one. Against this practice nothing can be urged; but the method adopted in Berks, Wilts, Hants, and Oxford of putting down Sanfoin alone for four or five years has grave disadvantages.

Dr. STEBLER reports that this plant has proved a great boon to certain districts in Switzerland, and that, although best suited to warm climates, it does fairly well even in those cantons that possess a comparatively cold and harsh temperature. By this plant, he says, it becomes possible to turn ground to use which otherwise would be without value. It stands excessive drought, succeeds even without manure, and is of long duration. If sown too often in the same land, or at short intervals, the land gets "Sanfoin sick," and refuses to grow it. As its roots descend to twice or thrice the depth that those of Lucern do, the nature of the subsoil is of much importance to it. However unfavourable the surface soil may be, Sanfoin will prosper if the subsoil is favourable, always provided that the surface soil is, at all events, sufficiently fertile to nourish the plants the first year so as to allow them time to push their roots into the subsoil.

It prospers best in fertile land of a calcareous or marly nature, with a sunny aspect; and requires a subsoil which, without being humid, is sufficiently mellow to allow the roots to penetrate it. Compared with other plants the growth of Sanfoin is slow. The yield is poor the first year and pretty good the second, but it is in the third year that the plant comes to its full development—after that the roots have established themselves in the subsoil. People make the first cutting when the plant is in full flower, as it loses its value soon after that period. When well established it is not so liable to injury from winter frosts as from the evil effects of wet, cold summers. It lends itself better to the haymaking process than Red Clover does, loses less of its leaves in that ordeal, and, as regards value as forage, is superior to Red Clover. Sanfoin hay is not only nourishing, but is also health-giving or tonic in its effects, from which peculiarity it derives its name. It is especially beneficial to horses. The best crops to precede Sanfoin are those which clear the soil of weeds and leave it in a mellow condition. The best time to sow is in the spring—about the end of March or early in April. It can be sown with a cereal, but this is not usually done, and is somewhat risky, unless the cereal is to be cut green. It is for the most part sown alone, and seldom in association with other grasses, as in such circumstances it is liable to perish.

The Seed is very seldom adulterated, but in its natural state it contains many impurities, of which the most prominent are the seeds of the Common Salad Burnet (*Poterium sanguisorba*) the prinprenelle of the French,—also seeds of the Brome grasses.

Those are both easily removed, and the seed usually offered in Great Britain and Ireland is clean and merchantable.

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### Guinea Grass.

(*Panicum jumentorum.*)

We see this, and the two grasses which follow, sometimes referred to as strong growing grasses, giving a heavy produce which might be suitable for ensilage. The Guinea Grass is described by Dr. Vasey as a large vigorous perennial grass, attaining in good soil a height of from six to ten feet. The leaves are one to two feet long, and frequently an inch or more wide—rough on the edges and with a few scattered hairs on the surface. It is a native of Africa, but has been introduced into many tropical countries—and in the West Indies is extensively cultivated for pasturage. It has been introduced into Florida, but is not yet much known in the Southern States. It seldom matures seed in the United States, but can be propagated by dividing the roots, or by obtaining the seeds from foreign countries. If the roots are planted in March or April, it is said they will be ready for the first mowing by the end of May, and that mowing may be repeated every six weeks till frost occurs. It is too tender, Dr. Vasey says, to be cultivated except in the warmest portions of the States. He adds further, that an analysis made by the chemist of the Agricultural Department showed this grass to be very rich in nutritive materials.

### Sugar Corn or Sugar Grass.

(*Sorghum vulgare. Sorghum halapense, &c.*)

(Known in North America as Johnson Grass.)

Dr. VASEY reports that *Sorghum vulgare* is frequently sown thickly for a forage crop in certain of the States, and, in good seasons, with proper cultivation, furnishes a very heavy yield. *Sorghum halapense*—known as Johnson grass—was imported from Turkey to South Carolina in 1835, and is highly valued by agriculturists in the Southern States. It is said to have been introduced into California from Australia, and is there known as Evergreen Millet. A Kansas farmer reports that he has tried it on very dry soil on an upland farm with very good results. It is reported to be perfectly hardy, rapid in growth, affording three cuttings in one season, and producing a heavy growth of aftermath for fall-grazing. Horses and cattle are fond of it, both in its dry and green condition. Probably no grass gives better promise for the dry and arid lands of the West. In Utah it has been cultivated under the name of Arabian Millet grass.

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### Indian Corn or Maize.

(*Zea mays.*)

The Maize is a stout, erect annual, growing from the height of three to four feet or eight to ten feet, according to the variety; the leaves are from one to two feet long and two or three inches broad. Grown for its grain, says a writer in Morton's *Encyclopædia*, it has constantly

failed in England as an object of permanent cultivation.

The common large Maize is however sometimes grown for mowing, with great advantage in climates where the grain will not ripen. Its abundant produce and excellent quality as green fodder, especially for horned cattle, would make it worth a trial for the same purpose in this country.

[Professor Long has in hand a series of experiments with the object of testing the value of Maize, Sorghum, and other large grasses for ensilage and green fodder purposes. The publication of the results of his investigations will be received with much interest, and cannot fail to be a valuable addition to the literature of this subject.]

## APPENDIX.



### I.

#### To Judge Seeds.

*The quality of a parcel of seed* is to be judged according to the following points, viz.:—*Colour, Weight, Size of Grain, Purity, Genuineness, Germinating faculty*, and of those the three latter are the most important.

*Purity* is understood to mean freedom from seeds of any other species or variety, as well as from weed seeds, broken seeds, or dirt.

*Genuineness*, which means trueness to name.

*Germinating faculty* means the proportion per cent. of true and pure grains that possess the faculty of growth. This is tested by taking a hundred grains from the bulk as they come, picking out and discarding the foreign matter, *i.e.*, seeds of other plants or broken seeds, bits of dirt, &c. (by counting those you get the percentage of impurity). Put the remainder—*i.e.* the true and sound seed—through the process of germination, and ascertain how many seeds grow.

*Colour*.—New, well-saved seed has a fresh, bright, plump appearance. According as seed gets old it becomes faded, brown, and wrinkled, loses the plump appearance, and of course takes lower rank as regards germinating power.

*Weight*.—"An important consideration in estimating

the value of grass seeds is the weight per bushel of the sample," as there may be a very wide difference in different samples of a particular species—chaffy, unripe seeds weighing perhaps only one-third of what a prime, well-cleaned sample of the same species would show.

For instance, Italian Ryegrass seed can be had as light as 8 lbs. to the bushel, and as high as 22 lbs. (in some rare cases even higher). Foxtail, according to Mr. Hunter, may vary from 5 lbs. to 12 lbs. per bushel, Cocksfoot from 6 lbs. to 20 lbs., and Meadow Fescue from 10 lbs. to 28 lbs.

Grass seeds should therefore never be bought by measure, which is quite misleading. As a matter of course, light, chaffy seed will germinate badly, as the light weight implies the absence of kernel. As a farmer wants *seed*, and not empty husks, it follows that a knowledge of the weight per bushel is the next best thing to a knowledge of the germinating faculty.

In practice it is not easy for a seedsman to give guaranteed germinations in the hurry of a season, especially when, as in the case of seedsmen in country towns, they have to make up many small orders; but there is no difficulty whatever about ascertaining the weight per bushel, and grass seeds that approximate in weight to the standards given in this work should germinate well if pure and sound.

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## II.

### Chemical Analyses of the Grasses.

Undernoted will be found a table extracted from an extremely interesting and useful report on the Grasses

of the United States compiled by the United States Department of Agriculture. A study of the tables given in the above-named report shows clearly that the composition of the plant varies according to difference of soil, situation, climate, time when cut, and general environment,—so that the publication of chemical analyses is of little use unless accompanied by descriptions setting forth all above particulars. The conclusion the compiler of the report arrives at is, to use his own words: "SPECIES ARE NOT IN THEMSELVES AT ALL FIXED IN THEIR COMPOSITION, THERE BEING AS LARGE VARIATIONS AMONG SPECIMENS OF THE SAME AS BETWEEN SPECIMENS OF DIFFERENT SPECIES." For instance, in the case of *Timothy grass*, procured from different localities, the undernoted will show a wide margin of difference in some of the most important constituents of the plant.

*Analyses of Timothy Grass.*

(Cut in full bloom.)

Locality.	Ash.	Fat.	Nitrogen Free Extract.	Crude Fibre.	Albuminoids.	Total Nitrogen.	Non-Albunoid Nitrogen.	Per cent. of Total Nitrogen as Non-Albunoid.
Depart. Garden, 1881	7.16	4.47	50.03	27.35	10.99	1.75	.51	29.1
Do. 1880	5.66	3.58	58.93	21.93	9.90	1.58	.38	24.0
Maryland . . . .	4.93	4.22	52.83	30.43	7.69	1.23	.15	12.2
New Hampshire . .	4.57	4.20	57.16	28.28	5.79	.93	.10	10.8
Indiana . . . . .	7.05	2.18	52.99	32.26	5.52	.88	.00	.0



Even a superficial glance at the foregoing will show that in the grass grown in the Department Garden in 1881 there is twice as much fat and ditto albuminoids as that grown in Indiana; and again, one cannot fail to be struck with the difference in the analyses of the Timothy grown in the Department Garden in 1880 as compared with 1881. A similar table is given showing the variations in composition of *Cocksfoot* grown in different localities—also tables showing composition of the grasses cut at different periods of growth, which are highly instructive, but too long for reproduction here. We have, however, compiled from those a table which may be interesting as showing the average and comparative compositions of some of the most important of the grasses.

The more detailed tables, of which the following is an abridgment, furnish data from which is derived the general conclusion that as a grass grows older its contents of water decrease, and so also does its ash, fat, and albuminoids, while there is an increase in the carbohydrates (sugar, starch, and gum) and in the crude fibre.

There is almost no exception to the fact that the water decreases in the maturer specimens; that is to say, the plant gradually dries up and becomes less succulent. The ash is very dependent on locality and surroundings, and as the analyses here given includes whatever soil may be mechanically adherent to the blade or stalk as collected, it sometimes shows irregularities. The albuminoids decrease in amount with great regularity. The fibre sometimes decreases (as, for instance, in *Bromus erectus*), but the change in that direction is never large. The non-albuminoid constituents (of the exact value of which to the animal our know-

Grass.	Average of	Dry Substance.				Total Nitrogen.	Fresh Grass (some constituents).			
		Ash.	Fat.	Nitro- gen, Free Ex- tract.	Crude Fibre.		Albumi- noids.	Water.	Fat.	Crude Fibre.
Perennial Ryegrass . . .	Five cuttings, May 1st to June 1st.	8.40	3.59	56.26	21.26	10.49	74.63	.86	5.49	2.53
Cocksfoot . . .	Four cuttings, April 23d to June 1st.	8.90	3.33	53.08	23.65	11.03	77.22	.77	5.44	2.47
Do., later growth . . .	Three cuttings, June 18th to July 1st.	7.12	3.65	55.03	24.73	9.48	63.13	1.34	9.11	3.44
Do., first year's growth . . .	Four cuttings, June 12th to Oct. 25th.	10.78	6.55	48.84	21.49	12.34	73.77	1.71	5.64	3.25
Tall Oat grass . . .	Two cuttings, May 25th to June 4th.	7.90	4.11	53.34	22.92	11.72	68.35	1.29	7.34	3.53
Yorkshire Fog . . .	Two cuttings, April 2d to May 25th.	9.10	4.21	55.00	21.82	9.86	66.45	1.36	7.82	2.91
Meadow Foxtail . . .	Four cuttings, April 19th to May 12th.	8.26	4.00	53.09	22.44	12.18	70.10	1.15	6.84	3.25
Timothy, good soil . . .	Six cuttings, June 1st to June 23d.	7.85	3.74	55.49	21.75	11.16	70.00	1.13	6.52	3.31
Do., poor soil . . .	Two cuttings, June 4th to July 1st.	6.10	3.46	59.28	23.18	7.97	67.06	1.14	7.51	2.60
Smooth - Stalked Meadow grass, good soil . . .	Four cuttings, April 23d to June 5th.	7.6	4.27	51.00	22.34	15.30	66.32	1.32	7.10	4.61
Do., poor soil . . .	Five cuttings, April 27th to June 8th.	6.96	3.52	56.44	23.73	9.35	61.30	1.34	9.35	3.31
Schroeder's Brome grass . . .	Five cuttings, April 23d to June 1st.	8.82	3.38	53.14	21.73	12.93	73.52	.83	5.80	3.28
<i>Poa compressa</i> , from poor soil, light gravel . . .	Four cuttings, June 1st to June 23d.	6.44	4.52	58.83	19.4	11.16	64.77	1.56	6.67	3.83
Sheep's Fescue . . .	Five cuttings, April 27th to June 1st.	6.00	3.39	56.37	23.76	10.47	62.00	1.25	9.06	3.90

ledge is rather uncertain) are often quite the reverse of constant in their manner of appearance and disappearance, and show themselves to be more affected by environment than any other constituent is. The averages show that the best grasses contain the least non-albuminoids. The usual changes in the non-albuminoids seem to point to the possibility that they increase at the time of the formation of the seed in the act of transferring to the seeds, as amides, the nitrogen of the plant.

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### III.

#### Some Points in Haymaking.\*

Hay is not simply the dried stems and leaves of grasses and clovers, or, in other words, there is more than mere drying required in making hay.

The first point is to cut the grasses and clovers, which are to form the hay, at the proper time, so as to have the largest quantity of food. This time is immediately after flowering, when the pollen has been shed, and before the seed has begun to ripen. When a plant has shed its pollen and ceased to flower, it has reached its full growth, and it then contains the maximum amount of feeding in it. No further sustenance is derived from the soil to any appreciable extent, but the fertilised ovules begin to swell and mature into ripe seeds. The material which forms

\* Condensed from Treatise by Professor M'Connell, F.H.A.S., R.A.S.E.

the seed is derived from other parts of the plant, where it previously existed as starch, sugar, &c., by a process of transition, so that the stems and leaves lose all their succulent nutritious parts, and only the woody fibre is left; thus hay ripened for seed is not so good for feeding as it would be if "green cut." As different grasses ripen at different times, however, it is not possible to catch all those in a mixture of "seeds," or in meadow hay, at the proper stage, so that an average must be hit on. In practice, of course, the state of the weather and the forwardness of other work on the farm generally, have more to do with the time of beginning to cut than anything else, but strenuous endeavours should be made not to let the crop get ripe, but rather cut green; the aftermath will be all the better.

The turning, cocking, and piking are all preparatory to getting the hay safe in the stack; and as these depend on the nature of the stuff and the state of the weather, it is impossible to lay down rules. Everything is done for the purpose of drying the fodder to prevent heating; but the writer has seen more stuff spoiled from being too dry, or from getting too much weather, than from over-heating. If it has been dried too much from actual sunshine it becomes hard, brown, and wiry, and there is not enough of moisture left in to start the "haying fermentation" (of which more anon); if it has been exposed to too much wet weather the juices (containing sugar, soluble albumen, &c.) get washed out, especially if the crop is tossed about much; while, if it is lying in a heap and wet, alcoholic fermentation is set up at the expense of the sugar. The fragrance of grass and

good hay is due to the presence of a volatile organic principle known as *coumarine* ( $C_9H_6O_2$ ), and this is dissolved out by the alcohol in the presence of warm rain water. The green colouring matter (chlorophyll) is also separated by alcohol, and becomes yellow by oxidation when the swathe lies too long. Thus both the valuable food elements, the fragrance, and the colour of the hay are lost by weathering.

It is pretty much a matter of opinion as to whether a little heating ("sweating") improves the quality of hay or not. Circumstances differ; horses and cattle generally relish it better if the process has been properly done, while in some markets—notably in London—the hay which has the appearance and odour of tobacco finds the readiest sale. Overheating, however, will produce the same effect as weathering, while it is deleterious to the animals that eat the stuff. When a field of grass is cut the plants are, in a sense, immediately killed; but though a stalk of grass, as a whole, ceases to live, yet the individual cells of which it is formed still retain their vitality so long as the moisture and temperature are suitable. When the plant's connection with the root is severed, a process called by Mr. Fry "intercellular oxidation," or, in other words, "haying fermentation," takes place. This oxidation is the cause of heating in stacks, and if not overdone is a desirable state of matters. Its action is to change starch into sugar, and this actually takes place in the stems of the grasses. To this change is due the fragrance of hay when half dried, and the avidity with which cattle eat it at this stage.

When the stuff is completely dried, however, the cells are killed by dessication, and the action ceases.

For this reason over well-dried hay is a mistake, as the process of converting the starch into sugar ought to go on in the rick, producing a gentle heat if not overdone, and improving the flavour and digestibility of the product. The point to be attended to, therefore, is to put up the hay not too much dried, so that the cells may be living and able to form sugar, but yet dry enough to prevent oxidation or heating from going past the sugar stage, and thus spoiling the stalk: keep it green, fragrant, and with the maximum of sugar. The way to do this can only be learnt by experience.

---

### Silos and Ensilage.

Dr. AITKEN, Chemist of the Highland and Agricultural Society of Scotland, thus summarises the advantages of ensilage:—

(1) It secures the crop at its juiciest and most nutritious period of growth; (2) it is independent of the weather; (3) it is suitable for late districts, or for late wet seasons, when hay cannot be well made or oats properly ripened; (4) it enables the crop to be early taken off the ground—whereby the land may be sooner made available for other purposes, such as pasturing or sowing a second crop; (5) it prevents loss when grass comes away too abundantly, or when there is too much roughness on the pastures; (6) it enables all kinds of waste grass from road-sides and plantations to be secured in good condition; (7) it is more economical to produce, and is a better feeding material than tur-

nips; (8) it is especially suitable for clay land where turnips are grown with difficulty, and where the land is frequently too wet for grazing; (9) it is found to produce an increased flow of milk when fed to dairy cows, and does not affect the taste of the milk or the butter; (10) it can be kept for a long time, and can be turned out in good condition when stored turnips are rapidly decaying or are used up; (11) when properly made it is not liable to any accident, and reduces the feeding of stock to a system of the utmost simplicity.

After the exhaustive experiments that have been made, there can now be no doubt that it will be more economical for farmers to preserve their fodder in silos than to attempt to make the grass into hay during a wet season. Well made ensilage, as at present produced, is far superior to ill-secured hay, but whether it is as good as the best hay, as claimed by some, is a matter not yet decided.

A perfect silo must be air-tight, water-tight, and a non-conductor of heat. It may be of any form provided the covering can closely follow the ensilage as it sinks. There should be no drain or other outlet for moisture at the bottom. The pressure can be produced by the direct weight of a covering of sand or earth—or by mechanical means, such as weighted levers, chains and screws, or other methods now well known. The weighting must be so placed as to sink along with the ensilage, and so exercise a continuous pressure. It is better to construct the silo partly under and partly above ground, so that the labour of getting out the ensilage may not be excessive, and that it may not be too high above ground for convenient filling from waggons.

In case it may be convenient to cut the green crop before the blooming stage, fine weather must be chosen and the cut fodder allowed to lie all day, or perhaps longer, to allow some of the excess moisture to evaporate. Green Rye especially, which contains a good deal of moisture, should be carefully dried before ensiling if it is not sufficiently matured. Experiments prove that fodder containing too much moisture never turns out first-class silage. A cut crop should not be allowed to remain in the field until it is to a certain extent dried and dead. The first filling of the silo should be rather drier than the rest of the fodder; about two feet deep should be put in the first day, and about four feet every succeeding day till the silo is full, after which it may be filled up every other day as it sinks. When filling the silo, the fodder should be well trodden *close to the walls*.

For about £20 a silo could be built 16 feet long, 12 feet wide, and 12 feet deep, made of wood, roofed with corrugated iron, and weighted with a continuous weight. This would hold about 50 tons of ensilage.

We would recommend farmers to try ensilage, making on a small scale at first, and then to extend the system as they found it advantageous. Where the fodder crop is to be consumed on the farm during the winter months, ensilage is preferable to hay-making—inasmuch as it preserves more of the constituents of the original crop than hay does.—(Abridged from Goulding's "Farmers' Diary.")



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Dipping; Sheep Marking; Scoring Numerals.—RAM BREEDING.—PREPARING  
SHEEP FOR SHOW: Selecting Show Sheep; Feeding Show Sheep; Shearing and  
Trimming; Judging Show Sheep.—PREPARING SHEEP FOR MARKET.—EWE  
MILKING.—WOOL GROWING: The Wool Trade.—THE COLLIE DOG.—APPENDIX:  
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