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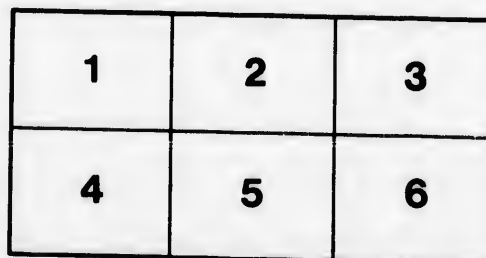
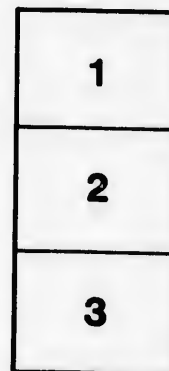
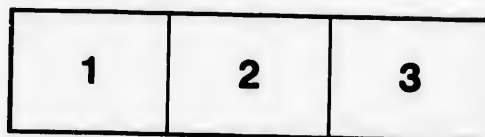
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BULLETIN 99.

JULY, 1895.

Ontario Agricultural College and Experimental Farm

**GRASSES
OF
ONTARIO.**



BY
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AND
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PUBLISHED BY
THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.

TORONTO:
PRINTED BY WARWICK BROS. & RUTTER.
1895.

THE ONTARIO AGRICULTURAL COLLEGE

AND

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GRASSES OF ONTARIO.

INTRODUCTION.

No one will question the correctness of the statement, that grasses are amongst the most useful plants grown on the farm; and there is no doubt that farmers should study them carefully and learn all they can about those which are suited to their different localities and to the particular branches of agriculture in which they are respectively engaged.

Ordinary works on botany say very little about grasses, and the great majority of young men know still less about even the most common varieties. Hence Messrs. Harrison and Day have prepared this bulletin and are sending it out in the hope that a considerable number of the young farmers of this province may use it so as to get an exact and thoroughly practical knowledge of those grasses which may be grown in their respective localities.

The popular portions of the bulletin are very simple and can be easily understood by all readers, and the more scientific descriptions introduced in connection with the illustrations, are intended for use in Public and High Schools and for the guidance of young men who may be disposed to study the grasses closely, so as to become familiar with the form, name, and uses of each variety.

Cut 21 has been borrowed from Mr. James Fletcher, entomologist and botanist of the Dominion Experimental Farms, and all the other cuts used are electrotypes made by permission from plates in the possession of the Department of Agriculture, Washington, D.C. The kindness and courtesy of Mr. Fletcher and of the officials of the United States Department of Agriculture are hereby acknowledged.

JAMES MILLS,
President.

Ontario Agricultural College,
Guelph, July, 1895.

A BRIEF DESCRIPTION OF THE PARTS OF GRASSES.

Roots. The roots of grasses are usually *fibrous*; and the fibres of which they are composed extend downwards into the ground to a greater or less depth. The deeper they go, the better the plant withstands drought and the more it impoverishes the soil. Sometimes the roots, being very numerous and very much branched, bind the soil into a matted turf; at other times, they creep along beneath the surface (are described as *creeping*) and throw up underground shoots, which root themselves, send up stems, and form new plants. These latter are very difficult to eradicate and are apt to become a nuisance. Hence it is not advisable to grow them, unless they produce an exceptionally large quantity of nutritious food. Couch grass (*Agropyrum repens*) furnishes a good example of this undesirable kind.

Stems. The stems of grasses that rise above the ground are usually hollow and are technically called *culms*. These stems are generally cylindrical, as well as hollow; but they are sometimes compressed and flattened, as in the case of Canadian Blue Grass (*Poa compressa*) and a few others.

Further, the stems of grasses are divided at intervals by thickened, solid portions called nodes, or joints. These were formerly supposed to strengthen the stem; but, according to Hackel, their sole function is to lift up stems that have been beaten or trodden down. The leaves, and sometimes the branches, start at these points.

The stem of grasses is divided by Lindley into three parts: (1) The lower part, which is procumbent and produces roots, but is itself distinguished from true roots by bearing scales and sending out, not only roots, but underground branches called *rhizomes*, or *root stocks*; (2) the stem proper; and (3) the upper part (where the spikelets are attached) called the *rhachis*.

The stem often has at its base a bulbous formation, which contains a store of food to be used by the plant when specially required; as, for instance, in time of drouth.

The stem may be what is known as *erect*, *ascending*, *bending*, *decumbent* (reclining on the ground but rising at the top), *leafy*, when the leaf sheaths close around it, or *naked*, when there are no leaves on the upper portion.

The *rhachis*, or upper part of the stem, is described as *simple* or *branched*, *round* or *angular*.

Leaves. All leaves of grasses consist of two parts, the *blade* and the *sheath*; in a few tropical species, a *petiole*, or leaf-stalk, is also found. The upper part of the leaf is called the blade. It is long and narrow, with parallel edges, and is described as *linear*. The

lower part, which folds around the stem, is called the *sheath*. It usually extends round so far that the two edges overlap each other; and, as it matures more quickly than the stem, its stiffer tissues serve as a protection to the culm in the earlier stages of its growth.

At the point of union between the blade and the sheath, there is often a small, thin, scale-like, membranous organ, called the *ligule*. It is a prolongation of the sheath; it always lies very close to the stem; and Schlechtendahl has suggested that its function is to keep water from getting in between the sheath and the stem.

The length and breadth of the blade vary considerably. Very narrow blades, such as those of Sheep's Fescue, are described as *awl-shaped*; and comparatively broad ones, as in ribbon grass, are spoken of as *sword-shaped*. In some instances, the apex of the leaf is *acute*; in others, *tapering* or *blunt*.

There is one central rib running down the leaf, called the *mid-nerve* or *mid-rib*, and numerous finer ones running parallel on each side. The extremely strong mid-rib that is found in corn, sorghum, etc., gives especial firmness to the leaf. When there are no strongly marked ribs, the leaf is characterized as *flat*; and its surface may be *smooth*, *rough*, *downy*, or *hairy*. The margin is spoken of as *plane*, *downy*, *hairy*, or *serrate* (saw-edged).

By the position of the leaves on the stem of grasses, a character is afforded by which they may be easily distinguished from the sedges, a closely related family of grass-like plants. Beginning with any leaf on the stem of a true grass, one will find the next leaf exactly on the opposite side of the stem, and the next directly above the starting point. This arrangement of leaves is technically described as *distichous*. In sedges, however, the arrangement is three-ranked, i. e., it is the third leaf from the first, which is directly above the first.

In the day time, the leaves stand out from the stem, with the upper surface turned upwards; but, at night, they lie quite close to the stem and, according to Hackel, their surfaces are at an angle of 90° from the position which they occupied during the day. These so-called sleep movements are due to the influence of light and are exhibited by many trees, as well as grasses; for example, some *mimosas*.

Other things being equal, the quality and quantity of the leaves of grasses determine their agricultural value.

Inflorescence, or the Arrangement of the Flowering Parts. The small, individual flowers of grasses are called *spikelets*. These together make up what is known as the *Inflorescence*; and they are arranged in a dense, compact, or diffuse form.

When the flowers have no pedicels (or stalks) and are closely packed together on the axis, or stem of the plant, they form a *spike*, as in the case of Timothy or Meadow Foxtail (Plate A. Fig. 1).

If the flowers are arranged on distinct, nearly equal pedicels, at intervals on the stem, the flower cluster is called a *raceme* (a somewhat rare form in grasses); but if they are on compound, branching pedicels, as in Blue Grass, they form what botanists speak of as a *panicle*. (Plate A. Fig. 14.)

If the pedicels are arranged in a circle round the stem, as in Red Top, they form what is called a *whorl*; if they are all on one side of the stem, as in Buffalo grass, Gramma grass, the inflorescence is said to be *one-sided* (Plate A. Fig. 7); if the spikelets are arranged cylindrically, as in Timothy, it is described as *cylindrically round*; if they droop, as in Fowl Meadow Grass, *Poa serotina*, (Plate 20), it is represented as *nodding*; and if quite close together, as in Orchard grass (Plate A. Fig. 16), it is spoken of as *crowded*.

THE INFLORESCENCE OF GRASSES.

As indicated in the accompanying illustrations. (Plate A.)

- Fig. 1. *Alopecurus pratensis* (meadow foxtail), showing dense spike.
- Fig. 2. *Paspalum dilatatum*, showing elongated spike.
- Fig. 3. *Hordeum pratense* (wild barley), showing a spike.
- Fig. 4. *Agropyrum repens* (couch grass), showing a spike.
- Fig. 5. *Elymus condensatus* (giant rye grass), showing a spike.
- Fig. 6. *Bouteloua polystachya* (gramma grass), showing a spike.
- Fig. 7. *Bouteloua oligostachya* (gramma grass), showing a spike.
- Fig. 8. *Panicum Crus-galli* (barnyard grass), showing a panicle.
- Fig. 9. *Agrostis exarata* (variety of red top), showing a panicle.
- Fig. 10. *Koeleria cristata* (a prairie grass), showing a panicle.
- Fig. 11. *Distichlis maritima* (salt grass), showing a panicle.
- Fig. 12. *Bromus secalinus* (chess), showing a panicle.
- Fig. 13. *Hierochloa borealis* (Indian hay), showing a panicle.
- Fig. 14. *Poa pratensis* (Kentucky blue grass), showing a panicle.
- Fig. 16. *Dactylis glomerata* (orchard grass), showing a panicle.

Spikelet. The spikelet consists of three or more scales or bracts, called *glumes*. The first two of these, counting from beneath, are sterile and known as *empty glumes*. Some species, however, have but one of these empty glumes; and, in others, the second is only rudimentarily developed. The next glume above is called the *flowering glume*; and opposite to this, or between it and the axis, is generally placed a smaller and thinner scale, called the *palea* or *palet*. The midrib of either the glume or the palea is often prolonged beyond the end. This prolongation is called an *awn*. It may arise from the base or from any other part of the glumes or the palea; and it is *straight, smooth, twisted, bent, or bristly*, and of every variety of length.



PLATE A.

Opposite or inside of the palea, there are often present on the axis two small delicate scales called *lodicules*. These are much swollen with sap during flowering, and serve to open the flower and expose the stamens and pistil. In species in which they are absent, the reproductive organs extend above the glumes.

The peculiarities of the glumes and palea, as the number of nerves, and the texture of these scaly appendages, etc., furnish the chief means of distinguishing the different genera and species.

DISSECTION OF THE FLOWERS OF GRASSES,

As indicated in the accompanying illustrations. (Plate B).

- Fig. 1. *Agrostis vulgaris* (red top), showing two spikelets, one closed, one opened.
- Fig. 2. *Agrostis exarata* (variety of red top), showing two spikelets, one closed, one opened.
- Fig. 3. *Sporobolus Indicus* (carpet grass), showing two spikelets, one closed, one opened.
- Fig. 4. *Culamagrostis Canadensis* (blue joint grass), showing an opened spikelet.
- Fig. 5. *Phleum pratense* (timothy), showing two spikelets, one closed, one opened.
- Fig. 6. *Muhlenbergia diffusa* (Nimble Will), showing two spikelets, one closed, one opened.
- Fig. 7. *Paspalum dilatatum*, showing two spikelets, one closed, one opened.
- Fig. 8. *Paspalum lave*, showing two spikelets, one closed, one opened.
- Fig. 9. *Aristida purpurea* (beard grass), showing spikelet.
- Fig. 10. *Setaria setosa*, showing two spikelets, one closed, one opened.
- Fig. 11. *Setaria glauca* (yellow foxtail), showing two spikelets, one closed, one opened.
- Fig. 12. *Alopecurus pratensis* (meadow foxtail), showing two spikelets, one closed, one opened.
- Fig. 13. *Holcus linatus* (velvet grass), showing two spikelets, one closed, one opened.
- Fig. 14. *Deschampsia caespitosa* (hair grass), showing two spikelets, one closed, one opened.
- Fig. 15. *Poa serotina* (fowl meadow grass), showing spikelet and one flower.
- Fig. 16. *Bromus erectus* (brome grass), showing spikelet and one flower.
- Fig. 17. *Buchlos dactyloides* (buffalo grass), showing male and female spikelets.

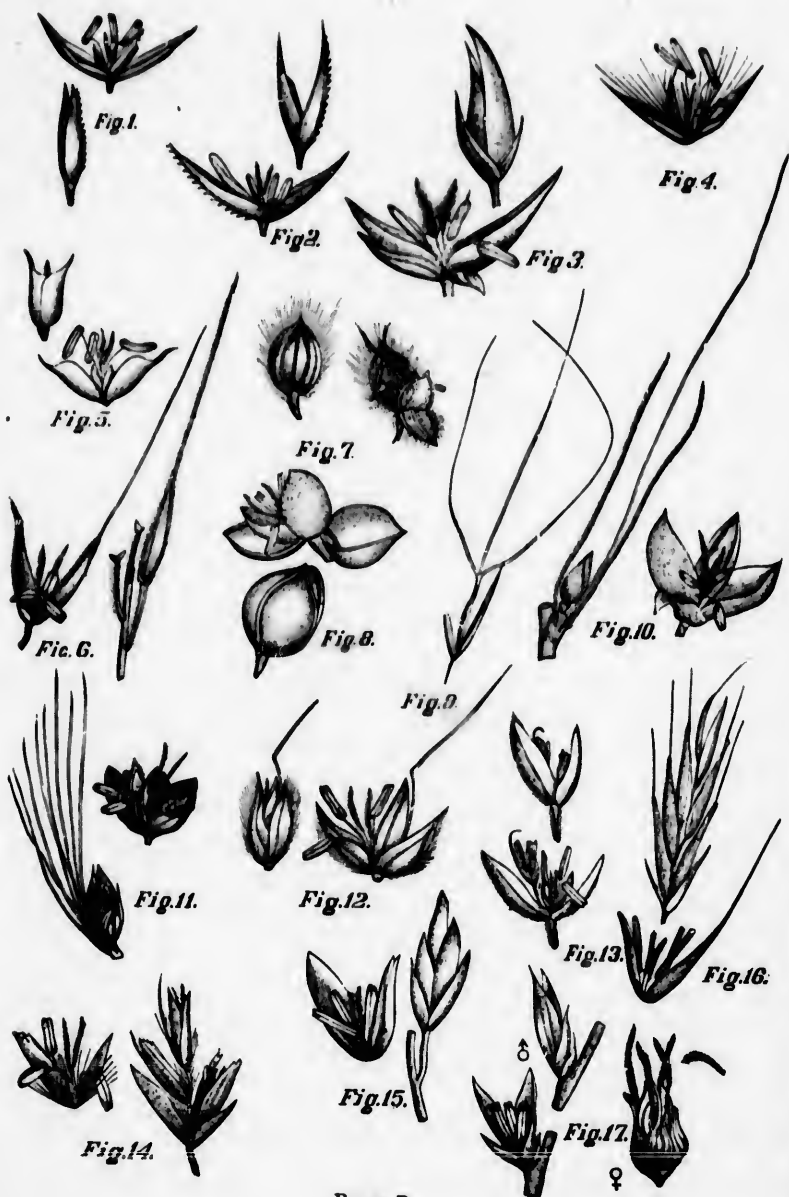


PLATE B.

Stamens. The reproductive organs of grasses, as of other plants, are called stamens and pistils. Each stamen consists of two parts; a *filament*, or slender stalk, and (attached to the upper end of the filament) an *anther*, or little sac (usually double) for holding the *pollen*, or fertilizing powder.

In grasses, the filaments are slender and distinct; and on the tip of each is a narrow anther, attached about the middle. The middle of the anther being the point of attachment, it swings to and fro on the filament. The movement of the anther aids materially in scattering the pollen; and, because of this movement, the anther in grasses is described as *versatile*. (See Plate B., figures 1 and 4.)

The pollen of grasses is very fine, spherical, and smooth, is discharged in abundance, and scattered by the wind. Cross-fertilization is the rule; but self-fertilization also takes place, as in the case of wheat.

Pistils. The pistil (or central organ of the flower) usually consists of three parts: the *ovary*, or seed-bearing sac; above this, one or more *styles*, or stalk-like prolongations; and on the top of each style, a *stigma*, or the part which receives the pollen. The style is sometimes very short or wanting altogether.

The pistil of grasses has from one to three styles, each surmounted by a stigma; and the stigmas are usually curved and feathery, giving abundant surface for catching the pollen from the anthers. (Plate B., fig. 12.)

The ovary in grasses is usually round or oval; the fruit is one-seeded; the husk, or pericarp, surrounds the seed; and the palea sometimes adheres to it.

The *embryo*, or young plantlet, lies beneath the skin of the seed, on the front side, at the base.

**VERY BRIEF BOTANICAL DESCRIPTION OF GRASSES,
FOLLOWED IN EACH CASE BY NOTES ON THEIR
AGRICULTURAL VALUE.**

Phleum pratense. Linn.—Timothy, Herd's Grass, or Cat's Tail Grass. (Plate 1.)

Roots.—Perennial, fibrous.

Culms.—Tall, erect, and firm.

Leaves.—4 or 5 on stem, rather broad, roughish.

Inflorescence.—Long cylindrical spike ; densely many flowered.

Glumes—Empty, The back fringed with hairs and tipped with a short bristle.

Flowering, Five-ribbed, notched on upper part, covered by outer glumes.

Palea.—Short and pointed, with margins delicately fringed.

Stamens.—Long, with feathery stigmas protruding from apex at flowering time.

Flowers, about beginning of July.

Timothy grows best on soils containing considerable humus, but gives very fair yields on a wide range of soils. For hay, it is one of our most valuable grasses, the product being of excellent quality, heavy, easily cured, and saleable at the highest price. But, for pasture, it is not first-class. The bulbs at the bases of the stems expose it to injury from vermin, insects, and close grazing. It also suffers severely from drought ; and, under the most favorable conditions, it affords only a scant aftermath.

Timothy yields a liberal crop of seed, which is easily threshed and cleaned. When sown alone, from 10 to 12 lbs. of seed per acre is required.



PLATE 1. TIMOTHY (*Phleum pratense*).

Lolium perenne. Linn.—Ray or Rye grass, Perennial Rye Grass, or Darnel. (Plate 2.)

Roots.—Perennial, fibrous, and sometimes producing running shoots.

Culms.—2 to 3 feet high.

Leaves.—Very leafy, flat, narrow, and pointed, dark green in color.

Inflorescence.—Spike like panicle, 6 in. or longer.

Spikelets.—8 to 15 flowered, placed edgewise on stem, and arranged alternately on the axis.

Glumes—*Empty*, outer one nearly as long as spikelet, or longer inner one, usually lacking.

Flowering, rounded on back and acutely pointed.

Palea.—Short, 2 keeled (2 ridges.)

In general appearance the panicle resembles couch grass.

Lolium Italicum.—Italian Rye grass, a long awn on the flowering glume, leaves broad and succulent, stem longer but more delicate, and lasting only 2 or 3 years, leaves lighter colored.

Lolium temulentum.—Distinguished from *L. perenne* by length of outer glume and long awns of flowering glume, has a bad reputation, as the seeds contain a narcotic principle, injurious to man and beast.

Of the rye grasses, Perennial Rye grass is the best known. The name, however, is misleading, since, in this country, it cannot be depended upon to give a crop for more than one year, and is therefore entirely unsuitable for meadows or pastures that are required to stand for several years. It is a grass of good quality; and, on rich lands, it yields a fairly heavy crop of hay not much inferior to timothy.



PLATE 2. *Lolium perenne*. (Perennial Rye Grass.)

Dactylis glomerata. Linn.—Orchard grass, Rough Cock's foot.
(Plate 3.)

Roots.—Perennial, fibrous.

Culms.—Stout and rough.

Leaves.—Rough, broadly linear, light green color, slightly hairy, flat and keeled. 5 to 6 in number.

Inflorescence.—Dense, branching panicle, lower part more open owing to length of 3-4 flower stalks, upper part more dense.

Spikelets.—Several flowered, crowded in one sided clusters.

Glumes.—All herbaceous. *Empty*, smaller than flowering.

Flowering, ovate-lanceolate, and rough, with a short awn or point.

Palea.—2 toothed at summit, fringed at base.

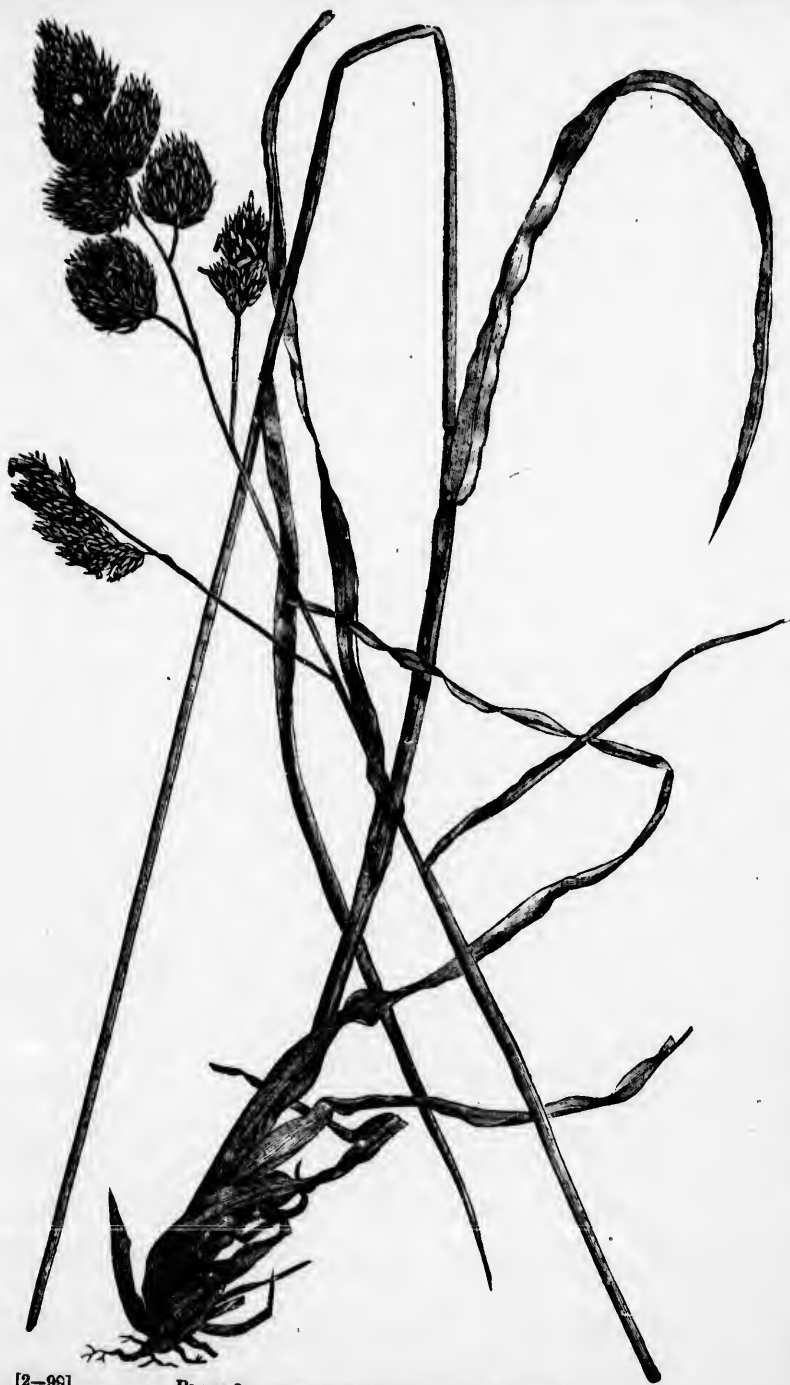
Flowers—July 1-14.

Grows in dense tufts, and is very rank growing and hardy.

Orchard Grass is a very hardy perennial. It grows on almost any cultivated soil, but prefers a rich loam, and thrives in shaded locations better than any other cultivated grass. It has a tendency to grow in tufts and to crowd out other grasses, but is nevertheless one of the most valuable varieties for pasture, as it grows early and late in the season, and remains green throughout the longest droughts. It also furnishes a good aftermath, and bears very close grazing. In the management of an Orchard grass pasture, it is a good plan to mow those parts which have not been closely cropped. When this is done, a fine growth of aftermath may be expected.

For hay, Orchard grass is not so highly esteemed as Timothy; and when intended for this purpose, it should be cut in early bloom, or even before blooming.

When sown alone, about 24 lbs. of seed per acre should be used.



[2-98]

PLATE 3. *Dactylis glomerata*, (Orchard Grass.)

Festuca elatior. Linn.—Taller or Meadow Fescue, English Blue Grass, Evergreen Grass, Randall Grass. (Plate 4.)

Roots.—Perennial, fibrous, and deep.

Culms.—Smooth and erect.

Leaves.—Flat, broadish, long, and abundant.

Inflorescence.—Narrow, contracted before and after flowering, short branches, somewhat one sided.

Spikelet.—Crowded, 5 to 10 flowered.

Glumes.—Empty, shorter than flowering.

Flowering, 5 nerved, blunt, with rough awn at apex.

Palea.—Acute, green rib along each side, with hairy nerves.

Flowers—About end of June.

Grows in clumps or tufts, very variable.

Variety—*F. praetensis*. 1-3 ft. high, simpler or closer panicle of smaller spikelets, very liable to have ergot.

Tall Fescue and Meadow Fescue are really different varieties, but they are so similar in general characters that they may be treated as one. Meadow Fescue is somewhat earlier than Tall Fescue, and does not yield such a heavy crop. These two grasses are hardy perennials, grow on a great variety of soils, and are consequently suitable for all pasture mixtures. They yield a fairly heavy hay crop of good quality, but their chief use is for pasture.

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PLATE 4. *Festuca elatior*, (Meadow Fescue.)

Festuca ovina. Linn.—Sheep's Fescue, Pine Bunch Grass.
(Plate 5.)

Roots.—Perennial, deep, fibrous.

Culm.—Smooth and slender, 1-1½ ft. high.

Leaves.—Mostly radical, very narrow and convolute, growing in dense tufts from the root, awl shaped, and dark in color.

Inflorescence.—One-sided, short and more or less compound panicle, open in flowering, 2-4 in. long.

Spikelet.—3-8 flowered.

Glumes.—Outer, acute and narrow ; upper, 3 ribbed ; lower, 1 ribbed.

Flowering, lanceolate and roughish with short rough awn.

Palea.—Two teeth at summit, green ribs in margin.

Flowers— June 20-30.

There are many varieties of this grass, which do well even in very sandy soils.

Sheep's Fescue is a small variety with very fine leaves. It has little value unless for rocky pastures. There is another variety, called Hard Fescue, which is rather more valuable than the above, though neither of them is at all suitable for hay.



PLATE 6. *Festuca ovina*, (Sheep's Fescue.)

Arrhenatherum avenaceum. R. & S.—Oat grass, tall oat grass, evergreen grass, meadow oat grass, false oat grass, tall meadow oat grass, grass of the Andes, French rye grass. (Plate 6.)

Root.—Perennial.

Culms.—Erect, rather stout, 2-4 ft. high, of dark green tint.

Leaves.—Broad and flat, about 4 or 5, rough on upper surface, gradually pointed. Ligule conspicuous and hairy on back; short hair on upper surface of blade and on other parts.

Inflorescence.—Elongated, loose, 6-10 in. long, drooping, branches unequal.

Spikelet.—Two-flowered with rudimentary third flower, middle flower perfect, lowest flower staminate only, on short stalks.

Glumes.—Glume of lowest flower bearing a long bent awn below middle of back.

Outer, thin and transparent; *flowering*, green, 7-nerved.

Palea.—Linear, thin, and transparent, 2-nerved and 2-toothed.

Flowers—July 7-20.

Grows in loose tufts.

Tall Oat grass is a very hardy perennial. It grows early and late in the season, and will withstand long periods of drought. Though somewhat bitter, stock eat it well, and it is therefore a suitable grass for permanent pastures, especially on poor lands. For hay, it should be cut as soon as it blossoms. If allowed to stand a very short time after it blooms, it becomes woody and makes very poor hay. It yields a good aftermath, and though not highly esteemed in Great Britain, it is deservedly popular in districts where the rainfall is comparatively slight.

In addition to the above, there is a Yellow Oat grass which is sometimes included in mixtures. It is a light cropper and is not likely to prove valuable in this country.

The seed of Tall Oat grass weighs about 14 lbs. to the bushel, in the chaff, and when sown alone, about two bushels per acre is required.





PLATE 6. *Arrhenatherum avenaceum*, (Tall Oat Grass).

Poa pratensis. Linn.—June grass, spear grass, Kentucky Blue grass, Blue grass,—English grass, smooth stalked meadow grass, Green grass. (Plate 7.)

Roots.—Perennial running root stock.

Culms.—Stems smooth, ligule short and blunt, $1\frac{1}{2}$ to 2 ft. high.

Leaves.—Abundance of long radical leaves, rather narrow and pointed.

Inflorescence.—Short, pyramidal, branches mostly in fives, loose spreading, 2.4 in.

Spikelet.—3-5 flowered, crowded, ovate, mostly on short stalks.

Glumes.—Empty, unequal, the first narrow and one-nerved, the second broader and three-nerved.

Flowering, hairy on margin and keel, five-nerved tuft of cobwebby hairs at base.

Palea.—Short, two-toothed.

Flowers in June.

There are a number of varieties of this grass, differing in agricultural importance. The chief merit of the grass lies in the abundance of the soft radical leaves.

It is one of the best known of our native grasses, and is most commonly called June grass. It is also one of the earliest grasses, and furnishes pasture of exceptionally nutritious character during the early part of the season, but does not withstand the summer droughts so well as many other grasses. As it usually finds its way into permanent pastures when the soil is suitable, it is seldom necessary to include it in seed mixtures for this purpose. It is an excellent grass for lawns, its running rootstocks and fine leaves forming a tough, velvety sward. Compared with timothy, its hay value is rather low.

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Plate 7. *Poa pratensis* (Kentucky Blue grass).

Poa compressa. Linn.—Wire grass, English Blue grass, Smaller Blue grass, Creeping Poa, Canadian Blue grass. (Plate 8.)

Roots.—Running rootstock, perennial.

Culms.—Hard and much flattened, 1-18 in. long, frequently bent at lower joints and then ascending.

Leaves.—Short, scanty, smooth. Bluish green in color, ligule small

Inflorescence.—Dense and narrow, somewhat one-sided, 1-3 in. long, simple and contracted.

Spikelet.—Sessile, small, 4-6 flowered.

Glumes.—Outer, unequal, 3-ribbed.

Flowering, 5-ribbed.

Palea.—Two-nerved, nerves rough, with short hairs.

Flowers—July 1-10.

Low habit of growth, flattened or compressed stems, contracted panicle, less creeping roots, furnish characters by which it is easy to distinguish it from Kentucky Blue grass.

Poa compressa is of little value for hay, owing to its small growth. What pasturage it affords is nutritious, and it will grow on very poor soil, such as sand, gravel, or hard clay.

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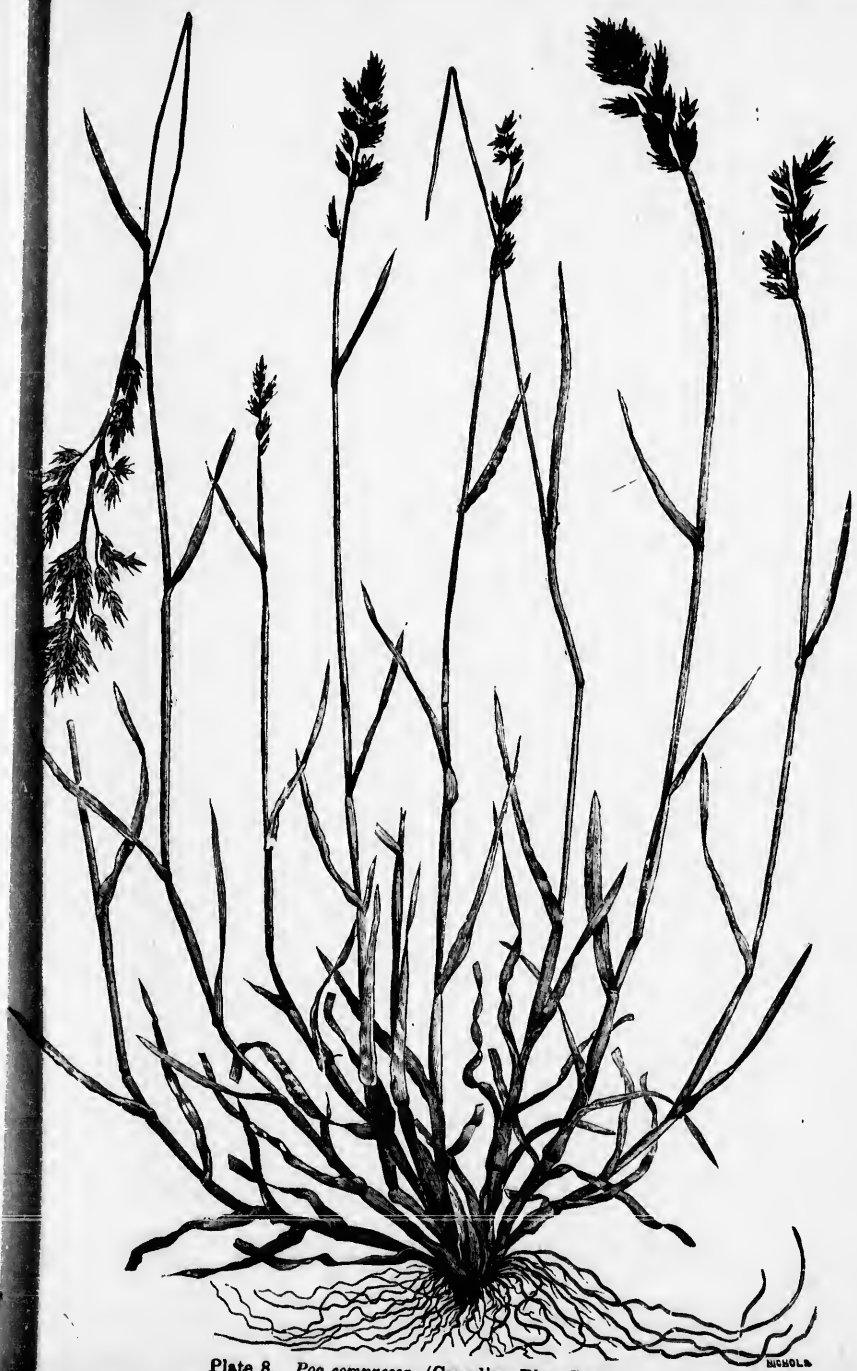


Plate 8. *Poa compressa* (Canadian Blue Grass.)

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Agrostis vulgaris. With.—Rep Top, Bent Grass, Fine Bent, Fine Top. (Plate 9.)

Roots.—Perennial, creeping, interlacing and forming a dense sod.

Culms.—Tufted, and slender. Ligule short.

Leaves.—4 or 5, flat, narrow, and roughish.

Inflorescence.—Spreading after flowering, panicle with whorled Branches.

Spikelet.—1-flowered.

Glumes.—Empty, equal, and longer than the flowering glume.

Flowering, very thin, awned on back, 3-5 nerved.

Palea.—Thin, minute, or none.

Flowers—July 1-10.

Red Top is a fairly hardy perennial, and is best adapted to rather low lands. It is most suitable for pasture mixtures or for lawns, though for the latter purpose probably *Agrostis canina* (Rhode Island Bent Grass) would be more suitable. It is not of much value for hay.

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Plate 9. *Agrostis vulgaris* (Red Top.)

Alopecurus pratensis. Linn.—Meadow Foxtail, English Foxtail. (Plate 10.)

Roots.—Perennial, Fibrous, and creeping.

Culms.—Upright, smooth, 2 in. high.

Leaves.—Upper leaf much shorter than its inflated sheath, 4 or 5 at even distance, rather broad and flat.

Inflorescence.—Stout, 1-2½ in. long, cylindrical spike. Awn conspicuously projecting.

Glumes.—Lower, acute, awnless, and hairy ;

Flowering, obtuse, awn rising from near the base, half its length twisted.

Palea.—None.

Flowers—June 7-20.

Resembles Timothy, but culm and leaves are shorter ; spikes shorter, broader, and softer ; plant less firm and rough.

Meadow Foxtail is a very early, hardy grass of good quality, used in mixtures for permanent pastures. It requires a rich soil in order to give satisfactory results, and takes several years to become established. It makes hay of good quality, but yields too light a crop and takes too long to become established, to be a profitable grass for this purpose.

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Plate 10. *Alopecurus pratensis* (Meadow Foxtail.)

Setaria Italica. Kunth.—Italian Millet, Golden Millet, Leaf Tail Millet, Bengal Grass, Hungarian Grass. (Plate 11).

Roots.—Annual.

Culms.—Erect, 2-3 ft. high.

Leaves.—Long, broad, and flat.

Inflorescence.—Spike-like panicle, nodding, yellowish or purple.

Glumes.—Empty, 3, the lower one small, the second smaller than the third ;

Flowering, hardened.

Palea.—Thin.

Stamens.—Sometimes 4 in number.

The terms "Hungarian Grass" and "Millet" are so variably applied that they lead to hopeless confusion. There are a great many varieties in this family, and among the more valuable for cultivation may be mentioned Salzer's Dakota, Golden, Golden Wonder, and Pearl.

Millet requires a rich, warm soil. It forms a valuable "catch crop," that is, it may be sown late in the season to replace a crop that has failed. It should not be sown until the weather becomes warm, usually during June, though it may be sown much later. In preparing the soil, fine tilth is necessary. The quantity of seed used varies considerably, but about 40 lbs. per acre will be found satisfactory in most cases. When cut in early bloom, millet makes a fair substitute for hay. If allowed to stand until the seeds have formed, it draws much more heavily upon the soil, and the seeds are generally believed to have an injurious effect upon the kidneys of the animals to which they are fed.

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Authoxanthum odoratum. Linn.—Sweet Vernal Grass,
Sweet Scented Vernal Grass, Vernal Grass. (Plate 12.)

Roots.—Perennial, fibrous.

Culms.—Slender, 1 to 1½ ft. high.

Leaves.—Hairy, flat and pointed, scant foliage.

Inflorescence.—Spike-like, but having many very short, dense branches
2-3 in. long, narrow and close.

Spikelets.—3-flowered, only the terminal one perfect, brown or tinged
with green.

Glumes.—Empty glumes in two pairs, hairy, two-lobed and awned
on back.

Flowering, small, smooth, and awnless.

Palea.—Short, three-nerved.

Flowers about end of June.

A low, sweet smelling perennial, the scent arising from a product
called cumarin. In Europe the scent is extracted and manufactured
into perfume.

Odor appears when dry. It is used in grass mixtures in Great
Britain, but does not appear to thrive in our climate.



PLATE 12. *Anthoxanthum odoratum* (Sweet Vernal.)

Elymus Virginicus. Lynn.—Wild Rye grass, Lyme grass, Terrell grass. (Plate 13.)

Roots.—Fibrous, perennial.

Culm.—Stout, 2-3 ft. high.

Leaves.—Leafy, 10-15 in. long, broad and rough.

Inflorescence.—Erect and rigid, 4-5 in. long.

Spikelet.—2-3 at each joint, all alike, and fertile.

Glumes.—*Empty*, lanceolate, very thick and coarse, strongly nerved, and bristle pointed ;

Flowering, shorter than above, thick, rounded on back, and having stiff awn.

Palea.—Shorter than its glume, 2-keeled, oblong, and blunt.

Flowers—July 10-20.

Abounds in marshes and along streams.

By the time it blooms the lower leaves are dead.

This grass is not suitable for seed mixtures on cultivated lands, but furnishes some food for stock in marshy places.

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PLATE 13. *Elymus Virginicus* (Wild Rye.)

Deuxia Canadensis.—Beauv. (*Calamagrostis Canadensis*). Blue Joint, Small reed-grass, Sand grass. (Plate 14.)

Roots.—Perennial, creeping root stocks, spreads from underground stems.

Culm.—Stout, tall, erect, and smooth, up to 4 ft. high.

Leaves.—Flat when fresh, slightly hairy, 1 ft. long, long ligule, very leafy.

Inflorescence.—Open panicle, spreading, especially when flowering, purple tinged, 4-8 in. long.

Spikelet.—1-flowered, with a short hairy pedicel, supposed to be a rudimentary flower.

Glumes.—Empty, lanceolate and acute ;

Flowering, delicately awned, having silky white tuft of hairs at base.

Palea.—Slim, smaller than its glume, and transparent.

Flowers—July 1-14.

Canadian Blue Joint is a valuable grass for low lands that cannot be drained, and grows on land that is too wet for red top. It is commonly found in "beaver meadows" and marshes, but may also be grown on cultivated land. It remains green after the seeds are ripe, and is relished by stock in all stages of its growth, affording a large amount of nutritious pasturage, and a fairly heavy crop of palatable hay.

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PLATE 14. *Calamagrostis Canadensis* (Blue Joint)

Muhlenbergia Mexicana. Trin.—Drop Seed Grass, Wood Grass, Knot Root Grass. (Plate 15.)

Roots.—Scaly, creeping, perennial.

Culms.—Upright, much branched, 2-3 ft. high.

Leaves.—Numerous, flat.

Inflorescence.—Contracted, densely flowered panicle.

Glumes.—Lower, awnless, sharp pointed, unequal.

Flowering, three-nerved, acute, hairy at base.

Palea.—Very acute, smaller than its glume.

Flowers—about end of July.

This species is very serviceable in binding sand, with its strong creeping rhizomes. On rich land, it yields from 2 to 3 tons per acre of very fair hay, and affords considerable pasturage.



PLATE 15. *Muhlenbergia Mexicana* (Satin Grass)

Muhlenbergia glomerata. Trin.—Spiked Muhlenbergia, Muhlenberg's Grass, Satin Grass, Wild Timothy. (Plate 16)

Roots.—Hard and knotty with numerous firm scales.

Culms.—Upright, stiffly erect, hard, somewhat compressed, sparingly branched, 1-3 ft. high.

Leaves.—Blades linear, 2-4 in. long, rough.

Inflorescence.—2-3 in. long, narrow, contracted, clustered spike, becoming looser below.

Glumes.—Empty, awned, nearly equal.

Flowering, twice length of the empty.

Palea.—Two-nerved, acute, and short pointed.

Flowers—about end of July.

This grass is frequently called "Wild Timothy" from the fact that the heads slightly resemble those of Timothy. It is noted for its late period of flowering. On low lands it yields considerable pasturage and hay of no mean quality.

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PLATE 16. *Muhlenbergia glomerata* (Wild Timothy.)

Muhlenbergia sylvatica. Torr. and Gray.—Bearded Satin Grass. (Plate 17.)

Roots.—Perennial, fibrous, scaly rootstock.

Culms.—Ascending, much branched, and spreading, 2-4 ft. high.

Leaves.—Leafy, flat, rather broad, and sharp pointed.

Inflorescence.—Dense, many flowered panicle, purplish color.

Glumes.—Empty, almost equal, bristle pointed, nearly as long as flowering ;

Flowering, awn twice or thrice length of spikelet.

Palea.—Two-nerved, rough at apex.

Resembles *Muhlenbergia Mexicana*, but panicle is looser and bears a bristly awn. On low rich land it is rather a heavier cropper than *M. Mexicana*.



Plate 17. *Muhlenbergia sylvatica*, (Bearded Satin Grass.)

Glyceria Canadensis. Trin.—Rattlesnake Grass, Tall quaking grass. (Plate 18.)

Roots.—Perennial.

Culms.—Stout, 2-3 ft. high, smooth.

Leaves.—Long, lower ones longer and broader than the upper ones.

Inflorescence.—Panicle, 8-9 inches long, large, spreading; branches slender, long, and branching, mostly in threes.

Spikelets.—Oblong, 6-8 flowered, flattened.

Glumes.—Empty, 2, unequal, shorter than the flowering glumes—one to three nerved;

Flowering, smooth, blunt apex, 5-9 nerves, prominent and parallel.

Palea.—Shorter than its glume, and two-nerved.

Flowers—in July.

Grows in tufts in wet places and along river banks. Forms good pasturage in wet meadows and makes fair hay. Also is a fine ornamental grass.



PLATE '18. *Glyceria Canadensis* (Rattlesnake Grass.)

Phalaris arundinacea. Linn.—Reed canary grass, Ribbon grass. (Plate 19.)

Roots.—Perennial, fibrous, strong, and creeping.

Culms.—Stout, smooth, and leafy, from 2-5 feet high.

Leaves.—6-10 in. long, $1\frac{1}{2}$ in. wide, flat, lanceolate; margins rougher than surface; ligule short and rounded above.

Inflorescence.—Long, dense spike, 3-6 in. long.

Spikelet.—One-flowered and fertile.

Glumes.—Empty, 4, the third and fourth being reduced to hairy rudiments; 2nd and 3rd obscured, nerved and hairy on back.

Flowering, one-nerved and awnless.

Palea.—Rounded, one-nerved.

Flowers—about end of June.

The ribbon grass of gardens, the leaves striped with white, is a variety of *Phalaris arundinacea*.

Suitable only for pasture on wet, swampy land. In the early stages of its growth it is eaten rapidly by stock, but becomes very woody when mature.



Poa serotina, Ehrh.—False Red Top, Fowl meadow grass, Duck grass, Swamp wire grass. (Plate 20.)

Roots.—Perennial, running rootstock.

Culms.—Tufted, erect, slender, 2-3 feet high.

Leaves.—Narrowly linear, soft and smooth.

Inflorescence.—Elongated panicle, tinged with dull purple, slender, and nodding, branches in fives.

Spikelet.—2-4 flowered, short stalked.

Glumes.—Outer, $\frac{1}{8}$ in. long, sharp pointed, rough on keel ;

Flowering, very obscurely nerved, cobwebby at base, obtuse or blunt.

Palea.—Acute.

Flowers—July 1-12.

Stems remain green after seed is ripe.

Poa serotina has attracted considerable attention as a grass that will grow on very moist lands, or on lands that are occasionally flooded. Stock eat it readily, and when cut it makes hay of fair quality. It is perhaps worthy of more extended trial in mixtures for low, rich lands.

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Plate 20. *Poa serotina* (Fowl Meadow Grass.)

Hierochloe borealis. Roem and Schultes.—Vanilla or Seneca grass, Holy grass, Indian Hay. (Plate 21.)

Roots.—Creeping, perennial.

Culms.—Erect, round, smooth, 1-2 ft. high.

Leaves.—Short blades, flat, broad, lanceolate, rough on upper surface; long sheaths.

Inflorescence.—Somewhat one-sided, spreading, pyramidal panicle, 2-5 in. long.

Spikelets.—Chestnut colored, ovate, and glossy, three-flowered.

Glumes.—Outer, equal, broad, acute, smooth.

Flowering, 5-ribbed, hairy.

Palea.—Two-nerved.

Stamens.—3 in the barren and 2 in fertile florets.

Flowers—May 15-30.

The plants when dry have a vanilla like odor, whence the first name; sometimes strewn before church doors on holy days, and used by Indians for making mats and baskets. In some places it has become a weed.



PLATE 21. *Hierochloa borealis* (Indian Hay).

Panicum Orus-galli. Linn.—Barnyard grass, Barn grass, Cock's foot, Large Crowfoot grass. (Plate 22.)

Roots.—Annual, fibrous.

Culms.—Thick, stout, branching from base.

Leaves.—Very numerous, rather broad and flat, smooth but rough margined.

Inflorescence.—1-3 in. long, crowded spikelets in dense panicle.

Glumes—*Outer*, 3, the first, broad and short, 3-nerved; the second and third, smooth, downy, the 2nd, 5-nerved, the 3rd, 2-nerved and awned.

Flowering, thin and transparent, smooth.

Palea.—Small and polished.

Flowers in August.

It grows in low rich land, and in the neighborhood of barns and dwellings. It is of very little agricultural value.





PLATE 22. (*Panicum Crus-galli*. Barnyard Grass).

Agropyrum repens. Beauv.—Couch, Quitch, Quick, Quack, Quake, Scutch, Twitch, Dutch, Dog, Wheat, Durfa, Devil's Grass. (Plate 23.)

Roots.—Perennial, creeping extensively, penetrating deeply into the ground, jointed rootstock.

Culms.—1-3 ft. high.

Leaves.—Flat, roughish above; upper ones broader than those springing from root.

Inflorescence.—Close, narrow spike.

Spikelet.—4-8 flowered, slightly notched stem, smooth.

Glumes—Empty, equal and opposite, 1-3 nerved.

Flowering, similar, pointed or awned, and with rounded back.

Palea.—Nearly as long as its glume, two marginal, green nerves.

Flowers—July 5-20.

Whatever value Couch Grass may have for pasture, its habit of taking and keeping possession of the soil renders it extremely objectionable. It flourishes best in loamy or humus soils, from which it is especially difficult to eradicate.

To destroy this grass, the cultivation should be such as to prevent its appearing above the surface. Hoed crops of various kinds, or a bare fallow, on which buckwheat may be sown and ploughed under, will be found useful. A well manured and carefully cultivated rape crop is especially effective as a means of destroying this grass.



PLATE 23. *Agropyrum repens* (Couch Grass.)

Bromus secalinus. Linn.—Chess, Cheat. (Plate 24.)

Roots.—Annual, fibrous.

Culms.—Simple, round, erect, and smooth, about 3 ft. high.

Leaves.—Broadish, flat, pointed, ribbed, rough on edges and under surface, downy above.

Inflorescence.—Spreading, drooping, little branched, diffuse panicle.

Spikelets.—Oblong-ovate, 7-10 flowered.

Glumes.—Empty, unequal, acute, and awnless ;

Flowering, shorter than pa'et, short awn or awnless.

Palea.—Two keeled, grain adhering to palea, strongly nerved, the nerves fringed with bristles.

Flowers—July 1-10.

“The idea that chess is degenerated wheat is erroneous and entirely without foundation. Chess seed will produce chess and only chess.”

Chess is most commonly found among wheat and rye. The flour obtained from it is dark colored and narcotic. Care in the selection of seed grain and careful cultivation tending to prevent the maturing of these seeds are the chief remedies.

To the same order belong the brome grasses of which there are many varieties. Perhaps the best known is *Bromus inermis* (Awnless Brome Grass), which is highly spoken of in some parts of the United States, but which is not sufficiently well known in Ontario to be pronounced upon.





PLATE 24. *Bromus secalinus* (Chess.)

Avena fatua. L.—Wild Oat. (Plate 25.)

Roots.—Annual, fibrous, thickened at base.

Culms.—Erect, simple, smooth.

Leaves.—Leafy, linear, flat, and rough.

Inflorescence. Loose panicle, nodding, branched, and spreading.

Spikelets.—Pendulous and long.

Glumes.—Empty, large, long, and unequal ;

Flowering, rounded on back, 5-11 nerved, bearing a bent awn and covered with long brown hairs.

Palea.—Shorter than its glume, ribbed, green along the margin, fringed at edge.

Flowers—in July.

Wild Oats are at home in any soil that will grow cereals, and they ripen their seeds among almost any cereal crop. The seeds possess wonderful vitality, some of them remaining buried in the soil for years and germinating as soon as they are brought under favorable conditions.

From what has been said, it follows that on a field infested with wild oats, cereal crops should be dropped out of the rotation as far as possible ; and hoed crops, soiling crops, hay, and pasture should take their place. To get the land under grass, it should be fallowed during part of the season, the cultivation being frequent and shallow, to destroy all seeds that may have germinated in the upper layer of soil. The land can then be sown with winter wheat and seeded, or with an early variety of barley, which should be cut on the green side. The treatment mentioned, is suitable for pasture land, or land which has produced a hay or soiling crop during the fore part of the season.



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Plate 25. *Arena fatua* (Wild Oat.)

Setaria glauca. Beauv.—Foftail, Yellow Foftail, Bottle
grass, Puff grass, Pigeon grass. (Plate 26.)

Roots.—Perennial.

Culms.—Erect, about 2 ft. high, rough; sheath smooth, ligule, a
fringe of hairs.

Leaves.—Flat, quite rough above, and smoother on under surface.

Inflorescence.—Dense, close spike, cylindrical, bristly, and tawny
yellow in color.

Spikelets.—Ovoid, below the joint are solitary or clustered bristles,
resembling awns, 6-12 in cluster.

Glumes.—Empty, 3, lower one small and the second shorter than
the third;

Flowering, transversely wrinkled.

Palea.—Thin.

Flowers in August.

It has very little agricultural value. It is a common weed in
stubble, fallow, or root fields.



Plate 26. *Setaria glauca*. (Yellow Foxtail.)

GENERAL OBSERVATIONS IN CONCLUSION.

In ordering grass seeds, it is always best to give the scientific as well as the common name of the varieties ordered. This is advisable in order to prevent mistakes, for frequently the same common name is applied to different varieties by different people.

Grass and clover seeds form a common medium for the distribution of weed seeds, and it therefore becomes necessary for the buyer to exercise great care in his selection. Only responsible dealers should be patronized.

In the preparation of the soil for grass seeds, fertility, cleanliness, and fineness of tilth are of prime importance. It is the height of folly to sow grass seed on poor, dirty, badly cultivated soil. The cleaning crop should precede the grass, and it is just as unreasonable to expect a good crop of hay from poor soil as it is to expect a heavy crop of grain under like conditions. Also, the finer the state of tilth to which the land is worked, the larger is the percentage of grass seeds which will germinate, and the better able are the young plants to withstand the summer droughts.

Care should also be taken not to cover grass seeds deeply. In light soils they admit of being covered more deeply than in clay, but in any soil light covering is in order. If a harrow is used after the seed is sown it should be a very light one; but rolling is usually sufficient.

The question of grass mixtures is a very complicated one, and it is impossible to state which would be the most suitable mixture for all conditions. It is highly probable that the old standard mixture of timothy and clover will continue to be used in many districts for years to come. As noted before, however, timothy has many deficiencies as a pasture grass, and does not compare with orchard grass, fescue, or tall oat grass, for this purpose. Its great powers of remaining green during droughts, and the strong vitality of its seeds, render orchard grass particularly valuable for pasture.

Though no attempt is made to dictate regarding seed mixtures, it is perhaps not out of place to give a few examples. A mixture that has been used on the College Farm is as follows:

Red clover	6 lbs.
Alsike	3 "
Timothy	4 "
Perennial Rye Grass	2 "
Total	15 lb. per acre.

This mixture is for meadows that are to be broken up at the end of the second year. The alsike clover not only gives variety, but, if there are any low places in the field, it thrives much better on the low land than the red clover. The value of perennial rye grass in the mixture is doubtful, and on many soils it may profitably be discarded; or, perhaps better still (if the land is to be pastured during part of the time), its place may be taken by orchard grass.

For permanent pastures, or lands that are to be pastured for several years, the following mixture was suggested by Mr. Zavitz, our Experimentalist, in the College Report for 1893:

Orchard grass	4 lbs.
Meadow Fescue	4 "
Tall Oak grass	3 "
Timothy	2 "
Meadow Foxtail	2 "
Alfalfa	5 "
Alsike clover	2 "
White clover	1 "
Yellow clover	1 "

Total seed per acre 24 lbs.

The foregoing mixture was not given by Mr. Zavitz as conclusive, nor is it offered here as such. On low, rather wet lands or on land with a stiff clay subsoil, it would be little use to sow Alfalfa, and grasses could be selected to take its place. Thus a great many changes could be made in the mixture to suit the conditions under which it was to be sown, without materially altering its value.

For lawns, the following will be found a very satisfactory mixture:

Kentucky Blue Grass	5 lbs.
Red Top	5 "
White Clover	5 "

Total..... 15 lbs. per acre.

Rhode Island Bent (*Agrostis canina*) might be substituted for red top, or a less quantity of white clover might be used, according to the taste of the user.

As a rule, it is unsatisfactory to purchase any prepared seed mixtures. It is far better to deal with some reliable seedsman, order seeds by their scientific as well as their common names, and prepare a mixture to suit oneself. By following this plan a person knows what he is getting; but ready-made mixtures frequently contain an abundance of trash, utterly worthless for the purpose intended.

Composition of Grasses described in this Bulletin—Compiled from Dominion and United States analyses

Species.		Stage of growth.	Fresh or Green material.					Water, free substance.				
Technical.	Common.		Water.	Ash.	Album.	Fibre.	Car. by drites.	Fat.	Ash.	Album.	Fibre.	Car. by drites.
1 Phleum pratense	Timothy	Spearhead	71.35	2.05	3.30	7.22	15.03	1.14	7.37	12.63	25.98	50.03
3 Lolium perenne	"	Seed formed	64.59	1.56	2.80	10.80	19.23	1.00	4.38	7.96	30.43	54.31
4 Dactylis glomerata	Perennial Rye	In flower	79.40	1.59	2.12	6.22	10.17	1.50	7.72	10.50	30.83	48.44
5 Festuca elatior	Orchard grass	Hay	14.30	6.87	7.49	22.33	46.96	2.05	6.02	8.74	26.03	54.80
6 Festuca ovina	Meadow Fescue	In flower	74.38	1.72	2.93	9.88	10.65	1.54	6.73	11.44	38.61	41.08
7 Arrhenatherum avenaceum	Sheep's Fescue	Just before flowering.	67.00	1.83	3.26	7.85	13.21	1.83	6.60	9.90	23.79	58.20
8 Poa pratensis	Tall oat grass.	Before flowering	62.30	2.99	3.31	9.17	20.71	1.32	7.93	8.78	24.33	54.93
9 Poa compressa	Kentucky Blue grass.	In flower	66.05	2.19	4.63	7.55	19.26	1.26	6.26	13.62	23.13	53.27
10 Agrostis vulgaris	Canadian Blue grass.	After flowering	61.40	2.81	4.29	8.50	21.93	1.11	7.27	11.02	23.02	56.82
11 Alopecurus pratensis	Red Top	In flower	61.40	2.81	4.29	8.50	21.93	1.11	7.27	11.02	23.02	56.82
12 Setaria Italica	Meadow Fox tail	In flower	70.76	2.38	3.23	7.86	14.77	1.93	8.39	11.49	28.72	48.27
13 Anthoxanthum odoratum	Hungarian Millet	In flower	68.06	1.91	2.91	9.40	17.24	1.48	6.00	9.13	29.44	53.93
14 Mulienbergia Mexicana	Vernal grass	In flower	78.80	1.50	2.01	4.37	12.61	1.71	7.09	9.47	30.63	59.40
15 Elymus virginicus	Satin grass	Seed formed	49.78	2.89	4.64	14.92	27.59	68.4	7.71	9.25	23.72	54.91
16 Calamagrostis Canadensis	Wild Rye	In flower	68.38	1.26	2.62	11.34	16.01	39.4	4.04	8.23	38.04	47.38
17 Glycyrrhiza Canadensis	Canadian Blue Joint.	Seed formed.	56.69	2.02	4.57	16.05	19.28	1.38	4.68	10.56	38.09	45.49
18 Phalaris arundinacea	"	Hay	14.30	6.26	6.97	21.91	48.64	1.89	7.30	8.13	25.60	56.77
20 Poa serotina	Reed Canary grass	In flower	62.72	2.86	5.40	11.19	17.37	1.46	7.67	14.50	30.03	46.56
21 Hierochloa borealis	Fowl meadow grass.	In flower	67.53	2.22	5.39	7.35	16.62	1.87	6.84	16.62	22.67	51.19
22 Panicum Crus-galli	Indian Hay	In seed.	67.57	2.18	3.93	11.83	16.54	1.96	6.74	12.12	36.48	41.73
23 Agropyrum repens	Barnyard grass.	Hay	75.39	1.64	4.93	6.14	10.69	1.29	6.63	20.00	43.25	54.89
24 Bromus secalinus	Couch grass	In flower	14.30	5.98	6.66	24.78	46.44	1.84	6.98	7.17	28.91	54.19
25 Avena fatua	Chess	Ripe	72.88	2.02	4.64	8.15	11.57	1.81	4.75	15.75	30.03	42.63
26 Setaria glauca	Wild oat	Hay	14.30	6.10	6.61	20.39	49.11	1.13	4.97	7.71	23.79	57.80
	Yellow Fox tail	Seed	63.40	2.25	7.50	22.42	48.10	3.43	4.96	8.75	26.16	66.13
			63.40	2.30	2.86	8.13	17.47	8.17	9.94	8.52	21.94	68.54

