host of seeds which adhere to their coats, or which they have swallowed and drop uninjured upon the soil."—(Prof. A. N. Prentiss, in Prize Essay.)

A few examples may be given to illustrate the distribution of grass seeds. The panicles of *Panicum capillare*, when ripe, easily separate from the culm and are freely tossed about and carried by the wind, scattering seeds as they go for long distances, even leaping over fences and bushes.

When snow arrives its surface becomes slightly packed, and seeds, with their chaff or branches still left on the dead culms, are occasionally torn away and drifted for long distances before the wind.

Small seeds in the mud adhere to the feet of many kinds of animals, and are thence transported from one place to another.

The elongating and spreading root-stalks of some grasses and clovers enable them to spread and occupy different ground or more ground.

The chapter on the geographical distribution of grasses will be given in the second volume.

CHAPTER VI.

GRASSES FOR CULTIVATION.

PHLEUM, L. TIMOTHY.

Spikelets in spike-like panicles, 1-flowered, rachilla very short and jointed above the empty glumes, extending beyond the floret, rarely bearing a rudimentary flower. Flower perfect. The empty glumes persistent, nearly equal, membranous, much compressed laterally, keeled, awned, or mucronate. Floral glume much shorter, broader, hyaline, truncate or toothed, 3-5-nerved. Palea narrow, hyaline. Lodicules 2, hyaline, toothed on the outer margins. Stamens 3. Styles distinct, long, slender, hairy. Caryopsis ovoid, enclosed in the floral glume, and palea, free.

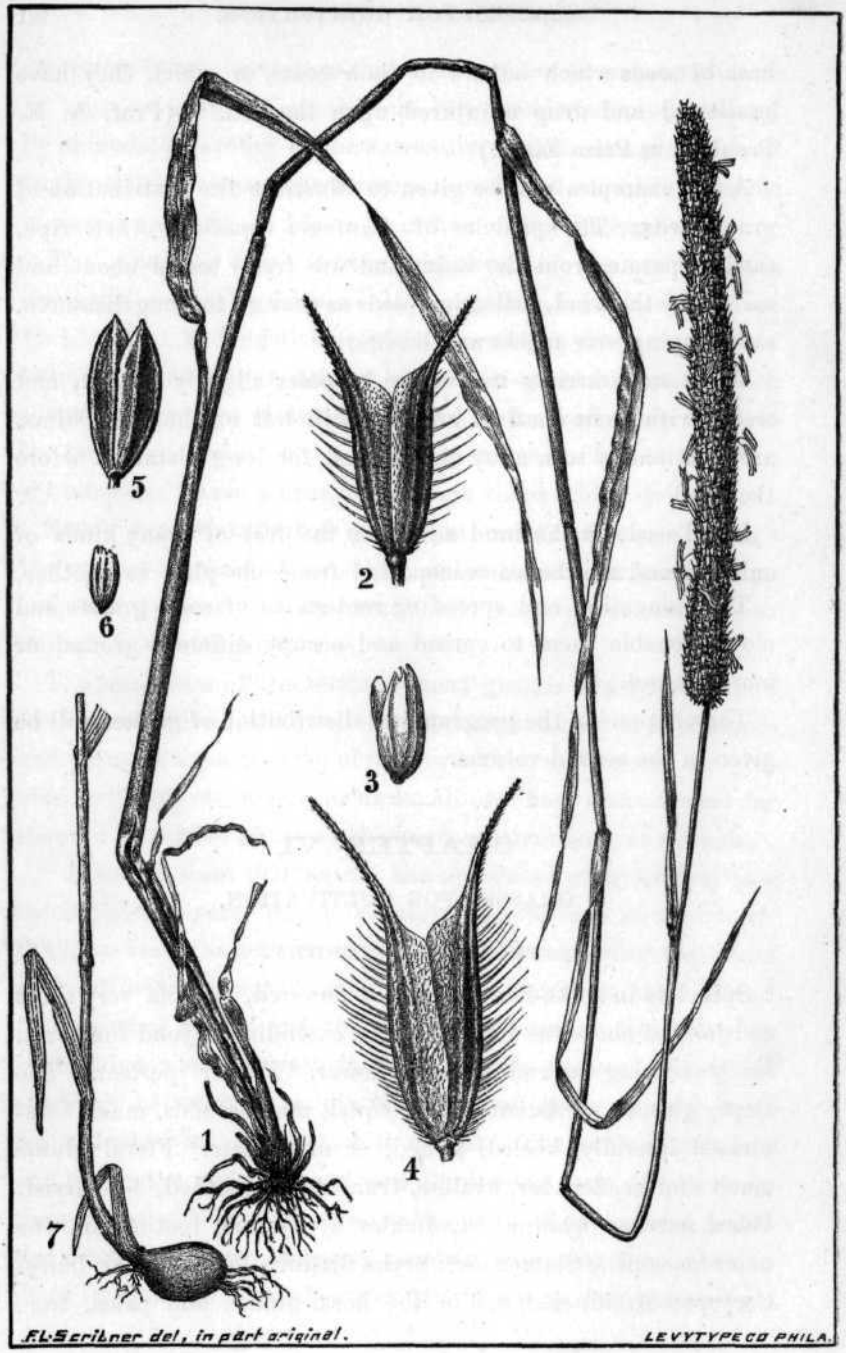


FIG. 62.

Erect annuals or perennials with flat leaves. Ten species in N. and S. temperate and arctic regions.

P. pratense, L., Timothy, Herd's-Grass, Meadow Cat's Tail.—Panicle cylindrical. Empty glumes truncate with a scarious tip, and a hispid keel.

This is the best known, most extensively sown, and one of the most profitable grasses of any in the United States. In Pennsylvania and some other States, *Agrostis vulgaris* is called "herd's grass," while at the north this is known as "red top." There are several other grasses called "cat's tail" in different portions of our country. The first common name comes from Timothy Hanson of Maryland, who introduced the grass from England about 1720. The next name comes from a man by the name of Herd, who found it growing in New Hampshire and began its cultivation.

In 1760 or '61, Peter Wynch took seeds of it from Virginia to England. It is a native of Europe, and very likely also indigenous to some portions of the United States. It is widely distributed in north Africa, western Asia, and other portions of the world. Timothy is a perennial not likely to be mistaken for any other grass, and in fact this is about the only one that is generally known by all farmers.

The leaves are short and flat, and on good soil the stem is from two to four or more feet high, each bearing one stiff, erect, rough spike as long and as thick as a lead pencil. The plant is rather coarse to the touch and sight.

Having a large bulk of stems, with few leaves, the hay wastes but little in transportation. The grass stands up well, the hay is easily cured, heavy for its bulk, presents a good appearance, and suffers less than many other grasses when allowed to go to seed before cutting.

Fig. 62.—*1*. Plant of *Phleum pratense, L.*; *2*, spikelet; *3*, floral glume and palea; *4*, spikelet of *P. alpinum*; *5*, spikelet of *P. arenarium*; *6*, floral glume; 7, base of culm of *P. pratense*, showing one enlarged solid internode, tubor, or corm, improperly called a "bulb."—(Trinius and Scribner.)

Everyone in town and country knows the grass as soon as he sees it and can distinguish it from all others, hence a leading reason why it is raised, fed, and sold. Consumers buy Timothy and fear to buy anything else, even though it were better, because they do not know what it is. They will buy even if it is dead ripe.

The same remark applies to a well known and popular grass, perennial rye grass, generally raised in England. After a long time if a grass or fruit becomes well known, and it has good qualities if not the best, people buy it because they know what they are getting.

In this country Timothy is often sown alone, at the rate of about eleven pounds to the acre. The sowing usually occurs in autumn with wheat or rye, or in the spring with oats or barley. It is often sown as the only forage crop on moist land or on strong, clay loam, but on lighter land it is usual to sow on some red clover also. If quite sandy, clover without any true grass is generally sown. Timothy is two to four weeks behind red clover in coming into flower ready for the mower. Among its other good qualities, Timothy seeds very freely, yielding 6 to 10 or more bushels of cleaned seed to the acre; and this is easily saved and threshed with a flail or a machine, can be easily cleaned and separated from seeds of weeds, and can be put onto the market in abundance and sold cheaply. It only takes from one to two pecks to sow an acre, and this costs but little.

While Timothy has many good qualities to recommend it, it has many marked defects. When sown with clover, it makes but a small growth and must be cut young, if the clover is secured in good season. It starts very slowly in spring, is a long time in coming into flower, and after cutting the second growth is slow, feeble, and of little consequence, seldom large enough to cut a second time or to afford much pasture. If cut early the tuber at the base of the stalk does not become sufficiently

matured to keep the plant alive and healthy. If cut close, the tuber is cut off, and the plants suffer and become feeble, and perhaps perish.

It is hardly suited for pasture at any time, unless it is kept quite large. Horses, sheep, and especially hogs, must not be allowed to eat it close to the ground. In England it stands pasturing in spring without much injury to the hay crop. Besides these objections, Timothy is likely to be short lived; the tubers are easily trodden out by cattle, killed by drought or frost, or eaten by mice or gophers. It sometimes rusts badly. It is not hard to kill when cultivating for another crop; it starts quite readily from the seed, and is well suited for one good crop of hay in a season, but is not well adapted for pasture. It is not as well liked in Kansas and vicinity and in the south as it is at the northeast.

Timothy is one of the five grasses in the list recommended by Mr. De Laune for permanent pasture and meadow in England.

For Kansas, hear what Professor Shelton says:

"Of this favorite eastern sort, we shall say but little, believing that over a large portion of the State it is of little value. We have obtained good yields upon the college farm, and have seen good crops of Timothy grown west of this point. Still it suffers much from drought, and from the attacks of chinch-bugs, and it rarely survives the ravages of the grasshoppers."

For Nebraska, read from a lecture by Dr. Bessey:

"My inquiries were very generally answered, and in a most satisfactory manner. They all indicate that throughout the greater portion of the eastern half or two-thirds of the State, Timothy is an exceedingly valuable grass for farm use. It is invariably doing well, and in many instances producing crops of hay far beyond the most sanguine expectations of those who sowed it. It is of course not to be expected that it will succeed, as we pass far into the northwestern portion of the State."

From Howard's Manual we learn that: "At the south it does not thrive on upland."

Major H. E. Alvord, of New York, in *Rural New Yorker*, reports as follows:

"Timothy is not a favorite of mine. Its hold upon the land is too slight, and, as a rule, it falls off in yield too fast after the first crop. My preference is to treat it like a grain crop—sow alone on well prepared land, in August, a half bushel of seed to the acre. After cutting the first crop turn over at once, manure and re-seed; or cut once, top-dress well, cut a rowen crop, then one crop the second year, plow and re-seed. I know of no suitable mixture for Timothy, if for hay, and do not consider it as desirable as a large part of any mixture for pasture."

Waldo F. Brown, of Ohio, writes in these words:

"I think that land seeded to Timothy and with three or four pounds of Mammoth Clover seed sown to the acre, will produce one-half more hay than Timothy alone, and the clover cures beautifully with the Timothy.

"In sowing Timothy for hay, I use a bushel of seed to three acres, and think the quality of the hay much better than when sown thin. There are many farmers of my acquaintance who sow a bushel to ten acres, and then allow it to stand till dead ripe before cutting."

With reference to saving the seed of Timothy, the following was written for *The Prairie Farmer* by Hon. Samuel Dysart:

"It is very difficult to fix any specified time for harvesting this crop, because a change in the weather may make a great difference in the ripeness in a single day. When the amount to be harvested is not large, a better yield of seed will be had by letting it stand until all the heads are ripe, and a few of the early ones shelled off. But in doing this there is much risk. A windy day may thresh half the crop. A shower of rain, followed by a warm sun, will change the color of a field in a few hours. Of

late years I have harvested from 75 to 100 acres of this crop annually. I make it a rule to start the harvester into it when the early heads begin to shell at the tips. The straw of most of it is then quite green, and if carefully put up, makes fair feed for stock after threshing. If cut before fully ripe, much care must be taken in shocking, or there will be a great loss of seed in threshing, for this reason: When Timothy is ripe, the cell which holds the seed opens. If cut too green and the bundles are left exposed to the sun, the straw dries like hay, these small cells do not open, and no machine can knock the seed out of them. If cut before fully ripé this difficulty may be largely overcome by putting in round shocks as soon as cut, packing the bundles close together to exclude the air. In this condition the natural process of ripening will go on; but if set up two and two, as many set the bundles, it will dry and stop at the same stage as when cut. A good crop of Timothy should give eight bushels to the acre. I have had more, and also less. As a farm crop there is more uncertainty in saving it than others grains. It must stand in the shock at least two weeks to be dry enough for threshing. During that time, if heavy rains and high winds occur, there will be considerable waste in the shock. The less the bundles are handled after drying, the less waste. Hence I thresh it directly from the shock. All separators are now made with sieves for cleaning this crop."

DACTYLIS, L.

Spikelets several-flowered, laterally compressed, nearly sessile, crowded in dense one-sided fascicles, at the end of the branches, forming a one-sided panicle. Flowers all perfect, or the uppermost one staminate. Empty glumes unequal, membranous, keeled, the upper one larger, 3-nerved. The floral glume larger than the empty glumes, cartilaginous. keeled, 5-nerved; awn short, scabrid, Palea 2-fid. nerves ciliate. Lodicules 2,

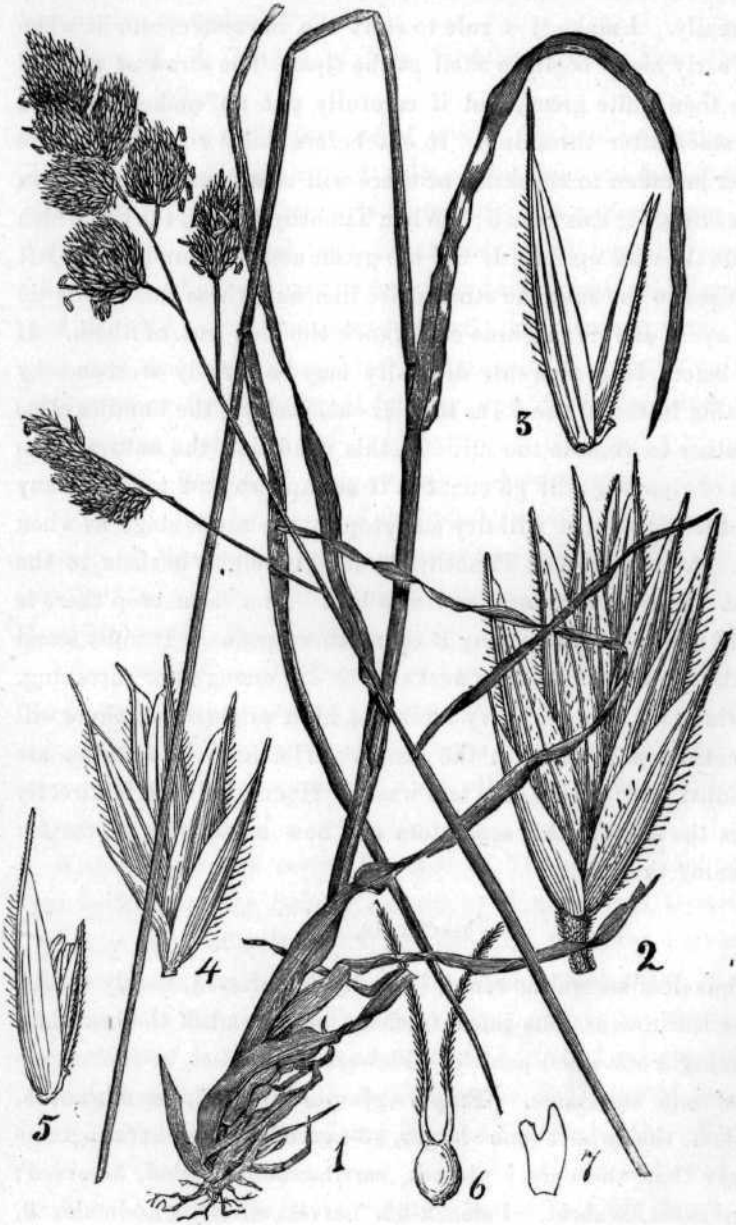


FIG. 63.

acutely toothed. Stamens 3. Styles distinct, stigmas feathery. Caryopsis compressed, loosely inclosed in the floral glume, and palea free. A perennial grass with broad leaves. One species, found in cold and temperate regions of Europe, Asia, and Africa.

D. glomerata, L. Orchard Grass, Cock's-Foot.—Leaves long, keeled, conduplicate when dry, culms stout, rough, 2–5 feet. Ligule long, panicle 2–6 inches, often tinged with violet spikelets 3–5-fld., $\frac{1}{3}$in. long.

For the past fifteen years or more the writer has been accumulating notes and making observations and experiments in reference to our most noted grasses, and concerning none of the true grasses has there been more said or written or more inquiries made than about the one above named. Like every question capable of dispute, this one has two sides, and shrewd men of the same neighborhood often differ very much in their estimation of orchard grass.

The grass is perennial, lasting for many years, two to three, or even five feet or more in height, rather large, coarse, rough, of a light green color, and grows in dense tufts unless crowded by thick seeding. The lower leaves are sometimes two feet or more in length. The clustered spikelets make dense masses on the small spreading panicle; the flowers appear with those of early red clover.

It is a native of Europe, and is also now found in North Africa, India, and North America, and perhaps in other countries. Although it came to this country from Europe, it did not attract much attention in England until sent back there in 1764 from Virginia.

So far as quality is concerned, if cut in season or pastured when young it stands well the test of cattle and the chemist.

FIG. 63.—*Dactylis glomerata*, L. (Orchard grass); *1*, entire plant; *2* and *4*, spikelets; *3* and *5*, florets; *6*, young pistil; *7*, a lodicule.—(Spikelets by Scribner.)

It is very nutritious, the seeds start quickly and make a vigorous growth, and if the grass is not a very valuable one, it is certainly not for the lack of good testimonials.

The stems are not very abundant when compared with the leaves, hence the plant is more suitable for pasture than for meadow.

James Hunter, of England, considers: "For permanent pasture for alternate husbandry, or for hay, there is no more valuable grass, and its liberal use for all these purposes is strongly recommended."

Mr. De Laune estimates it as "By far the most valuable of all grasses because it grows in all soils; it produces the greatest amount of keep; it is the must nutritious grass, and seems to grow faster and stronger in extremes of weather, either wet or dry, than any other grass." This is one of the five which he recommends for permanent grass lands.

According to Baron J. B. Lawes, "It is very abundant and productive on good soils and is much improved by cultivation. It is really prominent only with a liberal supply of ammonia, associated with a correspondingly liberal supply of mineral constituents. It is a formidable opponent to other grasses, where it has once got possession."

The following from Alexander Hyde of Massachusetts, is excellent and to the purpose. "We have found it one of the most luxuriant and nutritious, both for grazing and for hay. It never says die. It is the first to furnish a bite for the cattle in spring, is little affected by the droughts of July and August, and continues growing until the severe cold of November locks up the sources of nourishment. When cut or grazed it starts up with the vigor of the fabled hydra. We advise no man to sow it on his lawn, for it would need cutting every day before breakfast. If cut while in blossom, both cattle and horses are exceedingly fond of the hay, and do well on it. If left to stand till the

seeds are matured, it becomes more tough and woody than even Timothy, and cattle will need to have their teeth sharpened to eat it in this stage of its growth.

"Orchard grass loves a deep, rich, moist soil, and in such a soil no other grass yields such an abundant harvest. Why it is so much neglected among us we cannot divine, unless it is the fashion of sowing Timothy and clover, and fashion is as much a tyrant among farmers as among the ladies, though showing his power in a different mode."

A. W. Cheever, a most successful farmer and editor of Massachusetts writes: "I have now cultivated this grass some ten or twelve years, and feel that I can speak of it understandingly. It is a grass that must be understood to be appreciated. Grown on poor, dry land, by a poor, lazy farmer, who is always behind hand with his work, it will not give satisfaction; but on rich, moist land, capable of cutting two or three crops in a season, sown thickly with a mixture of clover and June grass, or other kinds ripening at or about the same time, and under the management of a wide-awake farmer, I can confidently pronounce it the most valuable grass known in this country at the present time. It may be cut two or three times a year, producing large crops of the very best of fodder, just as long as the fertility of the land can be maintained by top dressing. It is the earliest grass in the spring and the latest in fall."

E. H. Libby, in 1883, wrote me that "A little while ago the *New England Homestead* contained numerous letters from farmers week after week, speaking in the highest terms of this grass."

T. D. Curtis, of New York, says, Orchard grass is a most excellent hay plant, but it requires a rich soil. A well sodded pasture of this grass is a thing to admire as well as for use and profit.

Wm. Crozier, of New York, speaks as follows:

"Heretofore the base grass in all the Northern States has been

Timothy; but experiments that have been carried on for a period of twenty years have led me to believe that orchard grass is much better fitted to be the leading kind in mixtures, whether for pasture or for hay, or used alone or otherwise; and I place it far in advance not only of Timothy, but of any other grass we have thus far in cultivation. It is very early. The advantage of this earliness is not only that it gives three weeks longer for the aftermath to grow, but another reason, far more important is, that at this date the white ox-eye daisy (*Chrysanthemum leucanthemum,*) and other troublesome weeds are not yet in a condition to seed, so that should any of them happen to be in the fields, they are destroyed by being cut before they have ripened their seeds."

The following is by Prof. I. P. Roberts, of New York:

"Orchard grass is hardy with us, and gives an abundant yield of good hay, if cut early and carefully cured. Where we have used it as the principal grass in pastures, it becomes patchy; that is, some portions of the field the cattle will eat close, while other portions, where the grass gets a little start, will go to seed, after which all growth ceases till the next season. I have frequently mowed the pastures as the grass was heading out; sometimes the cut grass was left on the field, sometimes cured for hay. It grows in hummocks to such an extent that evaporation from the soil in dry weather goes on so rapidly that the other grasses perish for want of moisture, and then, too, orchard grass is always 'dry' and takes the lion's share of the moisture. Except for timber lots, and for mixing with a variety of grasses for permanent pastures, its value is not great with us."

A writer in the Connecticut Report of the Board of Agriculture for 1868, remarks: "Orchard grass does well on dry land, giving a large yield of coarse, black looking hay, very sweet and palatable to cattle, but it must be cut early, suffering more from standing too long than any other grass with which I am familiar.

On moist places it runs to tufts. No grass does better in the shade than this, and none gives so quick a second growth, or so strong aftermath. With me it ripens precisely with red clover, and I always sow them together. Clover and orchard grass I sow together in the spring, using 12 pounds of clover and two bushels of orchard grass per acre."

L. F. Allen, of Buffalo, New York, approves of a favorable article in the *New York Tribune*, saying: "I have had it in continuous mowing and pasturage for upwards of forty years without disturbing it. As a market hay, I admit that Timothy is more salable, because town's people do not know the value of the orchard grass, which is just as good for any kind of animal."

In the *Country Gentleman* for 1883, the same man of wide experience and observation, remarks: "Why it is that farmers are so dull in the use of orchard grass, passes my comprehension, when, on a single trial of its virtues, mixed with red clover when sown, equal in proportion for a hay crop, it is better for any class of stock than Timothy."

The late Hon. George Geddes, of New York, said: "It is a very valuable grass, but unless thickly sown it is inclined to grow in tussocks or bunches."

T. A. Cole, Madison Co., New York, in *New York Tribune*, remarks:

"After twenty years of experience, I have settled down upon orchard grass as possessing greater merits than any other, for both pasture and meadow, for fattening animals or for dairy stock. When cut for hay, just before its bloom, and cured with as little sun as possible, it will make more milk than any other variety known to me; if left to ripen it is worthless. When sown thick enough it does not grow in tussocks and will crowd out white daisies, and in five or six years I have seen it crowd out quack-grass. Hundreds of farmers in this region are raising it, and in every instance consider it superior as a forage plant."

The following is from the pen of Major H. E. Alvord, of New York, and was written for the *Rural New Yorker:*

"Orchard grass is a variety which has no superior for pasture or hay, and it matures so early that the crop may be easily got out of the way before Timothy or red top is fit to cut. But orchard grass must have a good strong soil, and can be made most profitable by keeping land thus seeded in sod for a series of years. If cut twice a year or three times, as is often possible, it must be liberally top-dressed. With the land previously in good condition and a well prepared seed-bed, orchard grass is very satisfactory, grown by itself. For this purpose, I would sow it as soon as the land can be put in order in the spring, or in the latter part of August, using at least two bushels of seed to the acre, put on with the greatest care, as it is a difficut material to handle. In 1884, orchard grass was in bloom in May, at Houghton Farm, and good hay was made the first week in June. The period of cutting as to maturity of plant, should be regulated according to the use to be made of the hay. It can be cut so as to make hay as fine as any rowen or coarser than any heavy Timothy. If a mixture is desired for hay, tall meadow oat-grass and clover are the best for maturing with the orchard grass. Although orchard grass is hardy, furnishes the first green bite in the spring, and the last in the fall, and usually provides good protection with its own aftermath, it will winter kill where not well covered with snow, if the land is moist. It prefers a location rather high and dry, naturally or artificially well drained."

Prof. J. R. Page, of Virginia, says: "It does well and yields one and a half to two tons per acre."

W. F. Tallant, of the same State, in the *Country Gentleman* remarks: "It will grow more in one week after cutting than blue grass will in a month. It makes a larger aftermath, and makes it quicker than any other grass I know of. It is ready to cut before harvest and after planting. Timothy is too near

wheat harvest, so that it is often left until that is over, when it is entirely too ripe. I have tried it on rich land and poor land with good results."

Orchard grass is much raised in Kentucky, where it has been grown since 1817.

Richard Waters, of Oldham county, in *The Tribune*, says: "Orchard grass grows best in good, strong loam, reasonably dry, not on sandy land, nor in wet land. It will graze more stock to the acre, and can be grazed ten days earlier in the spring than any other grass. It makes good winter pasture, and during one recent winter I kept 800 ewes on this grass all winter without any other feed."

On the same subject, we learn from Dr. J. B. Killebrew, of Tennessee: "It likes a soil moderately dry, porous, fertile, and inclined to be sandy. It withstands hot, dry weather better than any other valuable grass."

A prominent writer in *The Rural World*, of Missouri, states:

"When suitably located and properly grown, it is one of the best of our cultivated grasses, but when not so located and grown, it is of indifferent value. Sow two bushels of seed to the acre, if sown alone."

Prof. D. L. Phares, of Mississippi, prefers to sow this grass in the spring without a grain crop, and on well prepared land. It thrives well without renewal on the same ground for thirty or forty years, and is easily exterminated when the land is desired for other crops. The growth in clumps may be obviated by thick seeding.

"Altogether and from every standpoint, I am compelled to say still, as I did many years ago, that I prefer orchard to any other grass. I could fill volumes with testimonials more strongly expressed than my own in favor of this grass over all others.

"It produces seed freely, and they germinate with certainty, a bushel weighing twelve to fifteen pounds."

In *Howard's Manual of Grasses*, we read: "This valuable grass ranks next in importance to the tall meadow-oat-grass for hay and winter pasture. The second growth after cutting should be reserved for winter grazing. Where hay is an object, meadow-oat and orchard grass should be sowed with red clover and white, as each of the four blossoms at the same time and is simultaneously ready for the scythe. The cultivation of these two grasses at the South cannot be too strongly recommended on soils adapted to them."

Prof. S. A. Knapp, of Iowa, after looking the ground all over, concludes that orchard grass is valuable for early and summer use, but not superior for late fall pasture upon the open prairie.

Prof. G. E. Morrow, of Illinois, in *Rural New Yorker*, says:

"Both for pasture and for hay, I think we have underrated the value of orchard grass, if sown thickly and not allowed to become harsh and woody by standing too long."

Those living on the dry prairies will be interested in the following from Professor Shelton, of Kansas:

"Two years ago, in giving our experience with this grass, we stated that it had proved to be 'one of the very best and safest of all the pasture grasses that we have tried.' It has proved with us but an indifferent hay plant, yielding moderately upon ordinary soils; and the hay, when well secured, is not relished by our stock. In our experience the hay is hardly equal to that cut from the prairie. Our experience is totally against this grass as a hay plant; but, in grazing, its valuable qualities soon become apparent to the farmer. We feel confident that it will yield fully twice the feed that can be obtained from the same area of blue grass or Timothy, and in nutritive qualities is certainly greatly superior to blue grass. Orchard grass is one of the earliest grasses to start in the spring, and the last to succumb to the frost in the fall. By giving it a good start in the fall, it will furnish good pasture far into the winter. It is consumed with great relish by stock of all

kinds, especially if the grass is cropped short. It seems to do equally well upon heavy clay and sandy soil; and any rich and well drained soil seems suited to it. It germinates about as easily as oats; and, with good seed, no difficulty is experienced in getting a 'stand' that will endure moderate cropping the first fall after seeding. As might be inferred from its common name, it does better when moderately shaded, and is admirably suited to orchard culture; yet there are few grasses that will so well endure the prolonged sunshine of our dry seasons. For these reasons we feel safe in recommending this grass to the farmers of central Kansas for the purposes of pasture.

"Clover has always thrived with orchard grass, besides furnishing to animals that variety of food so agreeable to the taste. We have found that orchard grass is relished even by swine, and therefore it makes excellent 'hog pastures.' In our experience, too, no amount of tramping or close grazing at any season has been able to injure a well-rooted sod.

"Orchard grass will endure late seeding better, perhaps, than any other sort; but this operation ought not to be delayed much beyond the middle of April."

Still later on he concludes as follows:

"Of all the large number of grasses that have been tested at the College Farm during the past twelve years, this has proved the most generally useful, because: 1, a 'stand' is easily and quickly obtained; 2, it yields wonderfully of pasturage and hay if the land is good—indeed orchard grass is such a gross feeder that it is not worth a trial upon very poor land; 3, it does not winter-kill, does not 'head out,' is not injured by too close cropping, and will survive an uninterrupted four months' drought. It winter-killed badly in 1885–6."

Hear a few good words from Dr. Bessey.

"The nutritive value of orchard grass, as determined by chemical analysis, shows it to rank well up toward the high value

of blue grass. It is much more nutritious than Timothy, and very nearly as valuable as red-top. It is shown by trial to grow well in many parts of Nebraska, and is considered by many to be one of our best grasses."

Hon. L. N. Bonham, of Ohio, among other things says: "If the land is not too strong, orchard grass is an improvement sown with clover intended for hay. In strong, black land, however, I have found the culm incased by the several folds of the leaves, so thick and sappy that it does not cure before the leaves are so dry as to crumble into powder. On poorer land I prefer orchard grass with clover. Where pasture is desired, orchard grass adds greatly to the value of the clover field. It furnishes a variety, recovers quickly after mowing or being eaten down, and comes early. It is not appreciated, and is neglected by farmers because the seed is more difficult to sow and is more expensive than clover or Timothy per acre. Its chief value is for pasture."

As we might expect where a grass has been so long in cultivation, it varies much in vigor and size. In England some attention has been given to selecting vigorous varieties. Like Indian corn, it is well to select seeds from large, thrifty, well grown plants.

B. A. R., of Bowling Green, Kentucky, thus describes the mode of saving seeds of orchard grass:

"About the time the seeds are ripe, and before they commence to shatter, take a reaper and set the sickle about one foot above the ground, so as to be above the leaves or blades, and cut, bind and shock as wheat, only make the bundles and shocks smaller. Leave the shocks uncapped for three or four weeks, exposed to the action of the sun and rain. This is necessary to make it thresh clean from the head. At the end of three or four weeks, as above stated, place a canvass in the bottom of the bed or frame in which it is to be hauled (to avoid waste, as it shatters very badly at this time), and haul to the place of threshing. If not ready to thresh right away, you must cover it with something,

stack it, or put in barn, as too much dampness will prove injurious to the seed at this time. Remember to handle over a canvass as much as possible whenever you move it, for otherwise the loss will be considerable. As for the yield, that is very variable—all the way from five to fifteen bushels per acre, according to the age of the meadow and fertility of the soil. Orchard grass increases its yield every year from the second to the sixth or seventh after sowing. But even at this seemingly small yield it is very profitable, as the labor is not very great and there is an abundance of good hay left to be mowed after the seed are saved."

Of the producers or of country merchants of Kentucky and Tennessee, the seed may be obtained for much less than is usually paid to the seed dealers of the northern States. It is usually put up in eight-bushel sacks, 14 lbs. being allowed to the bushel.

These long quotations have been selected from wide awake, observing men living in remote parts of our great country. I have neglected to quote much from those who speak against it, believing that they do not understand the grass and consequently make mistakes in its management.

As a rule it blossoms but once a year, and then about a month ahead of Timothy and red top.

It is often mentioned as very suitable for growing in the shade, but June grass does as well, comparatively. It will not spread and make a fine, handsome turf.

Many cut it too late, when the hay will be of poor quality.

A farmer should not have too much of it for meadow, because it all comes on at once, and then it should be cut; the weather often controls the time of cutting. If rainy when the grass is in flower we must wait often a week or more. In such cases most grasses endure the delay better than orchard grass.

Some object to its use as the seed costs too much, from one to two dollars a bushel, making the seed for an acre cost from two to five dollars. Others sow on stiff, poor soil, where it makes a feeble growth.

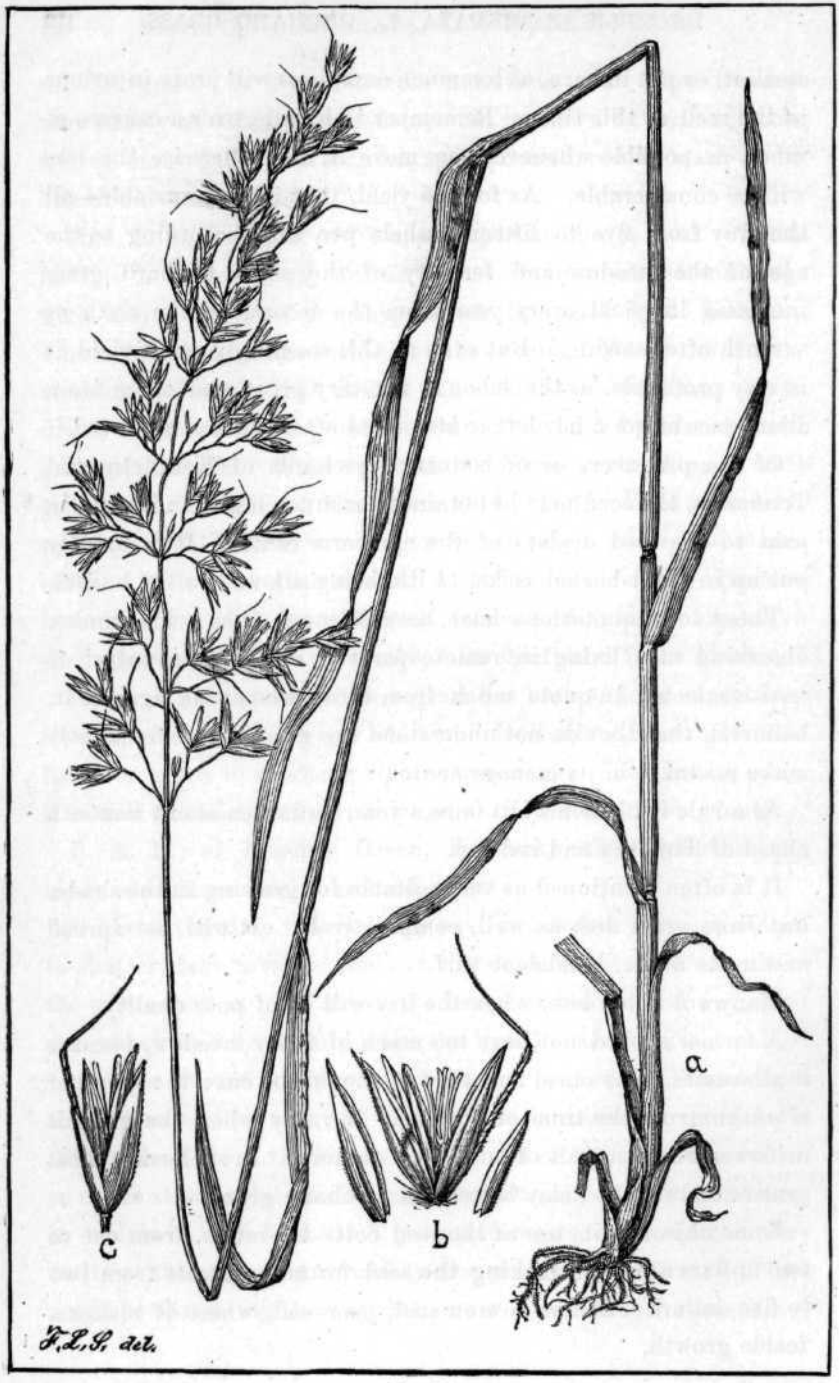


FIG. 64.

ARRHENATHERUM, BEAUV.

Spikelets subterete, 2-flowered, panicled; rachilla jointed above the empty glumes, extending above the upper flower; the lower flower staminate, the upper perfect or pistillate. Empty glumes persistent, membranous, unequal, mucronate; the floral glumes firm, 5-7-nerved, the lower one bearing a long, bent awn below the middle, the upper one bristle-pointed near the tip or awnless, or rarely bearing a stout, bent awn. Palea narrow, hyaline, 2-nerved. Lodicules 2-fid. Stamens 3. Styles short, distinct, stigmas feathery. Caryopsis ovoid, free. Perennials, leaves flat or convolute when dry. Three species, found in Europe, northern Africa, and western Asia.

A. avenaceum, Beauv. Tall Oat-Grass, False Oat-Grass, French Rye-Grass, Evergreen Grass [at the south].—(*Avena elatior*, L.) Panicle narrow, long, nodding. Spikelets ⅓-in., floral glume, with bristly hairs at the base, palea shining; introduced.

Within the past few years this grass has become somewhat prominent, and has won many notes of praise from the farmers, especially from those living in the south and west. It has long been grown in some portions of Virginia.

Tall oat-grass is a hardy perennial, growing from three to six feet high and bearing a loose panicle somewhat resembling one of the common oats, only more slender in every way. It is common in Europe and western Asia, and has some peculiarities which ought to be well understood by those attempting to grow it for meadow or pasture.

In place of much experience by our best farmers, the writer will quote the somewhat conflicting views of several eminent authorities.

Dr. Lindley, of England, said: "It is bitter and ungrateful

Fig. 64.—*Arrhenatherum avenaceum*, Beauv. (Tall Oat-Grass): *a*, plant; *c*, spikelet nearly closed; *b*, rather more enlarged and the outer glumes removed.—(Details by Scribner.)

to animals, and there is no reason why this grass should be regarded as fit for cultivation. The variety *bulbosum* is apt to become a troublesome weed, difficult to extirpate."

William Gorrie, of England, says: "It is most extensively cultivated on the continent; speedily attains to maturity from seed, yields continuously from early spring till winter frosts a large bulk of produce, yet it contains a small proportion of nutriment and possesses a very disagreeable, bitter taste, which causes it to be avoided by horses, cattle, and sheep. It is very subject to rust and black smut. It abounds chiefly on light, dry, arable soils. Its cultivation under any circumstances would not fail to create suspicions of lunacy against the grower. Its extirpation alone demands attention."

Baron J. B. Lawes says: "The endowments favorable to this grass are its hardiness, its comparative indifference to the character of the soil, its particularly ample root growth, both deep and superficial, its strong, tufted habit, and its early flowering tendency. It yields a considerable quantity of foliage on the culms, which affords a good deal of leafy feed in the spring. It produces rapidly after cutting; its taste is bitter, but it is not disliked by cattle. It does not grow abundantly except upon poor soils, and is, upon the whole, of somewhat questionable value. It is much grown in France."

The late Professor James Buckman, also of England, a good botanist who had given much study to the grasses, said: "This is exceedingly bitter, uniformly refused by cows and sheep unless starved to it by want of something better. We think it would be better to discourage its growth. We have two forms, one of which is the variety *bulbosum*, growing in sandy lands. In this the bulbs become enlarged and look like a string of onions on a small scale, which gives it the name of 'onion couch.' The only way to get rid of it is to hand pick it after repeated plowing and harrowing."

Even the English seedsmen, who recommend the use of many sorts, the value of which is questioned by farmers, do not include tall oat grass in the list of valuable grasses.

But the reader doubtless cares less about what the English think of tall oat grass, than he does about what some of the best American farmers think of it.

Judge Jesse Buell, of Connecticut, in 1823, quotes the opinion of Dr. Muhlenburg and Mr. Taylor, of Virginia, who place this at the head of good grasses. It possesses the advantages of early, late, and quick growth, for which the orchard grass is esteemed, and is well calculated for a pasture grass. Dickenson, quoted by Buell, says: "It makes good hay, but is most beneficial when retained in a close state of feeding."

Prof. D. L. Phares, of Mississippi, says: "It has a wonderful capacity of withstanding the severest heats and droughts of summer and colds of winter. It admits of being cut twice a year, yielding twice as much hay as Timothy, and is probably the best winter grass that can be obtained. To make good hay it must be cut the instant it blooms. For green soiling it may be cut four or five times, with favorable seasons. Along the more southerly belt it may be sown in November and onward till the middle of December. It is one of the most certain grasses to have a good catch."

The late Mr. C. W. Howard thought, this grass deserved to be placed at the head of winter grasses for the South. It does not answer well on moist land. Seed sown in the spring will produce seed in the fall.

Prof. E. W. Shelton, of Kansas, says: "This grass has within a few years been extensively sold in the West under the name of 'evergreen grass.' We have tried it for a number of years upon a considerable scale. No grass that we have yet tried has, during its first season, made such a vigorous growth as meadow oat-grass did last year. In this respect it has greatly surpassed our old

favorite, orchard grass. It made a much better stand than did orchard grass growing beside it, and endured the severe and protracted drought of the latter part of the season better, retaining its intense green throughout. This grass, although sown late in April, gave a heavy cutting of hay in July, a feat that we have never before accomplished with any other sort. It makes excellent pasturage early in the spring and late in the fall, but as a hay plant, and for general pasturage, it is greatly inferior in Kansas to orchard grass."

The Students' Farm Journal, of Iowa Agricultual College, sums up its merits as follows:

"It vegetates earlier in the spring than any grass we have ever seen, producing pasture for cattle by April 15. It stood five feet ten inches May 1, started April 5. This is a great item to the farmer, for hay and corn are worth something in April and so is the time required in their feeding. It grows strong and even throughout the entire year and very late in the fall. It is best for pasture but makes coarse hay, but of fine flavor if cut early. It will blossom twice in one season if cut early. Its flavor and smell are good. By chemical analysis this grass contains some more flesh or muscle forming material than Timothy. More fiber and less fat. But chemical analysis is not the most important element used in judging of a plant's value. It is better than Timothy in not being so hard on the soil, and produces nearly twice as much hay. No grass in the college experimental grass garden is more promising than this. It ripens earlier than Timothy and is therefore better mixing with clover."

Lieutenant Governor Sessions, of Ionia, Michigan, has given this grass a good trial and reports: "In a very dry season the newly seeded clover and Timothy disappeared, but the oat-grass sown with it grew well. It more than holds its own with clover and Timothy. It is rank and early and will seed twice each season. It makes good pasture and good hay, and is very pro-

lific. I want a permanent grass, so I have not tried to destroy it."

The writer has raised this grass on rather light, sandy soil at Lansing, Michigan, for twelve years or more, has seen it in some other localities in the State, and thinks he can tell why there are such conflicting opinions in relation to its value. In England the climate is moist, and the finer succulent grasses thrive well, while tall oat-grass does better in a hotter, dryer climate. He has had occasion to kill several plats and has had no more trouble with it than in killing so much Timothy. There are some bulbs on the sort raised in Michigan, but they are not hard to kill. Like orchard grass, it ripens very quickly after blooming, and to make good hay there must be no delay in cutting. As it blossoms rather early, many let it go too long before cutting, when the stems become woody and of poor quality. Again, bad weather often interferes with the cutting just at the right time, and poor hay is the result. A man doesn't want a very large quantity of this grass to mow, unless he is prepared to cut it all in a day or two. It makes a fine growth the first season after sowing, and if sown alone will cut a good crop of hay.

I find that stock eat the grass well, though most likely they would prefer to have some grass not so bitter for a part of the time. The seed is rather light, weighing fourteen pounds to the bushel in the chaff. About two bushels to the acre are usually sown. Only half of the flowers set seed, as every other one is staminate. The seed is rather large, starts early, and soon makes a vigorous plant. This fits it for alternate husbandry and for dry countries.

In saving the seed, care needs to be used to cut the grass just as soon as the top of the panicle is ready. Not a half day should go by or seed will be lost. It is cut high, bound in small bundles, shocked till well cured, when it is drawn to the threshing floor on a wagon supplied with a canvas to save the shelling seeds. It yields from ten to twenty bushels of seed to the acre.

FESTUCA, L. FESCUE.

Spikelets 3 or more flowered, subterete, in a compact or slightly spreading panicle, rachilla jointed above the empty glumes and between the flowers; flowers perfect or rarely staminate, empty glumes, persistent, unequal, shorter than the lowest floral acute, keeled, the outer 1-nerved, the inner larger, usually 3-nerved. Floral glumes narrow with 3-5 obscure nerves, acute, mucronate or awned at or near the tips. Palea shorter, 2-nerved. Lodicules 2, notched. Stamens 1-3. Styles short, terminal, distinct; stigmas feathery. Caryopsis oblong or linear, more or less adherent to the floral glume and palea. Many are tufted perennials; leaves flat, covolute when dry, or narrow and permanently conduplicate. The glumes are longer and more pointed than in *Poa*, otherwise the two genera blend together.

About 80 distinct species, many of which are quite variable. Found in arctic, cold, and temperate regions.

F. elatior, L. Tall Meadow Fescue, Randall Grass, Evergreen Grass.—A perennial, 2-4 ft. hi., usually tufted. Leaves broad, flat, panicle narrow, erect or nodding, 5-9 in. Spikelets 3-7-flowered, about ¼ in. Floral glume pointed, 5-ribbed. When the panicle is much branched the glumes are narrower and more pointed, and the ribs less distinct.

This is a very variable perennial, two to four or even five feet in height, generally growing in tufts or bunches, which from year to year creep slowly upward, as the new growth springs from the side of the old culms, a little above that of the previous year.

The roots are stout and woody, with a slight tendency to sucker. The leaves are rather firm, flat, varying much in length and breadth, but often one to two feet long.

The nodding, spreading panicle somewhat resembles that of a

slender top of chess, with which every farmer is familiar. It flowers about a week or ten days before Timothy.

This valuable grass, with several kindred species and varieties, is found throughout Europe, western Asia, and has been introduced into North America.

Tall fescue has long been in high favor with the best farmers of Great Britain, as it is well liked by all domestic herbivorous animals.

Mr. Gorrie, a competent British authority, speaks of it as the most important species of the fescues, highly valuable for permanent grass lands, both for spring and autumn, but not the best suited for alternate husbandry, as it does not attain to full productive powers till the third year from sowing. It is very nutritious, making excellent hay as well as pasture.

This grass is seldom sown in a pure state, but is frequently met with, in the northern States especially, where the soil is heavy and inclined to be moist. It seeds freely, and the seeds germinate quickly and make strong young plants. If used alone, sow two bushels to the acre.

For the South, Dr. Phares considers it one of the best winter grasses, and says it is much prized as far north as Virginia, where it furnishes cattle good grazing in mid-winter. To the writer this seems to be one of the most promising grasses for the dry prairie lands of the west.

Festuca pratensis, Huds. Meadow Fescue, Randall Grass.— By many botanists this is considered a mere variety of the former species, or the former grass a mere variety of this one; some choosing one name, some the other. The one now under consideration much resembles the tall fescue. It is a little earlier, considerable smaller, with shorter, thinner leaves, less inclined to grow in tufts, top narrower and simpler. The reader should consult the remarks on *Festuca elatior*, which mostly apply to this one also. Most of the seeds sold for tall meadow fescue are

FIG. 65.

those of meadow fescue or perennial rye-grass, and most of those sold for meadow fescue are all seeds of rye-grass, or they are very extensively adulterated with those of rye-grass, to the extent of fifty to ninety per cent.

In the words of James Hunter, a seedsman of England: "So closely to the naked eye do the seeds of meadow fescue resemble the seeds of perennial rye-grass, that abundant opportunities for adulteration are afforded and are certainly not neglected. The fact that the average price of perennial rye-grass is only about one-fourth or one-fifth that of meadow fescue, sufficiently explains the motives of those who mix these seeds."

The writer knows well that the frequent adulteration of the seeds of meadow fescue is one of the chief causes why so little is raised in this country. A farmer not knowing either grass, orders seed of this one and gets seeds of rye-grass, which produce plants not satisfactory to his needs. This is one of the five grasses recommended by Mr. De Laune, of England, for permanent pastures and meadows, the others being tall fescue, orchard grass, Timothy, and meadow foxtail. His valuable experience is noticed under the head of "testing seeds," and "what to sow."

The writer at present would advise no one to buy seeds of meadow or tall fescue unless he is a good botanist or employs a good botanist to examine the seeds for its identity.

For the South, Prof. Phares thinks "Randall, evergreen grass, or meadow fescue is a magnificent winter grass; in fact it may be grazed from September till June. Or taking stock off in April, it will make a large crop of seed, and a heavy crop of hay, as the seeds mature while the stems and leaves are still green. This may be made to yield two to four tons of hay per acre and of high nutritive rank. It grows well on wet or dry bottoms, hillsides and tops, gravelly and loamy

FIG. 65.—*Festuca elatior*, L. (Taller Fescue); Part of plant, *a*, spikelet enlarged; *b*, floret enlarged.—(Scribner.)

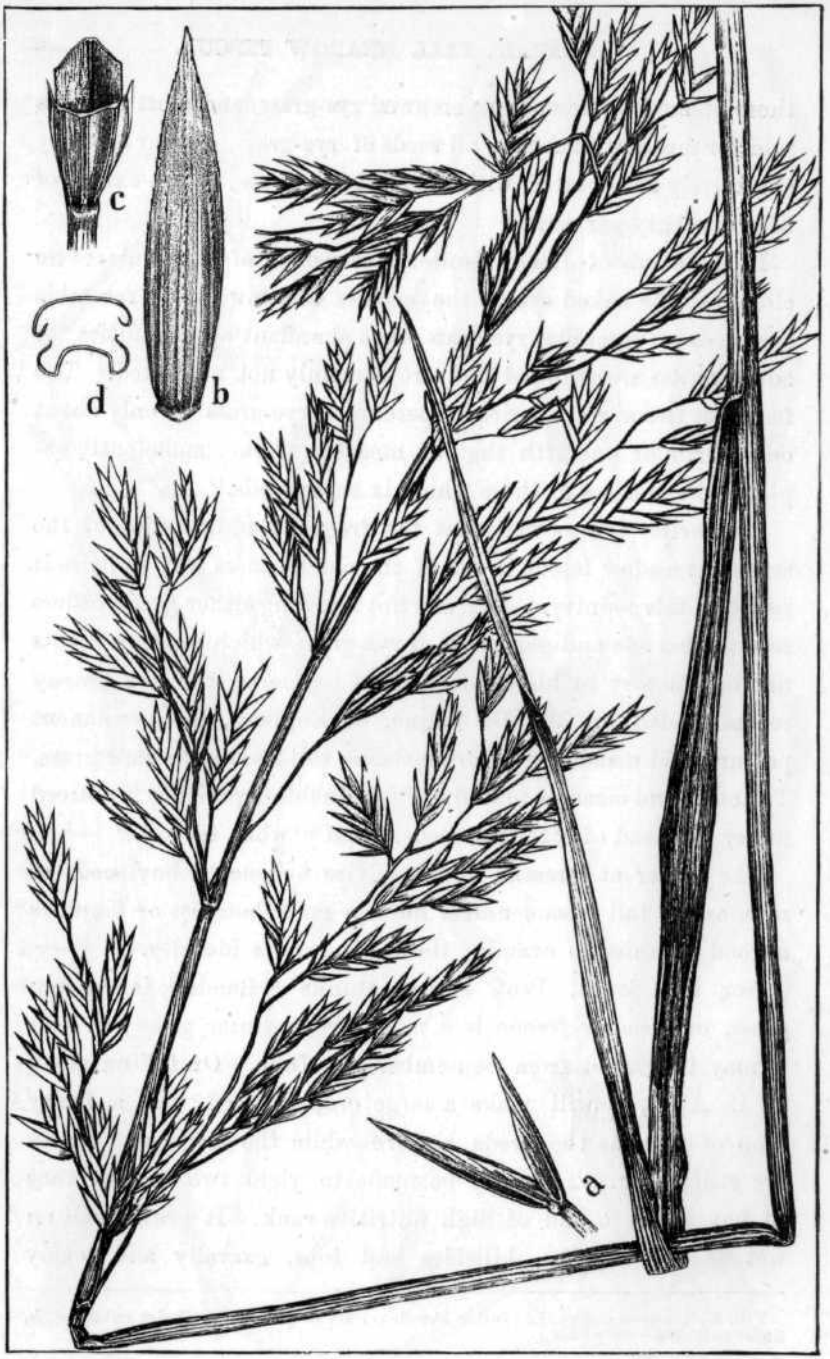


Fig. 66.

lands and clays, and having many fibrous roots running down eight to fifteen inches, resists the droughts."

For Kansas, read what Professor Shelton writes: "After experimenting for twelve years, I have often wondered that the cultivation of this grass has not been more widely extended. It gives a good amount of early and late feed of good quality, and yields heavily, of good hay. It endures dry weather, in strong lands, without injury. People east and west can afford to give this Festuca a trial. Sow two to two and a half bushels of seed to the acre."

Professors Latta and Troop, of Indiana, say that "Meadow Fescue and Taller Fescue do remarkably well at Lafayette, and we look upon them as the coming grasses of this section. The first seems to give better satisfaction as hay, while the second furnishes more pasture after cutting. Its leaves are too rough and harsh for hay."

As before said the various samples of this grass already vary much in size and vigor, and this shows what might be done with a little time and care in selecting certain types and in raising each by itself. Like Indian corn, they seem ready to break up into permanent varieties. Prof. James Buckman, of England, tried, side by side, the two fescues above named, and another called *Festuca loliacea*, and found all intermediate stages passing from one into either of the others, but under certain circumstances each maintained its distinct characters.

Festuca elatior var. arundinacea, Tall Meadow Fescue.—Leaves longer, broader, firmer, culm stouter and taller, panicle more erect, roots larger and stouter than *F. elatior*.

For seven years the writer has had three separate forms or *races* of the larger fescues, each of which came from seeds of distinct selected plants. The mixed seed at first was received

FIG. 66.—*Festuca elatior* var. *arundinacea*; part of plant; *a* outer glumes; *b*, floral glume; *c*, section of floral glum and palea; *d*, a cross-section of same.—(Sudworth).

from the Kew Gardens. Of all the races this one seems the best adapted to the dry prairie regions of the Central United States.

Festuca ovina, L., Sheep's Fescue.—A small perennial, densely tufted, leaves chiefly radical, very narrow, conduplicate, appearing cylindrical, the upper more or less flattened. Panicle one-sided, short; spikelets, 4-10-fld. Glumes faintly nerved. Dry, hilly pastures, very variable. Of little value, but here mentioned because it is so common and likely to be found.

Festuca duriuscula, L., Hard Fescue.—Compared with the preceding, less densely tufted, taller, larger, sheaths downy. Panicle more open, varying much in color. All intermediate forms can be selected from this to the preceding, of which many consider it a mere variety.

For dry pastures this seems to be worthy of some attention.

POA, L.

Spikelets, 2-6-flowered, compressed, in loose or close panicles; bunches, 2-nate or in ½-whorls. Rachilla jointed between the flowers which are perfect, rarely imperfect. Empty glumes unequal, shorter than the lowest floral one, keeled, acute or obtuse; the lower 1-nerved, the upper larger, 3-nerved. Floral glume often webbed below, keeled, acute or obtuse, 5, rarely 7-nerved, tips hyaline. Palea 2-nerved, ciliate. Lodicules tumid below. Stamens 3. Styles 2, short, terminal, distinct, stigmas feathery. Caryopsis avoid, oblong, grooved, free. Annuals or perennials, low or tall, leaves flat or conduplicate. About 80 species, chiefly in cold or temperate regions, nearly related to the fescues, having shorter and more compressed glumes, without awns.

P. pratensis, L. June Grass, Spear Grass, Green Grass, Smooth-stalked Meadow Grass, Blue Grass, Kentucky Blue Grass.—A perennial, 1-2 ft. hi., with creeping root stocks. Culm,

smooth, terete. Leves narrow, keeled, tip closed, ligule short, obtuse. Panicle pyramidal, 2-3 inches long, with slender, spreading branches, 3-5-nate. Spikelets ovate or oblong, 3-5-flowered. Floral glume silky-hairy on the keel, 5-nerved. See Fig. 51.

This is one of the most common and most useful grasses in the Northern temperate zone; especially valuable in North America for lawns and permanent pastures.

It is not so highly esteemed in Great Britain as in this country, as there it is objected to on account of excluding other grasses which are considered more valuable in that climate. It is found also in Asia and Australia, varying considerably in size and appearance.

June grass varies in height, from a few inches to a foot, and in rich ground, where the stems have not yet become crowded, samples may be found which exceed four feet. It is noted for root stocks which spread rapidly and fill the ground near the surface with a close mat of turf, much like quack grass. This makes the grass very tenacious and hard to kill, especially in moist land or in wet seasons when the land is used for a hoed crop. The crowding of these root stocks weakens the stems above ground and soon a large amount of vegetable matter accumulates near the surface.

It flowers about the same time as the earliest red clover and orchard grass, and nearly all comes on at once. The seed soon matures, and, unlike *Poa compressa* and *Poa serotina*, the culms soon turn yellow and die, and the leaves become feeble or perish.

It flowers but once a year. The leaves are slender and when dry fold up like the two halves of a book when closed.

As stock feed off the leaves, many of them, and some new ones, continue to elongate by growth at the base of the blade near the apex of the sheath. The apex of the blade is the oldest portion; the base the youngest.

In a wet season, in a hedge, the writer found some leaves still green and thrifty where they were almost (5½ ft.) five and a half feet long.

Although this grass is so very common, yet frequent inquiries are made in reference to its value. Are June grass and Kentucky blue grass, or blue grass of Kentucky, the same?

Frequent experiments and careful study by the botanists prove that they are without question identical—one and the same.

We have a rather thin, short, late grass, with short leaves, a small top, and a flattened stem. This one noted in the last sentence is very rich, of a dark bluish-green color, and is often called "blue grass," a name which it richly deserves. It is *Poa compressa,* wire grass or flat stemed poa, an account of which should be read in this connection.

June grass starts quickly in spring, after mowing or feeding, unless the weather be quite dry. It is very rarely injured by the cold, and very hard to kill by dry weather, hot sun, the tramping of hoofs, or close mowing. It is a perennial, living on and on almost indefinitely.

In most soils the stalks are too short for a large yield of hay, but if cut early, in flower or a little before, and well cured, the hay is very rich, and will go a great way, considering its bulk.

It is too frequently condemned for its single crop of short stems and leaves.

It does not get a great name on account of its value for meadow, but on account of its endurance and great worth for permanent pasture and lawn.

The leaves keep growing and make much feed, if the soil and season be not unfavorable.

Like all other grasses for feeding in cold weather or in a very dry spell, it should be allowed to get a good start before this trying time arrives.

But few sections of country are suited to a permanent and fine

growth of June grass. Such land is always deep, rich, and valuable for many other crops. The forest trees in such sections of the United States are usually large, tall, thick, abounding in sugar maple, black walnut, hickory, white, black, and blue ashes, red elm, black cherry, and burr oak.

A Kentucky farmer says: "Whoever has lime-stone land has blue grass; whoever has blue grass has the basis of all agricultural prosperity, and that man, if he has not the finest horses, cattle, and sheep has no one to blame but himself."

Besides some portions of Kentucky, there are also a few counties or parts of counties in Ohio, Michigan, and Indiana.

It requires three years or more to become well established, and on this account should not be sown for one or two crops of grass or hay.

Among the numerous plats of grasses, clovers, and other experimental plants of the Michigan Agricultural College, not one is so persistently omnipresent as June grass The seeds push up and make young plants at all growing seasons of the year; these cannot always be certainly detected until their tops appear. In Michigan it is certainly a good fighter. The spreading so rapidly by root stocks, and its tenacity of life, account for the fact that it soon appears in pastures or old meadows when the other grasses die out. June grass is not very often sown for pasture or meadow, yet it abounds in most of our pastures, especially if they have not been plowed for some time.

Read Professor Phares as to its success in the South: "Kentucky blue grass grows as well in most parts of the Gulf States as in Kentucky or any other State. In these States this grass is perennial and excellent for hay and grazing through a large part of the year."

In the famous experiments on meadow grasses by J. B. Lawes, in England, *Poa pratensis* on the permanently unmatured land made a very poor fight, amounting to one-quarter of one per cent

or even less of the herbage, while on plats receiving a large quantity of potash, phosphate of lime, and salts of ammonia, in fact everything that is necessary to grow luxuriant grass, it managed to fight its way onward, so that in ten years it was credited with twenty-two per cent of the whole herbage.

With a still more generous diet, it had to give way to cock's foot [orchard grass], which in turn gave way to meadow foxtail.

Concerning this grass for Kansas, Professor Shelton writes: "What we said five years ago in writing of this grass has been fully borne out by recent experience. It can be grown almost anywhere in the now settled portions of the State. We have never failed to secure a good stand, and ultimately a good sod,—even during such very dry seasons as 1875,—when good seed was sown upon well prepared land, and at the proper season, which is early in the spring. However, our experience with the grass,—a very extended one by the way,—has convinced us that, for all useful purposes except lawns, in central and western Kansas, this is one of the most worthless of the tame grasses. It starts early in the season, and for a short time yields a small amount of quite inferior feed; but in May it ripens its seed, the grass becomes brown, dry, and fibrous, and in this dormant condition it remains until fall, and often until the following spring. We have invariably found, too, that, in a field containing other sorts, cattle will not touch blue grass until all these others are consumed. Moreover, dry weather will almost certainly injure blue grass sod seriously, when no damage is sustained by orchard grass and clover growing in the same field. On the other hand, in the eastern portions of the State, particularly in the counties bordering the Missouri river, we know from personal observation that blue-grass thrives abundantly, and is very profitable grass.

"We can easily see that this grass possesses great value for a region like Illinois and Kentucky, where winter rains abound, enabling it to make a slow and continuous growth; but the

Kansas winter is generally our dryest season, and for this reason we doubt much if this old favorite sort has any place in our agriculture. To obtain a good stand quickly, blue grass seed should be sown in the early spring; and in amount not less than three bushels per acre of ground."

The following in reference to the quality of this grass, is from the pen of of Dr. Bessey, of Nebraska:

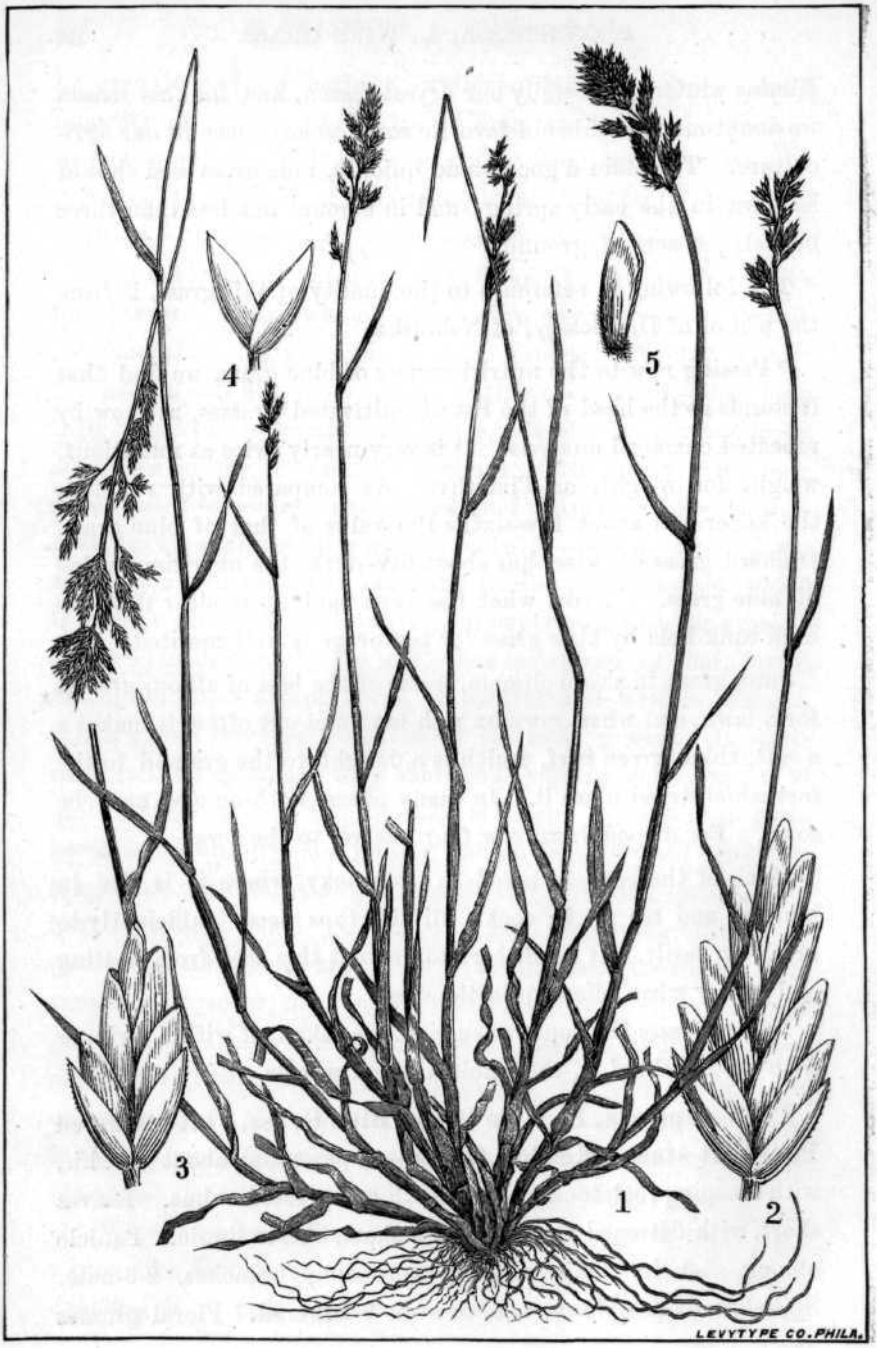
"Passing now to the nutritiousness of blue grass, we find that it stands at the head of the list of cultivated grasses, as show by repeated chemical analysis. It is very nearly twice as nutritious, weight for weight, as Timothy. As compared with red top, the latter has about five-sixths the value of that of blue grass. Orchard grass likewise, has about five-sixths the nutritious value of blue grass. From what has been said, it is clear that the high rank held by blue grass for pasturage is well merited."

June grass, in a cool climate, is one of the best of all our grasses for a lawn, and when sown on rich land and cut often, it makes a a soft, thick green turf, which is a delight to the eye and to the feet which tread upon it. In many places nothing else need be sown. For a good lawn sow four bushels to the acre.

Much of the seed is saved in Kentucky, where it is tied in bundles and set up in cocks till the tops decay sufficiently to break up easily. It needs care to prevent this seed from heating and iujury when piled up in the chaff.

In some cases the tops, when ripe, are taken off with a stripper with a box behind it, the whole kept on wheels.

Poa compressa, L. Wire Grass, Blue Grass, Flat-stemmed Poa, Flat-staked Meadow Grass.—A perennial, about 1 ft. hi., with creeping rootstocks, and smooth compressed culms. Leaves short, with flattened sheaths, and a short, obtuse ligule. Panicle oblong, 2-3 in. long, slightly spreading branches, 2-3-nate. Spikelets ovate-oblong, 4, 6, or even 9-flowered. Floral glumes



FIG, 67.

with minute silky hairs along the keel, margins hyaline; nerves obscure.

Although not purposely sown anywhere, so far as the writer can learn, it deserves notice because so often found in rather dry, thin pastures on sand, gravel, or clay soil, in company with June grass, which it somewhat resembles.

The grass is a perennial, a foot or more high, with a stem nearly solid, hard to cut, soon gumming the knives of the mower. When compared with June grass, it flowers several weeks later, the panicle is shorter, narrower, more compact; the leaves shorter, the stem much flattened, and the whole plant of a much darker color. In this country it does not spread rapidly by root-stalks, as is the case with June grass and quack grass, but in England it does spread rapidly.

It well deserves the name "blue grass," by which it is often known, as the whole plant has a dark, bluish, glaucous-green color. It is to be regretted that the name "blue grass" was ever applied to *Poa pratensis*, as is commonly the case in Kentucky and vicinity.

Prof. D. L. Phares, in his manual of grasses for the Southern States, says: "*Poa compressa* is blue, the 'true blue' grass, from which the genus received its trivial name. It has priority of claim to the name *blue* grass, and justly too, as the leaves have a deep bluish tint."

Like *Poa serotina*, fowl meadow grass, it may be allowed to get ripe before cutting, as its stalks remain green and nutritious. No grass makes richer pasture or richer hay.

Gould says: "It never forms a close turf, and is rarely found intermixed with other grasses. It never yields a great bulk of hay, but this bulk weighs very heavily, frequently a ton or a ton and a half to the acre, where one would not expect to get half a ton.

FIG. 67.—*1*, Plant of *Poa compressa*; *2*, *3*, spikelets; *4*, empty glumes; *5*, floral glume. (1 from U. S. Agricultual Report. 2-5, F. L. Scribner.)

"It is certain that cows that feed 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. Sheep fatten astonishingly when fed upon it.

"The crops are remarkably even; it rarely suffers from excessive wetness or dryness. By manuring, we have increased the size of the culms, and caused them to grow two feet high. It is one of the hardiest grasses known. It is, perhaps, rather better suited to moist, gravelly clays. It keeps green even until the heavy frosts of winter. It loses less weight in drying than any other species. Although this grass is spoken of by most writers on the subject in terms of contempt, we must differ very decidedly from them, and adhere to the opinion which we have formed after much observation and experience, that it is one of the most valuable and nutritious of them all."

Poa serotina, Ehrh. Fowl Meadow Grass, False Red Top.—Culms rather weak, 2-3 ft. hi. Leaves narrow, smooth, ligules $\frac{3}{16}$ in. Panicle, 6-14 in., slender, open, branches mostly 5-nate. Spikelets numerous, acute, short, pedicelled, often purplish. Floral glumes obscurely nerved, webbed at base.

The name "Fowl" meadow is said to have been applied to this grass because ducks and other wild water birds were supposed to have introduced the grass into a poor low meadow in Dedham, Massachusetts.

This is a native grass, found on bottom lands in the eastern half of the Northern States. It flowers about the same time as Timothy. It makes a soft, pliable hay of excellent quality. The stems in damp weather branch at the lower joints, and thus the grass inclines to spread. On account of the large top, and the slender stem, this grass when sown alone is rather inclined to

FIG. 68.—*1*, Plant of *Poa serotina*: *2*, *3*, spikelets; *4*, floral glume. (The first from U. S. Agricultural Report, 2-4, F. L. Scribner.)

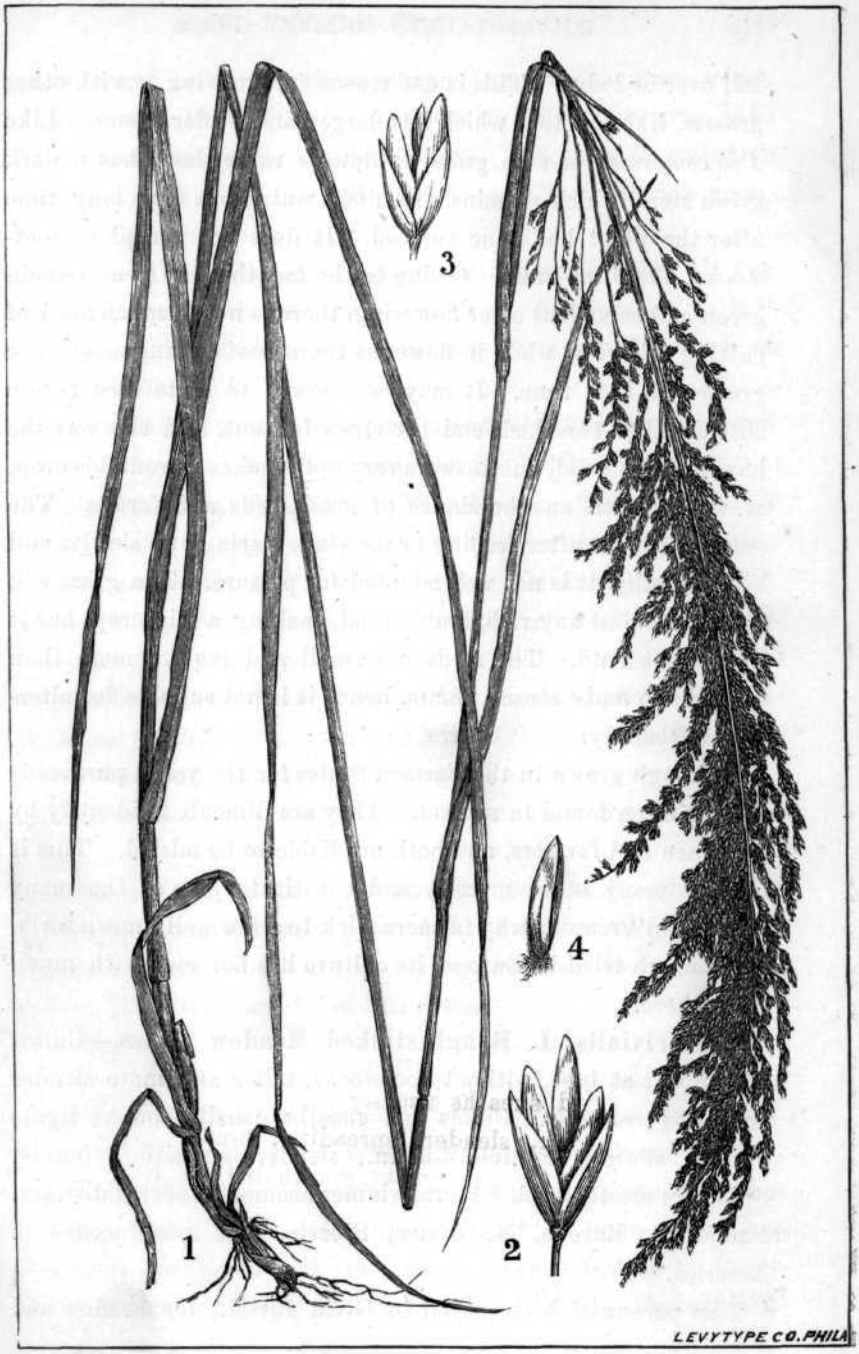


FIG. 68.

fall over or lodge. This is one reason for growing it with other grasses, like red top, which has larger and stiffer stems. Like *Poa compressa* or wire grass, it flowers rather late, has a dark green stem, which remains green and nutritious for a long time after the plant has gone to seed. It does not spread by rootstocks, like June grass. Owing to the fact that the stems remain green and succulent after flowering, there is not so much need of cutting this grass when in flower as there is of cutting most other grasses at that time. It may be allowed to go to seed before cutting, then threshed, and the straw fed out. In this way the hay is not so good, but answers very well, makes a profitable crop, as we get both an abundance of good seeds and forage. The second growth, after feeding or mowing, starts quite slowly, and like Timothy, it is not well adapted for pasture. The grass will grow on almost any rich, arable land, making a fair crop, but it likes moist land. The seeds are small and require more than one year to make strong plants, hence it is not suitable for alternate husbandry.

Although grown in the Eastern States for 150 years, pure seeds are not often found in market. They are difficult to identify by seedsmen and farmers, and both are liable to be misled. This is true of many other grasses, and constitutes one of the many "practical" reasons why farmers stick to a few well known sorts.

Although tried in Europe, its culture has not met with much favor there.

Poa trivialis, L. Rough-stalked Meadow Grass.—Culms decumbent at base, without rootstocks, taller and more slender than *Poa pratensis*. Culms and sheaths usually rough; ligule oblong, acute. Panicle 4-6 in., slender, spreading, 5-nate. Spikelets mostly 3-fld. Floral glumes accumate, nerves distinct. Found in Europe, N. Africa, Siberia, and introduced into America.

This perennial is employed in Great Britain for meadow and

pasture, and is there usually much preferred to June grass, which it much resembles. It is to that country what June grass is to the eastern part of the United States. The grass is suited to deep, moist loam, to sow with red top and fowl meadow grass, but poorly suited to dry soils.

The late Prof. James Buckman, of England, said: "*Poa trivialis*, is a month later than June grass and inferior to it." In Europe the seeds of June grass are often sold for those of *Poa trivialis*.

In my plats of grasses in several places, this has always proved a slow grower, and has soon been crowded out by June grass.

P. arachnifera, Torr. Texas Blue Grass.—This plant is well supplied with creeping rootstocks, and is taller than *P. pratensis*. The leaves are long and slender; ligule short and obtuse. Panicle 4-6 in. by ¾ in., light colored. Floral glumes prominently ciliate on the keel below the middle; at the base usually are very long, webby hairs. Palea ciliate on the nerves, slightly adherent to the caryopsis, which is twice as long as that of *P. pratensis*.

For the South, as a pasture grass, this one seems very promising. It is hardy and a more rapid grower than Kentucky blue grass.

As far north as Kansas, Professor Shelton says, it endures the winters and resists drought perfectly, making *three or four times* as much pasture or hay as does its near relative, Kentucky blue grass. He is very hopeful of this grass.

AGROSTIS, L.

Spikelets small, 1-fld., panicled, flower perfect, empty glumes persistent below the joint, keeled, acute; floral glume shorter, broad hyaline, frequently supplied with a slender awn below the middle. Palea very slender, hyaline, short or none. Stamens mostly 3. Styles distinct, very short, stigmas feathery. Caryopsis included in the floral glume, free. Annuals or perennials,

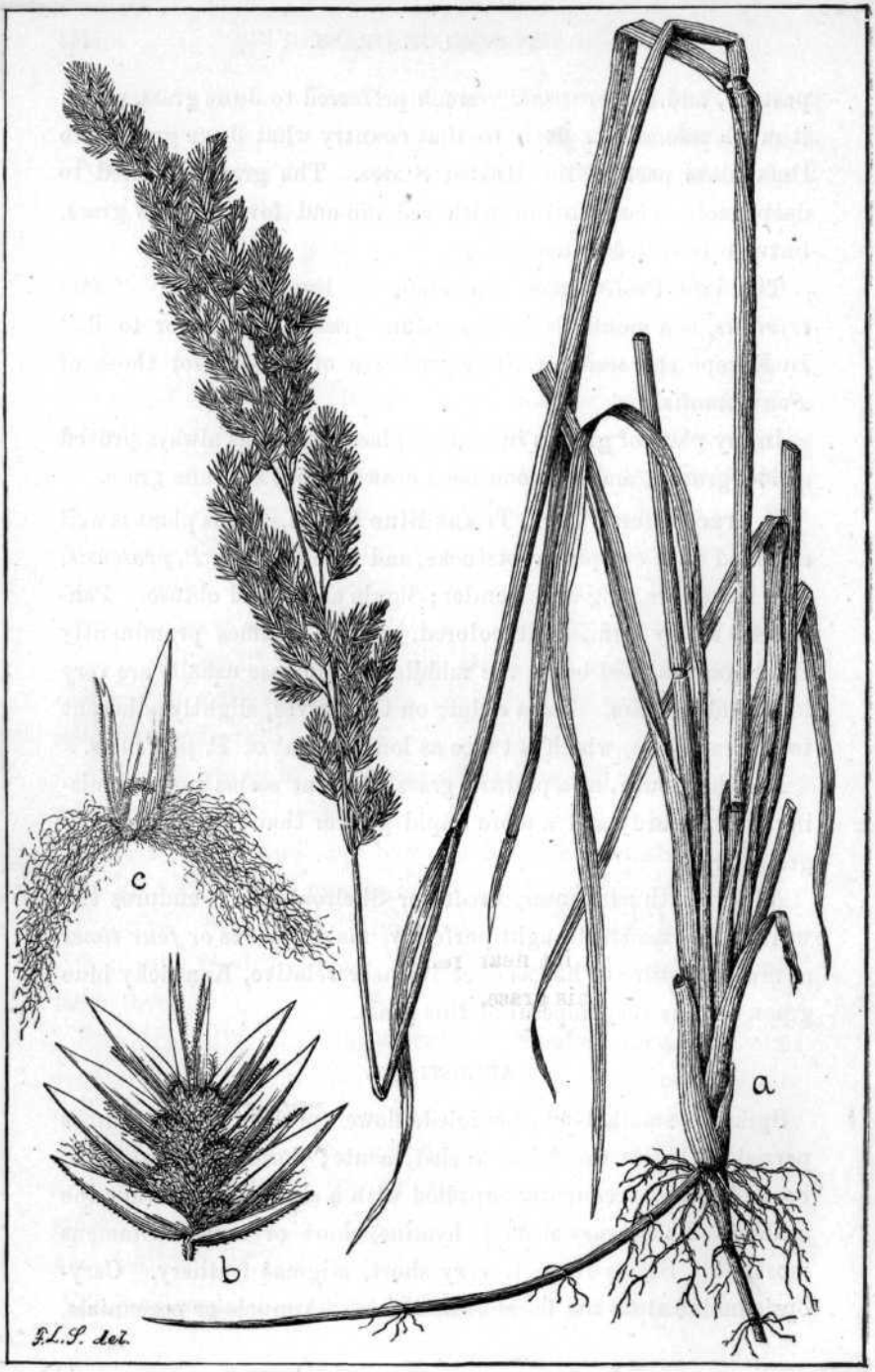


FIG. 69.

tufted, leaves flat or bristly. Panicle terminal, usually slender, much branched; branches slender, spikelets numerous.

About 100 species, mostly found in temperate regions.

A. vulgaris, var. alba, With, Red Top, Herd's Grass (of the South), **Burden's Grass, Summer Dew Grass.**—Culms 1-2 ft. hi., ascending, smooth, from creeping rootstocks. Leaves short, flat; ligule oblong. Panicle oblong, 3x8 in., branches spreading. Empty glumes subequal, or the lower longer, ovate or lanceolate, acute, often purple. Floral glume shorter, truncate, 3-nerved; awn short or none. Palea about one-half as long as the floral glume.

This is erroneously sometimes called "fowl meadow grass." In England it is also called "red bent," "purple bent," "creeping rooted bent," "black twich."

It is a well known, common, native, perennial grass, found on moist bottom lands, where it flowers with Timothy or later. The spreading panicle varies considerably in appearance, but is usually tinged with purple.

It starts rather late in spring or after cutting, affording very good pasture, remaining green for a great part of the year. It yields from one to two tons of hay to the acre; is of good quality and rather light for its bulk. Chemical analysis shows it to rank next to June grass, very high in nutritive qualities.

Red top in this country is often sown on marshes, too wet for some of the better grasses. It is not well adapted to alternate husbandry, as it takes several years to become well established.

Gould says: "Its interlacing thick roots consolidate the sward, making a firm matting, which prevents the feet of cattle from poaching. It is generally considered a valuable grass in this country, though by no means the best one. Cattle eat hay made from it with a relish, and as a pasture grass it is much valued by

FIG. 69.—*a*, Plant of *Poa arachnifera*, Torr, (Texas Blue Grass); *b*, spikelet, enlarged and spread out; *c*, floret.—(Scribner).

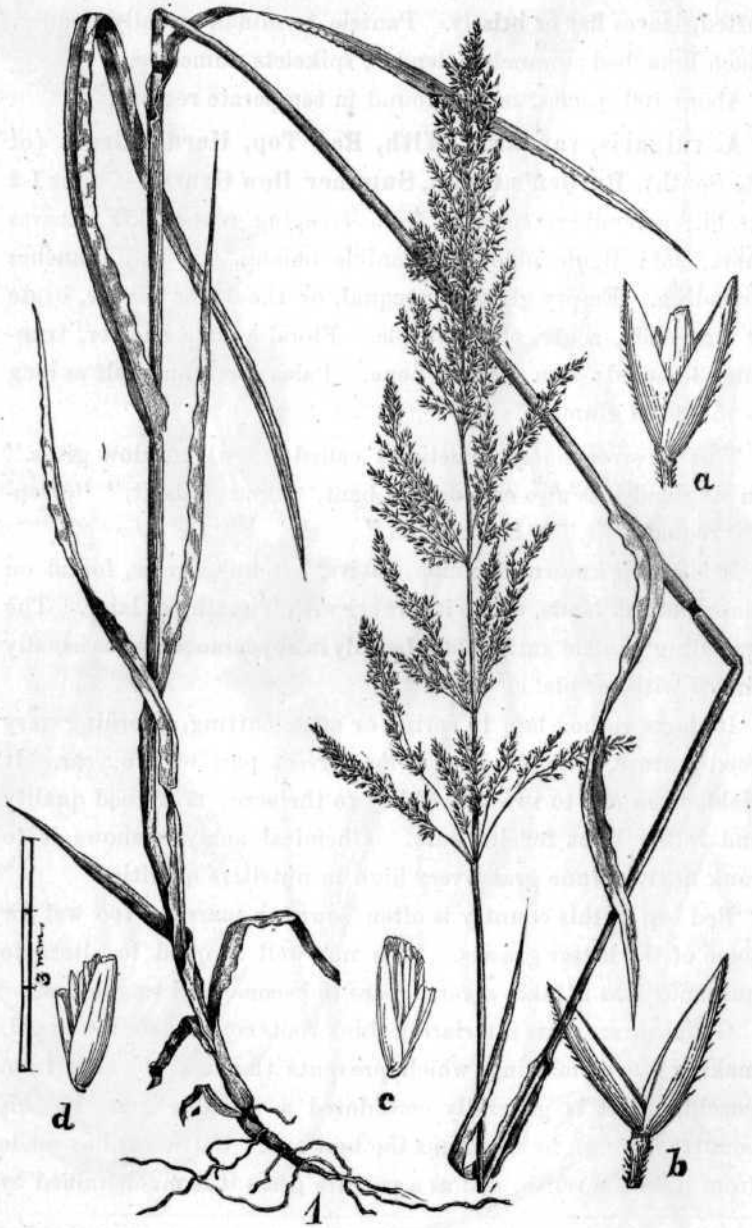


FIG. 70.

dairymen, and in their opinion the butter would suffer much by its removal."

Professor Phares says "It furnishes considerable grazing during warm 'spells' in winter, and in spring and summer an abundant supply of nutrition. It will continue indefinitely, though easily subdued by the plow. It seems to grow taller in the southern States than it does farther north, and it makes more and better hay and grazing. It does well with Timothy, but will finally root out the latter. Sow about two bushels (24 lbs.) per acre if alone.

"Red top may be pastured here through most of the year, furnishing considerable grazing even along through winters, growing on almost all soils if not kept too long submerged in water. It is very hardy, and in mixed pastures exterminates, after a few years, most other grasses."

Killebrew, of Tennessee, says: "Red top is next in importance to Timothy as a meadow grass. Grazing is necessary to its preservation, as, if allowed to go to seed a few years, it dies out.

It is the most permanent grass we have, and by means of its long, creeping roots will, even if sown too thin, quickly take possession of the ground. On uplands it is not a good producer. It stands the effects of drought much better than Timothy. For stopping gullies in old fields it is superior to blue grass. The seed is usually sold in the chaff. It is probably better adapted to all the soils of the State [Tennessee] than any other grass."

Howard of Georgia, says: "It will grow almost in running water. It yields a valuable return on thinner land than, perhaps, any other of the cultivated grasses. Timothy and red top should be sown together, as they are ready for the scythe at the same time. This mixture is better than either grass singly."

In England *Agrostis vulgaris* differs somewhat from the same

FIG. 70.—*Agrostis vulgaris* var. *alba*. (Red Top); number *1*, a plant; *a*, spikelet; *b*, empty glumes; *c*, *d*, florets.—(Scribner.)

grass in this country. In that country it is not given in the lists of grasses recommended for cultivation.

Dr. Lindley says: "They are little better than weeds, except in soils where better grasses cannot be obtained. It grows in *dry*, gravelly, sandy places, and is a troublesome weed."

Mr. Gorrie, of England, says: "Remarkably variable in habit and appearance, too common and disliked by cattle. It starts late in spring."

Baron J. B. Lawes, says: "It flourishes most on dry soils, and is a troublesome weed on arable land, disliked by cattle and sheep. It is reported as useless, and should be discouraged as much as possible. In manuring the land, the proportion of this grass was very much reduced in every instance, a result certainly not to be regretted."

Agrostis alba, L. Creeping or Marsh Bent, Fiorin, White Bent, White Top, Bonnet Grass.—A perennial, 6-24 in. hi., often prostrate below. Leaves flat, sheaths smooth, ligule long, acute. Panicle contracted, narrow, 3 in., many small branches in a whorl. Palea with two tufts of hairs at the base. Very variable.

By some this is equivalent to *Agrostis stolonifera*, by others it is thought to be a mere variety of red top, or red top a mere variety of this grass. Although not considered very valuable, yet it is often recommended in Great Britain in mixtures for permanent pastures. It starts early and holds out very late in autumn. A creeping habit makes it much like June grass, difficult to kill out on wet land. It is not suitable for dry land, but for wet, bottom lands or for permanent irrigated meadows, where it often produces large crops.

Along the Connecticut river, the straws are cut for braiding to make bonnets. In this country, so far as the writer has seen,

FIG. 71.—*Agrostis canina* L. (Brown Bent. Rhode Island Bent). *a*, plant; *b*, spikelet *c*, back of floral glume with awn. (Riechenbach.)

FIG. 71.

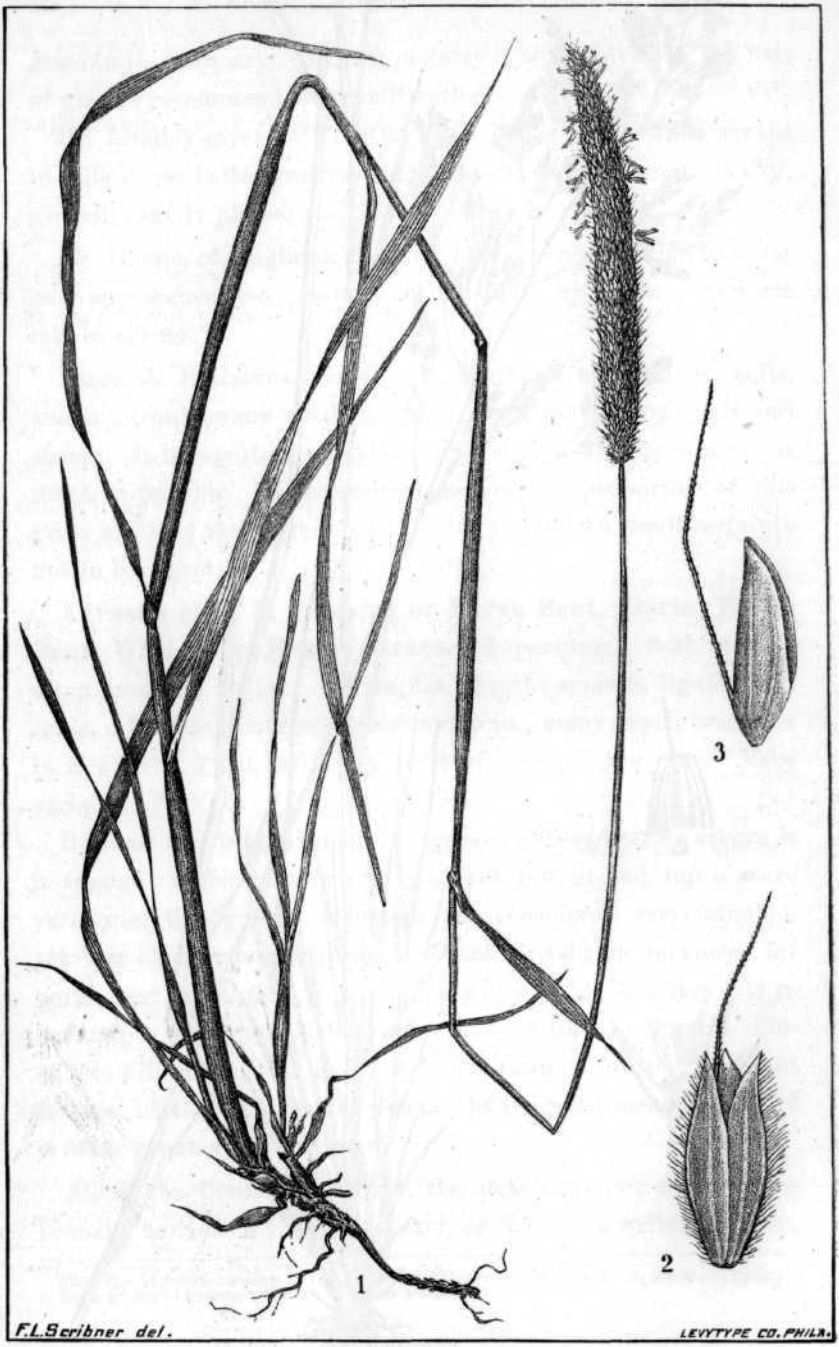


FIG. 72.

fiorin does not seem to be as large, vigorous, productive, or as valuable as our own native red top.

Agrostis canina, L. Brown Bent, Rhode Island Bent, Fine Top, Furze Top, Burden's Grass.—A very variable perennial, much like small plants of *A vulgaris*. Culms 6-18 in. hi., stoloniferous. Ligule oblong. Panicle 2-4 in., contracting in fruit, usually purple. Floral glumes shorter than the empty, 5-nerved; awned on the back, near the middle or below. Palea minute or none.

Widely distributed in cool regions.

J. B. Alcott says: "There is as much difference between this and red top as there is between the Tom Thumb pea and the marrowfat. It will make beautiful, close, fine sod upon quite sterile soils. This, red top will not do. It is especially satisfactory for lawns, which in strong soils is apt to overgrow."

It makes very good pasture, though it is too small and grows too closely to afford much of a bite. For fifteen years the writer has watched it in Michigan, on thin soils and on rich soils, on moist land and on dry, sandy land, and he unhesitatingly recommends it as one of the very best grasses to mix with June grass for producing a fine lawn. If sown alone, four bushels of seed in the chaff is none too much.

This grass, with considerable variation, is often found on mountains in Europe, Asia, Australia, and North America.

A small *Agrostis*, probably *A. vulgaris*, of Europe, has been much used for lawns, and by some it has passed for *A. canina*.

ALOPECURUS, L. FOX TAIL.

Spikelets 1-flowered, flat, crowded into a head or cylindrical spike-like panicle, jointed at the apex of the enlarged pedicel, flowers perfect. Glumes 3 or 4, the 2 outer empty, acute, awnless or short awned, often connate below, flat-keeled, the keel ciliate

FIG. 72.—*1*, Plant of *Alopecurus pratensis*, a little reduced; *2*, spikelet; *3*, floral glume.—(Trinus and Scribner.)

and sometimes winged; the floral glume obtuse, hyaline, 3-5 nerved, with a short awn on the back, or mucronate, the margins joined at the base into a tube inclosing the flower; the palea sometimes present, narrow, hyaline, keeled, acute, partly included by the floral glume. Stamens 3. Styles distinct or rarely joined at the base or the middle, stigmas short, hairy. Annual or perennial grasses, erect or decumbent at the base; leaves either flat or convolute, upper sheaths often inflated. Spikelets or panicles spike-like, terminal.

About 20 species in temperate and cold countries.

A. pratensis, L. Meadow Foxtail.—A soft erect perennial, 1-3 ft. hi. Leaves flat, upper sheath inflated, longer than its blade; ligule oblong truncate. Spikelets 3-8 in., $\frac{1}{4}$ in. or more in diameter, dense, obtuse, soft, pale green. Spikelets $\frac{1}{6}$-$\frac{1}{4}$ in. long. Empty glumes, membranous ciliate on the keel only, ovate lanceolate, acute, connate at the base. Floral glumes ciliate, as long as the empty glumes, awn near the base and projecting half its length.

Found in Europe, North Africa, Western Asia, introduced into America.

In Great Britain and other parts of Europe with a like climate, this is one of the best known and highly esteemed grasses which is cultivated for permanent meadow and pasture.

It bears considerable resemblance to Timothy, though the culm and leaves are shorter, the spikes shorter, broader, and softer; the whole plant less firm and rough, and it starts much earlier in spring, flowering three or four weeks before this well known grass.

Meadow foxtail is not well adapted for alternate husbandry, as it requires three or four years to become well established, but on deep, rich, moist, or irrigated soils, in a cool climate not subject to droughts or very hot weather, it is a fine grass and peculiarly well adapted for permanent pasture. It makes a quick growth

in spring or after feeding or mowing. It is fine, nutritious, and palatable for all kinds of stock.

Like Timothy, it has no tendency to spread, as is the case with June grass, quack grass, and white clover. Mr. Lawes' experiments show that it thrives best with high manuring, supplying much nitrogen. In this respect it comes into competition with orchard grass.

There is considerable difficulty in procuring good seed, which is very light, and sold in the chaff, only weighing five pounds to the bushel. If sowed alone, three bushels to the acre is none too much. The seeds are often adulterated with those of *Holcus lanatus*, *Alopecurus agrostis* and rye-grass. The first two grasses are of very poor quality, the latter is much cheaper and costs not over one-eighth part as much per pound. Other seeds are also often found with those of meadow foxtail.

The seeds ripen unevenly, some beginning to fail while much is yet immature or even in flower.

Many glumes are empty; insects, blight, or something else causing the failures. The small seed produces a small, feeble plant, which requires a favorable chance for a long time before it becomes well established.

It will not likely ever be popular over a very large portion of the United States. It is well adapted to parts of New England, New York, Canada, and mountain districts farther west and south. It is a native of Europe, and one of the five grasses recommended for permanent grass lands by Mr. De Laune, of England.

ANTHOXANTHUM, L. SWEET VERNAL-GRASS.

Spikelets 1-flowered, narrow, slightly compressed, crowded into a cylindrical spike-like panicle; rachilla jointed above the lower glumes, often hairy. Glumes 6, the 2 lower persistent below the joint, acute, mucronate, or very short awned, the second longer

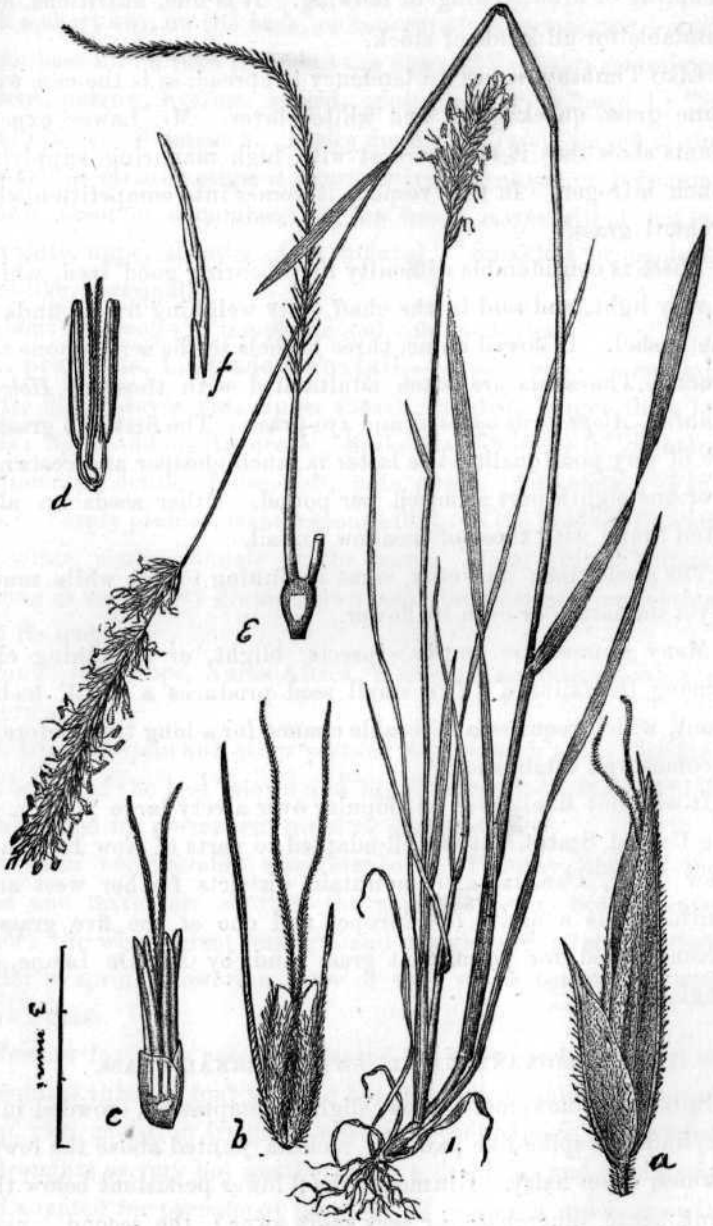


FIG. 73.

than the others, the two intermediate glumes much shorter, empty, narrow, keeled, with an awn on the back or very near the base, the two upper glumes much shorter, hyaline, obtuse, awnless, of which the fifth is very broad, including the narrow 1-nerved sixth (or palea ?) and the flower; other palea 0. Stamens, 2. Styles, distinct, with long, feathery stigmas. Caryopsis oblong, included by the inner glumes, free.

Aromatic or sweet scented annuals or perennials, with flat leaves. The terminal panicle spike-like, pedunculate, dense or rather loose, with many very short dense branches.

Species, four or five, European.

A. odoratum, L. Sweet Scented Vernal Grass.—A rather slender, erect perennial, 1-2½ ft. high. Leaves slightly hairy, ligule oblong, obtuse, blade of upper leaf about 1 in. long; sheath slightly inflated. Spike-like panicle, 1½–3 in. long. Spikelets ¼–⅓ in. long, linear, oblong. First glume ovate, acute, 1-nerved, half as long as the second which is 3-nerved, elliptical when spread out. The third and fourth empty glumes emarginate, obscurely 5-nerved below the apex; the straight awn of the former above the middle, projecting ½ its length. The twisted awn of the latter below the middle, projecting twice the length of the glume.

Native of Europe, widely dispersed in temperate Asia, North America, Australia, often sown for pastures and lawns.

Sweet scented vernal grass is a pretty name, and suggestive of something agreeable, and is one of a very small number of grasses which possess this peculiar odor. The grass is perennial, with a culm one to two feet high. It starts very early in spring and soon flowers. It has often been recommended for lawns and pastures, but for the latter purpose some of the best farmers of

FIG. 73.—*Anthoxanthum odoratum*, L. (Sweet Vernal Grass); *1*, plant; *a*, spikelet; *b*, the same with the outer glumes removed; *c*, the same as *b* with the empty glumes removed; *d*, the stamens and pistil; *e*, the pistil with one style removed; *f*, one of the hairs from the stigma.—(*e*, *f*, from Kunth, the others by Scribner.)

England now omit sowing this grass. Its fragrance when wilted, bruised or dried, is its chief recommendation, and about the only one for its use on the lawn. It is too apt to kill or be crowded out, a little coarse, bunchy, and uneven for a velvet and elastic turf. It likes rich, moist soil and cool summers. T. M., in Treasury of Botany, says: "The fragrant resinous principle which occurs in this grass, and is called coumarin, is a widely diffused natural perfume, being found in the Tonka Bean, the Faham tea-plant, the sweet-wood-ruff, melilotus, and the blue or Swiss melilot."

"In Northern Michigan, and probably in other places, the Indians raise this grass and use the stems for mats, card baskets, and other small articles. It is sometimes used for bonnets, hats, and bouquets. The culms and flowers possess the strongest perfume, which remains for a long time after drying."

"The Italians," says Dr. Lindley, "Are said to employ the distilled water as a perfume."

The writer and one of his students made some experiments in feeding sweet vernal when in flower. A young horse kept on dry feed, preferred fresh June grass to sweet vernal, but ate all of both, small bunches.

Some meadow foxtail and sweet vernal had been cut in flower, and dried for some days. One short-horn cow rather preferred the foxtail, but ate both readily. Another ate both alike, another ate the foxtail and refused the sweet vernal. An Ayrshire cow ate both greedily without preference. Two of the farm horses ate both alike, while a third preferred the foxtail, but ate both readily. The cows had been in pasture some weeks, the horses had been kept on dry feed.

Gould says: "It is nowhere considered a very valuable species for hay, as the culms are wide apart, very thin, and bear but few leaves; hence it gives a light crop of hay, at best not over three-quarters of a ton of hay from an acre. The seeds are not very

abundant, nor easy of acquisition. Sheep are not fond of it. It was once thought to give a sweet flavor to butter and to mutton; but these notions are now exploded. It may be beneficial medicinally, as cattle will eat a little of it mixed with other grasses, but when in any considerable bulk they always refuse it."

Baron J. B. Lawes says: "Upon the whole this grass takes rank somewhat low in the scale of the better grasses for permanent purposes. The growth is much discouraged by highly nitrogenous and farm-yard manures, such as greatly increased the amount and proportion of the graminaceous hay plants, as a whole. It only becomes prominent under conditions which do not induce special luxuriance in its competitors, and it seems to be more injured by association with more luxuriant grasses than by the direct action of manures."

The seeds are sometimes adulterated with those of *Anthoxanthum Puelii*, a much smaller and insignificant plant, which is an annual. The grass is a native of Europe, and is extensively naturalized in North America.

LOLIUM, L.

Spikelets many flowered, sessile, distichous, compressed in a simple spike, placed with one edge to the rachis. Rachilla jointed between the flowers; flowers perfect or rarely imperfect. Empty glumes, firm, 5-7-nerved, convex on the back, obtuse, acute, or awned; the empty glume next to the rachis wanting, except in the terminal spikelet. Palea shorter than the floral glume, narrow, 2-keeled. Lodicules ovate, ciliate. Stamens 3. Styles distinct, very short, stigmas feathery. Caryopsis oblong, smooth, adherent to the palea. Annuals or perennials, with flat leaves. Spike terminal, elongated, spikelets placed on alternate sides of a jointed rachis.

Species about 20, found in north temperate regions.

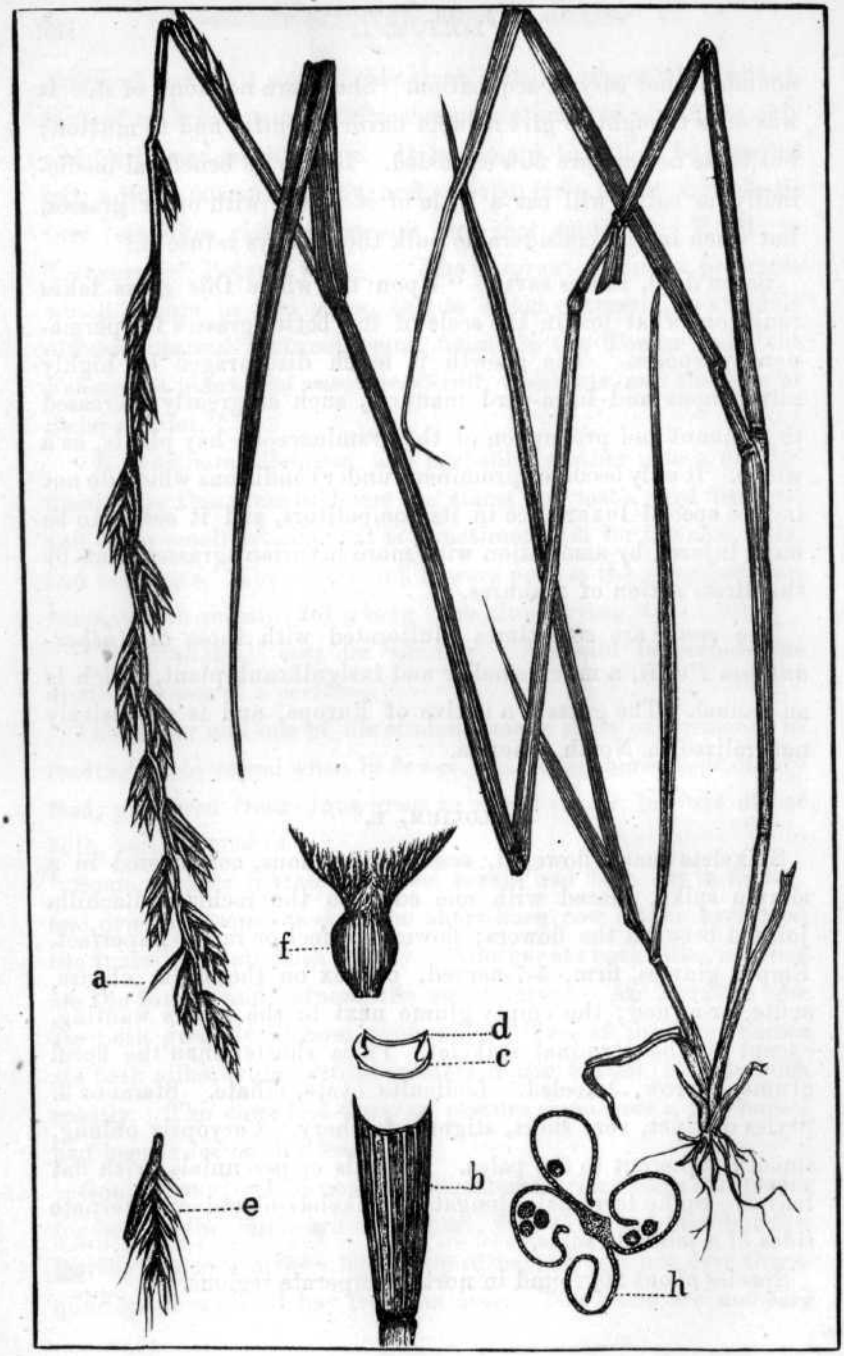


FIG. 74.

L. perenne, L. Perennial Rye or Ray Grass, Darnel.—An erect or slightly decumbent perennial, 1-3 ft. hi., smooth, culm slightly compressed. Leaves flat, shining; ligules short. Spike 4-10 in., slender. Spikelets 8-16, obtuse or pointed, rarely awned, ⅓-½ in. long. Empty glumes strongly ribbed, linear-lanceolate, floral glume linear-oblong. In the terminal spikelet the second glume is usually empty.

In many portions of moist, temperate Europe, this grass has for over 200 years taken the rank among the farmers that Timothy has in the United States. Rye grass is termed a perennial, though it can hardly be relied on to last for more than two to five years, and especially after one seeding, the plants mostly soon perish. Self-sown seed, ripening on the ground, help supply a continuous crop of plants.

It seeds bountifully, frequently producing forty bushels or more to the acre; these are of a large size and make strong plants on a great variety of soils soon after sowing. The stems are one to two or even three feet high, including the straight spike at the top, giving it somewhat the aspect of quack grass. The leaves are abundant, dark green, flat, glossy, succulent, and the whole plant is nutritious.

This grass, with its simple spike, is easily recognized, and people can soon become acquainted with its peculiarities. Its short life and vigorous habit make it a grass especially suited to alternate husbandry, and not for permanent pasture or meadow, although, through ignorance and long precedent, it has very generally been recommended for the latter purpose.

The plants start early, flower early, and repeatedly during the growing season. Seeds are cheap, easily obtained, always in market, and well advertised by the dealers. Above we see stated

FIG. 74.—*Lolium perenne* (Perennial Rye Grass). *a*, Empty glume pulled back from the rest of the spikelet; *b*, floral glume cut above the middle; *c*, *d*, cross sections of floral glume and palea; *e*, spikelet with a portion of rachis of *L. perenne* var. *Italicum*; *f*, ovary and styles; *h*, cross section of an anther with a few grains of pollen.—(Sudworth.)

some of the main reasons why rye-grass has been so popular.

Rye-grass was one of the first if not the first grass ever cultivated in Great Britain, as long ago as 1677, nearly 100 years before the cultivation of Timothy or orchard grass.

Owing to this long cultivation, under varying conditions of soil and climate, as we should expect, the grass has broken up into many varieties, which are more or less permanent and well marked.

As early as 1823, one experimenter pointed out sixty varieties. A few of these became permanent enough to reproduce themselves quite true from seed. Soon after this, a few of these races of rye-grass became quite noted under various names, such as "Pacey's," "Russell's," "Whitworth's," "Dixon's," and now several English seedsmen claim extra varieties and name them after some member of their firm.

Mr. Lawes writes: "It stands at the head of the list as to the quantity in culm. It is obviously a plant of relatively weak habit. It did not flourish where ammonia-salts were used, but where nitrogen was supplied as nitrate of soda, it was much more able to maintain some, though still a rather low position in the struggle."

Only 25 to 30 pounds of seed are required to sow an acre. This grass is often recommended for a lawn, but owing to its short life in most places, it is by no means adapted for that purpose.

Rye-grass has been quite extensively tested in various portions of the older States. It is emphatically a lover of rich land and a moist climate, without very great heat. In many portions of the interior of our country, subject to great extremes, this grass has not proved of much value. It is not well suited to the Southern States, especially the dryest portions. Further remarks concerning this grass may be found on a later page of this volume.

Lolium perenne, var. Italicum. Italian Rye Grass.—This is one of the most distinct, well known, and valuable of the permanent varieties of rye grass. It differs from the species in having short awns to the spikelets. It is larger and more vigorous, makes a quicker growth, but is only an annual, and of course cannot be relied on for more than one season. Where the ground is favorable, and especially if irrigated, it produces immense crops of valuable feed for live stock, yielding as high as seven and a half tons of dry hay per acre. For this crop it is cut four or five times. The seeds are sown in autumn or in early spring at the same rate as that of rye grass.

As was said on a former page of this work, annual grasses, like rye, and rye grass, may often be induced to live for two years or more if kept cut short and not allowed to seed.

For most parts of the Northern States, however, rye grass perishes with the cold winters, and except in some of the cooler and more moist portions of our country, has proved of little value. It will make little growth on dry ground.

CYNDON. PERS.

Spikelets small, 1-flowered, sessile on one side of a flattish rachis, alternately 2-ranked, rachilla jointed above the empty glumes, extended into a small stipe beyond the flower, flower perfect. The empty glumes persistent or deciduous, slender, keeled, acute, or obtuse. The floral glume broader than the empty glumes, membranous, ciliate, keeled, transversely pilose near the apex, awnless. Palea scarcely shorter than the floral glume, hyaline, 2-nerved, ciliate. Stamens 3. Styles distinct, clothed with short hairs. Caryopsis oblong, smooth, included, free.

Perennials, creeping or stoloniferous, with short, narrow, flat leaves. Spikes slender, 3-6, digitate at the apex of the culm, straight, erect, or spreading.

Four species in warm regions.

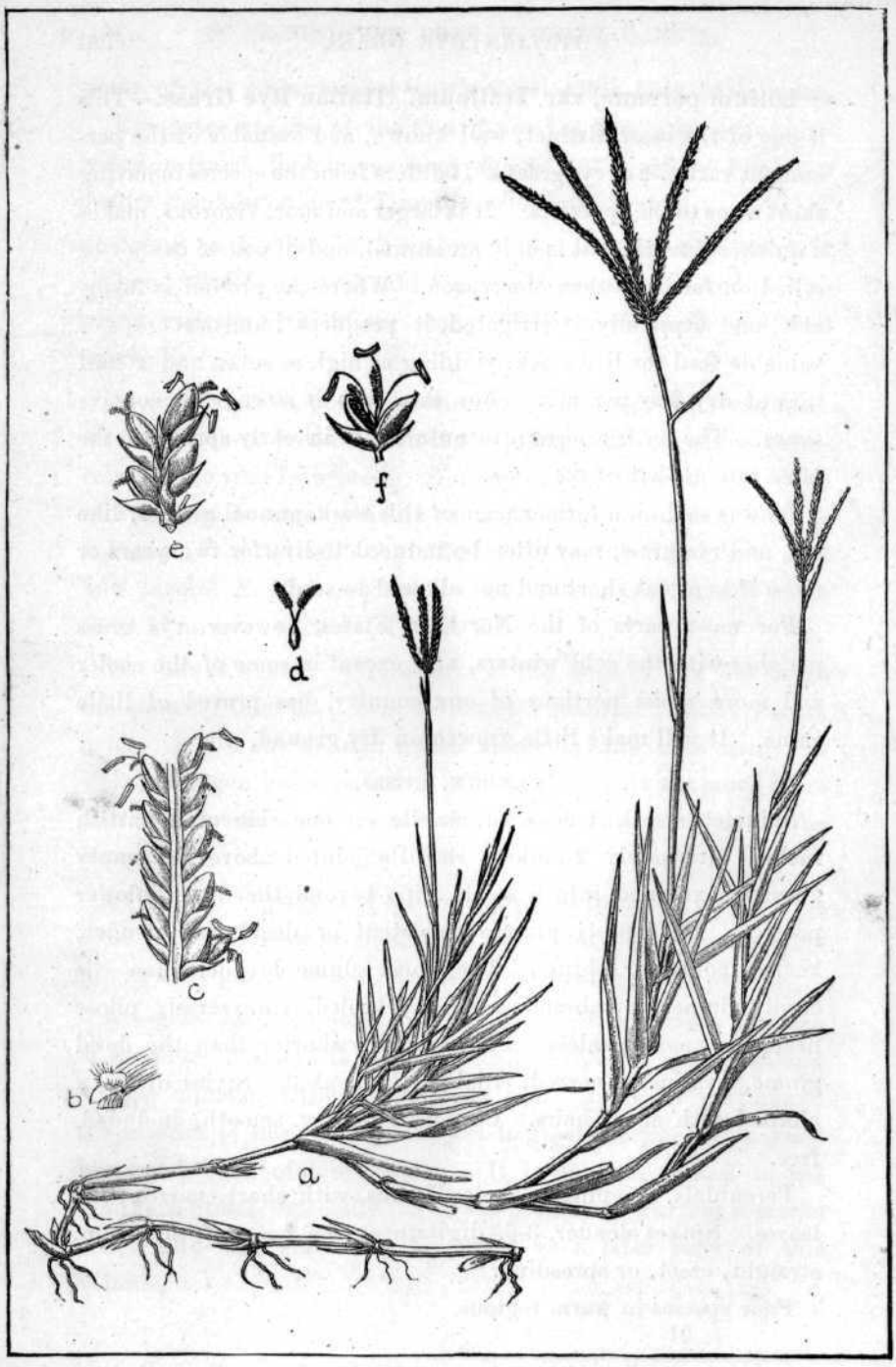


Fig. 75.

C. Dactylon, Pers. Bermuda, Wire or Scutch Grass.—Spikes 3-5, seldom seeding, but spreading rapidly by stout rootstocks. This grass belongs to southern Europe and to many other warm climates, and is a perennial, thriving from Michigan southward. The stems are low and come from extensively creeping rootstocks, which also penetrate the ground to the depth of three to six inches. The top spreads into several branches, somewhat resembling crab grass, an annual too common in neglected gardens. The leaves are short.

This grass is said to be celebrated in the sacred Vedas as the shield of India, and preserver of nations, as without it the cattle would perish.

For the Northern States it is of no value, starting very late in spring, with the leaves barely an inch high when meadow foxtail is in flower, but for permanent pasture in warm countries it is highly prized, standing heat and dry weather remarkably well. It rarely ripens seed in the United States, but may be propagated by washing the rootstocks, running them through a cutting machine and then sowing broad-cast.

Like quack grass, it is a terrible pest in field crops, where its deep, stout rootstocks make it hard to kill. Thorough cultivation will kill; if not pastured, June grass, cow peas, or other rapid growing plants will shade and choke it out.

The following is from Killebrew: "In the South it has been the chief reliance for pasture for a long time. It revels on sandy soils, and is used extensively on the southern rivers to hold the levees and the embankments of the roads. It forms a sward so tough it is almost impossible for a plow to pass through it. It will run down the sides of the deepest gully and stop its washing. It has the capacity to withstand any amount of heat and droughts, and droughts that are so dry as to check the growth of

FIG. 75.—*Cynodon Dactylon* (Bermuda Grass); *a*, Plant with rootstock; *c*, dorsal view of spike; *e*, front view; *f*, spikelet; *d*, pistil and lodicules; *b*, ligule. (Rieshenbach.)

blue grass will only make the Bermuda greener and more thrifty."

Mr. Elliott, quoted by Professor Phares, says: "The cultivation of this grass on the poor and extensive sand hills of our middle country would probably convert them into sheep walks of great value."

Here, Professor Phares remarks: "As a permanent pasture grass, I know no other that I consider so valuable as this, after having transplanted it from near the mouth of Red River to my present residence thirty-five years ago, and having started it on hundreds of other farms, commons, and levees for a longer period. As hay this grass has been cured and held in high esteem by many farmers in Mississippi for more than forty years.

"It does not bear dense shade, but grows best where most exposed to the intense heat of the sun. To make good pasture it must be kept well trodden and grazed to keep it tender, and to suppress other objectionable grasses and weeds. To make good hay and the largest yield, this grass must be mowed from three to five times every summer. Thus briars, broom grass, and other weeds are also repressed and prevented from seeding, multiplying, and ruining the meadow. Properly managed this grass grows from ten to fifteen inches high."

The following is from Howard's Manual. "Upon our ordinary upland I have found no difficulty in destroying it, by close cultivation in cotton for two years. Work the land in the dry, hot months of summer. When not pastured, broom grass or briars soon destroy it. I think it very doubtful whether there is an acre of land in the South thoroughly set with Bermuda grass, that is not worth more than any other crop that can be grown on it. The Bermuda and crab grass are at home in the South. They not only live, but live in spite of neglect, and when petted and encouraged, they make such grateful returns as astonish the

benefactor. While grazed, neither Lespedeza, broom sedge, blue grass, or any other growth will oust it."

Some accounts are given of very large crops of excellent hay made from this grass. Although short, it is thick, fine, and heavy.

The following is from Professor Shelton, of Kansas:

"Bermuda grass has been quite extensively introduced into Kansas from southern Missouri and Arkansas during the last two or three years; and the most extravagant claims have been made for it by interested parties. After five years' experience with this grass upon a considerable scale at the College farm, we have no hesitation in saying that for this section, and we are confident generally throughout the State, these claims are totally unfounded. Bermuda grass has shown itself with us to be quite worthless either for hay or pasture. Of all the tame grasses it is the latest to appear in the spring, and the lightest frosts cut it off level with the ground. Until the hot weather of June had set in, our Bermuda grass showed scarcely a sign of life and growth. But even then the amount of feed which it furnishes is quite insignificant. Moreover, our stock of all kinds showed no great fondness for it, leaving it always for orchard grass growing near by. We are confident that our farmers will do well to keep their farms clear of a grass which, like the Bermuda grass, has some of the worst qualities of the most pernicious weeds."

The latest is from Prof. F. A. Gulley, of Mississippi: "Blue grass, white clover, and orchard grass do well in certain places, but our best grass on most soils is Bermuda. In future, on the College farm, I shall plant Bermuda to the exclusion of other grasses, except on rich soil in small pasture lots near the barn. We plant it like corn and potatoes in strips across a field, where it soon spreads and will remain for all time to come, worse even than quack grass for persistence. On good land it will cut two to four tons of nice hay per acre which is easily cured. It fur-

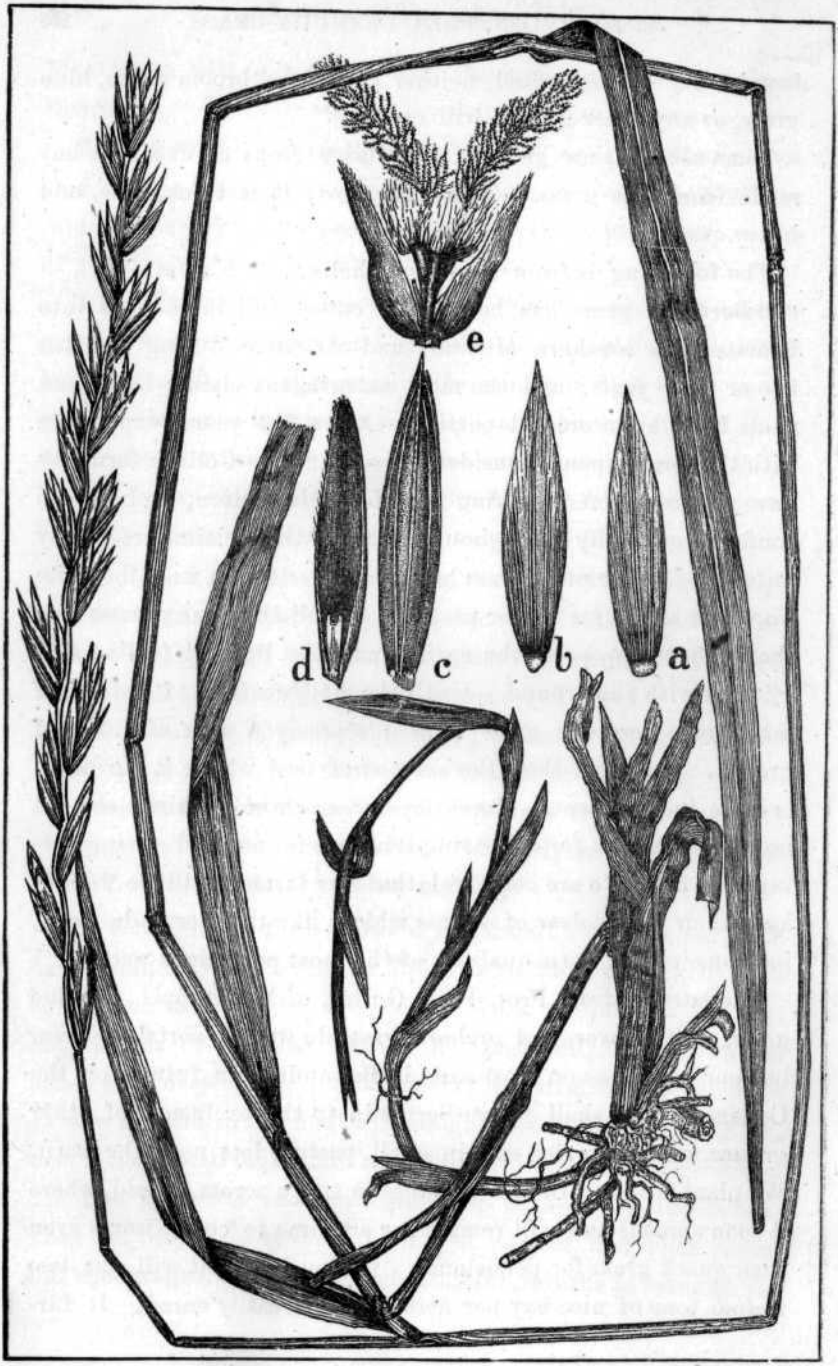


Fig. 76.

nishes a good deal of grazing on rather poor land, and grows right along through summer, when blue grass will dry out entirely. It is improved by breaking up every three or four years, and planting a crop

"I am beginning to believe that in this and Johnson grass, we have for this latitude, for hay and pasture, two plants that are not excelled by anything that grows in the north. They do not fraternize with cotton, so planters are very much afraid of them."

AGROPYRUM, J. GAERTN.

Spikelets many flowered, compressed, sessile, one at each joint of the zigzag rachis, distichous, placed with one side to the rachis, flowers perfect, or the upper ones imperfect. Empty glumes narrower than the floral glume, few nerved; floral glumes firm, convex on the back, 5-7-nerved, obtuse, acuminate, or awned, the upper one often empty or enclosing an imperfect flower. Palea shorter than the floral glume, 2-keeled. Lodicules, ovate, entire, ciliate. Stamens 3. Styles very short, distinct, stigmas feathery, subsessile. Caryopsis oblong, grooved, more or less hairy at the apex, adherent to the palea or free. Perennials or annuals, with leaves flat or convolute. Spike terminal.

About twenty species found in temperate climates.

A. repens, Beauv., (Triticum repens, L.) Quack, Quitch, Quick, Twitch, Couch, Dog, Scutch, Rye, Durfee, Chandler, Witch, Quake, Squitch, or **Fin's Grass or Creeping Wheat.** —A very variable perennial with long, creeping rootstocks. Culms 1-4 feet, smooth, glabrous. Leaves flat, sheaths terete, ligule short, spike 2-10 in., straight or curved, spikelets 4-8 fld., ¾-1 in. long. Empty glumes 5-7-nerved, rigid, cuspidate, acute or awned; floral glumes much the same, with an awn nearly its length, or sometimes awnless.

This grass is well known in most of the older portions of our

FIG. 76.—*Agropyrum repens* (Quack grass); part of a plant; *a*, lower empty glume; *b*, upper empty glume; *c*, floral glume; *d*, palea; *e*, lodicules, including the base of stamens, an abortive ovary and the feathery stigmas.—(Sudworth.)

country. It comes from Europe, though something very much like it is common on the great western plains, where it affords an excellent pasture.

The rootstocks fill the soil, and much resemble those of June grass, only they are larger. The leaves near the ground much resemble those of Timothy; the stems are one to three feet high, and each is terminated by a slender spike from two inches to a foot in length. It seldom produces seed till the plants become somewhat dwarfed or stunted by crowding or exhaustion of the soil.

Gould tells the truth when he says: "The farmers of the United States unite in one continuous howl of execration against this grass." They generally dread its presence, which most of them are ignorant of till it has become well established, often in many places on their farms. It is a clean, sweet grass, and affords much good pasture. In good soil, if not too old and crowded, it will cut a fine crop of hay of excellent quality, not surpassed in value by that of Timothy.

The editor of the Rural New Yorker says: "It will endure the severest droughts of the North; it will thrive in sandy or clayey soils; it is early to appear in the spring; it is the first to carpet a field with green after it has been mown or closely cropped; it makes a compact sod for the door-yard or lawn, and will become as 'velvety' under the frequent use of the lawn-mower as the bent grasses, red top or poas. Its merits are many. We do not know of any true grass about which more may be said in its praise. The great fault with quack is that it seems to be too much of a good thing. A field recently plowed for corn next spring, which had been in grass eight years or more, was nearly all quack—Timothy having disappeared entirely, and the rest forming a small percentage of blue grass and red top. The cultivation which we shall give the corn will practically subdue the quack unless the next summer should prove

unusually wet, so that when Timothy and clover are again sown upon the wheat at the end of the rotation there will be scarcely any to dispute their possession. But quack would reäppear in several years and if the land, as in the above case, were retained in grass for six years or more, the quack would again largely predominate. As our lands are sandy with gravelly sub-soil, they need frequent rains, so that a season rarely passes without a drought of lesser or greater severity prevailing. It is then that quack is easily destroyed. The shallow corn cultivator, always here used, exposes the quack roots to the parching air and sun and destroys them. Upon this farm quack is a blessing, though perhaps a troublesome one. We do not believe there is another grass which, when plowed under, will furnish a greater amount of suitable food for Indian corn, while the cultivation given for suppressing its summer growth is no more than that which a full corn crop needs.

"Hence it is that any disturbance of the roots during wet weather, or when the ground is at all moist, serves as much to spread the plant as to suppress it. These rootstocks grow rapidly and persistently, preferring to grow through any permeable obstacle rather than turn aside."

On making the best of quack grass, the *Country Gentleman* says: "When hoed crops are not too prominent or common, quack is not so bad. It is neither killed by drought, hard freezing, nor close feeding. When cut early it makes the best of hay. Where it has a foothold, docks, thistles, whiteweed, and other weeds are unable to put in an appearance. Land intended for permanent fields must be broken often, as the roots form such a close sod it soon binds out. When this is the case, plow and harrow well every third or fifth year after cutting."

In the same paper above named, Henry Ives says: "There are three ways to manage quack. One is for the timid man who thinks he cannot subdue it, and who works accordingly. He

gives it just about tillage enough to renovate and keep it thrifty. Another way is to cultivate enough to get a very good crop of something else; a third way is to kill it entirely. To do this, many summer fallow by thorough cultivation all summer; others plow late in the fall and next spring put in a crop. The cheapest way to clear land from quack, is to plow in the fall, then harrow in the spring, cultivate or gang-plow until rather a late planting time for corn, then plant, when the corn will come up quick, cultivate early and often. It cannot be killed by any process of raking and picking it off the ground."

As to the mode of killing, the writer has often tried, with excellent success, the plans named by the last writer. Plow late in the fall, and go on to the ground as soon as possible after thawing out—not waiting for the soil to settle. Cultivate well every three days till no traces are seen, which will usually leave time for a late crop of potatoes, corn, or rutabagas in the same season. It must not be allowed a breathing spell, as it then recuperates rapidly. Do not wait for a leaf to show itself. Give it no peace.

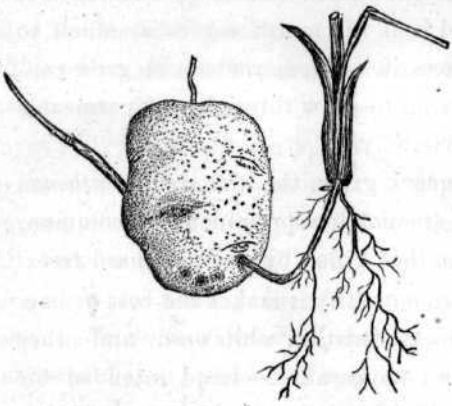


FIG. 77.—Rootstock of quack grass which has grown through a potato. Reduced one-third.—(Sudworth).

It thrives in the South as well as at the North.

The apex of a rootstock is quite sharp and stout, and not unfrequently grows through tubers of potato.

SORGHUM, PERS.

Spikelets in threes, panicled, the central one hermaphrodite, sessile, 1-fld.; the lateral ones pedicellate, male or sterile, with sometimes 1-3 pairs of spikelets at the nodes below. Glumes of the

sessile spikelet 4, the lower larger than the others, empty, lanceolate or ovate, hard and shining, obscurely nerved; the second empty, narrower, keeled, firm, acute or awned; the third much smaller, hyaline, empty; the fourth or floral glume very slender, hyaline, 2-lobed, awned. Palea minute or none. Stamens 3. Styles distinct, stigmas feathery. Caryopsis included, free. Annuals or perennials, often tall with broad, flat leaves, panicle terminal, large. Species now reduced to two. (*S. halapense and S. vulgare*). Extensively cultivated in warm and temperate climates.

S. halapense, L. Johnson Grass, Means' Grass, Cuba Grass, Egyptian Grass, Green Valley Grass, Arabian Millett, Egyptian Millett, Syrian Grass, Saint Mary's Grass.—From several sources I learn that in 1835 Gov. Means of South Carolina obtained the seed from Turkey. A few years later William Johnson of Alabama obtained the seed of the Governor, and was quite active in advertising its good qualities, hence the popular name of "Johnson grass."

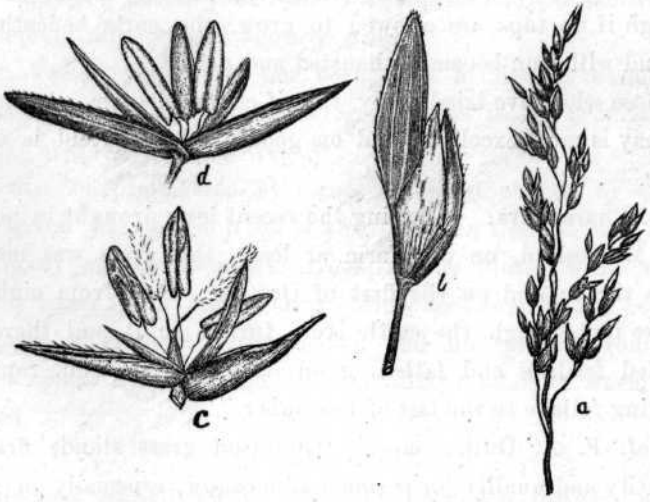


FIG. 78.—*a*, Portion of panicle of *Sorghum halapense*, L.; *b*, two spikelets, the other having been removed; *c*, lower spikelet with fertile flower; *d*, one upper spikelet with staminate flower. 1×6.—(Sudworth).

It has sometimes been called *Guinea grass*, though this name has more generally been applied to another, *Panicum jumentorum*.

Johnson grass is a coarse perennial, with large, stout rootstocks often half an inch in diameter. These penetrate the ground in every direction, and each joint may send up a stem after the manner of June or quack grass, only on a much larger scale.

The stems are three to six or more feet in height, and are amply supplied with long, broad leaves. The branching panicle somewhat resembles that of barn-yard grass. For the Southern States this grass has been highly praised by some and tried cautiously by others. It bears great heat and severe drought, and may be cut once a month during the growing season. It affords fine pasture, if any coarse grass can be said to furnish such a pasture, and the rootstocks furnish food for swine nearly equal to that of artichokes.

As might be expected, it is next to impossible to turn up these rootstocks with a plow; hence it is difficult to eradicate, though if no tops are allowed to grow, the parts beneath the ground will soon become exhausted and perish.

Those who have tried it say, that if cut in blossom, or earlier, the hay is most excellent, and on good land the yield is enormous.

Dr. Phares says: "During the recent long drought in northeast Mississippi, on one farm at least, this grass was mowed three times; and on the first of October, when from eight to twelve inches high, the cattle were turned in it and there remained feeding and fattening on its abundant, rich, rapidly-growing foliage to the last of December."

Prof. F. A. Gulley says: "Johnson grass stands first in quantity and quality for permanent meadow, especially on rich, well-drained, heavy land. This and Bermuda for the South are

equal to anything at the North. It is improved by breaking up once in a while."

Mr. Montgomery, of the same state, has no hesitancy in saying that it will produce more nutritious hay per acre on rich land than any meadow grass we can grow. To insure a fine quality of hay it should be mowed when the first seed stems appear. Overflows and standing water are death to it. A good plan to propagate this grass is to drop roots between the hills of corn and cultivate with the corn crop.

Here follows the statement of Professor Shelton, of Kansas: "We have had Johnson grass in cultivation upon the college farm for four years, and every year's experience with it makes its total worthlessness the more conspicuous. It never makes its appearance with us much before the first of June, and the first frost in the fall cuts it even with the ground. During the summer's heat it makes a coarse, scattering growth of herbage which our cattle persist in disliking. I notice that our patch slowly increases in size from scattering seeds and rootstocks. You can safely advise your readers in Kansas and the southwest, to keep entirely clear of Johnson grass."

Dr. Vasey says: "It has been tried in Kansas with very promising results. Probably no grass gives better promise for the dry arid lands of the West."

It may be propagated by pieces of rootstocks or by seeds. The writer has tested it on a small scale in Central Michigan, but many of the rootstocks are killed by winter while a few usually remain. It has produced some seed even in the coolest summers. The seeds start slowly, and no sprouts from any source appear above ground till the weather becomes warm and settled.

SETARIA, BEAUV.

Spikelets, ovate, jointed with the persistent pedicel, which bears one to many bristles, collected into a cylindrical spike-like

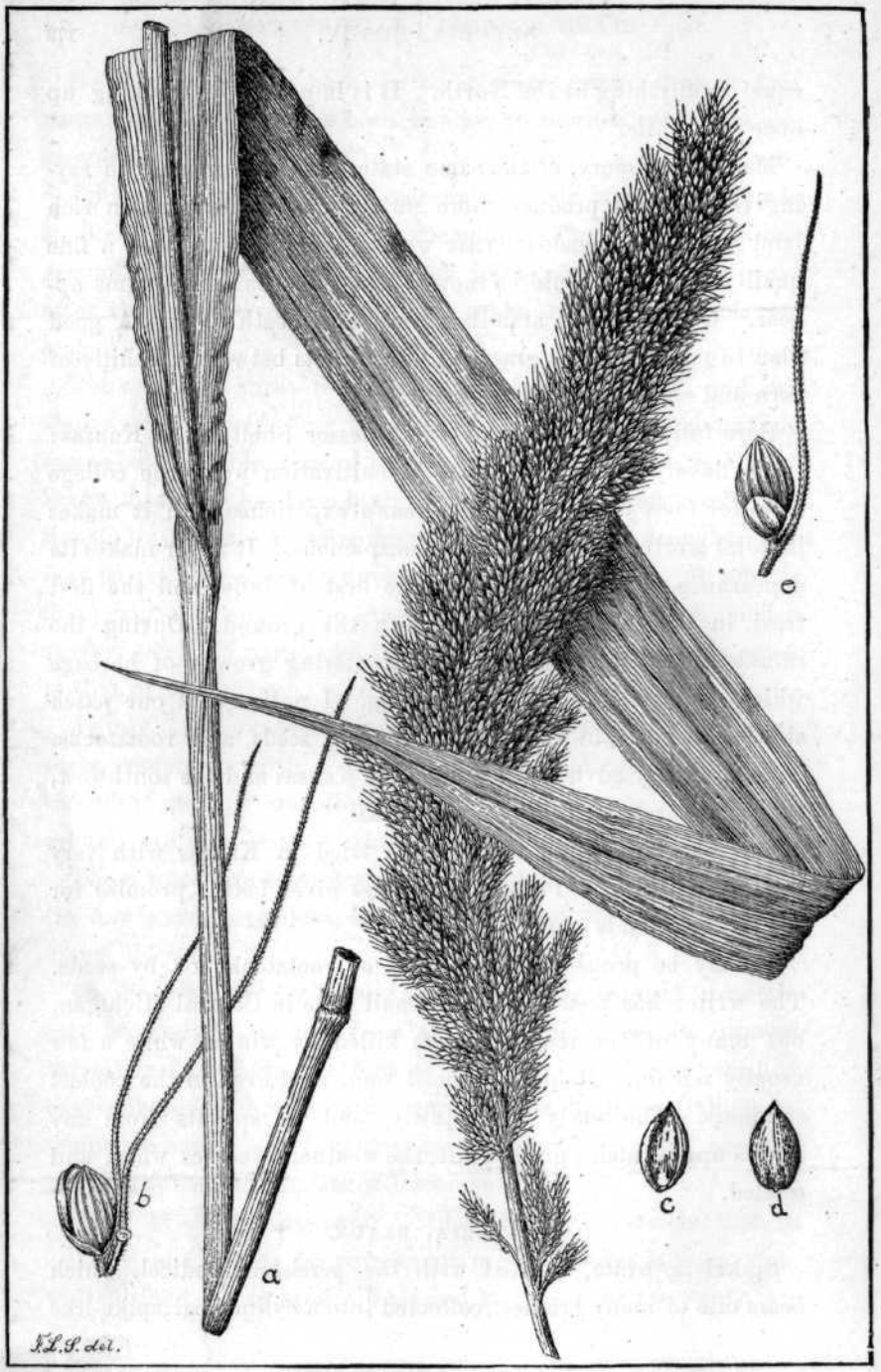


Fig. 79.

or narrow panicle. Glumes 4, the three outer membranous, the lower very small, the second shorter than the third, both empty, the third usually longer, empty or rarely inclosing a palea or male flower, or sterile; the terminal inclosing the perfect flower, shorter, obtuse, indurated as well as the inclosed palea, shining or transversely wrinkled, or simply dotted in lines. Stamens 3. Styles distinct from the base, elongated, stigmas feathery. Caryopsis included in the hard floral glume and palea, free. Annual grasses, often tall with flat leaves. Panicle terminal. Species about ten, found in tropical and temperate climates.

S. Italica Kunth, Hungarian or Bengal Grass, German, Italian, Mammoth, Golden or Cat-tail Millet.—A stout, quick-growing grass, 2-3½ ft. hi., with numerous broad, flat leaves and a nodding panicle 4-9 in. long by ¾-1¼ in. in diameter. Bristles two or three in a cluster.

The term "Millet" is also applied to various other species of plants, and is about as indefinite as the name "blue joint" or "bunch grass" or "pig weed."

The variety of millet which is principally grown as a hay crop in America was distributed through the United States Patent Office in 1854 under the name of *Panicum Germanicum*. There are many races, which, like those of Indian corn, are mixed up in hopeless confusion. It is much cultivated in the West and Southwest.

The millets are among the most ancient of cultivated grains, as is evinced by the variability in the species as well as by ancient mention, and their wide distribution. It is said that a third part of the inhabitants of the globe feed upon the different millets, especially in Africa, Turkey, Persia, India, and Japan. It is mentioned by Pliny as one of the cereals of his time. *Setaria Italica* has an Asiatic origin and a high antiquity, as is evinced

FIG. 79.—*Setaria Italica*. (Hungarian Grass); *a*, portion of plant; *b*, spikelet with the pedicel of a second; *c*, another view; *e*, fertile floret showing palea; *d*, dorsal view of same.—(*a* Redrawn from Trinius, *b*, *c*, and *d*, Scribner).

by its Sanscrit name "kangu" and "priyangu." In the old world one variety is grown on watered land, another in palm gardens, and another in dry fields.

The seeds of this or another species are even now sold in London shops as a substitute for rice in making puddings. It requires a dry, light, warm land or medium soil for its best production, and has a remarkable power of resisting drought. It will not grow till the weather becomes settled and warm. It is sensitive to cold and is a shallow feeder, and will bear crowding without injury. Its seeds will germinate under conditions of considerable dryness.

When cut it parts with its moisture very slowly, and cures into hay with difficulty.

When forced to grow fine through crowding, and grown on rich and suitable land, this plant makes from three to four or even five tons of fine-appearing fodder, sweet-smelling if cut early and properly cured, and is relished by stock. If cut early it is certainly quite equal to ordinary hay. If grown thinly the forage is coarse, and is not so well relished by animals. If not cut early its value is greatly impaired. After the seed is ripe it is said to be unhealthy for horses. It is ready for hay when the heads begin to appear generally over the field. One bushel of seed is sown to the acre, broadcast, or less when sown in drills. Sow only on rich land.

Its rapidity of growth in six or seven weeks after sowing, shows its availability as a catch crop in case there is a failure of the hay crop. As it is a shallow feeder it is well adapted for surface manuring.

The previous account is selected and adapted from an article by Dr. E. Lewis Sturtevant in *The National Live Stock Journal*, p. 522, 1881.

Dr. Armsby says: "The chemist gives it about the composition of fair meadow hay. It is deficient in protein and rich in

non-nitrogenous nutrients, and should be supplemented with oil cake."

Major H. E. Alvord, of Mass., in the *Rural New Yorker*, speaks as follows: "Hungarian grass is a valuable auxiliary. Where a piece of grass or grain, which looks well in the autumn or even in early spring, shows in May that it will not produce a profitable crop, its fragments may be depended upon to do most good as green manure. Then plow late in May, turning well, harrow two or three times at intervals, sow Hungarian grass the latter part of June, cut it in August and re-seed the land. Hungarian, according to age at harvesting, may be adapted to any class of stock. It makes quite a draft on the land, and, either when it is sown or with the following crop, a dressing of cheap fertilizer is no more than fair, like agricultural salt, kainit, or the raw ground Carolina phosphate. Knowledge of the facts in every case must determine what can be most economically used."

Waldo F. Brown, of Ohio, in the same paper, writes: "In a season when wheat and clover have been generally killed over a large area of country, many farmers are asking what can we substitute for hay? We have two good substitutes—millet and corn fodder. Either may be put in, in this latitude, as late as June 10, with a good prospect of a crop. Millet will yield largely on good land, but the land should be finely pulverized. It is best to sow as soon after a rain as the land can be worked, as if sown just before a rain there is more danger of weeds coming up with it. The seed should be covered lightly, and I prefer a plank drag for the purpose, as it presses the earth to the seed, and retains the moisture till it sprouts. When sown for hay, from three pecks to a bushel of seed per acre should be used."

DEYEUXIA, CLARION.

Spikelets 1-fld. in a close or open panicle, rachilla jointed above the lower glumes, often extending beyond the floret into a

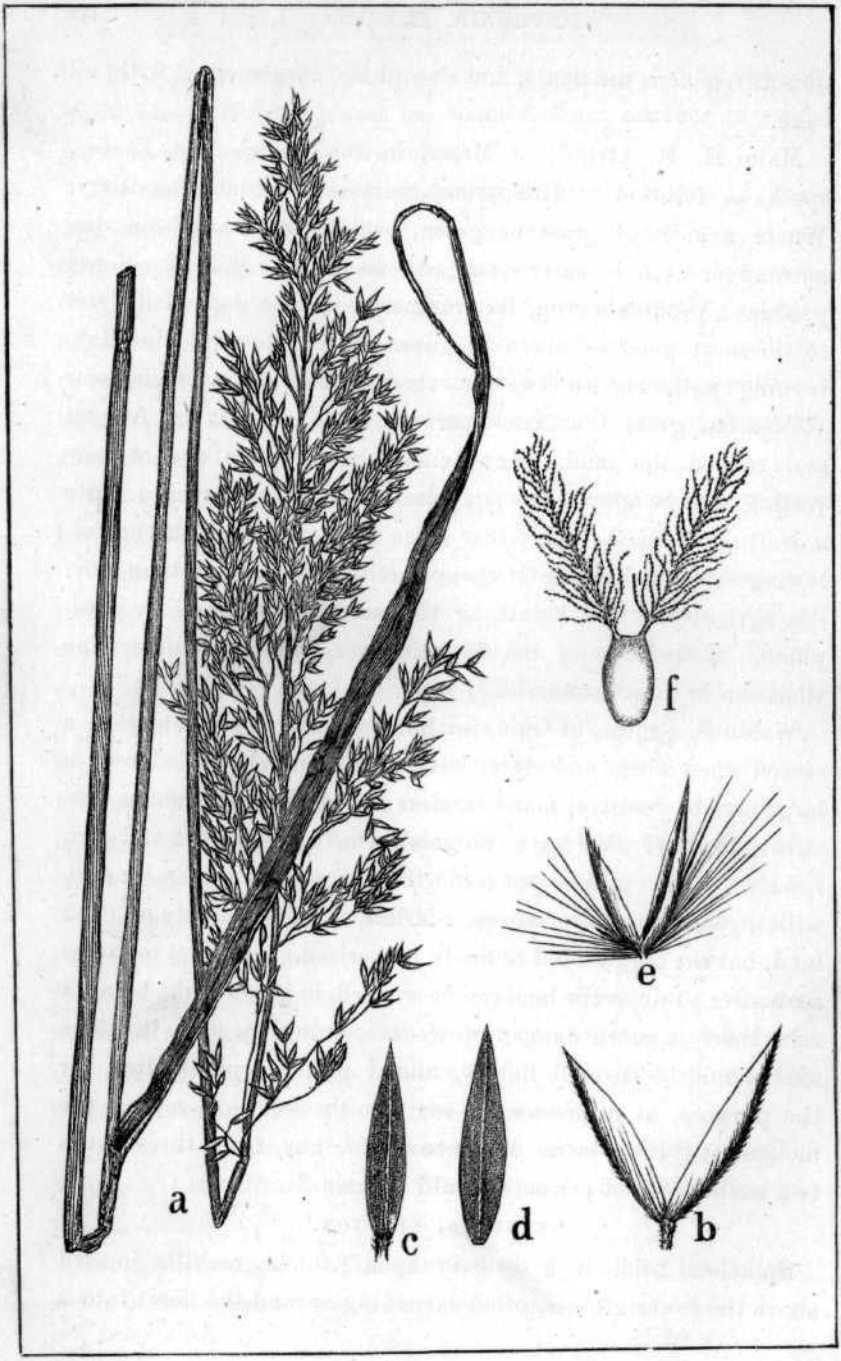


Fig. 80.

bristle-like or smooth rudiment of a flower; flower perfect. The empty glumes persistent below the joint, slightly unequal, awnless, keeled, membranous; the floral glume often with a ring of hairs at the base, 5-nerved, entire or 2-4-toothed, bearing a short awn on the back. Palea slender, 2-nerved, thin. Stamens 3. Styles distinct, short, stigmas feathery. Caryopsis obovoid or oblong, often oblique, included by the slender flowering glume and the palea, free, or slightly adherent.

Grasses with various habits. Panicle terminal. Nearly related to *Agrostis*.

About 120 species in temperate and cold regions.

D. (Calamagrostis,) Canadensis, Beauv. Blue Joint.—A perennial with creeping rootstocks, found in low grounds, 3-6-ft. high. Leaves flat, glaucous. Panicle open, 2-6 in. Spikelets purplish with the rachilla continued behind the palea as a short, hairy pedicel. Empty glumes, ovate, lanceolate, acute, the upper with an obscure nerve each side the middle one. Hairs numerous, as long as the floral glume, which bears a very slender, straight awn near the middle. Palea hyaline, two-thirds as long as its glume.

This native perennial grass is widely distributed in the marshes of the Northern States clear across the continent, where it attains a height of four to six feet or more. The narrow panicle somewhat resembles that of red top, only it is more slender.

Unfortunately, the common name is a very indefinite one, as many other and widely different grasses in various parts of our country have been called "blue joint." It is not much cultivated, but is quite common, and if cut rather early, while in flower, or sooner, it affords a very large yield of good hay. Blue joint will grow on land rather too wet for red top, and for such places, if they cannot be drained, we know of no grass more suitable for cultivation.

FIG. 80. *Deyeuxia Canadensis* (Blue Joint); *a*, upper part of a plant; *b*, empty glumes; *c*, *d*, back of same; *e*, floral glume, palea to the left, and at base a rudiment of a floret; *f*, ovary and styles.—(Sudworth).

FIG. 81.

The seeds are quite small and some time is required for the grass to become well established.

Concerning this grass, Gould says: "It constitutes about one-third of the natural grasses on the beaver dam meadows of the Adirondacks. It is certain that cattle relish it very much both in its green state and when made into hay, and it is equally certain that farmers who have it on their farms believe it to be one of the best grasses in their meadows."

MUHLENBERGIA. SCHREB.

Spikelets 1-flowered, small, panicled, flowers perfect. Glumes 3, the two lower empty, persistent below the joint, membranous or hyaline, equal or oftener unequal, sometimes minute, or one of them wholly wanting, keeled, acute, mucronate, or rarely short or long awned. The floret with a minute callus or sessile, usually bearded at base. The floral glume 3-5-nerved, firm or membranous, obtuse, acute, mucronate, or very often bearing a slender awn. Palea hyaline, included, 2-keeled. Lodicules 2, very small. Stamens usually 3. Styles distinct, stigmas plumose. Caryopsis narrow, subterete, inclosed by the floral glume, free.

Grasses of various habits. Panicles terminal and axillary, narrow and slender, loose and branching, dense or spike-like, spikelets small, slender.

About 60 species, mostly North American, a few found in the Andes and Asia.

M. glomerata, Trin, Muhlenberg's Grass, Satin Grass, Wild Timothy.—Culms erect, glaucous, 1-3 ft. high, branched, or rarely simple. Panicle spike-like, dense, excerted, 2–3 in. often lead colored, glumes awned, nearly equal. Common northward in bogs, or at the west on dryer land.

FIG. 81. *Muhlenbergia glomerata*; *a*, plant; *b*, spikelet; *c*, floret; (U. S. Agricultural Department and Scribner).

The following is by Dr. C. E. Bessey, now of Lincoln, Nebraska:

"Ten or twelve years ago I had my attention first called to this wild grass as one possessing many valuable qualities, making it desirable for introduction and cultivation. I found that the liverymen of central Iowa were in the habit of cutting those parts of the prairie which lie between the sloughs and the high land. The hay obtained from these places was of fine quality, being composed of leafy, branching stems of fine length and medium hardness. It was always cut late, but even then it was not often in seed. In fact, the rarity of the seeding is so great that I have heard it averred, over and over again, that it is a seedless grass. Of course this was an error, as all grasses are seed-bearing at some stage or other of their existence. In fact, it appears to seed freer under cultivation than in the wild state.

"So much for this grass in a general way. As to common name, I find no uniformity whatever. It is known here and there under many different names. For example, in some places it is known as Nimble Will; in others as Limber Bill, names which in other regions again are entirely unknown or applied to entirely different grasses. I have heard it called Fine Slough grass, a misnomer, as it does not grow in genuine sloughs at all. Again, the name of Small Willow Top is occasionally heard, although not confined to this grass alone. In the books, all the Muhlenberg grasses are called drop-seed grasses, a name which cannot be expected to come into general use. In reports it is often spoken of as simply fine prairie grass, which is, to say the least, exceedingly vague.

"The name I have used—Muhlenberg grass—is one which I think we might well adopt, in honor of the discoverer, old Dr. Muhlenberg, a botanist of the last century, who did much to bring before the world the natural resources of this country. Now it is curious that although this grass has been known in the

West for many years as a valuable wild one, there are to be found scarcely any references to its value in published books or reports to which I have access. Flint, in his great and valuable work, 'Grasses and Forage Plants,' describes it and then remarks, 'Of no agricultural value.' Dr. Darlington, in his book, 'American Weeds and Useful Plants,' does not even mention it; but in reference to a closely-allied species he says: 'It affords an indifferent pasture in the latter part of summer; but it is not of much worth.' Dr. Killebrew does not mention it in his book, 'Grasses, Meadows and Pastures.' Dr. Vasey, in 'The Agricultural Grasses of the United States,' says, 'Specimens have been sent from Colorado and Kansas and recommended as an excellent grass for hay.'

"Now, chemical analyses show that Muhlenberg grass is highly nutritious. In the years 1878 and 1879, at my suggestion, Mr. W. K. Robbins, a graduate of the Iowa Agricultural College, made analyses of this grass, with results which showed that in nutritiousness it ranked with red top and blue grass, and, in some instances, Timothy. More recent analyses by the government chemist at Washington make a still better showing. Taking an average of the analyses I find the following results:

"Timothy contains 4⅓ per cent of albuminoids.

"Orchard grass contains 6½ per cent of albuminoids.

"Red top contains 6⅔ per cent of albuminoids.

"Blue grass contains 8 per cent of albuminoids.

"Muhlenberg grass contains 17 2-5 per cent of albuminoids.

"That is, Muhlenberg grass is more than twice as nutritious, weight for weight, as blue grass. It is nearly three times as nutritious as red top and orchard grass, and about four times as nutritious as Timothy. Now I would not for a moment be understood as considering these analyses as settling the relative merits of these grasses. It is well known, however, that the analysis of a grass is one of the important factors in determining

FIG. 82.

its value, and I bring it in here as simply corroborating what the feeders of hay have been saying for a long time."

Muhlenbergia Mexicana, Trin.—Culms ascending, branching, 2–3 feet high; lateral panicle often included at base, linear, interrupted; glumes awnless, sharp-pointed, unequal.

It is quite luxuriant, thrives in the shade, and stands drought well.

Dr. Bessey also speaks well of this grass as well as of the preceding, for Iowa and Nebraska.

He writes: "When I called Prof. Budd's attention to it he said that he grew a three acre lot of it for four years, and that it yielded from 2½–3 tons per acre of hay of the highest quality. This agrees with other testimony. In fact, I have for the last ten years, from time to time, called attention to its value in the papers of this State."

If these species are as valuable as the above notes indicate, most likely several other species of the same genus are also valuable. The very small size of the seed and its slow growth when small, would make it unprofitable for alternate husbandry.

PENNISETUM, PERS.

Spikelets ovate or ovate-lanceolate, with one perfect flower, and a second male or neutral one below, solitary, or 2–3 together, closely surrounded by an involuce of bristles which are attached above the joint. Glumes 4, rarely 3, the lower small or 0, the second often equaling the spikelet, both empty; the third empty or including a palea or staminate flower; the terminal one shorter, including a perfect or pistillate flower, firmer than the palea. Stamens, 3. Styles distinct at the base or united for more or less of their length, stigmas feathery with short or long branches. Cariopsis included, free. Annuals or perennials, often branch-

FIG. 82.—*Muhlenbergia sylvatica*,—*1*, Top of a plant; *2*, spikelet. A grass of value in some localities.—(U. S. Agricultural Department and Scribner).

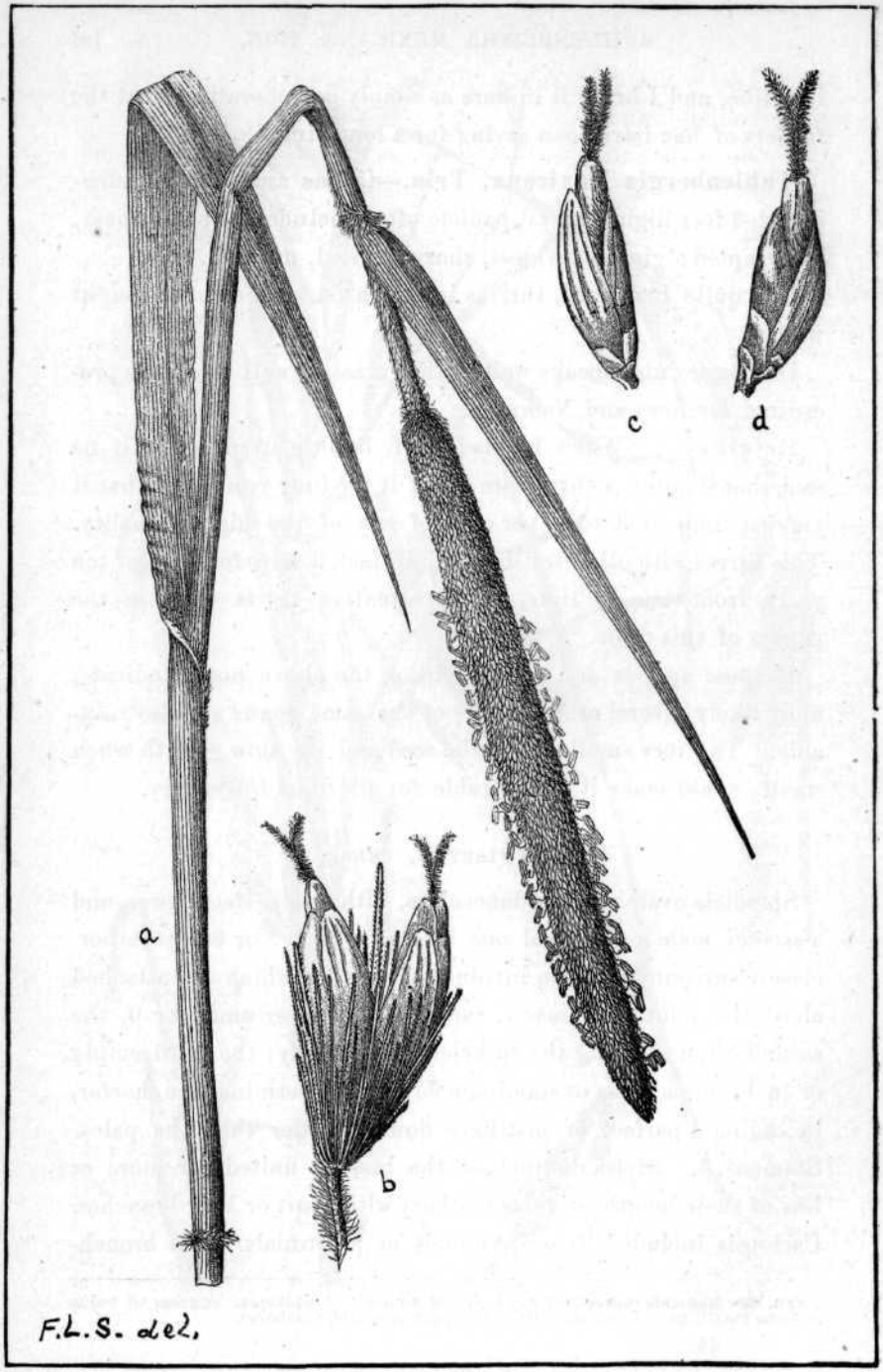


FIG. 83.

ing. Leaves flat. Spikelets crowded in a spike-like panicle, or on spike-like branches.

Species about 40, mostly African, a few in tropical Asia and America.

P. spicatum. Pearl, Indian, African, Cat-tails, or Horse Millet.—This grass has been spoken of very highly as a meadow grass for the South, where it has been grown for many years. It needs an abundance of heat, rich soil, and makes a rank, rapid growth six or eight feet high, each culm teminating in a stiff spike an inch in diameter and six to twelve inches in length. Branches come out in abundance near the ground, hence there will be all states of advancement in the spikes of flowers. As said of *Panicum Texanum* (Texas Millett) and *Sorghum halapense* (Johnson grass), it may be cut two or three times a year, and yield an abundant crop of rather coarse hay. It cures slowly. In central Michigan, where it has been tried, the summers are too cool for perfecting seed, and the crop does not become large till late in the season. Indian corn is certainly preferable for the North, and perhaps as suitable for the South.

PANICUM, L.

Spikelets born on a jointed pedicel, spikelets racemed or panicled, with one perfect terminal flower, and usually a second which is male or neutral. Glumes usually 4, the lowest small or minute, the second and third usually sub-equal, membranous, awnless or rarely awned, empty or the third including the rudiment of a palea or a male flower; the terminal including a perfect flower, shorter and more obtuse than the others, carioceous, as is also the included palea. Lodicules, 2, fleshy. Stamens, 3. Styles distinct or united at the base for a short distance, stigmas feathery. Caryopsis included in the firm floral glume and palea, free. Annuals or perennials of various habits.

FIG. 83.—*Penniscetum spicatum* (Pearl millet); *a*, top of a plant with a spike reduced one-half; *b*, a pair of spikelets on the short hairy pedicel, with bristly incolucre; *c*, view of one spikelet; *d*, another view.—(Scribner).

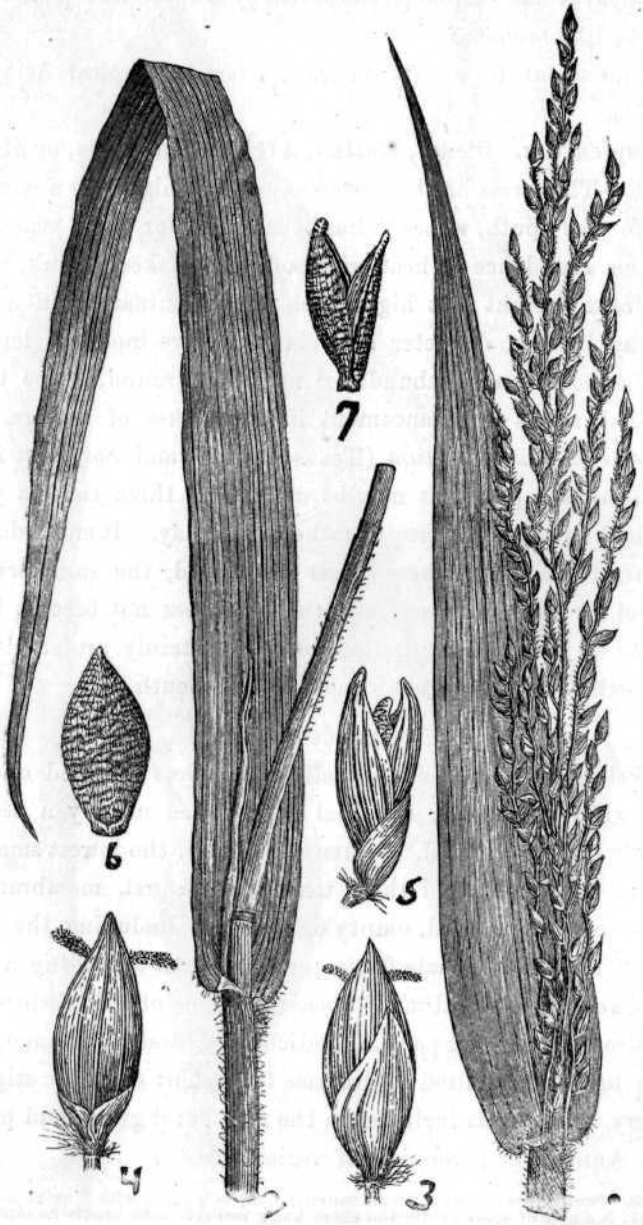


FIG. 84

About 250–280 species, widely scattered over the earth. A large and difficult genus.

P. Texanum, Buckl. Texas Millet, Texas Panic Grass.—A leafy annual, 2–5 ft. high, sparingly branched. Leaves 6–8x ¼–1 in; soft with rough margins. Panicle 6–8 in. long, narrow, erect, spikelets oblong, pointed. Lower, empty glume half as long as the second, acute, 5-nerved. The upper glume 5–7 nerved. The floral glume transversely wrinkled.

For most of the following I am indebted to Dr. G. Vasey. This grass is a native of Texas. It is a grass of rapid growth, succulent, yielding a large amount of forage.

Mr. Pryor Lea, of Texas, after trying it for some years, considers it superior to any grass that he ever saw for hay. It is a much more certain crop than millet, and cultivated with less labor, and all kinds of stock prefer it. It prospers best in the warmest season of the year.

A. W. Ravenel, of S. C., has tried Texas millet for several years, and esteems it very highly.

Dr. Phares, of Mississippi, says: "In habit it is much like crab grass, which is inclined to crowd out this millet."

Prof. S. B. Buckley, of Texas, says: "It grows thick and very rapidly, one or two months being sufficient to bring it to maturity for hay. It thrives best on the Colorado bottom lands, yet I have seen it growing on poor upland soil, but it was dwarfed at least one-half. It may be cut twice or three times a year."

It need hardly be said that this grass promises nothing for the northern United States.

AVENA, L.

Spikelets 2-flowered, very rarely 1-flowered, panicled, rachilla jointed between the flowers, lower flowers, at least, perfect, the upper often male or imperfect. Empty glumes persistent below

FIG. 84.—*Panicum Taxanum* (Texas Millet); numbers *1*, *2*, top of a plant; *3*, dorsal view of spikelet; *4*, front view; *5*, side view; *6*, floral glume; *7*, side view of floral glume and palea.—(U. S. Agricultural Department, details by Scribner).

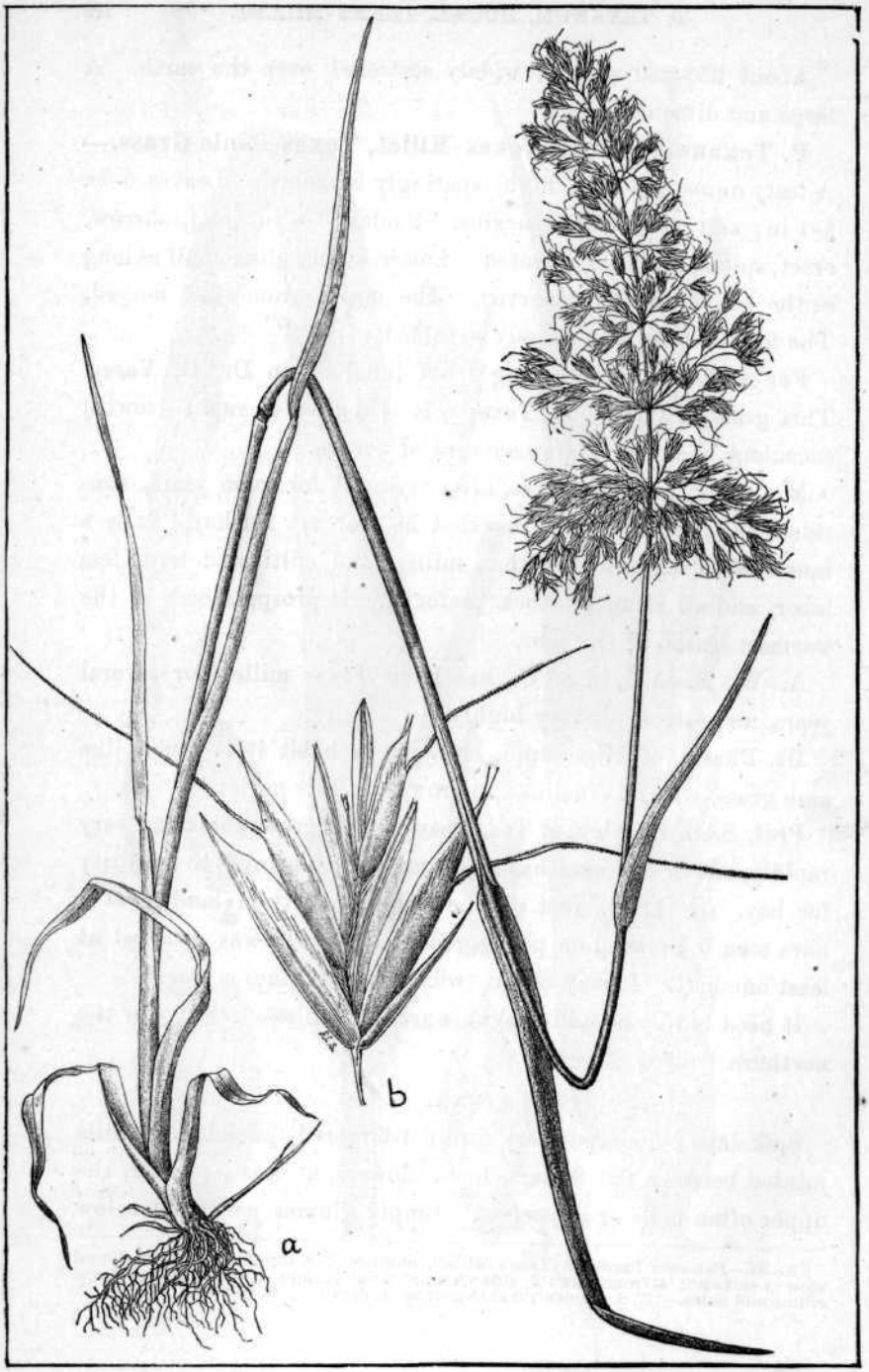


FIG. 85.

the joint, membranous, slightly unequal. Floral glumes convex on the back, acute, 5–9-nerved, often briefly 2-fid at the apex, the lower ones including a perfect flower and bearing on the back a twisted awn, the upper ones awnless, including a staminate or neutral flower. Palea narrow, 2-toothed or 2-fid. Lodicules 2-fid. Stamens, 3. Styles short, distinct, stigmas hairy. Caryopsis oblong or long-fusiform, pubescent or rarely smooth, sometimes deeply grooved, included by the floral glume and palea, free or more or less adhering to the palea. Annuals or perennials.

Species about 40. Found in many temperate regions.

A. flavescens, L. Yellow Oat, or Golden Oat-Grass.—An erect, smooth, glabrous perennial, culm 1–2 ft. hi., stoloniferous. Leaves flat, sheaths hairy; ligule truncate, ciliate. Panicle open, branches in ½ whorls. Spikelets compressed ¼ in., 3–4 fld., shining, yellowish. Empty glumes ovate, acuminate. Floral glumes keeled; awns divergent.

According to Baron Lawes, it is tufted, of rather weakly habit, the culms few and slender, producing flowers in June and July. It is found in cool, dry pastures and light soils. It is hardy and seeds early, is never sown alone, but is recommended as a minor ingredient with others for permanent pasture.

The seed is very often adulterated with seeds of *Aira flexuosa*, which is not worth raising.

I have seldom seen yellow oat grass in the pastures of the United States, and on trying it for several years in Michigan, I am compelled to say that it seems to promise little for this country.

HOLCUS, L.

Spikelets 2-fld., usually in collected dense oblong or interrupted panicles, rachilla jointed above the empty glumes, extending beyond the flowers as a small stipe; lower flower perfect, the

FIG. 85.—*Avena flavescens* (Yellow Oat Grass). *a*, A short plant.—(Sutton); *a*, spikelet.—(Scribner).

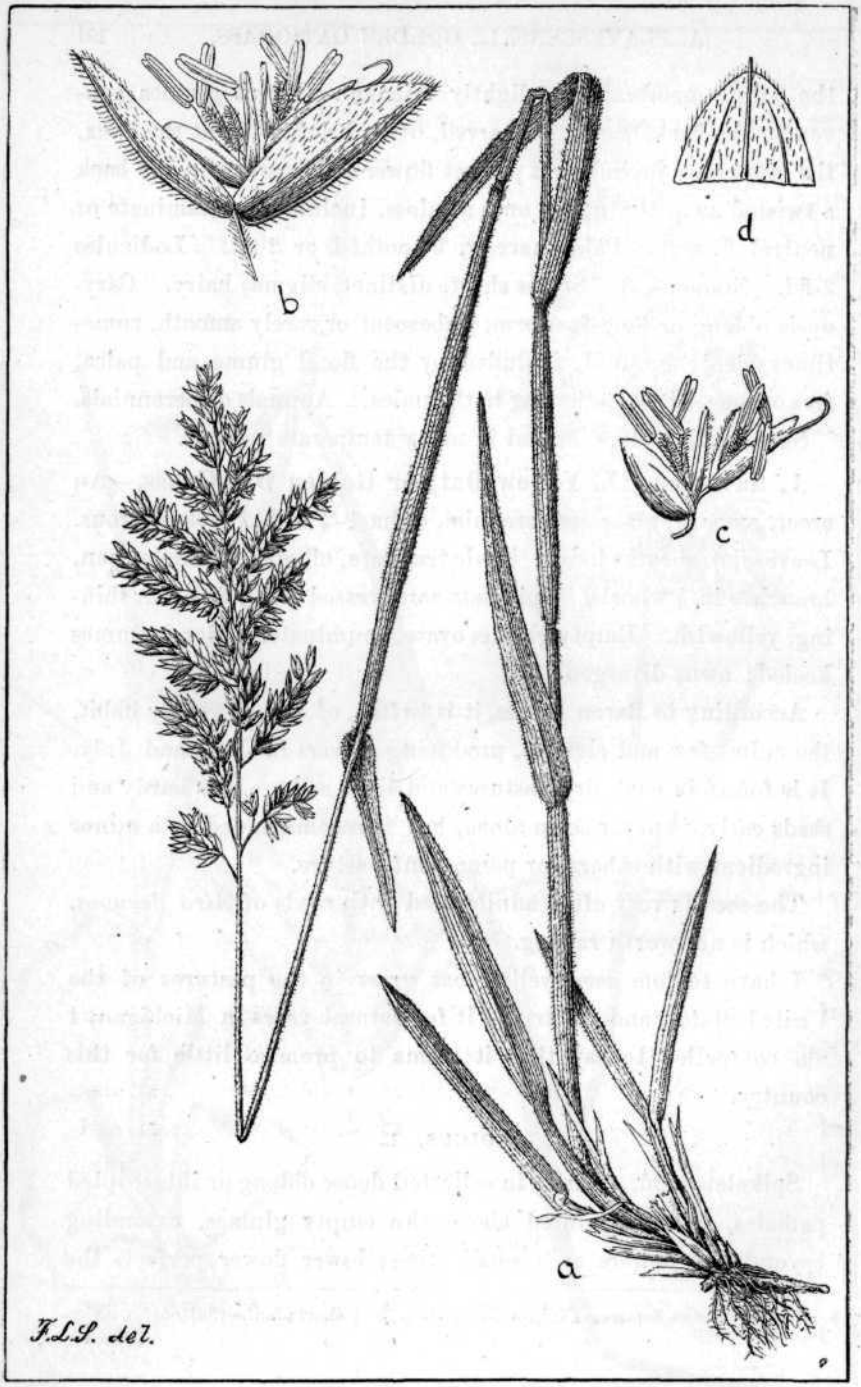


FIG. 86.

upper male. Empty glumes persistent below the joint, keeled, the lower 1-nerved, acute or acuminate, the second broader, 3-nerved, acute or awned. Floral glumes shorter than the empty ones, membranous, the lower awnless, at length firm, including a perfect flower, the upper quite similar, but including a staminate or neutral flower, and bearing on its back a slender curved awn. Palea narrow, 2-keeled. Lodicules oblique, acuminate. Stamens 3. Styles distinct, stigmas feathery. Caryopsis oblong, included by the firm glume, free. Soft annuals or perennials. Leaves flat or rarely convolute.

Species 8, belonging to Europe or Africa.

H. lanatus, L., Meadow Soft Grass, Velvet Grass, Yorkshire Fog, Salem Grass, White Timothy, Velvet Mesquit Grass.—A soft perennial, culms 6–24 in., ascending, leafy. Leaves flat, upper sheaths inflated; ligule short. Panicle 2–5 in., whitish green, often pinkish; branches 2–3-nate. Spikelets $\frac{1}{8}$ in., elliptic-oblong; empty glumes acute, nerves strong. [Specific character after Hooker.]

Velvet grass is mentioned here because it is so soft, velvety, conspicuous and handsome, that every one at once becomes interested in knowing the name and value, but it is still questionable whether it is worthy of cultivation anywhere.

Holcus lanatus is very productive of seed, and somewhat resembles orchard grass. The whole plant has a grayish aspect of pale white color often tinged with red. It is very common in England, and has been introduced with other seeds into various parts of this country. During summer on the moist old pastures of New England, we have often seen bunches untouched and going to seed, while June grass, red top and white clover were kept closely cropped.

Baron Lawes says: "This grass is not liked by cattle either

FIG. 86.—*Holcus lanatus* (Velvet Grass); *a*, A plant; *b*, spikelet; *c*, back of upper empty glume; *d*, two florets, without empty glumes.—(Scribner.)

when green or in hay, being too soft, spongy, and insipid. It is almost a weed, tending to usurp the land, and is one of the few poor grasses which is not reduced but increased by manuring a meadow [of mixed species]. The seed should be carefully excluded."

Dr. Phares says: "It has been introduced into Texas, and constitutes nine-tenths of all the so-called mesquit grass planted in the Southern States. It grows much larger than in the Eastern States or in England; and it seems too, to be more valuable and greatly improved here. It grows two to four feet high in the South."

Holcus mollis, L., Creeping Soft Grass.—This much resembles the former grass, but is not so common. In Great Britain the creeping habit makes it very troublesome. The nodes are villous, awn inflexed, exserted. Much like *H. lanatus*, but usually more slender.

CYNOSURUS, L.

Spikelets dimorphous, fascicled in a dense one-sided spike-like panicle; the terminal fascicle 2–3 fld., flowers perfect, the lower consisting of 1–2 neutral flowers. Rachilla of the fertile spikelet usually jointed above the lower glumes. The empty glumes linear, lanceolate, acute or short awned. Floral glumes broader, membranous, 1–3-nerved, mucronate or awned at the apex or on the back. The terminal one narrower, empty, inclosing a staminate flower, or reduced to an awn. Glumes of the sterile spikelets distichous, pectinate, all empty, sub-equal, linear, subulate, 1-nerved; rachilla continuous. Palea of the fertile flower narrow, 2-toothed. Lodicules with a basal lobe. Stamens 3. Styles distinct, short, stigmas plumose. Caryopsis oblong or elliptical, included by the glume and palea and adherent. Tufted annuals or perennials with flat leaves. The sterile spikelets form an involucre to the fertile one.

Species 3 or 4, found in Europe, western Asia, and northern Africa.

C. cristatus, L., Crested Dog's Tail.—A stoloniferous perennial, 1–2 ft. hi., culms terete, erect, smooth. Leaves short, narrow, slightly hairy; ligule 2-fid Spike 1–2 in., linear.

It has long been found in most meadows and pastures of Great Britain and the continent of Europe. It is still recommended by nearly or quite all those who sell grass seeds, especially for permanent pasture and lawns on dry light land, but we notice that some of the most observing and independent farmers in those countries seldom recommend it or use it on their lands.

Dr. Lindley said: "Its roots are long and wiry, and descend deep into the ground. It was quite early used for pastures and lawns; not very nutritious, not a favorite with stock."

Baron J. B. Lawes says: "This grass has a wide range of soils, and grows in dry, damp, and even in irrigated lands, and varies in character accordingly. It is better for pasture than hay, and was unable to maintain even a moderate degree of prominence where the conditions were favorable for the luxuriance of other graminaceous species."

The late James Buckman said: "We think it has been overmuch cultivated. It is not a favorite with deer or Southdowns. The culms soon become wiry and make poor hay, neither in quantity nor quality is it worthy a place in a good meadow.

"The culms are much used for straw-plaits, for which they are well adapted, both from their fineness and strength."

It is seldom met with in this country, and judging from our own efforts to grow this grass, we have little to expect in its favor

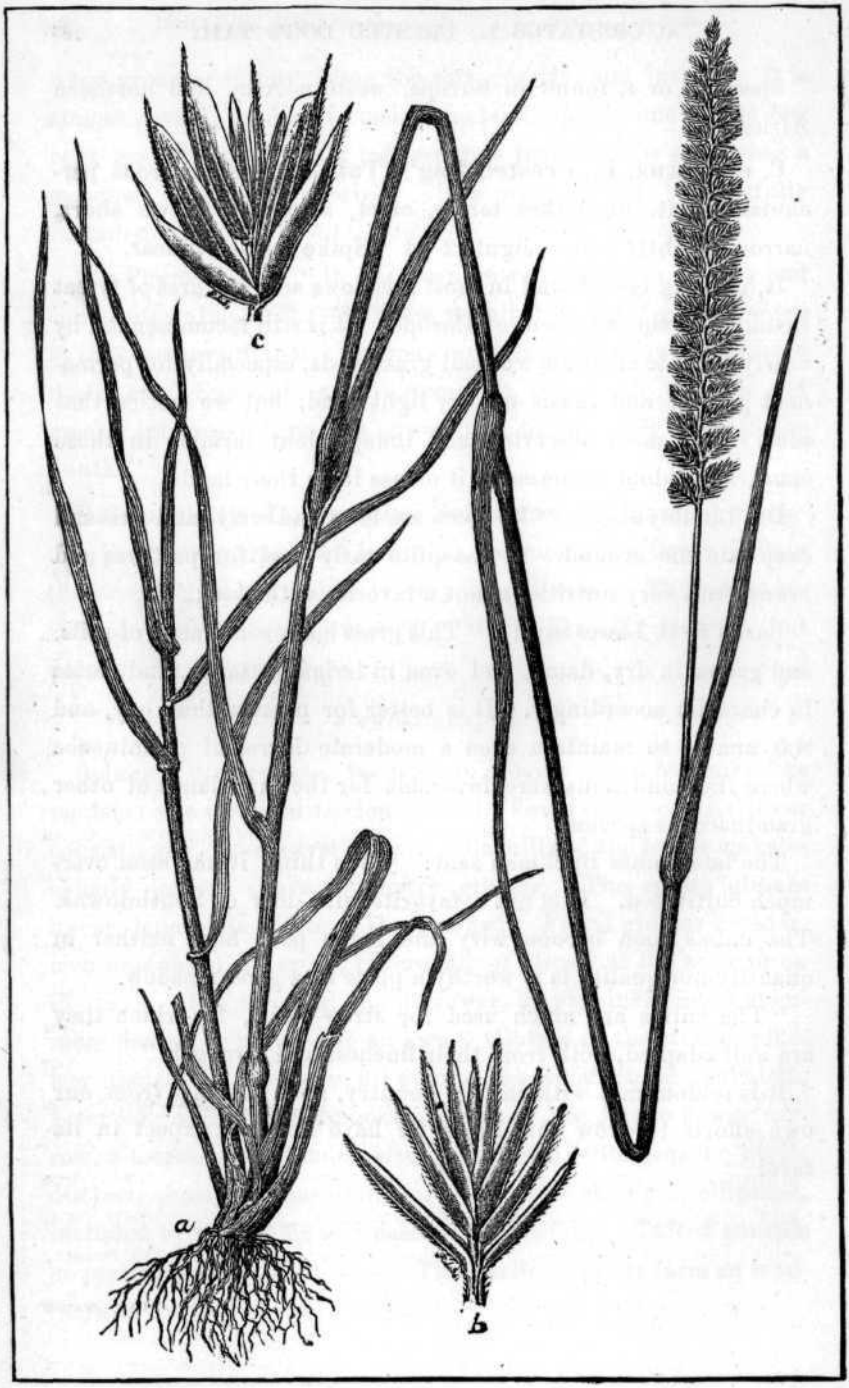


FIG. 87