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Departments of Chemistry and Botany.

Native and Introduced Forage Plants.

DUTCHER, BREED & STORGAARD, BROOKINGS.

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NATIVE AND INTRODUCED FORAGE PLANTS OF SOUTH DAKOTA.

DEPARTMENTS OF CHEMISTRY AND BOTANY.

INTRODUCTION.

NATIVE GRASSES.

The true grasses are one of the most valuable families of plants. To them belong the small grains (oats, wheat, barley, etc.), corn, the various sorts of cane, the great bamboo of Asia, and a host of other plants of more or less importance to man or beast. In the great prairie regions of the United States the grasses form by far the greater part of the natural vegetation and constitute one of the most valuable of the natural resources as well.

In our own state of South Dakota stock-raising has been one of the leading industries ever since its settlement, and will continue to be so for years to come. The state, as a whole, is peculiarly well adapted to stock-raising and dairying. One of the most important elements in this fitness is the great richness of the grass flora and of the native species in particular.

About one hundred and sixty species of grasses are known to grow within the limits of the state. Of these, about one hundred and five are native to the soil, the remainder being found either under cultivation or introduced some other way. Some of them are weeds, but the majority are more or less useful as forage plants.

The introduced species are much more common in the eastern and southern parts of the state, that is, in the older settled portions. Of the native species, probably sixty per cent are found quite generally distributed throughout the state. Many of these, however, though occurring in nearly all parts of the state

can only be said to be plentiful over a limited area. For example, the bushy blue stem grows in all parts of the state, but occurs in large quantities only in the Sioux Valley and in a few other localities less extended, principally along the lower Missouri. Some grasses are quite local in their distribution, usually owing to certain soil or climatic conditions, or to certain physical features of the country. Though so many different kinds of grasses help to make up the grass flora of the state, the greater part of the forage obtained is furnished by a much less number. Fully seventy per cent of the hay from grasses native to the soil is obtained from less than a dozen species. The same is true of the native pasturage. Probably ninety-five per cent of the native forage comes from less than twenty different kinds of grasses. In any one locality the number of kinds rarely exceeds a half dozen.

The state may be divided roughly into five regions, more or less well defined by the grass flora peculiar to each. (1) The Sioux Valley Region includes the most of the eastern and southern parts of the state. West of this lies the James River Valley extending through the entire state north and south. The lower part of this valley—near where it joins the Missouri—possesses a grass flora much like that of the Sioux valley, and may be considered as belonging more properly to that region. The greater part of it, however, is quite different in the main, so that we have (2) a James River Valley Region with a flora which is quite characteristic. West of this comes (3) the Missouri Valley proper with a great variety of grasses. Joining the Missouri Valley Region on the west is (4) the great Range Region of the state with a grass flora quite different from that of any other region. In the southwestern part of the state is found (5) the Black Hills Region, with a peculiar combination of mountain, woodland, and prairie forage plants.

THE SIOUX VALLEY REGION.—Probably the most characteristic grasses of the Sioux Valley region are the blue stems, particularly big blue stem and bushy blue stem. These grasses though occurring all over the state, are seldom found in great quantities outside of this region. There are, however, a few localities in the James River Valley and in the upper Missouri

Valley where they flourish. The blue stems thrive best in rich moist soil. They become more plentiful as civilization advances. As the buffalo and grama grasses disappear through excessive grazing and the changes incident to a more thorough cultivation of a part of the country, the blue stems take their places.

In eastern Nebraska, ten or fifteen years ago the blue stems could only be found in the bottom lands and "draws" while today they are plentiful everywhere on the high, dry soil of the hills as well as in the valleys. This same thing is happening in our own state. These grasses should be encouraged by every possible means.

Besides the blue stems there are several other grasses of great value common in this region. Switch grass is next in importance to the blue stems. In some of its many forms it is found more or less plentifully on both dry and moist soils. It constitutes a considerable part of the forage obtained from the lowland meadows. Other grasses somewhat common in this region are reed canary grass, blue joint, fowl meadow grass, the grama grasses, cord grass, the wheat grasses, and others of less importance. About 90 per cent of the native hay and 80 per cent of the pasturage is obtained from the first three grasses mentioned—big blue stem, bushy blue stem, and switch grass.

THE JAMES RIVER VALLEY REGION.—Though most of the grasses of this region occur also in the Sioux Valley, yet the general features of the grass flora are considerably different. The blue stems occur in this region but are seldom found in large quantities. Instead of furnishing most of the hay they furnish but a relatively small part of it. Switch grass is plentiful; and this grass, together with blue joint, sand grass, and the wheat grasses furnish by far the greater part of the hay, while these grasses and the grama grasses furnish most of the pasturage.

The wheat grasses, particularly western wheat grass (*Agropyrum glaucum occidentale*), are the most important "all round" grasses of this region. Western wheat grass furnishes about 90 per cent of the native hay as well as most of the pasturage. Land that has been allowed to "go back" soon comes up to this

grass and two and three tons to the acre have been cut from such fields. Blue joint and the sand grasses are also very common and are characteristic of the region. In dry, sterile, saline soils, salt grass occurs very plentifully. Porcupine grass and needle grass (*Stipa comata*) also occur and do considerable damage to sheep (particularly lambs) though they yield a considerable amount of early feed, and, if cut after the needles have fallen, are valuable for hay.

THE MISSOURI VALLEY REGION.—The grass flora of this region is peculiar because of its varied character. Along the lower part of the valley the blue stems are not uncommon, but they seldom occur in any considerable quantities in the upper part of the valley. Little blue stem is the commonest of these grasses, but is of little value for hay. Blue joint, sand grass, and cord grass are abundant along the sandy bottoms. Wheat grass and switch grass are also plentiful. On the dry uplands, back away from the river, grama, needle grass, wheat grass and buffalo grass abound. In many places needle grass is the principal hay grass. False buffalo grass is plentiful along the sandy river bottoms and often occurs in the bare places about ant hills, but it is of little value as forage.

THE RANGE REGION.—The number of species occurring here is much more limited than in any of the other regions. The greater part of the hay is cut from western wheat grass. In years of excessive drouth this grass seldom goes to seed, but lives over fall and winter by means of its underground stems or rootstocks. It is often so dry when cut that it can be raked and stacked immediately. This is so rich in nutrient substances that stock do well when fed upon it, even with little or no grain. Fully ninety-five per cent of the pasturage is obtained from wheat grass, blue grama and buffalo grass.

Among other grasses occurring in this region are cordgrass, slender cordgrass, little blue stem, needle grass, sand grass and salt grass.

THE BLACK HILLS REGION.—The grass flora of this region is rich in the number of its species. In the drier foot hills are found the grasses that have been mentioned as characteristic of the range region with a mixture of forms growing naturally on

more moist soils. In the Hills proper, many other species thrive because of the greater amount of moisture in the soil. In many of the moister valleys along the edge of the Hills the blue stems occur in greater or less abundance. Switch grass is plentiful. Western wheat grass is abundant in the foot hills.

SOME GENERAL CONSIDERATIONS.—A study of the meteorological records of the state shows that the climatic conditions are not alike in any of these regions.

The average temperature for the Sioux Valley, especially the upper part, is rather lower than that of any other region. That of the James Valley is higher. The averages of the Missouri Valley and the Black Hills are nearly the same—the latter being perhaps a little the milder; but either is warmer than the James Valley or the Sioux Valley.

The average annual precipitation is greatest in the Black Hills. There is but little difference between the average annual precipitation of the Sioux Valley and that of the James Valley in South Dakota. The Missouri Valley has less than either the Sioux or James Valley. The range region gets the least amount of rainfall. On the whole, however, these variations in temperature and rainfall are not great enough to account for all the differences between the floras of the various regions. There are certain soil conditions in each that exert a considerable influence upon the character of its flora. Then again, the lay of the land in each region may have a great effect upon the plants—especially upon their distribution.

The grass flora of the Sioux valley has been modified materially by cultivation of the soil, by pasturing and by a better control of prairie fires. The change has been greatest in this region partly because of certain modifications in the climatic and soil conditions, partly because of its being longest and generally most thickly settled, and partly because it is closely connected with the excellent blue stem region of Iowa, Nebraska and Minnesota.

It is evident that the differences between the native grass floras of the various regions, and the causes of these differences will have considerable bearing upon the question of the growing of introduced forage plants. It will not be surprising to

find that a forage plant that fails in one region will succeed in another or vice versa. With the irrigation possible in the James Valley many grasses can be grown that would not succeed in other parts of the state where no irrigation is possible. On the other hand, the soil of the Sioux Valley, because of the fact that it has been generally longer under cultivation, and because of different climatic or other conditions will, for some time at least, be better adapted to those forage plants that thrive best on the older cultivated soils. The fact that the blue stems are becoming so plentiful shows that conditions are becoming more and more favorable for such cultivated forage plants as timothy, clover, redtop and the like.

Careful conservation of surplus water from snows and rain by the building of dams at close intervals across runs and creeks and tree planting will increase the possibilities of raising the better class of forage plants.

One need not be discouraged then to find that a forage plant that has done well in one region fails in another. Careful study of the best native grasses will show what characters enable them to thrive when their weaker neighbors succumb in the struggle for existence. Then by selecting forage plants that have these characters best developed, much useless labor and waste of money may be avoided.

Land is plentiful in all parts of the state, and every farmer could, with profit, devote a small plot of one or two acres to experiments with the various forage plants of promise. It is better to work with only a few of the best kinds at a time. One can then be able to give them proper care and the results obtained will be of much more value. A single season is not long enough to decide properly, the value of any plant, especially those with perennial roots. Give a forage plant a fair trial for a series of seasons before discarding it entirely.

INTRODUCED OR CULTIVATED GRASSES.

The introduced grasses may be divided into two classes—those brought in for cultivation and those introduced accidentally, the seeds having been mixed with other grasses or grains, or by the many ways that nature has provided for the distribu-

tion of the various kinds of seeds. To the first class belong timothy, smooth brome grass, millet, the more important fescues, perennial or Italian rye grass, red top, orchard grass, and many others. All are more or less useful, though they cannot at present all be grown successfully in this state. To the second class belong grasses of much less importance as forage plants; but on the other hand many of them are pernicious weeds. Grasses of this class are represented by the foxtails, stink grass, chess and some of the panic grasses. They usually do more harm as weeds than good as forage plants, and when such is the case they should be exterminated in every possible way.

For the last five years experiments have been in progress on the grounds of the Experiment Station testing the hardiness and relative values of the various grasses in common cultivation and of a number of native species that seemed worthy of cultivation.

The most satisfactory grass tried thus far is the smooth brome grass (*Bromus inermis*) or as it is sometimes called, Hungarian brome grass. It catches readily and gives a good stand when sown either in drills or broadcast. It soon forms a good sod and makes a good growth the first year. It is one of the first grasses to appear in spring. It sprouts up immediately after cutting, giving an abundance of fall pasturage, and is not killed easily by the autumn frosts. Thus far it has endured almost perfectly both the drouth of summer and the dryness and severe freezings of winter. Timothy has done well on rich and rather moist soil, particularly when mixed with alsike or other clovers. It does well under irrigation. It will not thrive at present in the drier parts of the state and should never be used alone as a pasture grass. It will not stand close grazing in our climate and on our soil. To get the best results a timothy meadow should be treated at least every other year with a light coat of well rotted stable manure and then in early spring given a light harrowing.

Red fescue, sheep-fescue and hard fescue are all hardy enough to stand the climate in the eastern part of the state and probably also that of most localities east of the Missouri river or in the Black Hills. They furnish an abundance of pasturage but are

of no value for hay. They are particularly valuable on sheep ranches.

Tall fescue and meadow fescue give paying crops of hay on moist meadows. Of the two varieties meadow fescue is to be preferred. Both give best returns when mixed with other grasses such as red-top, orchard grass and smooth brome.

Kentucky blue grass or June grass as it is often called, is hardy in the Sioux Valley and will probably do well in many other parts of the state. Creeping spear grass or June grass, a near relative of Kentucky blue grass has also given good results. A number of instances have occurred where these grasses sowed directly upon the prairie sod have taken hold and gradually spread over much larger areas. Kentucky blue grass is the better grass of the two as it is a good hay grass as well as a good pasture grass while the other is fit only for pasture. The creeping spear grass is, if anything, hardier than the other, standing drought rather better. Neither should be cut or grazed too closely during July and August but should be allowed to produce enough leaves to shade the ground, thus protecting the roots, and root stocks from the hot sun.

No good trial has been made with orchard grass. In one experiment the grass did well on low moist soil. In some later experiments made on high dry soil seed purchased for orchard grass turned out to be perennial rye grass, a species of little value in this State. Orchard grass is a good grass, however, and generally hardy, so it is worthy of trial where one is trying to establish a good meadow.

The following grasses have proved of little or no value for this region: Johnson grass, sweet vernal, perennial rye grass, Rescue grass (also called Schrader's brome grass), and hair grass. The latter is fairly hardy but does not afford sufficient forage to pay for its cultivation.

The native grasses that have shown themselves worthy of cultivation are: Western wheat grass, slender wheat grass, blue joint, and reed canary grass. All have, thus far, been perfectly hardy and the yield of hay has been much larger than usually obtained from wild meadows.

Several attempts to get a good stand of switch grass have failed. One small patch, however, has done well enough to

show that much is to be expected from this grass. Up to the present time the blue stems have not done well from the seed but plats of sod taken from the prairies give something of promise. Further attempts will be made with these and with switch grass also.

Oregon blue grass though rather slow in catching and in forming a good sod has given excellent results when once well established.

Muhlenberg's grass has also given hopeful results.

CLOWERS.

It has generally been thought impossible to grow clovers in South Dakota, except perhaps in the extreme southeastern corner of the State. The hot sun and dry weather of July and August and the dryness and cold of the average winter have been thought to be too severe for these plants.

It is probably true that for the drier portion of the State there is little hope of the successful growing of many of the clovers for some years to come. The results of the experiments on the Station grounds, however, show that there are certain of the clovers and clover like plants that can be grown, and with a considerable amount of success too, in localities where the soil and climatic conditions are similar to those obtaining at Brookings and in the Sioux Valley, generally.

Alsike and White clover have given excellent results, particularly when mixed with some of the grasses such as timothy, meadow fescue, and the blue grasses. Up to the present time Alsike has been the most satisfactory clover tried.

Scarlet clover and mammoth clover are too tender for our region.

Red clover has sometimes succeeded but has also frequently failed. It does better in the older portions of the state. In many parts of the Sioux Valley some good clover and timothy fields are growing at the present time. All clovers do best when mixed with timothy or some other of the grasses.

The Melilots, both the yellow and the white, have shown themselves able to make a good growth under the most adverse circumstances. As they are biennials, but two crops can be cut

from one sowing. The forage obtained, while not first class, is much better than nothing and the yield is usually large. They should be cut before the stem becomes woody. They are good plants for soiling purposes and may be used to advantage when one is desirous of cleaning out or resting up a field.

Alfalfa has proven hardy and makes a good growth but has suffered so severely from a disease due to a fungus that it has not been a success. Future experiments will be made to ascertain whether this trouble may not be overcome.

Other plants of the clover family have given promise of more or less value as forage plants, but need more study before an intelligent report can be made upon them. The most important of these are goat's rue, sand clover, esparsette, and Hedysarum.

MISCELLANEOUS FORAGE PLANTS.

Besides the true grasses and the clovers mentioned in the preceding pages, there are a large number of other plants that are eaten by stock either as green or dry forage. Much of the early grazing along lake margins, streams, and in sloughs consists of sedges and rushes. Hay cut in such places is often also composed largely of these plants.

Along the Missouri river and throughout the region extending to the James river, stock feed a great deal upon a plant known among stockmen as *wild vetch*. It belongs to the clover family and occurs, more or less plentifully, throughout the prairie regions of the west. It is considered of great value by the stockmen. It is the *Hosackia purshiana* of the botanists and is closely related to the true vetches.

Knot-weed, or goose-grass is a common door yard or way side weed that is much sought after by stock, particularly by cattle.

EXPLANATION OF TERMS USED IN DESCRIBING FORAGE PLANTS.

Acute.—Sharp pointed.

Achenes.—Small, dry, hard, one-seeded fruits, as in some of the sedges.

Annual.—Living but one season.

Anther.—The organ containing the pollen or "dust" of the flower.

Apex.—The top or extreme end of a leaf or any other part of the plant.

Appressed.—Pressed together.

Ascending.—Rising obliquely from the ground.

Awl-shaped.—Narrowed gradually to a fine point, like an awl.

Awn.—A bristle-like projection from a glume or "chaff" often called a "beard."

Biennial.—Living through two seasons.

Blade.—The expanded portion of a leaf.

Bristles.—Short, stiff hairs.

Bulbous.—Thickened like a bulb.

Chaff.—The dried glumes and palets that cover the seeds of grasses.

Ciliate.—Having the edges fringed with hairs.

Compressed.—Flattened laterally.

Cuspidate.—Ending in a sharp tooth-like point.

Decumbent.—Lying on the ground, but with the top raised.

Entire.—Without notches or divisions.

Fertile.—Producing fruit.

Fibrous.—With thread like branches or divisions.

Glabrous.—Smooth, without hairs or roughness.

Glaucous.—Whitish on the surface, giving the parts a grayish or bluish green appearance.

Glumes.—The "chaff;" the two lowermost glumes of a spikelet are called the *empty glumes*, while the single glume just at the base of each flower is the *flowering glume*.

Inflorescence.—The arrangement of the flowers.

Herbaceous.—Herb-like, not woody.

Hirsute.—With rather stiff and coarse hairs.

Imbricate.—Closely overlapping each other, like the shingles of a roof.

Indigenous.—Native to the soil, not introduced.

Involute.—Rolled inward.

Joints.—Thickenings in the stem from which the leaves arise.

Keel.—A glume has a keel or is said to be *keeled* when its back is sharp or ridged like the keel of a boat.

Lanceolate.—Tapering gradually to a point.

Linear.—Long and narrow, with parallel sides.

Midrib.—The central and principal nerve of a leaf or glume.

Nerves.—The ribs or veins of a leaf, glume or other leaf-like organ.

Oblong.—Longer than wide, with nearly parallel sides.

Obovate.—Egg-shaped with the wider end uppermost.

Obtuse.—Blunt or rounded at the apex.

Ovary.—That part of the pistil containing the seed.

Ovate.—Egg-shaped.

Palet.—The inner chaff or scale of a flower, standing opposite to the flowering glume.

Panicle.—A spreading, bushy head as in oats.

Perennial.—Living more than two years.

Perigynium.—The sac-like body surrounding the ovary in certain sedges.

Petiole.—The stem of a leaf.

Pistil.—The central or female organ of a fertile flower.

Pistillate.—Having pistils but no stamens.

Pollen.—The powder contained in the anthers.

Ribs.—Prominent nerves of the leaves or like organs.

Root Stock.—An underground stem running horizontally.

Serrate.—Having teeth on the margin which are pointed toward the apex.

Sessile.—Without a foot-stalk or pedicel.

Sheath.—That part of the leaf which surrounds the stem of the plant.

Spike.—Such an arrangement of the flowers as that in wheat or rye.

Spikelet.—A cluster of flowers having a pair of outer glumes.

Stamen.—The male organ of a flower.

Staminate.—Having stamens but no pistils.

Sterile.—Imperfect flowers not producing seed.

Stoloniferous.—Sending out off-shoots or runners from the base.

Succulent.—Fleshy and juicy.

Tufted.—Growing in bunches.

Woolly.—Clothed with long, matted hairs.

SOME CHEMICAL CONSIDERATIONS.

The collection and analyses of the native and introduced forage plants of South Dakota has extended over several years. The work was begun in 1889 and was completed in 1893. The plants were carefully selected by hand so that each sample should contain but one species. They were gathered just when they were in bloom and best adapted for use as foddors. Moreover, in the case of the native grasses each sample was selected from a locality in which it was growing well and in which it appeared to be permanent.

As soon as a sample was gathered it was tied loosely and allowed to dry in the open air. All samples were brought to the requisite state of dryness suitable for grinding by exposure to the steam heated atmosphere of one of the laboratory rooms devoted to the preparation of samples. It will be readily understood, consequently, that hay made from any of these plants and cured in the open air would contain rather more moisture than that given for the air dry substance. As soon as a sample was ground it was placed in a tightly stoppered bottle until required for analysis. The grinding was effected by an ordinary Enterprise drug mill and was continued until the whole sample passed through a one millimeter mesh seive.

Some of the reasons which induced this Station to undertake the tedious and expensive investigation of these forage plants ought to be enumerated. In the first place common report among stock men declare that our forage plants are exceptionally nutritious. Moreover, the well known belief that northern grown grasses and grains are richer in nutrients than their bulkier relatives grown farther south, seemed to indicate the necessity of determining in just what respect, if in any, this increase in nutritive value consisted.

Again, should our forage plants be found to possess nutritive ratios differing from those previously determined the facts would be found useful in a rational and scientific system of stock feeding. And finally, some of the native plants have not been exhaustively investigated while many of them have not been analyzed at all or their analyses are not accessible to the general reader.

A comparison of the analyses here given with those in Experiment Station Bulletin 11, U. S. Department of Agriculture, will show that the crude fibre in South Dakota grown forage plants averages high. This fact taken together with the climatic conditions of much sunshine and dry weather during the fall months, will explain why in the range regions our grasses cure standing on the prairie and afford such valuable winter grazing. Moreover, the plants ripen before the frosts come. Indeed when snow does not interfere, and such interference is the exception rather than the rule, stock does well on the uncut grasses remaining on the prairies. It is no uncommon occurrence to find farmers mowing every month in the year. And in some cases two years' growth of grass is harvested at one mowing. While these practices are not to be recommended nevertheless they have been found useful in times of emergency. Hay should be cut and cured at the proper time to avoid deterioration.

By further comparison with the same tables it will appear that the crude protein runs high which materially narrows the nutritive ratio thus affording a more nearly balanced ration. This would explain the remarkable thrift of grass fed stock in the range regions. Other variations become apparent upon investigation.

EXPLANATION OF TERMS USED IN ANALYSIS.

WATER.—Although hay may be apparently dry to the touch, nevertheless it always contains more or less moisture when dried in the air. Moreover, it is very hygroscopic and the amount of moisture it contains at any one time will depend upon the state of the atmosphere and how it is stored. The water given in the analyses was obtained by drying the sample at the temperature of boiling water in a current of hydrogen.

ASH.—The ash is obtained by burning the fodder in open crucibles at the lowest possible temperature. The ash constituents of plants are valuable to the animal economy since they form an important part of many of the tissues and especially of the bones. Since the ash constituents are usually plentiful but little attention is paid to them in compounding rations.

ETHER EXTRACT.—The ether extract consists mainly of fats and oils and many writers refer to it simply as “fat.” But it contains other bodies such as gums and coloring matter and for the sake of accuracy the longer term is used here. It is obtained by treating the fodder with ether. These substances are heat and force producers and give origin to the deposits of fat in various parts of the animal.

CRUDE FIBRE.—The crude fibre is the woody portion of plants found in the cell walls. It is determined by dissolving out all other parts of the plant by means of dilute acids and alkalies. When digested, the crude fibre performs the same offices as the ether extract.

NITROGEN-FREE EXTRACT.—This extract consists mainly of sugars, starch, dextrin and gums. It is obtained by difference. The sum of all the other constituents is subtracted from 100. The name is not a very good one since it is not distinctive. This extract performs the same offices as the crude fibre in the animal economy.

The last two terms comprise substances which are composed of carbon, hydrogen and oxygen only. So they are often called by one comprehensive name, Carbo-hydrates. The crude fibre and the nitrogen-free extract are of about equal values for feeding purposes; but the ether extract is worth about 2.5 times as much as either the crude fibre or the nitrogen-free extract.

CRUDE PROTEIN.—Under this head is grouped a class of substances which contain in addition to carbon, hydrogen and oxygen, nitrogen also. The crude protein builds up the lean meat, the ligaments and connective tissues of animals. It also supplies the blood with albumen and the milk with casein. It is also an important constituent of the hair, skin, and other parts of the animal. When the supply of carbohydrates is scant, the crude protein may also supply heat for which purpose it is about equal to the carbohydrates. It is worth still less as a fat producer. But it is not economical to compel an animal to convert crude protein into fat or to use it to supply heat and energy. Crude protein is more expensive than the fats and carbohydrates and does not do their work so satisfactorily.

The crude protein is determined by breaking down the sam-

ple with powerful reagents which convert the nitrogen into ammonia. The nitrogen in the ammonia is then determined and the quantity found is multiplied by 6.25 to convert the results into crude protein.

It is evident that any lengthy description of analytical methods would be out of place here, so it must suffice to say that the methods followed are those of the official agricultural chemists. Every analysis has been repeated in duplicate. And if any doubt then existed concerning the results obtained, duplicate determinations have been repeated until no further doubt remained. Moreover, the most scrupulous care has been exercised in preparing all solutions and in testing all reagents employed in the analyses.

DIGESTIBILITY OF PLANT CONSTITUENTS.

It has been found that only a portion of each of the several constituents is digestible. The amount that is actually digested by animals has been determined by analyzing a portion of the fodder to be tried. A weighed quantity is then fed and the excreta of the animal is again subjected to analysis. Such digestion determinations have been mostly made by German chemists, although a few (about fifty) have been made by American chemists. It is to be regretted that the coefficients of digestibility can not be attached to each analysis.

The following table is a compilation taken from both German and American sources. While much is left to be desired it is safe to say that an intelligent use of this table will be more economical than any guess work that the most skillful feeder can do. The numbers given indicate the per cent of each constituent that is digestible:

Coefficients of Digestibility.

Name of feeding stuff.	Crude protein—per cent.	Fat or ether extract—per cent.	Nitrogen-free extract—per cent.	Crude fibre—per cent.
Crimson clover hay	69	49	72	49
Red clover hay	49	43	58	48
Alsike clover hay	56	53	64	46
Whole corn fodder	54	71	64	69
Corn stover	51	52	63	67
Blue joint	57	37	43	37
Timothy hay	49	56	64	53
Red top hay	60	44	59	61
Orchard grass hay	60	57	57	66
Witch grass	64	60	62	68
Mixed hay	48	50	57	48
Oat straw	38(?)	38	53	58
Wild oat grass	49	38	62	65
Vetch hay	76	60	66	54
Alfalfa hay	77	54	64	49
Wheat straw (Horses)	19	...	18	27
“ “ (Ruminants)	17	36	39	56
Rye straw, (Ruminants)	21	32	37	60
Barley straw “	20	42	54	56
Oats (Horses)	79	70	74	20
Barley (Horses)	80	42	87	100
Barley meal (pigs)	78	68	90	12
Corn (Ruminants)	79	85	91	62
“ (Pigs)	68	46	89	38
Pea meal (Pigs)	88	49	96	71
Wheat	78	82	76	76
Wheat bran	78	73	66	18
“ midlings {	78	73	66	18
Linseed cake	86	90	80	44
Potatoes (Pigs)	73	...	98	55
Sugar beets (Ruminants)	62	...	95	...
Mangels (Ruminants)	76	...	95	...
Turnips “	57	...	89	...
Skimmed milk (Pigs)	96	95	99	...

AMOUNT OF CONSTITUENTS REQUIRED BY ANIMALS.

An animal requires different amounts of nutritive substances depending upon what is required of the animal. Different kinds of animals also require varying amounts. The following table is of German origin and is the one now used in this country. It shows how much of each constituent is required for each 1,000 lbs weight of the animal. If the animal weighs

more or less than 1,000 lbs the weight of each constituent must be increased or diminished as the case may be.

FEEDING TABLE.—Pounds per Day Required for One Thousand Pounds Live Weight.

Kind of animal.	Total dry organic matter—lbs.	Digestible constituents of the fodder.			Amount of nutritive matter—lbs.	Nutritive ratio.	
		Crude protein.	Total carbohydrates, (from fibre and nitrogen-free extract)	Fat—lbs.			
Oxen at rest in stall.....	17.5	0.7	8.0	0.15	8.85	1: 12.0	
Sheep, wool producing, (coarse breed)....	20.0	1.2	10.3	0.20	11.70	1: 9.0	
“ “ “ (finer breed).....	22.5	1.5	11.4	0.25	13.15	1: 8.0	
Oxen at medium work.....	24.0	1.6	11.3	0.30	13.20	1: 7.5	
Oxen at hard work.....	26.0	2.4	13.2	0.50	16.10	1: 6.0	
Horses at light work.....	20.0	1.5	9.5	0.40	11.40	1: 7.0	
Horses at medium work.....	21.0	1.7	10.7	0.60	13.00	1: 7.0	
Horses at hard work.....	24.0	2.4	12.5	0.50	15.70	1: 6.0	
Milch cows.....	24.2	2.5	12.5	0.40	15.40	1: 5.4	
Fattening oxen, 1st period.....	27.0	2.5	15.0	0.50	18.00	1: 6.5	
Fattening oxen, 2nd period.....	26.0	3.0	14.8	0.70	18.50	1: 5.5	
Fattening oxen, 3rd period.....	25.0	2.7	14.8	0.60	18.10	1: 6.0	
Fattening sheep, 1st period.....	26.0	3.0	15.2	0.50	18.70	1: 5.5	
Fattening sheep, 2nd period.....	25.0	3.5	14.4	0.60	18.50	1: 4.5	
Fattening swine, 1st period.....	36.0	5.0	27.5		32.50	1: 5.5	
Fattening swine, 2nd period.....	31.0	4.0	24.0		28.00	1: 6.0	
Fattening swine, 3rd period.....	23.5	2.7	17.5		20.20	1: 6.5	
GROWING CATTLE.—							
Age	Average live weight per						
Months.	head.						
2—3	150 lbs.....	22.0	4.0	13.8	2.0	19.8	1: 4.7
3—6	300 lbs.....	23.4	3.2	13.5	1.0	17.7	1: 5.0
6—12	500 lbs.....	24.0	2.5	13.5	0.6	16.6	1: 6.0
12—18	700 lbs.....	24.0	2.0	13.0	0.4	15.4	1: 7.0
18—24	850 lbs.....	24.0	1.6	12.0	0.3	13.9	1: 8.0
GROWING SHEEP.—							
5—6	56 lbs.....	23.0	3.2	15.6	0.8	19.6	1: 5.5
6—3	68 lbs.....	25.0	2.7	13.3	0.6	16.6	1: 5.5
8—11	76 lbs.....	23.0	2.1	11.4	0.5	14.0	1: 6.0
11—15	82 lbs.....	22.5	1.7	10.9	0.4	13.0	1: 7.0
15—20	86 lbs.....	22.0	1.4	10.4	0.3	12.1	1: 8.0
GROWING SWINE.—Fattening.—							
2—3	50 lbs.....	42.0	7.5	30.0		37.5	1: 4.0
3—5	100 lbs.....	34.0	5.0	25.0		30.0	1: 5.0
5—6	125*.....	31.5	4.3	23.7		28.0	1: 5.5
6—8	170*.....	27.0	3.4	20.4		23.8	1: 6.0
8—12	250*.....	21.0	2.5	16.2		18.7	1: 6.5

*Substituted by Americans for the German weights 224, 270 and 350 lbs.

The following table gives the actual amounts required by each animal of the average weight given. This table is useful since it saves computations required by the preceding table in making allowance for the actual weight of the animal.

Pounds per Day per Head.

Kind of animal.		Total dry organic matter—lb.	Digestible constituents of the fodder.			Amount of nutritive matter—lbs.	Nutritive ratio.
			Crude protein.	Total carbohydrates, (from fibre and nitrogen free extract.)	Fat—lbs.		
GROWING CATTLE.—							
Age.	Average live weight per head.						
Months.							
2—3	150 lbs.....	3.3	0.6	2.1	0.30	3.00	1: 4.7
3—6	300 lbs.....	7.0	1.0	4.1	0.30	5.40	1: 5.0
6—12	500 lbs.....	12.0	1.3	6.8	0.30	8.40	1: 6.0
12—18	700 lbs.....	16.8	1.4	9.1	0.28	10.78	1: 7.0
18—24	850 lbs.....	20.4	1.4	10.3	0.26	11.96	1: 8.0
GROWING SHEEP.—							
5—6	56 lbs.....	1.6	0.18	0.87	0.045	1.095	1: 5.5
6—8	68 lbs.....	1.7	0.17	0.85	0.040	1.060	1: 5.5
8—11	76 lbs.....	1.7	0.16	0.85	0.037	1.047	1: 6.0
11—15	82 lbs.....	1.8	0.14	0.89	0.032	1.062	1: 7.0
15—20	86 lbs.....	1.9	0.12	0.88	0.025	1.025	1: 8.0
GROWING SWINE.—Fattening.—							
2—3	50 lbs.....	2.1	0.38	1.50		1.88	1: 4.0
3—5	100 lbs.....	3.4	0.50	2.50		3.00	1: 5.0
5—6	125 lbs.....	3.9	0.54	2.96		3.50	1: 5.5
6—8	170 lbs.....	4.6	0.58	3.47		4.05	1: 6.0
8—12	250 lbs.....	5.2	0.62	4.05		4.67	1: 6.5

NUTRITIVE RATIO.—In the preceding two tables the term nutritive ratio is used. This ratio expresses the relation between the digestible crude protein and the sum of the other digestible constituents after the fat has been multiplied by 2.5. This sum is some times called the “Carbohydrate Equivalence.” The nutritive ratio is determined as follows: From the analysis of any plant the per cent of crude protein is taken. This is multiplied by the per cent that is digestible in that plant.

This gives the first term of the ratio. In a similar manner treat the crude fibre, the nitrogen free extract and the fat or ether extract. This gives the per cent digestible of each of these substances. Now multiply the amount of digestible fat by 2.5 to make it equal in feeding value to the other two and then add in the per cent digestible of the crude fibre and nitrogen-free extract. The sum is the second term of the nutritive ratio. Now the ratio is reduced to its lowest terms by dividing both terms by the first. So the nutritive ratio really means the ratio between the protein and the carbohydrate equivalence. This may be illustrated by example. Take timothy hay. The water and ash do not enter into the computation, so they are neglected.

Crude Protein..... 7.92 x .49 = 3.97

This gives the first term of the nutritive ratio.

Ether Extract.....	3.21 x .56 x 2.5 =	3.93
Crude Fibre.....	30.82 x .53 =	16.35
Nitrogen-free Extract.....	40.04 x .64 =	26.27
		<hr/>
		46.55

Now the nutritive ratio is 3.97:46.55. Dividing both terms by the first the ratio assumes the form in which it is usually expressed, viz: 1:11.7.

COMPOUNDING RATIOS—It is now a universally accepted fact that each animal ought to be fed a properly balanced ration. It matters little what the source of food may be, provided it be wholesome and palatable. In order to facilitate the calculation of a properly balanced ration a table comprising nearly everything a farmer in this state is apt to have at hand by way of grains, by-products, etc., has been compiled and included in this article.

How a ration may be compounded from the tables given can best be illustrated by an example. Suppose we wish to compute a properly balanced ration for a milch cow weighing 1000 pounds. Also suppose a farmer has on hand western wheat grass (*Agropyrum glaucum*) hay, wheat bran and wheat middlings. The question is to determine how much of these substances should be fed daily.

We turn to the table of feeding standards and we find that a milch cow weighing 1000 pounds should have each day nutrients as follows:

Total dry original matter, 24 lbs; crude protein, 2.5 lbs; carbohydrates, 12.5 lbs; fat, .8 lbs. This has a nutritive ratio of 1:5.4. If the animal weighs more or less allowance must be made for the different weight.

Let us take say 20 lbs of the hay, 5 lbs of the bran and 4 lbs of the middlings and compute what quantities of the different nutrients will be furnished. In the first place we are met by the difficulty that no digestion coefficients have been determined for the wheat grass hay so we are compelled to take a hay supposably similar in this respect. Let us take orchard grass hay coefficients.

Now by turning to the analysis of wheat grass (*Agropyrum glaucum*) hay we find the per cent of nutrients it contains. Multiplying the different constituents by the proper coefficients and then multiplying the results by 20, the proposed number of pounds of hay, we find that the hay furnishes digestible nutrients as follows:

	Tot. Dry Org. Mat.	Crude Protein.	Carbo- hydrates.	Fats.	Nut. Ratio.
20 lbs hay.....	16.8	1.18	7.0	.3	} 1:5.4
5 " bran.....	4.4	.6	2.5	.2	
4 " middlings.	3.5	.5	1.6	.1	
	<u>24.7</u>	<u>2.3</u>	<u>11.1</u>	<u>.6</u>	

The bran and middlings required the same computations as the hay. We find that the ration comes pretty close to the standard. In case it had varied very widely, from this ration as a basis, the next trial would have brought it closer. It will be noticed that we have obtained a little too much dry matter and fats and not quite enough crude protein and carbohydrates. But the excess of fat will go towards making up the deficiency of the carbohydrates. We also notice that the nutritive ratio is the same as the standard.

But it ought to be said right here that it is very difficult to compound a proper ration without using some such substance as cotton seed meal or linseed cake, substances which have a very narrow ratio. And again it ought to be said that in a

state which raises so much flax as does South Dakota, linseed cake ought to be both cheap and plentiful everywhere. The erection of oil mills is most desirable on this account. Again it might be objected that too much hay entered into the composition of the ration. That is true and can be remedied by raising corn fodder, mangels, peas, etc.

There is one thing further that may need explanation and that is how the dry matter was obtained in the foregoing ration. The sum of the per cents of the water and ash in the hay used in the ration was subtracted from 100 per cent and the number of pounds of that hay was multiplied by the difference. The same computations were made for the bran and middlings.

In order that the analyses of a large variety of food stuffs may be at hand to cover all cases likely to arise in this state the following analyses have been compiled:

Analysis of Feeding Stuff's.

Kind of Food.	Air dry substance.					
	Water.	Ash.	Protein.	Fibre.	Nitrogen-free extract.	Fat.
Corn fodder.....	42.2	2.7	4.5	14.3	34.7	1.6
Corn stover.....	40.1	3.4	3.8	19.7	31.9	1.1
Oat straw.....	9.2	5.1	4.0	37.0	42.4	2.3
Wheat straw.....	9.6	4.2	3.4	38.1	43.4	1.3
Rye straw.....	7.1	3.2	3.0	38.9	46.6	1.2
Barley straw.....	14.3	4.4	3.4	41.8	34.7	1.4
Oats.....	11.0	3.0	11.8	9.5	59.7	5.0
Barley.....	10.9	2.4	12.4	2.7	69.8	1.8
Dent corn.....	10.6	1.5	10.3	2.2	70.4	5.0
Flint corn.....	11.3	1.4	10.5	1.7	70.1	5.0
Pea meal.....	10.5	2.6	20.2	14.4	51.1	1.2
Wheat.....	10.4	1.9	12.5	1.8	71.2	2.2
Wheat bran.....	11.5	5.4	16.1	8.0	54.5	4.5
Wheat middlings.....	12.1	3.3	15.6	4.6	60.4	4.0
Linseed cake, (Old process).....	9.2	5.7	32.9	8.9	35.4	7.9
Cotton seed meal.....	7.7	6.7	38.8	6.3	30.2	10.3
Potatoes.....	78.9	1.0	2.1	.6	17.3	.1
Sugar beets.....	86.5	.9	1.8	.9	9.8	.1
Mangels.....	90.9	1.1	1.4	.9	5.5	.2
Turnips.....	90.5	.8	1.1	1.2	6.2	.2
Skimmed milk.....	90.4	.7	3.3	.....	4.7	.9

In conclusion it may be said that a proper use of this Bulletin will be of advantage to every farmer in this state. By its aid

he will be able to identify the different species of forage plants, to determine which ones are probably best adapted to his locality, to determine what accompanying grains, etc., each one requires for feeding purposes, and it is to be hoped that an intelligent use of the data furnished will lead to a more varied and scientific system of farming.

JAS. H. SHEPARD, Chemist.

LITTLE BLUE STEM.

(Andropogon scoparius Michx.)

Stems in bunches, from coarse, strong roots; usually reddish or purplish but sometimes pale; 1 to 4 feet high, with several to many erect branches extending from the sheaths; leaves many, smooth with rough edges, usually rather short, sharp pointed, becoming rigid; flowers in slender, silky spikes which are solitary at the ends of the branches of the stem, and which often become purplish; spikelets sessile, from $\frac{1}{4}$ to nearly $\frac{1}{2}$ inch in length; empty glumes sharp pointed, the upper with long white hairs along the margins; awn twisted about twice the length of the glume bearing it. Plate 1. Easily recognized by its reddish or purplish appearance and by its habit of growing in bunches. It is called "broom sedge" in the south and often goes by the name of "bunch grass" on the western plains. It is found plentifully throughout the state and is one of the commonest grasses in the basins of the Bad Lands. Early in the season it no doubt furnishes a considerable amount of feed, but in this dry climate it becomes woody so soon that it is unfit for late grazing or hay, while stock refuses to eat it as long as any other grass can be had. It is hardly worthy of cultivation. The specimens analyzed were collected at Brookings.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.13	—
Ash	5.08	5.35
Ether Extract	2.26	2.38
Crude Fibre	32.63	34.39
Crude Protein	4.56	4.81
N.-free Extract	50.34	53.06
Total Nitrogen.....	.73	.77
Albuminoid Nitrogen.....	.71	.75



PLATE 1—Little Blue Stem,

BIG BLUE STEM.

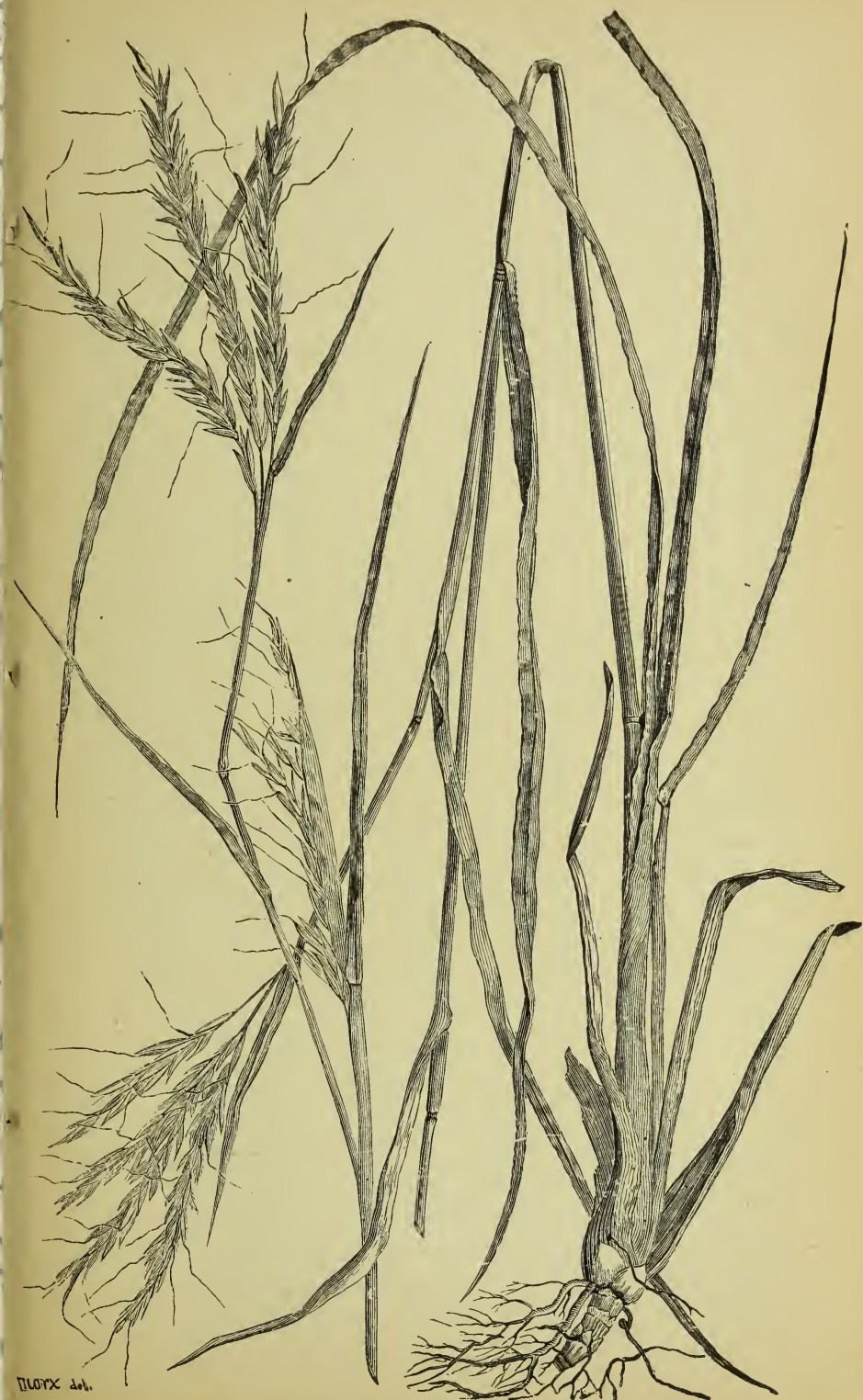
(Andropogon provincialis Lam.)

Roots perennial, very coarse, from short thick root stocks. Stems large, 3 to 6 feet high, more or less purplish, branched; each branch bearing at its top a cluster of 2 to 5 somewhat hairy, usually purplish spikes; leaves large, flat, roughish, usually a large cluster of root leaves at the base of the stem; spikelets of two sorts, one sessile and awned, the other stalked and awnless. Plate 2.

This grass may be known by its large purple stems, not in dense bunches, and clusters of purplish somewhat hairy spikes. It and some of its near relatives are sometimes called "Turkey-foot grass" because of the fancied resemblance of the clusters of spikes to a turkey's foot. It is found throughout the State on rich prairie soil. It is much more common in the Sioux Valley Region than elsewhere, but is gradually spreading to the westward. Some places along the Missouri river are already well covered by it. It is one of our most important native grazing and hay producing grasses. Under ordinary conditions it produces an abundance of root leaves. When the grass is cut before the stems become woody stock eat them as readily as the leaves. It is well worth fostering in every possible way. The specimens analyzed were collected in Brookings county.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.44	—
Ash.....	4.16	4.49
Ether Extract	1.86	2.01
Crude Fibre.....	33.88	36.60
Crude Protein.....	4.26	4.60
N.-free Extract	48.40	52.29
Total Nitrogen68	.74
Albuminoid Nitrogen.....	.67	.72



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PLATE 2—Big Blue Stem.

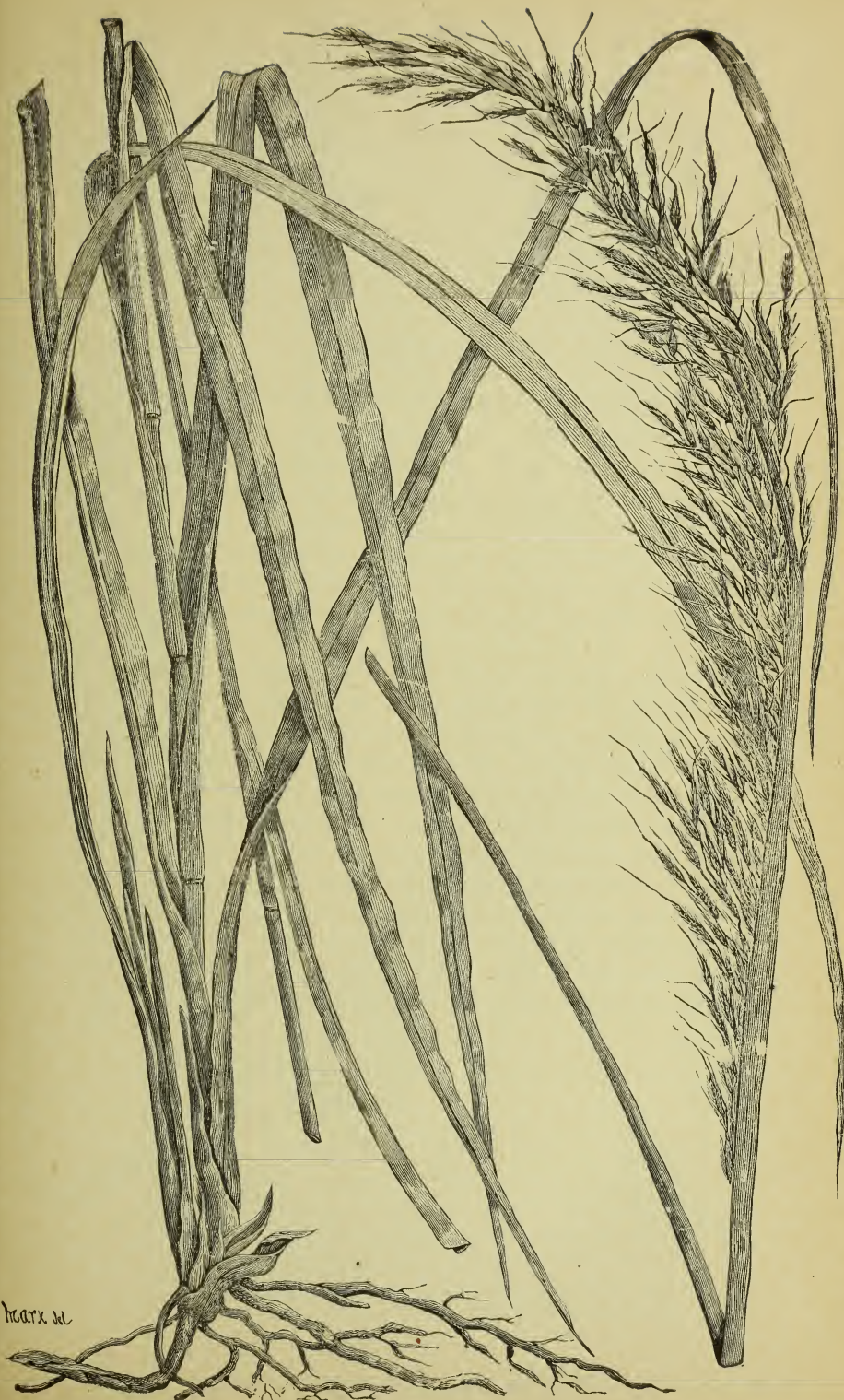
BUSHY BLUE STEM.

(Andropogon nutans L.)

Roots perennial from robust root-stocks; stems unbranched 2 to 5 feet high, green or purplish, hairy at the joints, leaves large and broad, roughish, tapering to a sharp point; upper sheaths smooth, lower often hairy; flowers in a bushy panicle, yellowish, reddish or purplish brown; spikelets hairy, the fertile ones with long, bent and twisted awns; panicle 6 inches to a foot in length. Plate 3. May be distinguished from our other blue stems by its bushy inflorescence and less purple stems. It occurs throughout the state, but is most plentiful in the Eastern and Southeastern parts. It yields an abundance of excellent hay and is particularly valuable because of the relatively large amount of long root-leaves which are produced. All stock eat it greedily. It may well be given the first place among our native grasses as a hay producing species. It thrives best on rich prairie bottoms. During dry seasons it produces but little seed though it usually makes a good growth of root leaves. The specimens analyzed were collected at Brookings.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.75	—
Ash	6.40	6.94
Ether Extract.....	1.57	1.70
Crude Fibre	34.73	37.64
Crude Protein	3.85	4.17
N.-free Extract	45.70	49.54
Total Nitrogen .....	.62	.67
Albuminoid Nitrogen .....	.58	.62



W. G. R. J.

PLATE 3—Bushy Blue Stem.

JOHNSON GRASS.

(*Andropogon sorghum* Brot., var. *halapensis* Hack.)

Stems tall and coarse, 3 to 6 feet high, from stout, deep-growing roots, green, some times branching; leaves very large and broad, smooth, long pointed; flowers in large, green or some times purplish, bushy panicles which are often as much as 1½ feet in length; spikelets more or less clustered on the branches of the panicle, usually covered with short, appressed hairs; fertile flowers with long twisted awns bent at the middle. Plate 4.

This grass is a native of the Old World and is grown quite extensively in the South, where it is a very valuable forage plant. It thrives well on a variety of soils and endures well both drouth and floods. When once well established in a field it is difficult to eradicate and hence may become a pernicious weed under certain circumstances. Several attempts have been made to grow it on the Station grounds but all have been unsuccessful. Our springs are so cold that it is almost impossible to get a good stand and when once started it cannot withstand the severe cold of winter. It is therefore to be regarded as of no value for this region. The specimens analyzed were cut on the college farm on the 9th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	9.86	—
Ash	5.71	6.33
Ether Extract	2.71	3.01
Crude Fibre.....	29.17	32.36
Crude Protein.....	12.77	14.17
N.-Free Extract.....	39.78	44.13
Total Nitrogen	2.04	2.27
Albuminoid Nitrogen,.....	1.55	1.72

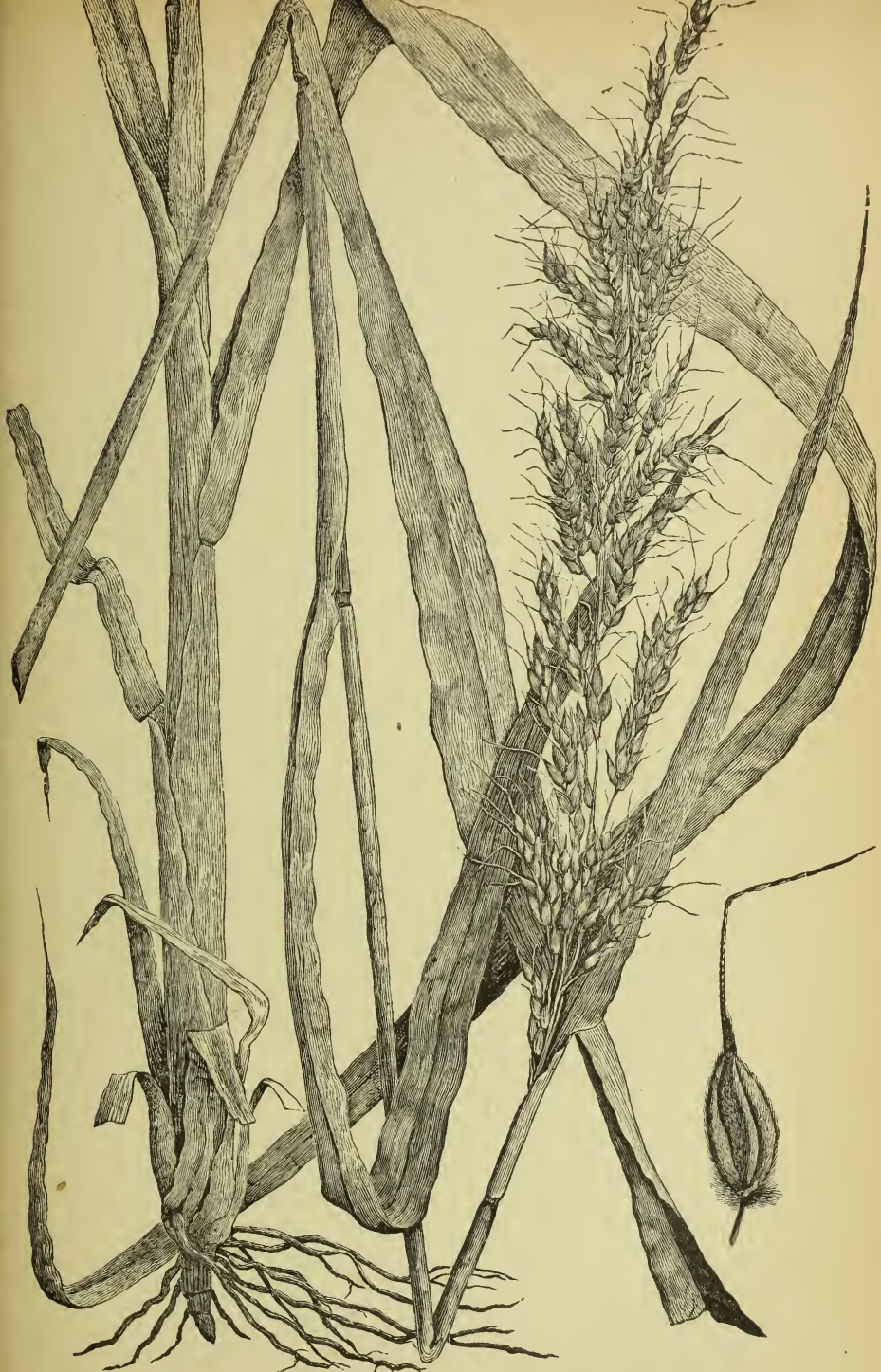


PLATE 4—Johnson Grass.

DWARF PANIC GRASS.

(*Panicum depauperatum* Muhl.)

Stem erect, from perennial roots, tufted, unbranched, from 4 to 16 inches high; leaves erect, 3 to 6 inches long, narrowly linear, sharp pointed, more or less soft hairy, particularly on the sheaths; flowers in small contracted panicles which are from one to two inches long and are borne on short flower stalks when they are overtopped by the leaves, or, later in the season, on elongated flowerstalks when they considerably exceed the leaves; spikelets one-eighth of an inch or less in length, obovate, hairy; lower glume about one-third the length of the upper ones, which are 7 to 9 nerved.

Rather an insignificant grass occurring throughout the state on upland meadows. It is perhaps, most plentiful in the Sioux Valley where it forms no small part of the native forage. This is a very nutritious grass and is eaten readily by all kinds of stock. In many parts of the country where fields have been allowed to go back the panic grasses soon take possession. After a time, however, they are crowded out by other and stronger growing grasses, as the wheat grasses and blue stems. Neither this nor the following species is worthy of cultivation. The specimens analyzed were collected at Brookings, June 25th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.06	—
Ash.....	12.42	13.08
Ether Extract.....	4.68	4.93
Crude Fibre.....	27.45	28.91
Crude Protein.....	8.68	9.14
N.-free Extract.....	41.71	43.93
Total Nitrogen.....	1.39	1.46
Albuminoid Nitrogen.....	.99	1.04

SMALL PANIC GRASS.

(Panicum scoparium Lam.)

Stems tufted, at first erect but often becoming reclining and branched, from a perennial root, somewhat roughened, from eight inches to two feet high; leaves upright, about three inches long and one-third of an inch wide, nerves more or less apparent, smooth with rough margins; sheaths and often the margins at the base of the leaves hairy; panicle two to three inches long, spreading, with alternate, simple, smooth branches; spikelets few, borne at the ends of the slender branches, about one-eighth of an inch long, obtuse, hairy.

This grass is quite common in the Eastern part of the state, particularly in the Sioux Valley. It is also common in the Black Hills Region, but seems to be of much rarer occurrence in the prairie regions of the central part of the state. In the Sioux Valley a form is common which seems to be intermediate between this species and *Panicum clandestinum*. In many parts of this region small panic grass, and dwarf panic grass, furnish a considerable part of our hay. The autumn form of small panic grass is quite different from the earlier form, having the leaves clustered together toward the top of the stems and smaller panicles more or less included in the sheaths. The specimens analyzed were collected at Brookings, June 20th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.83	—
Ash.....	8.88	9.74
Ether Extract.....	1.71	1.88
Crude Fibre.....	29.64	32.51
Crude Protein.....	9.97	10.94
N-free Extract.....	40.97	44.94
Total Nitrogen.....	1.59	1.75
Albuminoid Nitrogen.....	1.06	1.16

SWITCH GRASS.

(Panicum virgatum L.)

Stem stout, erect, from strong, perennial, creeping, scaly root-stocks, two to five feet high; leaves large, a foot or more long and one-fourth to nearly one-half an inch wide, flat, smooth except on the margin, sheaths often purplish; panicle very large, branched and spreading, or often drooping, from six inches long in the smaller forms to a foot and a half in the larger ones, often purplish; spikelets pointed, smooth, about one-seventh of an inch long, on rough pedicels; lower glume one-half to two-thirds as long as the upper one; glumes all sharp pointed. Plate 5.

One of the most valuable of our native grasses. It occurs throughout the state on dry and sandy as well as on rich, moist soils, though it much prefers the latter sort. In the Sioux and James Valleys it forms a large part of the hay. It promises to do well under cultivation giving a good yield of excellent hay if cut in proper season. If allowed to stand too long before cutting, it becomes harsh, woody and unpalatable. It is a very variable species. On the uplands the common form is usually smaller and quite glaucous (var. *glaucum* Vasey.) In the western part of the state a form with a close, oblong panicle (var. *confertum* Vasey) is not uncommon, while another with long, narrow panicles, and spikelets an eighth of an inch long (var. *elongata* Vasey) is of rarer occurrence. In many parts of the country this grass is known as "false red top," "tall panic grass," and "black bent." The ease with which the seed may be obtained and the other excellent qualities of this grass make it a species well worthy of cultivation. The specimens analyzed were collected at Brookings July 15th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.29	.....
Ash	6.50	7.01
Ether Extract.....	2.09	2.25
Crude Fibre.....	33.89	36.55
Crude Protein.....	6.24	6.73
N.-free Extract.....	43.99	47.45
Total Nitrogen.....	.99	1.08
Albuminoid Nitrogen.....	.88	.95

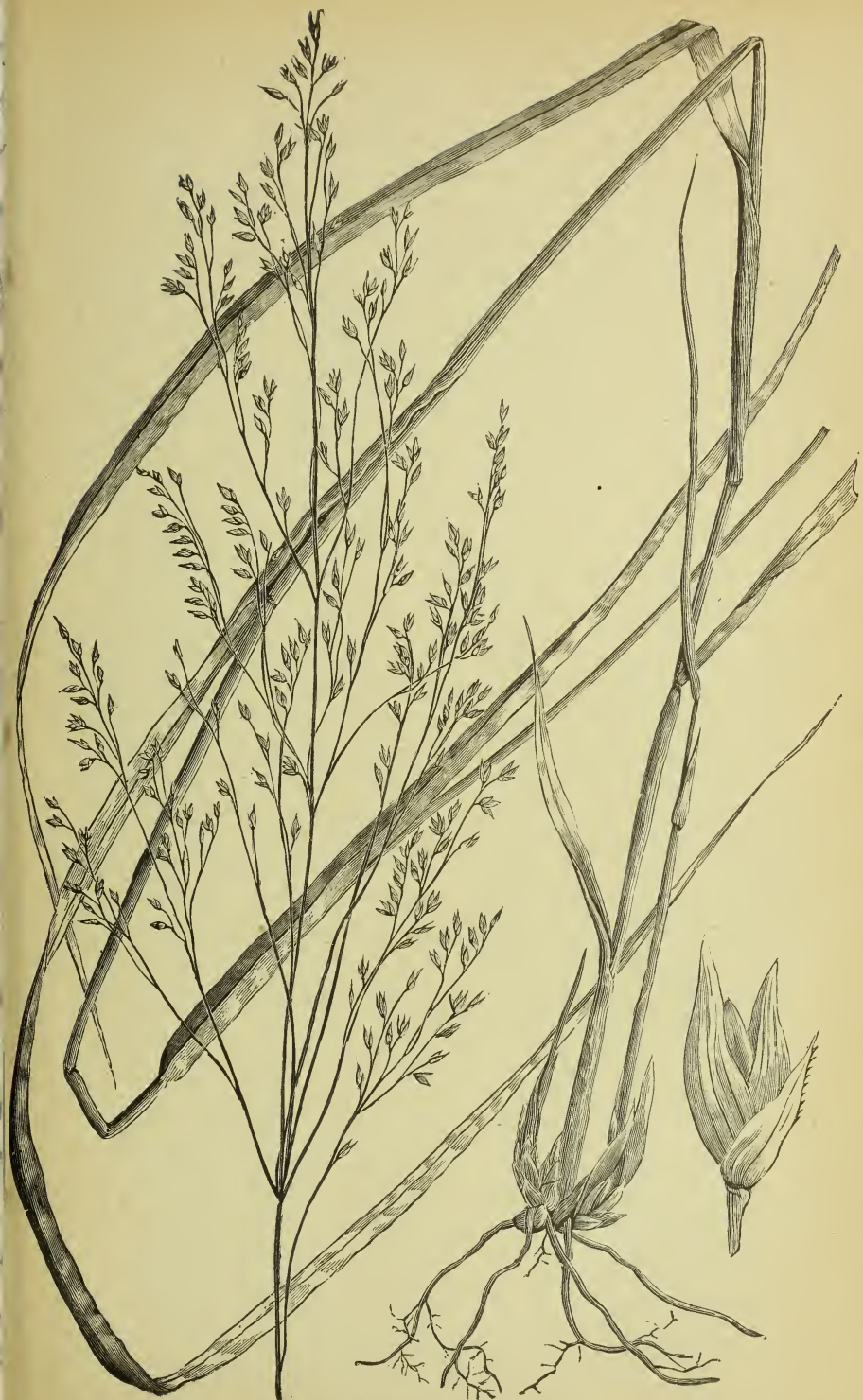


PLATE 5—Switch Grass.

BARN-YARD GRASS.

(Panicum crus-galli L.)

Stems coarse, usually decumbent, branching, one and one-half to four feet high; leaves large, six inches to a foot long and one-fourth to nearly three-fourths of an inch wide, rough; sheaths smooth or hairy; panicle dense with numerous spike-like branches upon which are crowded the usually rough spikelets; outer glumes either with or without a hispid awn of varying length. Plate 6.

A common, weedy grass occurring throughout the state. It is a native of the Old World. Though usually considered as a weed, if properly handled it yields large quantities of a very nutritious hay. It should be cut when it first begins to bloom. As a weed it is easily kept in check. In some of the Southern States it is much prized as a forage plant often yielding four or five tons of hay to the acre. As it usually re-seeds itself from year to year it is easily grown. It will probably never be so valuable here in the north. Besides the common form two other varieties occur in the state; one with the awns of the glume entirely wanting (var. *muticum* Vasey), and another with bristly spikelets, long-awned glumes and very hairy sheaths (var. *hispidum* (Muhl.) Torr.). The specimens analyzed were collected at Brookings, August 8th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.01	.....
Ash.....	9.30	10.09
Ether Extract.....	2.67	2.90
Crude Fibre.....	32.72	35.57
Crude Protein.....	9.40	10.22
N.-free Extract.....	37.90	41.20
Total Nitrogen.....	1.50	1.63
Albuminoid.....	1.28	1.39



PLATE 6—Barn-Yard Grass,

OLD WITCH GRASS.

(*Panicum capillare* L.)

Stem rather robust, erect or ascending, from an annual root, more or less branching, usually from one to one and a half, or rarely two feet high; leaves four to eight inches long, broad, flat, more or less covered with long hairs, particularly on the sheaths; flowers in very large panicles with wide-spreading, slender branches, often borne on the lateral branches of the stem also; spikelets on long capillary pedicels, smooth, variable in size, from less than one-twelfth to nearly one-sixth of an inch long, pointed.

Common throughout the greater part of the state. It is of little value as a forage plant and often becomes a weed. In many localities it is known as "tickle grass." The large panicles become free from the remainder of the plant and form "tumble weeds" which are blown about by the wind, often becoming so plentiful as to be quite troublesome. As the plant is an annual it is easily kept down. It is perhaps most useful as a fall forage since it is generally quite plentiful in stubble fields after harvest. The specimens analyzed were collected at Brookings August 12th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.36	—
Ash	11.43	12.34
Ether Extract	2.32	2.50
Crude Fibre.....	27.09	29.24
Crude Protein.....	10.58	11.42
N.-free Extract.....	41.22	44.50
Total Nitrogen.....	1.69	1.83
Albuminoid Nitrogen.....	1.30	1.40

BRISTLY FOX-TAIL.

(Setaria verticillata (L.) Beauv.)

Stems erect, from annual roots, one to three feet high, branched below; leaves minutely roughened; spike cylindrical, two to four inches long, dense, green; spikelets in dense, irregularly whorled clusters; bristles short, barbed downward, often causing the spikes to adhere to each other thus becoming more or less entangled.

Rare either in cultivation or as an escape. It is a native of Europe. Here in South Dakota it is probably of little importance either as a forage plant or as a weed. Easily recognized by its downwardly barbed bristles and the arrangement of the clustering spikelets. The specimens analyzed were grown on the college grounds and were cut August 6th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.25	—
Ash	12.32	13.43
Ether Extract.....	2.13	2.32
Crude Fibre.....	32.25	35.15
Crude Protein.....	15.77	17.19
N.-free Extract.....	29.28	31.91
Total Nitrogen.....	2.52	2.75
Albuminoid Nitrogen.....	1.55	1.69

GREEN FOXTAIL.

(Setaria viridis (L.) Beauv.)

Stem erect, from an annual root, usually unbranched, one and one-half to three feet high; leaves flat, pointed, rough; flowers in spikes which are two to five inches long, green, more or less pointed both above and below; bristles longer than the spikelets, about four to eight in a cluster; flowering glume longitudinally striate and dotted. Plate 7.

An introduced weedy grass found in fields and waste places. When properly cut and cured it furnishes a nutritious hay but the yield is much lighter than millet and the plant is difficult to destroy when once well established in a field. On the whole it is not worthy of cultivation and should be regarded as a bad weed. It can usually be distinguished from other species of the genus by its green, soft-bristly, nodding spikes or heads. Besides the common name given above this grass is known as "bottle grass," "pigeon grass" and "puss grass." The specimens analyzed were cut on the college farm, September 19th, 1891, and were in fruit.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.49	—
Ash	11.11	12.01
Ether Extract	2.49	2.69
Crude Fibre	30.26	32.71
Crude Protein	9.17	9.91
N.-free Extract	39.48	42.68
Total Nitrogen	1.46	1.59
Albuminoid Nitrogen	1.28	1.39



PLATE 7—Green Foxtail.

W. R. Schell U. del.

YELLOW FOXTAIL.

(Setaria glauca (L.) Beauv.)

Stems erect, from an annual root, simple or branched at the base, one and one-half to two and one-half feet high; leaves flat, long, roughish or nearly smooth; spike erect, rigid, cylindrical, two to four inches long, tawny yellow; bristles six to ten in a cluster, longer than the spikelets; flowering glume transversely wrinkled. Plate 8.

This, like the preceding, is a native of the Old World which has become introduced throughout the greater part of the state. Its rigid, cylindrical, tawny-yellow spikes serve to distinguish it from the other species of the genus. Like the green fox-tail it is a troublesome weed though it may be made to render some service as a forage plant. Though an annual it produces so many seeds and is such a vigorous grower that it is difficult to rid a field of it when once well started. It is perhaps most troublesome as a weed in small grains and grasses raised for seed. Care should be taken in buying grass seed, particularly timothy, as fox-tail is often present in greater or less quantities. The specimens analyzed were cut on the college farm August 8th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.17	—
Ash	13.40	14.59
Ether Extract.....	1.88	2.05
Crude Fibre.....	31.25	34.03
Crude Protein.....	10.53	11.47
N.-free Extract.....	34.77	37.86
Total Nitrogen.....	1.69	1.83
Albuminoid Nitrogen.....	1.11	1.21



PLATE 8—Yellow Foxtail.

MARK-DEL.

MILLET.

(*Setaria italica* (L.) Kunth.)

Stems erect, from annual roots, unbranched, one and one-half to four feet high; leaves very long and broad, rough; spike usually large, from two inches long in the smaller forms to eight or ten inches long and more or less compound in the larger and more highly cultivated ones, oblong or cylindrical, usually yellowish or purplish and nodding; bristles either longer or shorter than the spikelets. Plate 9.

This is one of the most useful of our cultivated annuals. There are many different varieties in cultivation such as German millet, Hungarian grass, Golden millet, etc. As it is usually ready for cutting (if for hay) in from two to two and one half months after sowing it is an excellent catch crop when others fail, and can be sown after most other crops are in and will then have plenty of time to mature. The yield of hay is usually a heavy one. When used for hay it should be cut as soon as possible after heading. If allowed to stand until the seeds are well formed it is thought to have a bad effect upon the kidneys of animals to which it is fed. On the other hand ground millet seed has been used for fattening hogs with good results. Because of its early maturity and the possibility of its being sown late and harvested early millet is an excellent crop to use in fighting certain pernicious weeds as, for example, the Russian thistle. Cut worms seldom damage it or even the crop following it the next season. The specimens analyzed were cut on the college farm on the 8th of August, 1892.

ANALYSIS.

	Air Dry Substance	Water Free Substance.
Water	8.74	—
Ash	10.19	11.17
Ether Extract.....	2.96	3.24
Crude Fibre.....	32.14	35.22
Crude Protein.....	11.10	12.16
N.-free Extract.....	34.87	38.21
Total Nitrogen...	1.78	1.95
Albuminoid Nitrogen.....	1.10	1.21



PLATE 9—Millet.

Marx del.

INDIAN RICE.

(Zizania aquatica L.)

Stems large, three to nine feet high, from coarse, fibrous, annual roots; leaves large, one and one-half to three feet long and half an inch or more wide, taper-pointed, smoothish or roughened on the margins and mid-rib; panicle large, a foot or more long, pyramidal, the lower, spreading branches bearing staminate flowers and the upper, erect branches bearing pistillate ones; flowerstalks club-shaped; flowering glume of pistillate flowers with a long awn or beard; grain slender, about half an inch long. Plate 10.

This grass is very common in most localities east of the Missouri river. It may occur west of the river but has not yet been reported from there. It grows best in shallow water along margins of streams. The grain is very nutritious and is said to be sometimes used as food by the Indians. It is a favorite food for water fowl of all kinds and is used in game preserves for this purpose. Cattle and horses eat the grass readily but as it grows in such marshy places it is usually so difficult of access that a relatively small amount of it is eaten by them. It will probably never enter very largely into the forage of the state but will always be one of the best grasses for use in lakes and streams of game preserves. The specimens analyzed were collected in the Sioux river, near Brookings, August 10th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.61	—
Ash	12.26	13.18
Ether Extract.....	2.26	2.43
Crude Fibre.....	34.88	37.51
Crude Protein.....	7.24	7.79
N.-free Extract.....	36.35	39.09
Total Nitrogen.....	1.16	1.25
Albuminoid Nitrogen.....	.99	1.06

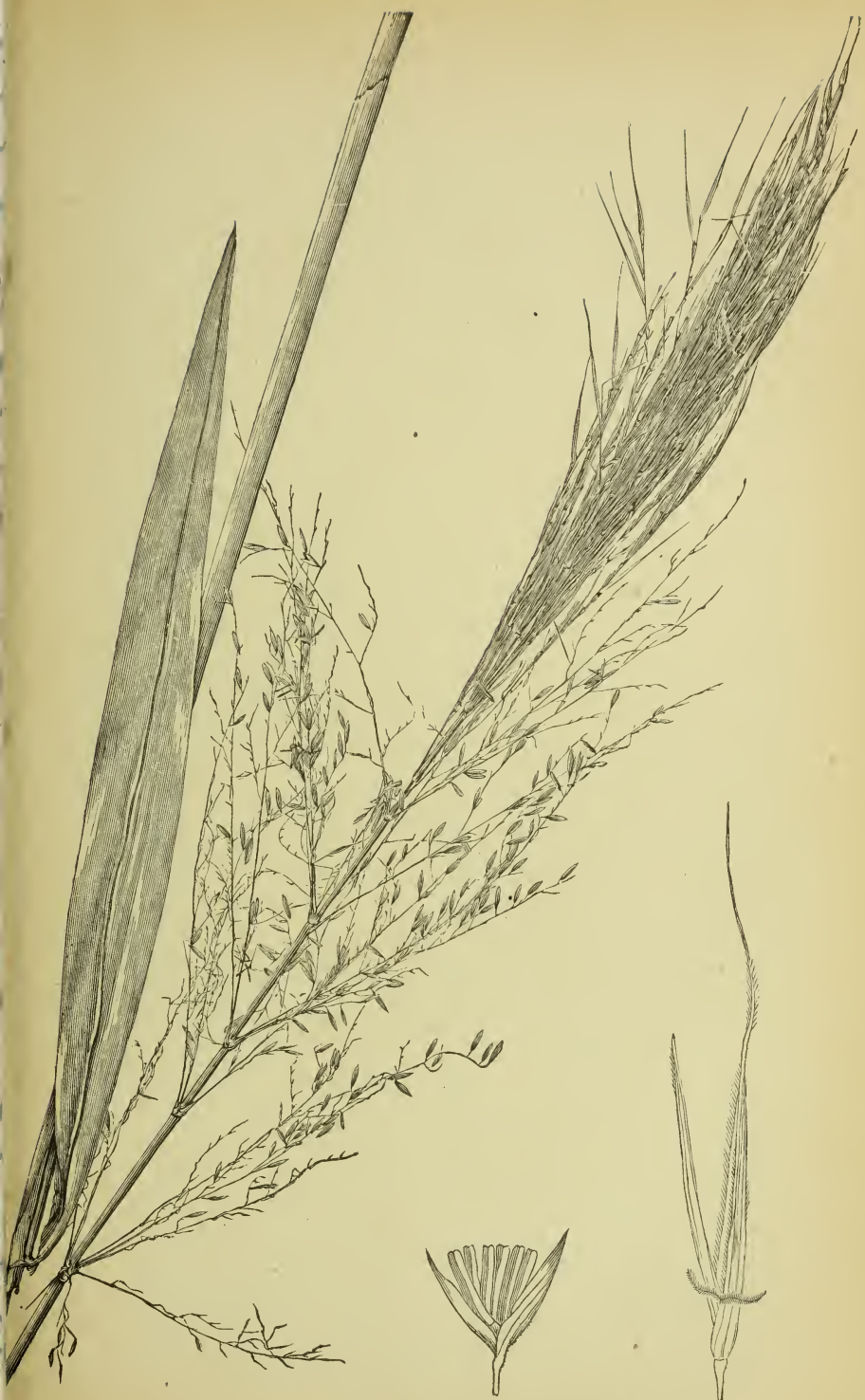


PLATE 10—Indian Rice.

VIRGINIA CUT-GRASS.

(*Homalocenchrus virginica* (Willd.) Britt.)

Stems slender, decumbent, branching below, two to four feet high, from stout root-stocks and fine, fibrous roots; leaves softish, flat, short-pointed, margins only slightly roughened, of a brighter green than those of the preceding species; panicle simple, about five or six inches long; spikelets only about one-eighth of an inch long, greenish, closely appressed to the slender branches of the panicle, the glumes only slightly ciliate on the keel. Plate 11.

Like the preceding species this grass occurs only in wet places and has only been found in the eastern part of the state. It may be distinguished from that species by its shorter, greener, softer leaves, smaller panicles and spikelets and more robust root-stocks. It makes a better quality of forage. It is, however, of comparatively little importance as a forage plant. The specimens analyzed were collected in Brookings county.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	4.68	—
Ash	15.88	16.66
Ether Extract.....	3.47	3.64
Crude Fibre.....	28.26	29.65
Crude Protein	5.88	6.17
N.-free Extract.....	41.83	43.88
Total Nitrogen.....	.94	.99
Albuminoid.....	.77	.81

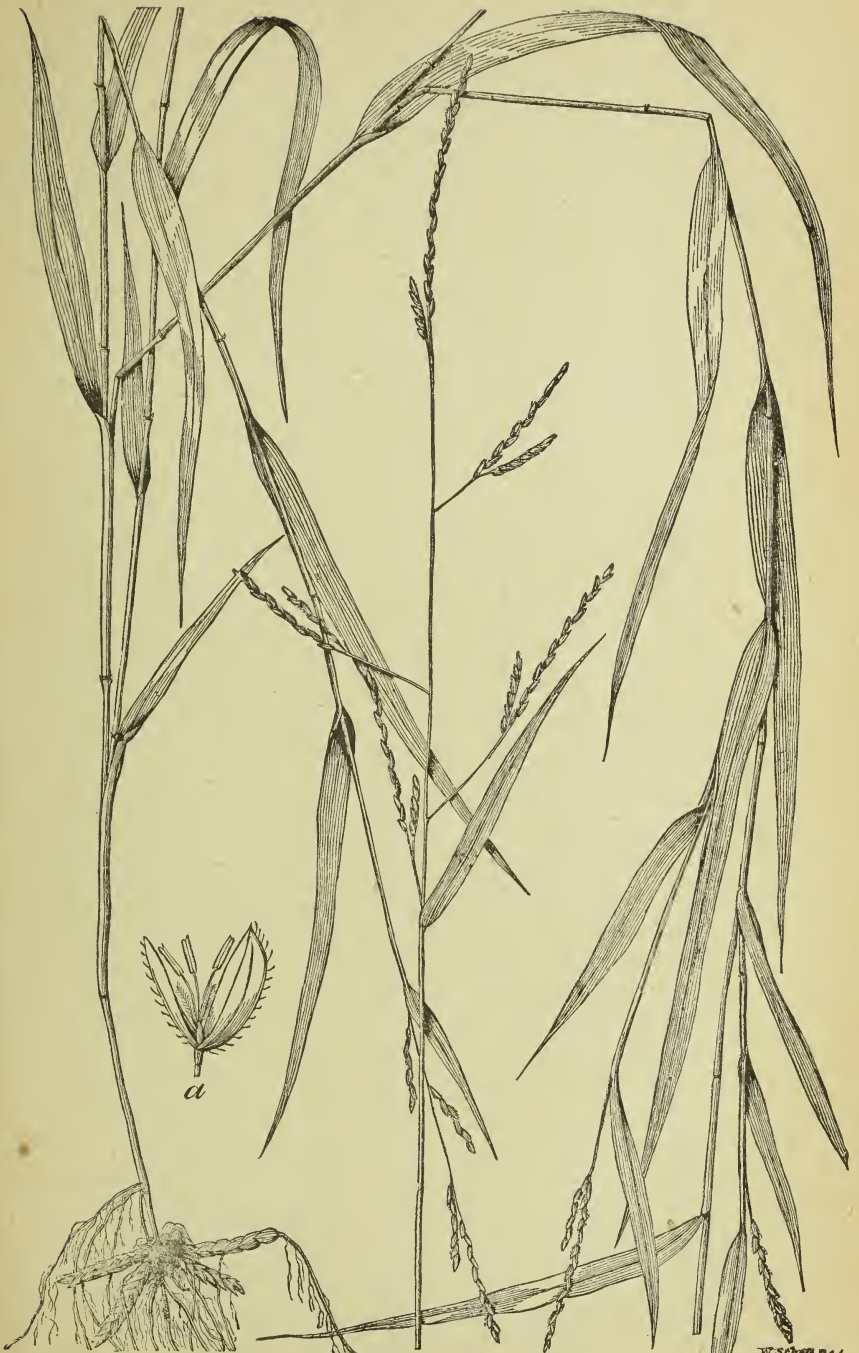


PLATE 11—Virginia Cut-Grass.

W. SCHUBERT

RICE CUT-GRASS.

(*Homalocenchrus oryzoides* (L.) Poll.)

Stems rather stout, erect or decumbent, more or less branching below, two and one-half to four feet high; with slender, creeping root-stalks; leaves often a foot or more long, from one-fourth to one-half of an inch wide, pale green, with very rough margins; panicle from six inches to over a foot long, diffusely branched; spikelets flat, about one-sixth of an inch long, whitish, the obtuse glumes bristly ciliate on the keel.

Not uncommon in wet places in the eastern part of the state. It may be easily recognized by its peculiar rice-like spikelets and broad, rough-margined leaves which cut into the flesh readily if drawn through the hand or over an exposed part of the body. It is not a good forage plant as it is rather too rough and harsh. Cattle and horses are not very fond of it even when green. Mixed with other grasses it is of some value when cut for hay. As it only occurs in very moist soils it will probably never be of any great value in our state. The analyzed specimens were collected along the Sioux river, near Brookings, the last of August.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	4.93	—
Ash	18.41	19.36
Ether Extract.....	2.51	2.64
Crude Fibre.....	26.29	27.65
Crude Protein.....	7.50	7.89
N.-free Extract.....	40.36	42.45
Total Nitrogen.....	1.20	1.26
Albuminoid Nitrogen.....	1.04	1.09

SWEET VERNAL GRASS.

(Anthoxanthum odoratum L.)

Stems slender, from six to eighteen inches high, from perennial roots, smooth; leaves scanty, short (one to three inches long), smooth; inflorescence, spike-like, one to three inches long, greenish brown; spikelets three flowered—only one of the flowers (the central one) fertile, spreading at flowering-time; glumes thin acute, keeled, those of the perfect flower awnless, those of the neutral flowers awned.

A small grass introduced from the Old World and cultivated mainly as a lawn grass, usually in connection with other species. In some parts of the Eastern United States it is sometimes found in meadows. It is very fragrant when drying and gives a pleasant odor to hay. It yields too lightly to pay for cultivation. It is not a success in this state. The specimens analyzed were grown on the Station grounds and were cut on the 8th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.82	—
Ash	10.41	11.29
Ether Extract.....	6.19	6.72
Crude Fibre.....	19.97	21.66
Crude Protein.....	16.62	18.03
N.-free Extract.....	38.99	42.30
Total Nitrogen.....	2.66	2.88
Albuminoid Nitrogen.....	2.24	2.43

REED CANARY GRASS.

(*Phalaris arundinacea* L.)

Stems, stout, erect, two to five feet high, smooth, from strong, creeping root stalks, leafy; leaves large (six to ten inches long by about half an inch in width), flat, roughish or smooth, sheaths smooth; panicle narrow, its branches short and appressed or somewhat spreading at flowering time, three to five inches long; spikelets numerous, crowded, about one-sixth of an inch long, more or less tinged with purple; empty glumes equal, spreading at flowering, much longer than the flowering glume, rough on the back but not wing-keeled; flowering glume smooth and shining, with two minute, hairy scales at its base, in fruit closely enclosing the smooth grain. Plate 12.

Widely distributed over the state, growing naturally in wet ground. It is one of the most important of our native species as it promises to do well under cultivation. In low meadows it often constitutes a large part of the hay. Stock eat it readily. On the Station grounds it has done well for three years, withstanding severe drouth even on high ground. It produces a coarse quality of hay and seeds plentifully. The leaves remain green until after the seeds are ripe so that after cutting with a header a good yield of hay of a fair quality may be obtained. The specimens analyzed were cut on the college farm June 20th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.37	—
Ash	8.42	9.19
Ether Extract.....	2.12	2.31
Crude Fibre.....	30.85	33.67
Crude Protein.....	7.59	8.28
N.-free Extract.....	42.65	46.55
Total Nitrogen.....	1.21	1.32
Albuminoid Nitrogen.....	.86	.94



HEDDMANN'S CO.

Marx del.

PLATE 12—Reed Canary Grass.

PURPLE BEARD GRASS.

(Aristida purpurea Nutt.)

Stems slender, tufted, erect, tough and wiry, about one foot high, from perennial, fibrous roots; leaves involute, with roughened sheaths, which are hairy at the throats and are longer than the internodes of the stem; spikelets paniced, purplish, one-flowered; lower empty glume about half as long as the upper one which is usually an inch in length, both short awned; flowering glume rolled around the flower, sharp-pointed below, the three rough awns at its apex nearly equal and from one to two inches long. Plate 13.

Very common throughout the drier portions of the state. It may be recognized by its triple-awned flowering glume, tufted habit of growth and tough, wiry stems. It often goes by the name of "bunch grass" or "wire grass." It is nearly worthless as a forage plant for it becomes tough and woody too early in the season. In most localities it is regarded as a weed. When in large tufts the tough woody stems are very difficult to cut with the mower and if much of this grass occurs in a hay field it is practically impossible to keep an edge on the sickle for any length of time. In some instances it has been of some value for early pasturage. The specimens analyzed were collected along the high lands near the Missouri river in the latter part of August. A more robust form (var. *hookeri* Trin.) occurs in the western part of the state.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.97	—
Ash	10.34	11.00
Ether Extract.....	1.73	1.84
Crude Fibre	34.66	36.86
Crude Protein.....	4.11	4.37
N.-free Extract.....	43.19	45.93
Total Nitrogen.....	.66	.70
Albuminoid Nitrogen.....	.60	.64



PLATE 13—Purple Beard Grass.

FEATHER BUNCH GRASS.

(Stipa viridula Trin.)

Stems clustered together in rather large bunches, erect, or ascending, one and one-half to four feet high, with numerous dead sheaths at the base, from tough perennial, fibrous roots; leaves flattish or becoming involute, from one to two feet in length, smoothish with roughened margins; panicle rather narrow and loose, from six inches to a foot or more long, greenish or sometimes with a purplish tinge; spikelets a quarter of an inch or more long; empty glumes rather thin and papery, bristle-pointed; flowering glume rolled around the flower, with a short, hard point below and a roughish, flexuous awn an inch to an inch and a half long above, hairy, especially at the ends. Plate 14.

This grass is more or less common in all parts of the state. It is quite variable, several varieties being found within our limits. It is a good pasture grass when kept closely grazed and is not as liable to injure stock as either of the other species found in the state. As a rule it does not give as great a yield of hay as those species because of its generally lighter growth of root leaves. It prefers rather dry soils. The specimen analyzed were cut July 2, 1891, at Brookings.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.10	—
Ash	6.43	7.07
Ether Extract.....	2.16	2.38
Crude Fibre.....	32.12	35.34
Crude Protein.....	6.87	7.56
N.-free Extract.....	43.32	47.66
Total Nitrogen.....	1.10	1.21
Albuminoid Nitrogen .....	.90	.99



MARX, Del.

PLATE 14—Feather Bunch Grass,

PORCUPINE GRASS.

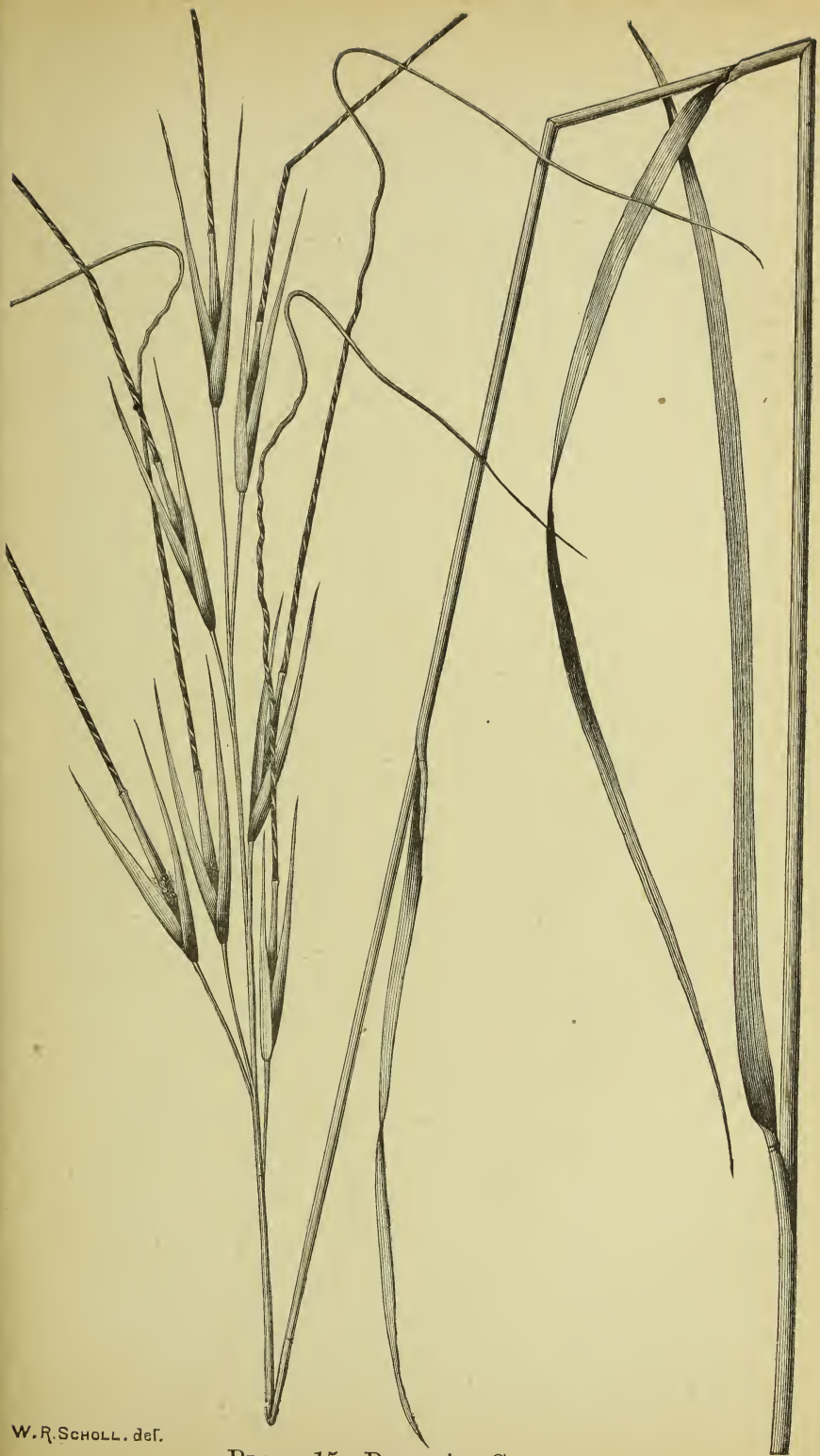
(*Stipa spartea* Trin.)

□ Stems stout, erect, smooth, more or less bunched, one and one-half to three feet high, from tough perennial roots; leaves more or less involute, thick and hard, rough on the margins, usually a foot or two long, root-leaves numerous and long; panicle about six inches long, contracted; spikelets an inch or more long, borne at the ends of the slender branches of the panicle; empty glumes lanceolate, with long awn-like points, greenish, one to one and one-half inches in length, the upper one longest; flowering glume, very hard and sharp-pointed at maturity, thickly hairy above the point; awn rough, stiff, four to six inches long, twisted and bent. Plate 15.

This grass is found throughout the state but is most common in the eastern part. It is largely replaced in the western part of the state by needle grass (*Stipa comata*) which may be distinguished from either porcupine grass or feather bunch grass by its shorter leaves and loose, open panicle, the lower part of which is more or less included in the uppermost sheath. Both porcupine grass and needle grass give good yields of hay of a fair quality. As the spear like fruits of these grasses some times injure stock, they should not be cut until after the fruits have fallen, which usually occurs in time for haying. When these grasses occur in pastures or ranges in sufficient quantities to be dangerous, they should be kept from going to seed by close grazing or by mowing. Late burning will be found useful in keeping them down and also in keeping many early growing weeds in check. The specimens analyzed were cut at Brookings on the 30th of June, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.93	—
Ash	5.43	6.03
Ether Extract	2.34	2.60
Crude Fibre	31.92	35.44
Crude Protein	7.57	8.40
N.-free Extract	42.81	47.53
Total Nitrogen.....	1.21	1.34
Albuminoid Nitrogen.....	1.01	1.13



W. R. SCHOLL. del.

PLATE 15—Porcupine Grass.

SPIKED MUHLENBERG'S GRASS.

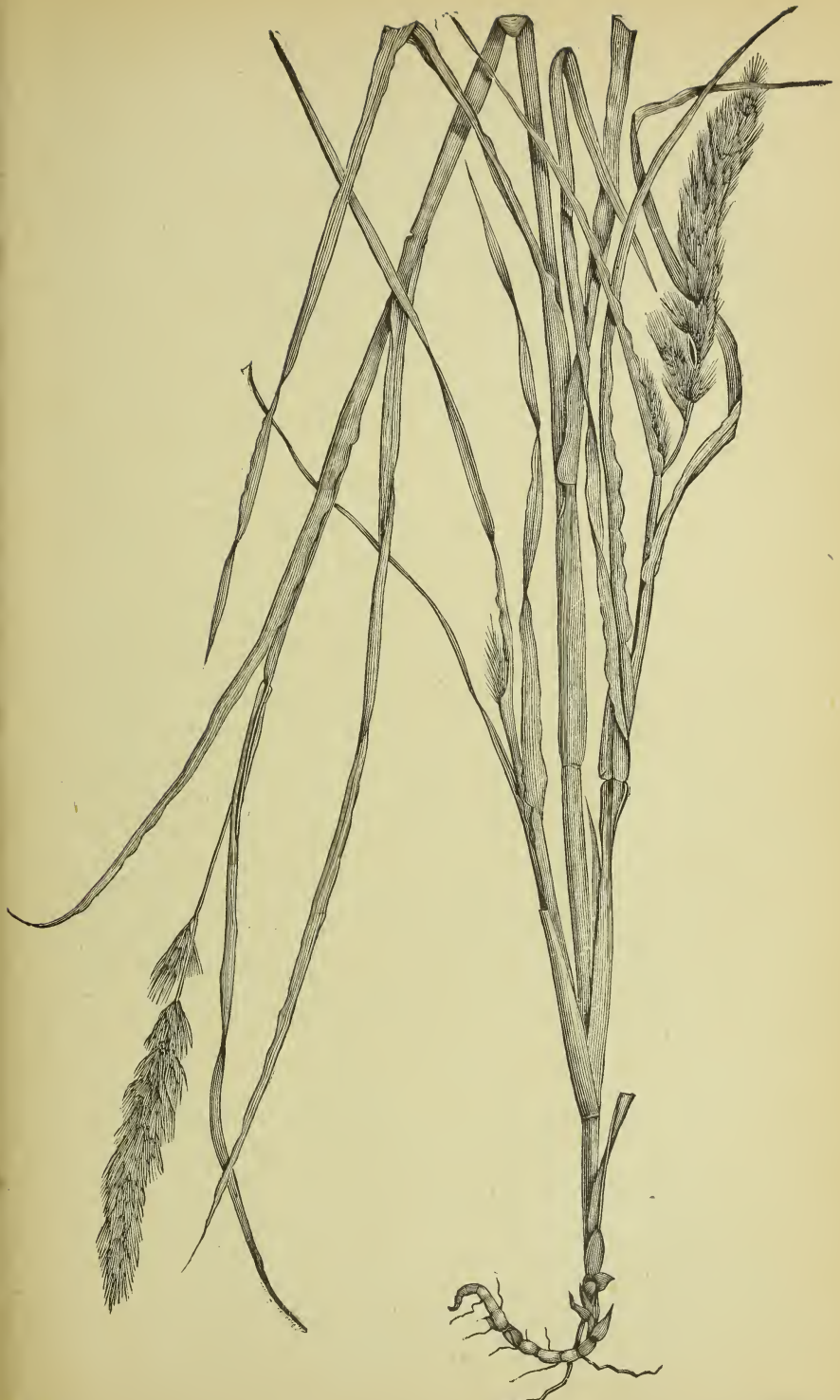
(Muhlenbergia racemosa (Michx.) B. S. P.)

Stems upright, two to three feet high, stiff, more or less branched, from perennial roots and hard, knotty, creeping rootstocks, very leafy; leaves narrow, rough, one to six inches long; panicle two to four inches long, narrow, composed of numerous, close sessile clusters of flowers, looser below, forming an interrupted false spike; spikelets sessile, numerous small; empty glumes awn-pointed, nearly equal, much longer than the very acute flowering glume. Plate 16.

This is a very common grass throughout the greater part of the state. It is quite valuable as a forage plant. It gives a good yield of hay of a fair quality. To obtain the best results it should not be allowed to stand too long as the stems become hard and woody. In Nebraska and Colorado as well as in many parts of the East this grass is very highly spoken of. Small plats of it cultivated on the Station grounds are doing well. It seems worthy of more attention. The specimens analyzed were cut on the college grounds on the 27th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	4.85	—
Ash	7.62	8.01
Ether Extract.....	1.99	2.09
Crude Fibre	35.35	37.15
Crude Protein	5.04	5.30
N.-free Extract	45.15	47.45
Total Nitrogen .....	.81	.85
Albuminoid Nitrogen .....	.73	.77



VAR. DEL.

PLATE 16—Spiked Muhlenberg's Grass.

H.H. NICHOLS. E.

MEXICAN WOOD GRASS.

(Muhlenbergia mexicana (L.) Trin.)

Stems erect, or spreading and ascending, much branched, two to three and one-half feet high, from rather short, scaly, creeping, root-stocks; perennial; leaves rather short and narrow, rough; panicles both terminal and lateral, narrow, two to six inches long, greenish or purplish; spikelets numerous, thickly clustered on the branches of the panicle, about one-tenth of an inch long; empty glumes sharp-pointed but awnless, unequal, the upper one about the length of the very acute flowering glume. Plate 17.

Not uncommon in the eastern part of the state where it grows chiefly in moist, shaded places. It is of no very great importance as a forage plant and is not worthy of cultivation. It does not thrive in dry soils. The specimens analyzed were collected at Sioux Falls on the 1st of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.31	—
Ash	9.67	10.43
Ether Extract.....	2.49	2.69
Crude Fibre.....	27.96	30.17
Crude Protein.....	13.05	14.08
N.-free Extract.....	39.52	42.64
Total Nitrogen.....	2.09	2.25
Albuminoid Nitrogen.....	1.35	1.45

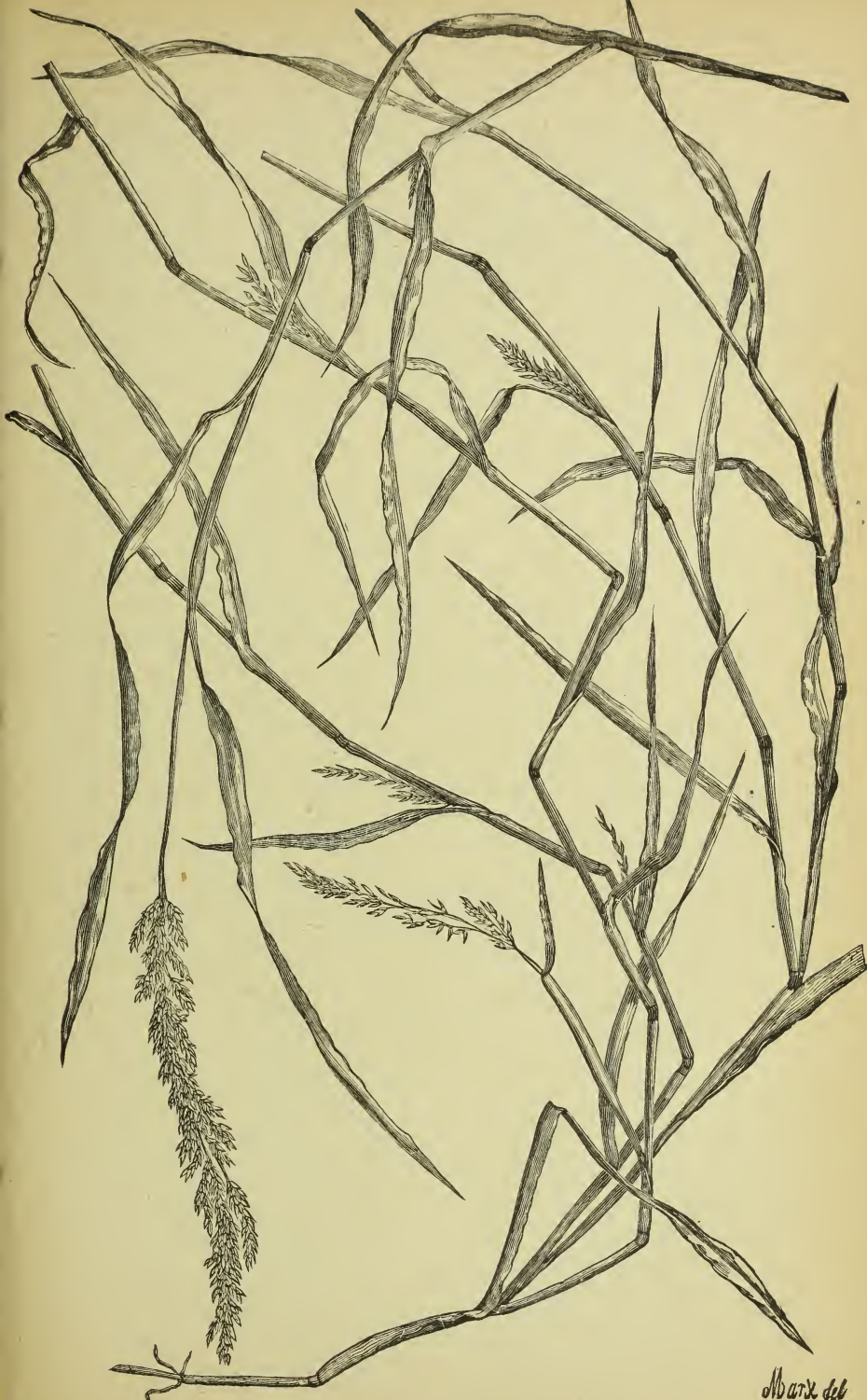


PLATE 17—Mexican Wood Grass.

Marx del

WOOD GRASS.

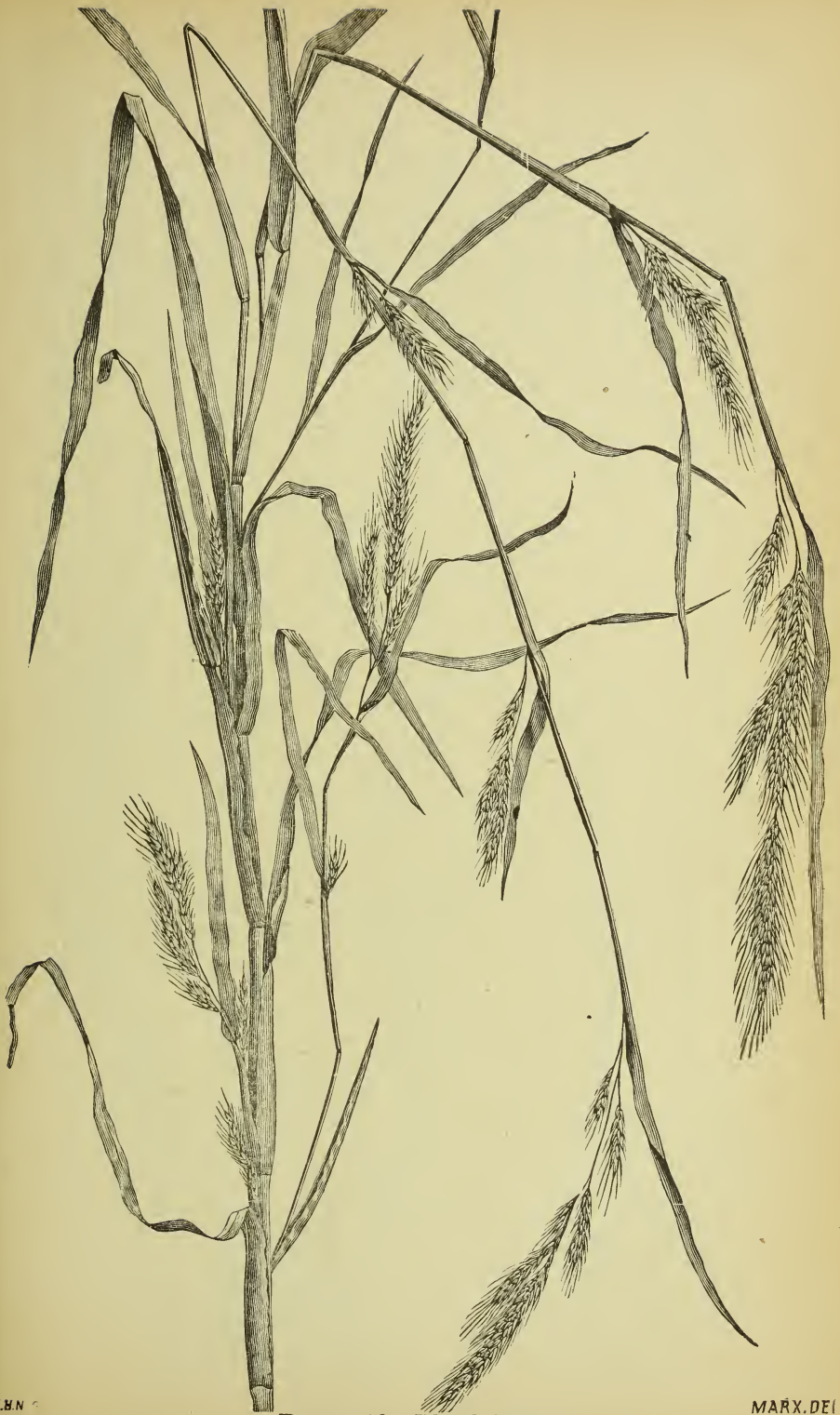
(Muhlenbergia sylvatica Torr. & Gray.)

Stems rather slender, ascending, branched, diffusely spreading, two to four feet high, leafy, from scaly, creeping root-stocks; perennial; leaves two to six inches long, flat, rather broader than in either of the other species, roughish; panicle narrow, spike-like, looser and not so densely flowered as in the preceding species; empty glumes nearly equal, bristle-pointed; flowering glume longer than the empty glumes, with an awn two or three times its own length. Plate 18.

This, like the preceding species, occurs only in the eastern part of the state. It prefers dry, open wood-lands. It affords a limited amount of forage but is of little value agriculturally. The specimens analyzed were collected at Big Stone on the 26th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.86	—
Ash	8.71	9.35
Ether Extract.....	2.28	2.45
Crude Fibre.....	33.41	35.87
Crude Protein.....	8.63	9.27
N.-free Extract.....	46.11	43.06
Total Nitrogen.....	1.38	1.48
Albuminoid Nitrogen.....	1.16	1.24



TIMOTHY.

(Phleum pratense L.)

Stems erect, simple, tufted, one and one-half to four feet high, often bulbous at the base, rough; roots fibrous, perennial; leaves four or five on each stem, short above and longer below, flat, rough; spike cylindrical, usually from two to six inches long; empty glumes with a fringe of hair on the back, tipped with a short bristle. Plate 19.

This is one of the best known hay grasses in the United States. It is a native of Europe and probably also of America and has been cultivated in the United States nearly one hundred and fifty years. Throughout the northern and western states it is considered the best grass that can be raised for hay. It does best on moist, loamy soil. Throughout the Sioux Valley region timothy is a paying crop if properly handled. In some parts of the Black Hills region it does well. Wherever irrigation is possible there will be no difficulty in making this grass pay well unless the soil is too light and sandy. Timothy does not root deeply enough to obtain much nourishment from the sub-soil and hence exhausts the soil. To overcome this difficulty the timothy field should be given a good top-dressing of well rotted manure in the fall or early winter. If the soil becomes "baked" a light harrowing should follow the application of the manure. The harrowing should be done in early spring. On the grounds of the Experiment Station timothy and alsike are doing well sown together. Good crops of timothy and of timothy and clover have been grown in various parts of the Sioux Valley for several years past. The specimens analyzed were cut on the college farm the middle of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	10.39	—
Ash	6.62	7.39
Ether Extract.....	3.21	3.58
Crude Fibre.....	30.82	34.39
Crude Protein.....	7.92	8.84
N.-free Extract.....	41.04	45.80
Total Nitrogen.....	1.27	1.42
Albuminoid Nitrogen.....	1.02	1.14



PLATE 19—Timothy.

MEADOW FOX-TAIL.

(Alopecurus pratensis L.)

Stems erect, smooth, tufted, unbranched, one and one-half to two and one-half feet high, from tough, perennial fibrous roots; leaves four or five on a stem, two to four inches long, rather broad and flat, tapering gradually to a sharp point, roughish, smooth on the sheaths, which are often swollen; spike cylindrical, densely flowered, soft, the awns of the flowers conspicuously projecting, one and one-half to three inches long; spikelets one-flowered, about one-fifth of an inch long; empty glumes nearly equal, strongly compressed, boat-shaped, very hairy on the keels; flowering glume folded upon itself, enclosing the flower, with the slender awn proceeding from its back near the base. Plate 20.

This is native of the Old World and bears some resemblance to timothy. It is thought to be a very valuable grass in the East. Like timothy it prefers a rich, moist loam. It comes up much earlier in the spring than that grass, however, and will endure close grazing without being killed out. It is not so good for a hay crop, but produces a much more luxuriant aftermath. Stock eat it very greedily either in pasture or as dry forage. The hay is not so heavy in proportion to the bulk as is that of timothy. On the Station grounds it has proven a valuable grass. It is an excellent plant to raise under irrigation. It is not easily affected by the hot sun and will stand frequent or close mowings much better than timothy. On this account it is often used as a lawn grass. The specimens analyzed were cut the 1st of June, 1892, on the grounds of the Experiment Station.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.62	—
Ash	9.84	10.54
Ether Extract.....	3.09	3.31
Crude Fibre.....	32.27	34.56
Crude Protein.....	9.25	9.91
N.-free Extract.....	38.93	41.69
Total Nitrogen.....	1.48	1.58
Albuminoid Nitrogen.....	1.36	1.45



R.H. NICHOLS-ENG.

PLATE 20—Meadow Fox-tail.

MARX-DEL.

WILD WATER FOX-TAIL.

(*Alopecurus geniculatus aristulatus* (Michx.) Torr.)

Stems usually bent at the lower joints and ascending, but some times nearly upright, tufted, smooth, often branching, usually from eight to eighteen inches high, from perennial, fibrous roots; leaves glaucous, about three or four on a stem, two to four inches long, flat, taper-pointed, smoothish or roughened, the sheaths smooth and usually somewhat swollen; spike cylindrical, from one and one-half to two inches long, or rarely longer, densely flowered, slenderer than in the preceding species; empty glumes obtuse, rather shorter than the flowering glume, the latter usually with a short awn.

A native grass more or less common throughout the state in low, wet places or in shallow water. It is of no value for cultivation. Along low, wet margins of ditches, ponds and sloughs it sometimes furnishes a small amount of pasturage. The specimens analyzed were collected at Brookings in the college pastures on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.80	—
Ash	11.11	12.05
Ether Extract	3.23	3.50
Crude Fibre.....	25.18	27.31
Crude Protein.....	8.36	9.07
N.-free Extract.....	44.32	48.07
Total Nitrogen.....	1.34	1.45
Albuminoid Nitrogen.....	1.33	1.44

BLACK MOUNTAIN RICE.

(*Oryzopsis melanocarpa* Muhl.)

Stems upright, rough, two to three feet high, leafy; roots perennial; leaves broad and flat, eight to twelve inches long, with a long tapering point, rough, the sheaths hairy at the throat; panicle narrow, simple or sparingly branched, usually about six to eight inches long; spikelets about three-eighths of an inch long; empty glumes green, equal, longer than the flowering glumes, lower one 7-9 nerved, the upper one 5-nerved; flowering glume enclosing the seed at maturity, blackish, with an awn about an inch long.

This grass has been found in but two places in the state—at Big Stone and in the northeastern part of Brookings county. It grows in dry woods and is probably of little value as a forage plant. The specimens analyzed were collected September 1st, 1892, in Brookings county.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.19	—
Ash	10.33	11.01
Ether Extract	1.95	2.08
Crude Fibre.....	31.61	33.70
Crude Protein.....	8.53	9.09
N.-Free Extract.....	41.39	44.12
Total Nitrogen.....	1.36	1.45
Albuminoid Nitrogen.....	1.18	1.25

INDIAN MILLET.

(*Oryzopsis micrantha* (Trin. & Rupr.) Thurb.)

Stems slender, erect, tufted, one and one-half to two feet high, from tough perennial roots; leaves numerous, rough, hard, slender, involute, with very long, sharp points; panicle two to six inches long, the slender spreading branches naked below and many-flowered at the upper ends; spikelets shining, about one-eighth of an inch long; flowering glume smooth, shorter than the empty glumes, enclosing the grain in fruit, with a slender, deciduous awn about three times its own length.

This grass is quite common in central and western South Dakota. Wherever it is found in any quantity it is considered to be of great value. There is another kind of "Indian millet," or "bunch grass" (*Oryzopsis cuspidata*) which has a distribution similar to that of this species. In the Bad Lands and along the Cheyenne river it is thought to be quite valuable. This is the grass illustrated in Plate 21.

It may be distinguished from the first named species by its very large wide-spreading panicle, large hairy fruit, and generally coarser habit of growth. Both seem to be worthy of trial under cultivation. The specimens analyzed were collected in Potter county the 1st of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.06	—
Ash.....	15.94	16.97
Ether Extract.....	2.21	2.35
Crude Fibre.....	29.10	30.98
Crude Protein.....	8.06	8.58
N.-free Extract.....	38.63	41.12
Total Nitrogen.....	1.29	1.37
Albuminoid Nitrogen.....	.97	1.03

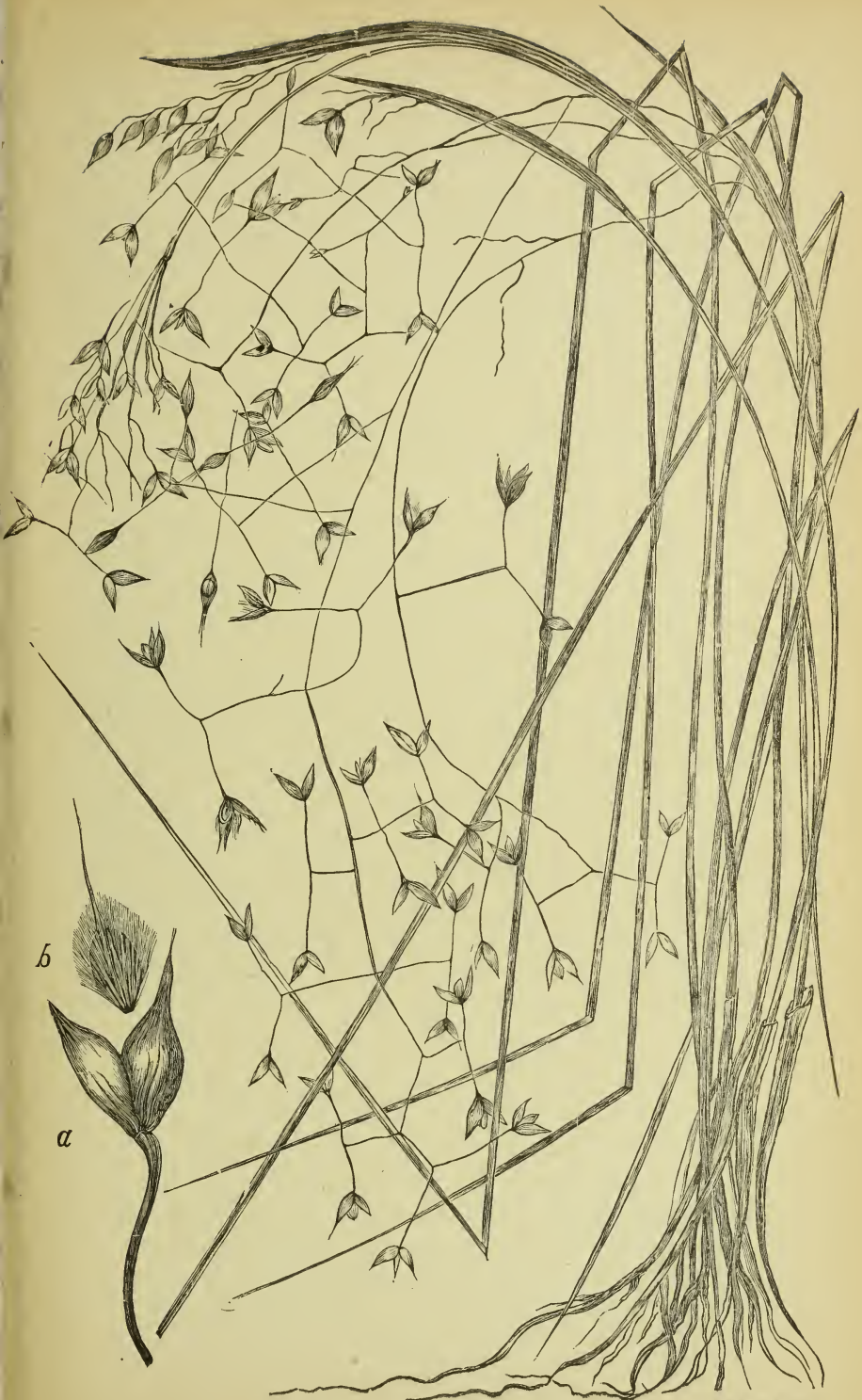


PLATE 21—Indian Millet,

W. TAYLOR DEL.

SOUTHERN POVERTY GRASS.

(*Sporobolus vaginaeflorus* (Torr.) Vasey.)

Stems slender, ascending, more or less bent below, branching, six to eighteen inches high, smooth, usually purplish above the sheaths, from annual, fibrous roots; leaves short (one to four inches long) involute, long-pointed; panicles simple and spike-like, lateral and terminal, often brownish or purplish, usually more or less included in the sheaths, especially those produced later in the season; spikelets one-flowered, small; empty glumes nearly equal, about as long as the flowering glume, all acute; grain brownish, oval, almost as long as the flowering glume and palet.

Widely distributed over the eastern half of the state but seldom plentiful in any one locality. It is most common in the Sioux Valley. It thrives best on rather dry soils and is found chiefly along roadsides and in waste places. The specimens analyzed were collected at Dell Rapids the 1st of September, 1892, and were then in fruit. The grass has very little agricultural value.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.64	—
Ash	5.50	5.83
Ether Extract.....	2.00	2.12
Crude Fibre.....	31.14	33.00
Crude Protein.....	9.20	9.75
N.-free Extract.....	46.52	49.30
Total Nitrogen.....	1.47	1.56
Albuminoid Nitrogen.....	1.18	1.25

PRAIRIE GRASS.

(Sporobolus cuspidatus (Torr.) Scribn.)

Stems slender and wiry, erect, branching, more or less tufted, a foot or more in height, from stout, perennial roots; leaves numerous, short, narrow and pointed, appressed to the stem; smooth; panicle exerted, simple, narrow, two to four or five inches long; spikelets smaller than in the preceding species; empty glumes very acute, shorter than the flowering glume which has a sharp, stiff point.

Widely distributed over the entire state. It thrives on a variety of soils but prefers that of the drier draws or swales. Though often occurring in pasturage or hay it possesses little value as a forage, except perhaps in parts of the state where better grasses do not thrive. The specimens analyzed were collected at Brookings on the 10th of August.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.55	—
Ash	4.78	5.23
Ether Extract.....	2.12	2.32
Crude Fibre.....	29.02	31.73
Crude Protein.....	6.38	6.98
N.-free Extract.....	49.15	53.75
Total Nitrogen... ..	1.02	1.12
Albuminoid Nitrogen.....	.95	1.04

WIRE GRASS.

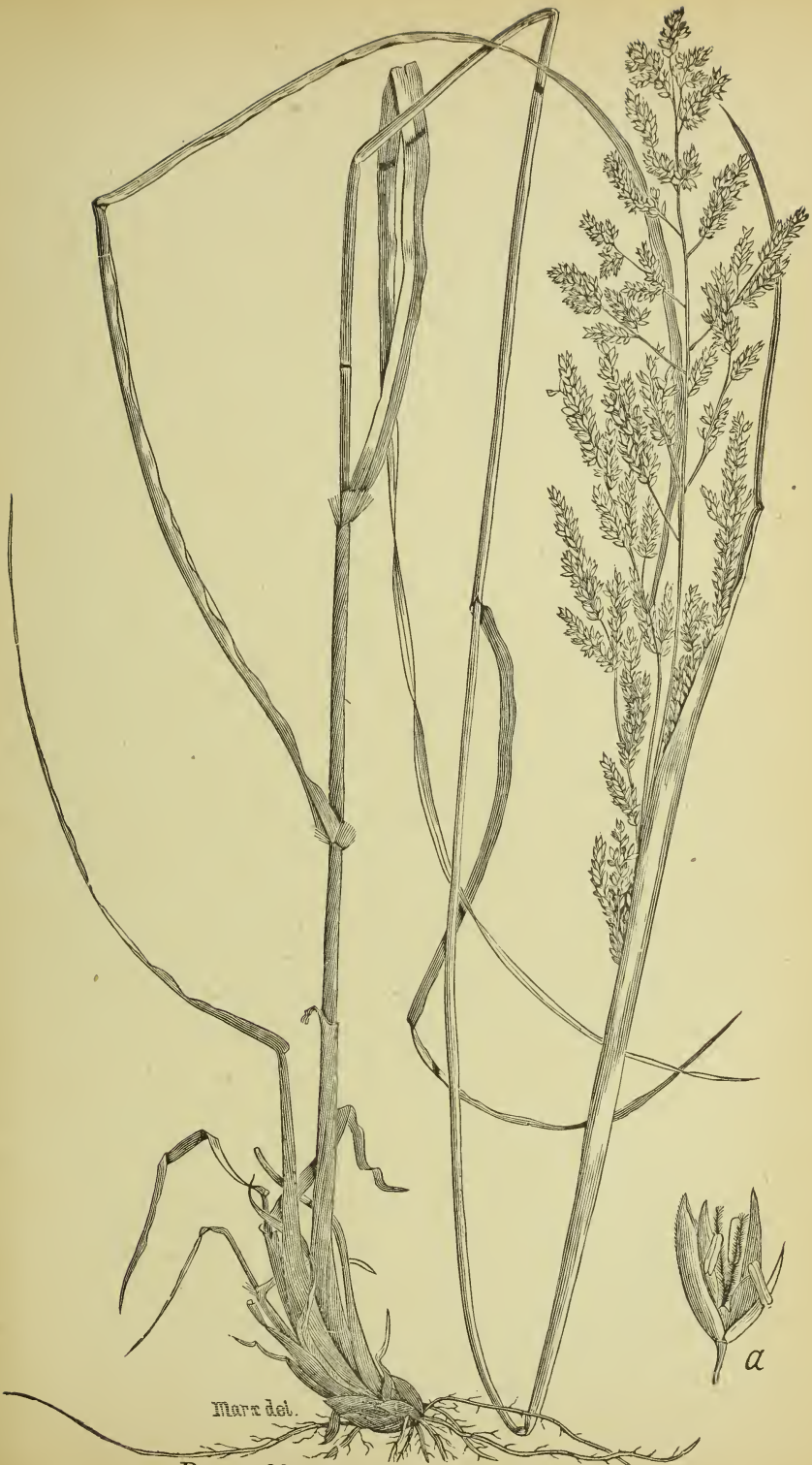
(*Sporobolus heterolepis* Gray.)

Stems erect, tufted, wiry, one and one-half to three feet high, smooth, from a mass of strong, fibrous, perennial roots; leaves involute, long and slender (particularly the root leaves which often reach two feet in length), rough on the edges; panicle long stalked, spreading, three to six inches long, with yellowish, sticky, glandular spots in the axils of, or at intervals along the branches, purplish brown; spikelets about one-fifth of an inch long on slender pedicels; empty glumes sharp pointed, very unequal, the upper one longer and broader; flowering glume and palea obtuse, nearly equal, shorter than the upper empty glume.

This is one of the most valuable grasses belonging to this genus. It is found in nearly all portions of the state but is most common in the eastern and southern parts. Throughout the Sioux Valley it is an important element in the prairie meadows and pastures. Owing to its tendency to grow in bunches it is often called "bunch grass." It yields a good quality of hay. The seeds are peculiar for giving off a strong, rather disagreeable odor when bruised. The specimens analyzed were cut near White, August 17th, 1892. There are two other grasses belonging to this genus that are valuable forage plants in the drier portions of the state. These are "prairie grass" (*Sporobolus cryptandrus*) and "bunch grass" or "alkali grass" (*Sporobolus airoides*.) The latter is one of the characteristic grasses of the Bad Lands. The first species is illustrated in Plate 22.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.90	—
Ash	4.82	5.23
Ether Extract.....	1.65	1.79
Crude Fibre.....	35.11	38.12
Crude Protein.....	5.65	6.13
N.-free Extract.....	44.87	48.72
Total Nitrogen.....	.90	.98
Albuminoid Nitrogen.....	.79	.86



Mars del.

PLATE 22—*Sporobolus Cryptandrus*.

ROUGH-LEAFED PRAIRIE GRASS.

(*Sporobolus asperifolius* (N. & M.) Thurb.)

Stems slender, six to sixteen inches high, profusely branching, weak and spreading, often rooting at the lower joints and forming broad, matted tufts, from perennial roots and creeping rootstocks; leaves numerous, short, (one to three inches), narrow, flat, pointed, rough, especially on the margins and upper surface; panicle usually more or less included at the base by the upper sheath, open and spreading, with fine capillary branches, three to seven inches long, and two to four inches wide, ovoid in outline; spikelets very small on long capillary pedicels; empty glumes rough, acute, nearly equal, and about as long as the flowering glume.

This is one of the characteristic grasses of the drier portions of the state. It is quite common in the Bad Lands and along the Cheyenne River. It also occurs sparingly along the divide east of the Missouri River. Although a harsh, wiry plant it furnishes a considerable amount of pasturage and when once well established it is very persistent, standing close grazing and tramping well. It may be recognized by its spreading, capillary panicles, rough leaves, and matted habit of growth. The specimens analyzed were collected in the Bad Lands on Indian Creek, August 19th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.75	—
Ash	7.62	8.26
Ether Extract	2.49	2.71
Crude Fibre	30.85	33.44
Crude Protein	4.42	4.79
N.-free Extract	46.87	50.81
Total Nitrogen .....	.71	.77
Albuminoid Nitrogen .....	.61	.66

TICKLE GRASS.

(Agrostis hiemalis (Walt.) B. S. P.)

Stems very slender, erect, tufted, one to two feet high, from fibrous roots; leaves short and narrow, involute or flat; panicle purplish, six to ten inches long, at length very loose and spreading, with long, clustered, capillary divisions which are branched above the middle; spikelets small, borne at the ends of the branches; empty glumes unequal, very acute, rough on the keel; flowering glume very thin, often with a minute awn.

This is a well-known grass, more or less plentiful throughout the state and growing mostly in rather dry places. It is of very little agricultural value being generally regarded as a weed though not a bad one. Its large, finely branched panicles break away soon after the seeds mature and are blown about by the wind, sometimes becoming so plentiful as to be quite disagreeable. The specimens analyzed were collected at Brookings on the 1st of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.24	—
Ash	10.28	11.33
Ether Extract.....	2.81	3.10
Crude Fibre.....	29.28	32.26
Crude Protein.....	8.02	8.84
N.-free Extract.....	40.37	44.48
Total Nitrogen.....	1.28	1.41
Albuminoid Nitrogen.....	1.16	1.28

RED TOP.

(*Agrostis alba vulgaris* (With.) Thurb.)

Stems rather slender, erect, smooth, one to two feet high, from creeping root-stocks; perennial; leaves flat, narrow, slightly roughened, two to six inches long; panicle with spreading branches, red-purple, three to six inches long; spikelets small, numerous; flowering glume thin, three nerved, awnless or rarely with a minute awn. Plate 23.

This is an introduced grass which has considerable value as a forage plant. In the east it is thought to be one of the best grasses that can be raised for dairying purposes. While it prefers low, moist soil it is nevertheless a valuable grass on dry soils that are not too gravelly. It usually does best when sown with other grasses or with clovers. Red top, timothy and clover form an excellent combination. The species (*Agrostis alba* L.) also occurs in the state, apparently as a native. On the college farm red top has been grown for several years with fairly good success. On low, moist soil the yield is good but on high gravelly land the grass does not do so well. It is quite hardy and endures close pasturing perfectly. Its vigorous underground stems or root-stocks enable it to thrive when many other grasses would be killed by drouth. The specimens analyzed were cut on the college farm on the 30th of June, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.85	—
Ash	9.03	9.80
Ether Extract	2.39	2.59
Crude Fibre	29.19	31.68
Crude Protein	11.93	12.95
N.-free Extract	39.61	42.98
Total Nitrogen.....	1.91	2.07
Albuminoid Nitrogen.....	1.28	1.38

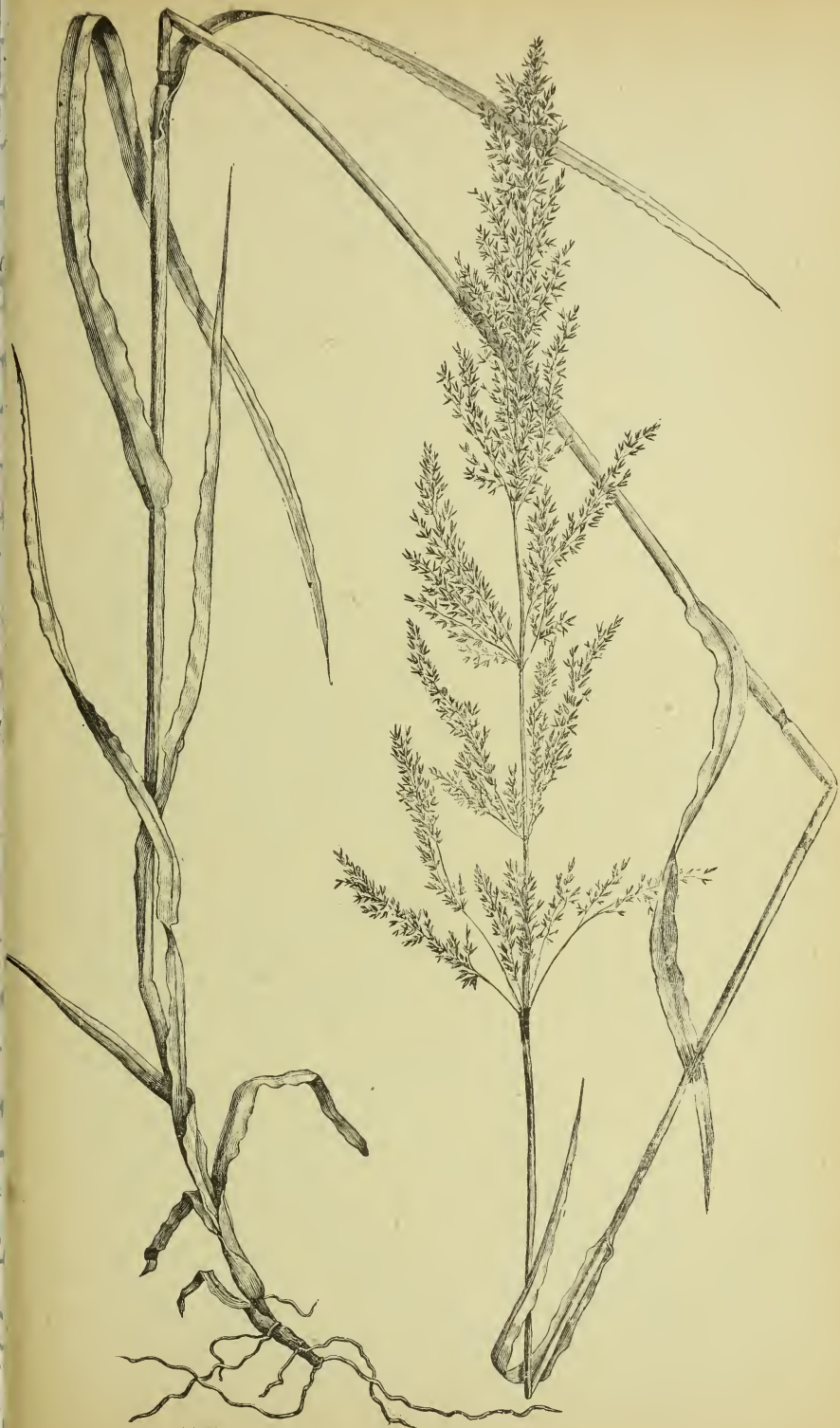


PLATE 23—Red Top.

INDIAN REED GRASS.

(Cinna arundinacea L.)

Stems stout, erect, smooth, three to six feet high, from perennial roots and creeping root-stocks, green, the joints brown; leaves large (about a foot long and one-fourth to one-half of an inch wide), flat, rough, the sheath smooth, ligule elongated and conspicuous; panicle large, loose and open in flower, afterwards becoming more close, six inches to a foot in length; spikelets about one-fifth of an inch long, numerous; empty glumes unequal, keeled, roughish, narrowly lanceolate, acute, green with narrow hyaline borders; flowering glume slightly exceeding the lower (shorter) empty glume, usually with a minute awn. Plate 24.

This grass has occurred, as yet, only in moist woods along the Sioux Valley. It is readily eaten by stock and gives a good quality of hay but it is too rare to be of any special agricultural value. The specimens analyzed were collected near Brookings.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.40	—
Ash.....	8.79	9.60
Ether Extract.....	3.63	3.96
Crude Fibre.....	26.09	28.48
Crude Protein.....	7.61	8.31
N.-free Extract.....	45.48	49.65
Total Nitrogen.....	1.22	1.33
Albuminoid.....	1.12	1.22

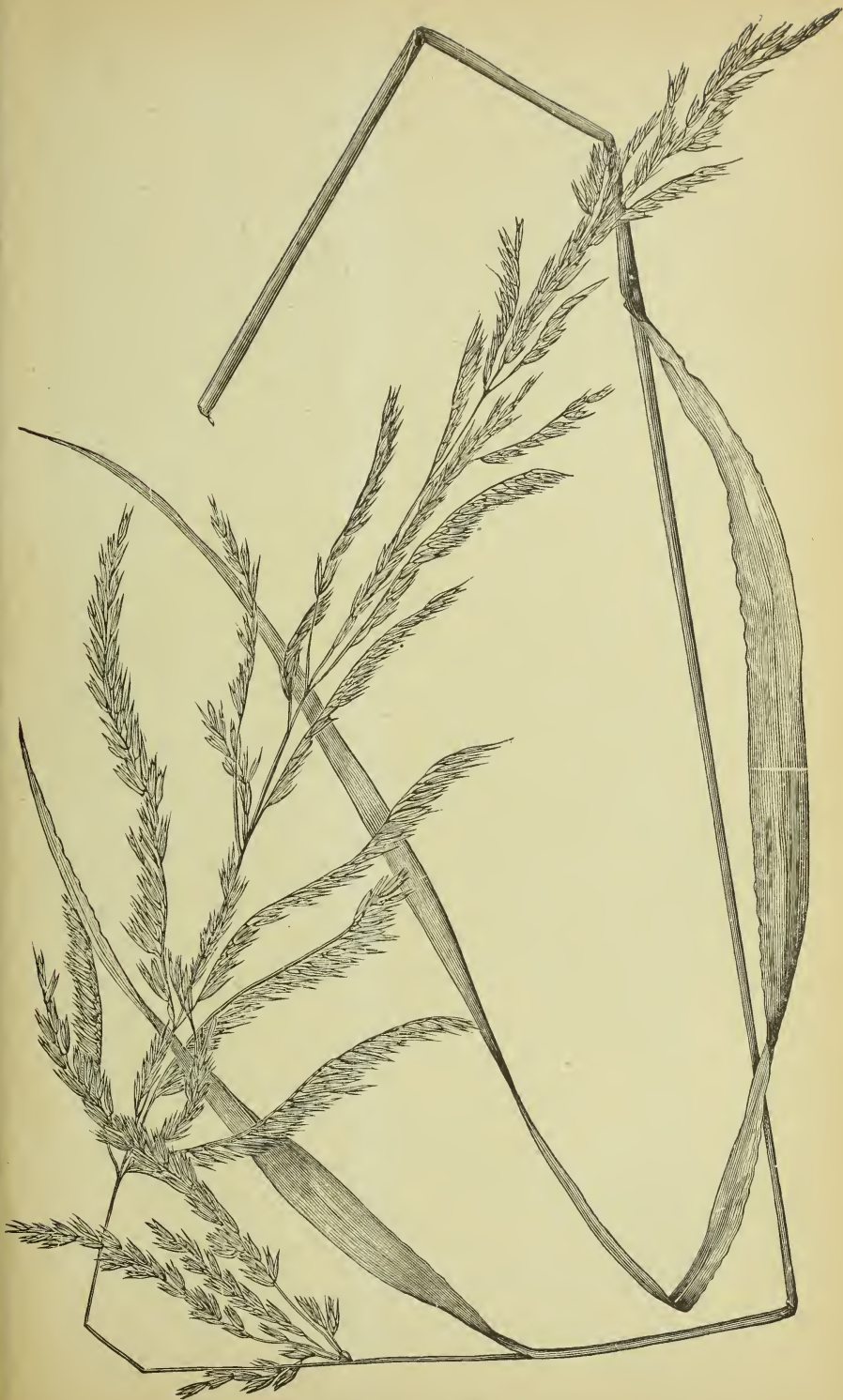


PLATE 24—Indian Reed Grass.

BLUE JOINT.

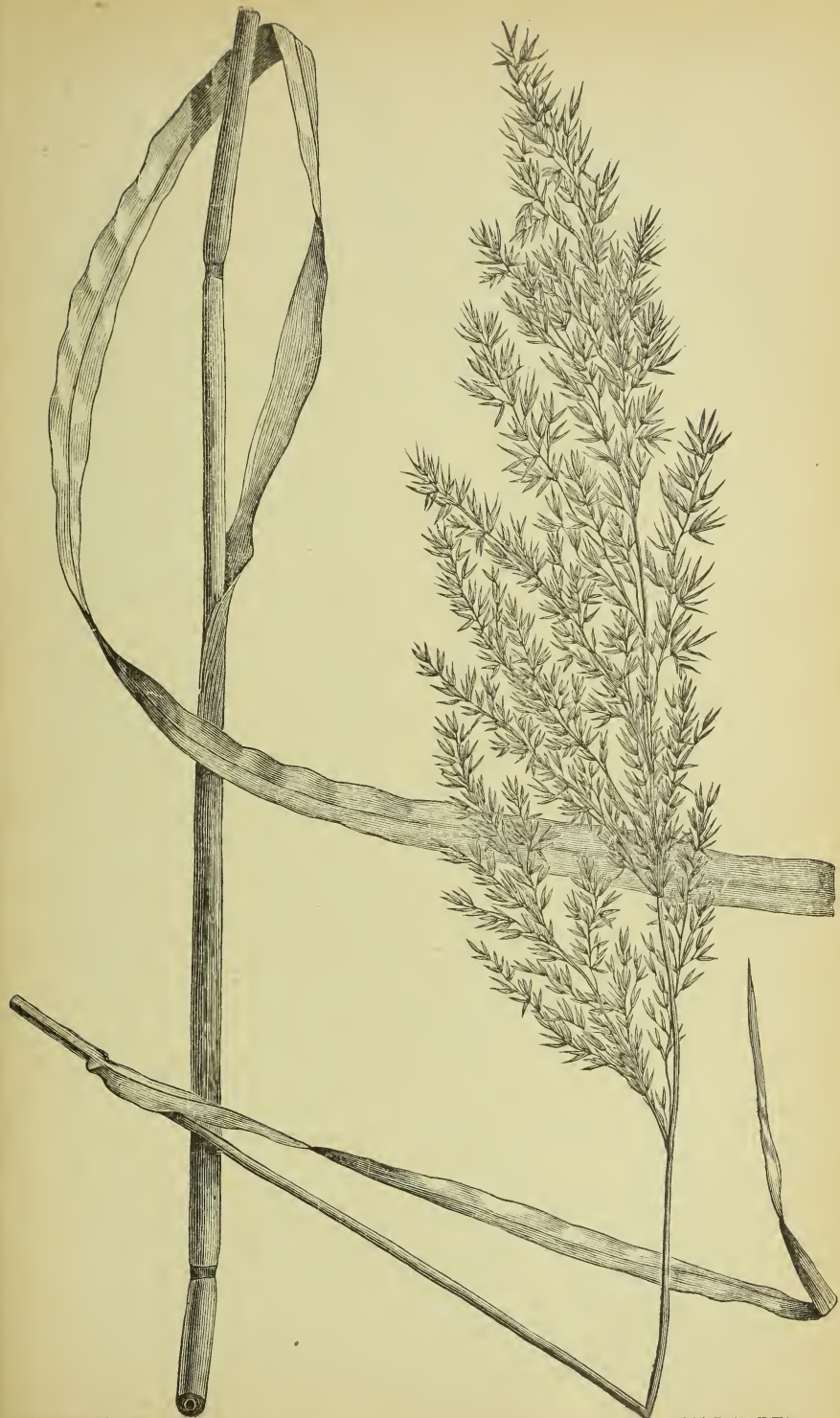
(*Calamagrostis canadensis* (Michx.) Beauv.)

Stems usually simple, erect, from perennial roots, three to five feet high, smooth; leaves large, flat, about a foot in length and from one-fourth to one-half an inch broad, roughish and glaucous; flowers arranged in loose, open panicles which are from four to eight inches long, usually purplish in color; spikelets one-tenth to one-eighth of an inch long; outer glumes lanceolate and acute; the silky white hairs at the base of the flowering glume as long as the glume itself; flowering glume thin and delicate, two-toothed at the apex, with the straight slender awn projecting from the back near the middle; palea about two thirds as long as the flowering glume. Plate 25.

A native grass growing in low, wet meadows. It may be recognized by its large size, purplish panicles, and *green* stems with *purplish joints* as contrasted with the *purplish stems* of the *blue stem grasses*. It occurs throughout the state generally but is most common in the James River Valley. A great many root leaves are produced by this grass and in favorable soils it yields large quantities of a coarse but otherwise excellent hay. In certain parts of the Northern United States and British America it is an important native grass and will bear further study as to its value under cultivation. The specimens analyzed were collected at Brookings on June 20th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.51	—
Ash.....	6.86	7.26
Ether Extract.....	1.33	1.41
Crude Fibre.....	36.46	38.59
Crude Protein.....	8.74	9.25
N.-free Extract.....	41.10	43.50
Total Nitrogen.....	1.40	1.48
Albuminoid Nitrogen.....	1.17	1.23



NICHOLS-ENG.

MARX-DEL.

PLATE 25—Blue Joint.

BIG SAND GRASS.

(*Calamovilfa longifolia* (Hook.) Scribner.)

Stems stout, erect, from very large, strong, scaly, creeping root-stocks, smooth, two to six feet high, all but the uppermost internode completely covered by the sheaths; leaves numerous, smooth, one to two feet in length, flattish or becoming involute, rigid, tapering into a long, slender point; ligule a narrow, woolly ring—the hairs more plentiful at the angles on either side; panicle from close (while young) becoming spreading and open, six inches to two feet long; spikelets whitish or often tinged with purple, one-fourth to one-third of an inch long; flowering glume nearly or quite equalling the upper or larger empty glume; the copious tuft of hair one-half to two-thirds as long as the flowering glume. Plate 26.

This is a native grass easily recognized by its large, pale panicles, numerous large, rigid leaves, and large creeping root-stocks. It occurs over the entire state but is most plentiful in the James River Valley and the region to the west of it. It thrives best in moist sandy or saline soils. It is too coarse to be recommended as a hay grass when other and finer growing species are available. The yield is always heavy and if cut in proper season the hay is of fair quality. In certain parts of the state it furnishes a considerable percentage of the winter forage and hence is of considerable value to the stock raisers in those localities. The specimens analyzed were collected at Forest City the 1st of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.26	—
Ash	4.65	5.07
Ether Extract.....	1.63	1.78
Crude Fibre.....	37.92	41.33
Crude Protein.....	3.34	3.84
N.-free Extract.....	44.20	48.18
Total Nitrogen... ..	.53	.58
Albuminoid Nitrogen.....	.43	.47



PLATE 26—Big Sand Grass.

SAND GRASS.

(Calamagrostis confinis Nutt.)

Stems rather robust, erect, from stout perennial roots, often somewhat branching below, smooth except near the panicle where it is roughish, green with joints purplish brown, leaves large, flattish, but becoming more or less involute, eight inches to a foot or more in length (the root leaves often over a foot and a half long), rough, particularly on the margins; sheaths usually roughish; ligule narrow and obtuse, about one-eighth of an inch in length; flowers in a close, short-branched panicle which is from four to seven inches long; spikelets about one-sixth of an inch long; empty glumes thickish, roughened, three-nerved; flowering glume nearly as long as the empty glumes, acute, thinnish, bearing a twisted awn from below the middle; palea nearly as long as the glume; hairs plentiful, shorter than the glumes.

This grass is not nearly so plentiful as blue joint from which it may be distinguished by its paler, closer panicles, larger flowers, involute leaves and generally smaller size of the whole plant. Thus far it has not been reported from outside of the Sioux Valley. It occurs generally in rather drier soil than does the common blue joint, and prefers sandy places—hence the common name—sand grass. If it were more plentiful it would be of considerable value as a forage grass—the abundance of root leaves furnishing a good yield of excellent hay. It is, however, of too rare occurrence to take any important place among native forage plants. The specimens analyzed were collected at Brookings, July 3rd, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.02	—
Ash.....	7.24	7.79
Ether Extract.....	2.01	2.16
Crude Fibre.....	35.29	37.95
Crude Protein.....	5.47	5.88
N.-free Extract.....	42.97	46.21
Total Nitrogen.....	.88	.94
Albuminoid Nitrogen.....	.78	.83

BIG CROW'S FOOT.

(Eleusine coracana Gaertn.)

Stems erect, very robust, smooth, branching, one to three feet high, from coarse, fibrous annual roots; leaves numerous, large, a foot or more in length, usually longer than the stem, flat, smooth or roughish on the margins; flowers arranged in spikes which are one-sided, digitately clustered (three to seven in a cluster) one and one-half to two inches long, densely flowered.

This is a coarse grass native to India and Africa which has been introduced into various parts of the United States. It makes a very rank growth and hence yields a heavy crop of hay which is not well relished by stock. It is rather tender for our climate and does much better in the South. On the grounds of the Experiment Station this grass gave a paying crop in 1891, but the next year the yield was very light, showing that it would not be a sure crop for a short season. It is, therefore, not as satisfactory an annual as either common millet or broom corn millet. The specimens analyzed were cut from the experimental plats on the Station grounds on the 9th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.81	—
Ash.....	10.25	11.00
Ether Extract.....	2.49	2.67
Crude Fibre.....	27.31	29.31
Crude Protein.....	11.50	12.34
N.-free Extract.....	41.64	44.68
Total Nitrogen.....	1.84	1.98
Albuminoid Nitrogen.....	1.09	1.17

TALL OAT GRASS.

(Arrhenatherum elatius (L.) M. K.)

Stems stout, erect, two to four feet high, from a mass of perennial, fibrous roots, leafy; leaves broad and flat, six to ten inches long, rough (the sheaths smooth), pointed; panicle narrow, loose, five to ten inches long; spikelets on rather short stalks, two-flowered (the lower one staminate only, the upper one perfect), about three-eighths of an inch long; empty glumes very unequal, the lower one smaller and one-nerved, the upper three-nerved, both thin and transparent, without awns; flowering glume seven nerved, hairy at the base, roughish; the flowering glume of the lower flower has a long, twisted, bent awn proceeding from its back just below the middle; that of the upper flower has only a small bristle-like awn near its apex. Plate 27.

Tall oat grass is a native of the Old World world where it is one of the most valued grasses both for hay and for pasturage. It makes a strong root-growth and lasts well in pastures. It does well in most localities in the Southern and Eastern United States. On the grounds of the Experiment Station it has promised well. It is an excellent grass for use in mixtures with such species as tall fescue, smooth brome, orchard grass and meadow fescue. It gives an abundant yield of hay and, up to the present, has proved hardy. It is deserving of trial on all but the very driest of soils. Its hardiness is shown from the fact that it has often escaped from cultivation and continues to thrive. The specimens analyzed were cut from the experimental plats on the Station grounds on the 30th of June, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.84	—
Ash	7.90	8.48
Ether Extract	2.85	3.06
Crude Fibre	28.72	30.83
Crude Protein	7.11	7.63
N.-free Extract	46.58	50.00
Total Nitrogen	1.14	1.22
Albuminoid Nitrogen .....	.95	1.02



PLATE 27—Tall Oat Grass.

CORD GRASS.

(Spartina cynosuroides (L.) Willd.)

Stems upright, stout, becoming hard and woody, three to seven feet high, from very large, scaly, perennial root-stocks; leaves two or three feet long, involute, pointed, tough and rigid, rough on the margins; spikes five to twenty, usually from one and one-half to three inches long, upright at first but becoming somewhat spreading at maturity; spikelets nearly half an inch long, one-flowered, flattened, sessile and crowded closely together in two rows; glumes awn-pointed with minute bristles along the back. Plate 28.

Common in low places throughout the entire West. It is particularly plentiful in draws in the Eastern part of the State and among the "Coteaus." It is the most common of the "slough grasses" and is of considerable value as a hay grass. If allowed to stand too long it becomes woody and yields a poor quality of hay but when cut in proper season is readily eaten by stock. The stems contain a considerable amount of sugars and hence are quite palatable even though hard and tough. In the drier regions in the central and western parts of the state it is largely replaced by the "Little Cord Grass" (*Spartina gracilis*.) The specimens analyzed were collected at Brookings on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.45	—
Ash	3.81	4.07
Ether Extract.....	1.13	1.21
Crude Fibre.....	36.03	38.51
Crude Protein.....	4.95	5.29
N.-free Extract.....	47.63	50.91
Total Nitrogen.....	.79	.85
Albuminoid Nitrogen .....	.58	.62

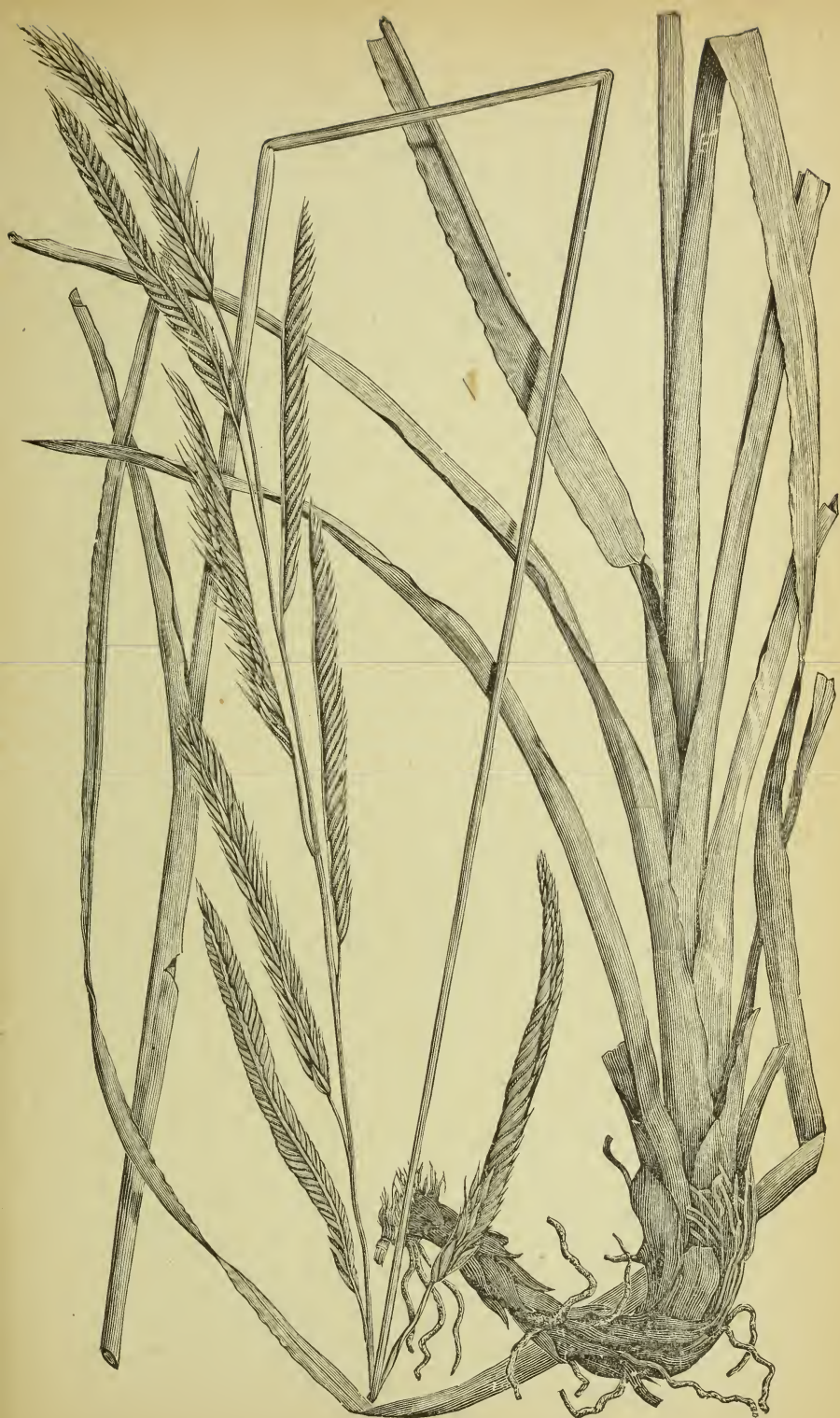


PLATE 28—Cord Grass.

WILD CRAB GRASS.

(Schedonnardus paniculatus (Nutt.) Coville.)

Stems low, weak and spreading, branching, six to eighteen inches high, leafy below, naked and more or less curved above, rough, from annual fibrous roots; leaves short narrow, roughish; panicle consisting of from three to ten distant, slender, straight or curved, widely spreading spikes, which are one to four inches long; spikelets small, sessile, appressed to the axis of the spike, one flowered; empty glumes unequal, rough on the keel, with sharp, awn-like points, shorter than the flowering glume.

Found plentifully throughout the state on dry soils. Readily distinguished from common crab grass by its curved, spreading panicles, its general habit of growth and the structure of its flowers. It furnishes a small amount of pasturage but is, on the whole, rather to be regarded as a weed than as a forage plant. The specimens analyzed were collected the latter part of August.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.60	—
Ash	9.14	9.79
Ether Extract.....	2.43	2.60
Crude Fibre.....	32.01	34.27
Crude Protein	7.50	8.02
N.-free Extract.....	42.32	45.31
Total Nitrogen.....	1.20	1.28
Albuminoid.....	.91	.98

BLACK GRAMA.

(*Bouteloua hirsuta* Lag.)

Stems slender, erect, tufted, smooth, six to fifteen inches high, from a mass of long and slender, but tough, fibrous roots; perennial; leaves most plentiful on the lower part of the stem, narrow, flat, usually covered with long, white hairs, one to three inches long; spikes one to three, or rarely four, densely flowered, about one inch in length; empty glumes usually dark purple, hairy on the back, each hair arising from a blackish wart; rudimentary flower with a smooth stalk.

Black grama occurs throughout the state but is less common than blue grama. It prefers dry soils and in the Eastern part of the state is most often found on dry and rocky places where very few other grasses will grow. It is quite variable both as to size and hairiness. In the western part of the state it often grows mixed with blue grama and adds considerably to the amount of native forage. Like blue grama it is often called buffalo grass. The specimens analyzed were collected at Dell Rapids on the first of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.28	—
Ash	9.40	10.14
Ether Extract	2.36	2.55
Crude Fibre.....	30.45	32.84
Crude Protein.....	5.45	5.88
N.-free Extract.....	45.06	48.60
Total Nitrogen.....	.87	.94
Albuminoid Nitrogen.....	.67	.73

BLUE GRAMA.

(Bouteloua oligostachya (Nutt.) Torr.)

Stems slender, erect, tufted, smooth, eight to sixteen inches high, from very tough, perennial, fibrous roots and slender root-stocks, very leafy below; the upper stem leaves short, narrow and pointed, involute, lower stem leaves and root leaves larger (three to five inches long), flattish or involute, long-pointed, leaves and sheaths all smooth; spikes one to three (rarely four or five), usually from one to two inches long, one-sided and more or less curved, densely flowered; spikelets about one-fifth of an inch long, containing one fertile flower and one or more sterile or rudimentary ones; empty glumes unequal, sparingly hairy on the back, dark purple; glumes of fertile flower soft-hairy, the lower (flowering glume) three lobed, the lobes awl-pointed, the upper (palea) two-lobed; sterile flower copiously white hairy at the top of its pedicel, its glume with three awns. Plate 29.

This is one of the commonest grasses in the state. In the eastern part it grows chiefly on the dry gravelly knolls but in western part, particularly on the "Range," it covers all the drier prairies. It is often, but improperly, called "buffalo grass." Over the larger portion of the western half of the state it furnishes by far the greater part of the pasturage. It cures well in autumn and hence furnishes excellent winter forage. Stock will usually keep in good condition upon it as long as it remains uncovered by the snow. It is of little or no value for hay as its leaves are too short and are closely matted to the ground. In open winters stockmen often winter large herds upon it with little or no other feed. The specimens analyzed were collected at Brookings on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.69	—
Ash	8.11	8.69
Ether Extract.....	2.03	2.18
Crude Fibre.....	29.30	31.40
Crude Protein.....	8.50	9.11
N.-free Extract.....	45.37	48.62
Total Nitrogen	1.36	1.46
Albuminoid Nitrogen.....	1.08	1.16

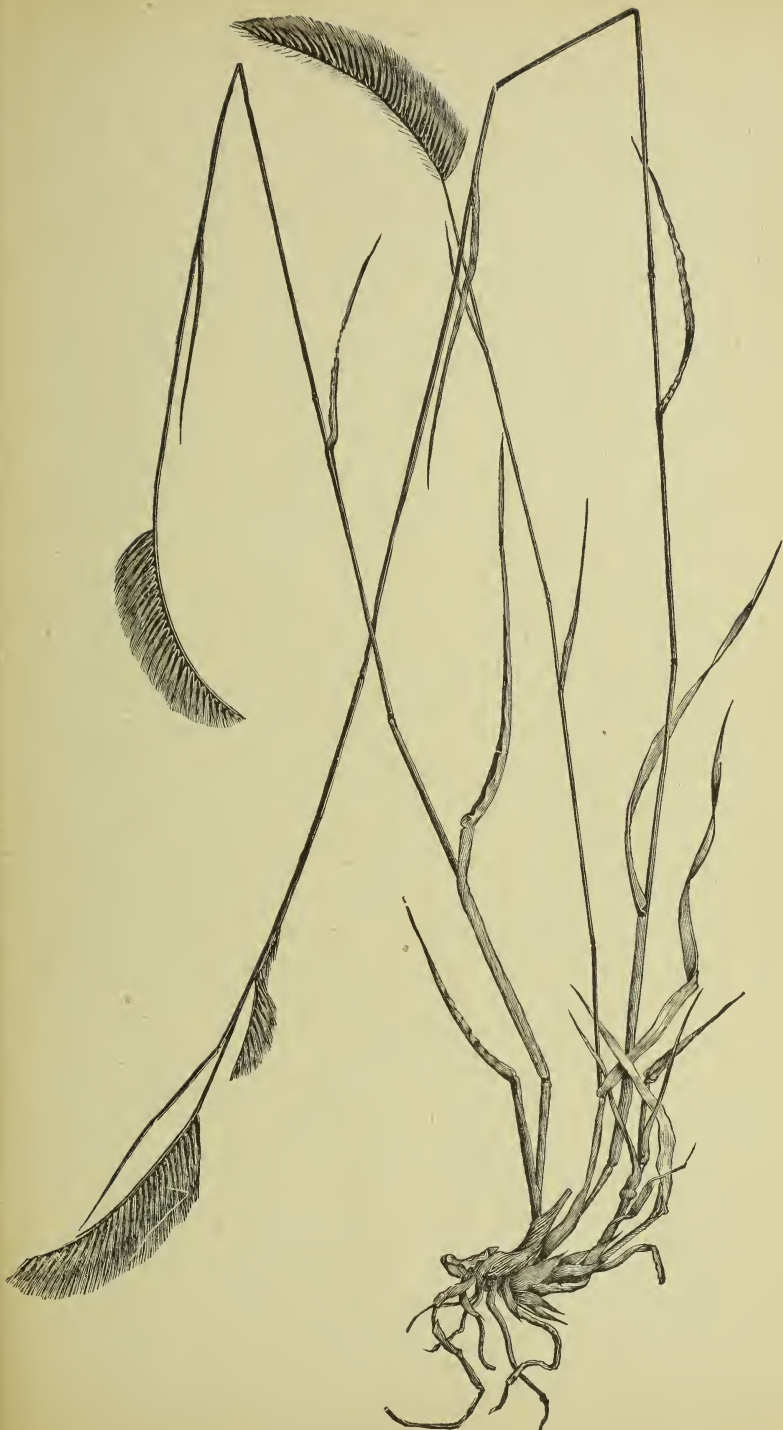


PLATE 29—Blue Grama.

TALL GRAMA OR MESQUITE GRASS.

(Bouteloua curtipendula (Michx.) Gray.)

Stems rather stout, erect, tufted, one to three feet high, from very tough, perennial, fibrous roots, with short, scaly off-shoots, leafy below; leaves flattish, narrow and long pointed, smooth or hairy; root leaves very long and plentiful; spikes about one-half of an inch long, numerous (twenty to sixty), generally purplish, arranged on one side of the stem some distance apart, reflexed; spikelets usually four to ten in each spike, about one-fifth of an inch long. Plate 30.

Tall Grama is found throughout the entire state and grows chiefly on upland prairies. It may be easily recognized by the one-sided arrangement of the numerous spikes. It is a very valuable forage grass, particularly when used for hay. In the eastern part of the state it is often found growing with the blue stems. Stock eat it readily as hay but are not as fond of it in pasturage as of the blue stems or of the blue grama. It is not so shy of civilization as are the other gramas and hence becomes of much value in the interim of the going out of these and the buffalo grass and the coming in of the blue stems. It has not yet been successfully cultivated. The specimens analyzed were cut on a prairie meadow, near Brookings, the last of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.05	—
Ash	9.07	9.76
Ether Extract.....	1.72	1.85
Crude Fibre.....	35 10	37.76
Crude Protein.....	5.19	5.58
N.-free Extract.....	41.87	45.05
Total Nitrogen.....	.83	.89
Albuminoid Nitrogen.....	.63	.67

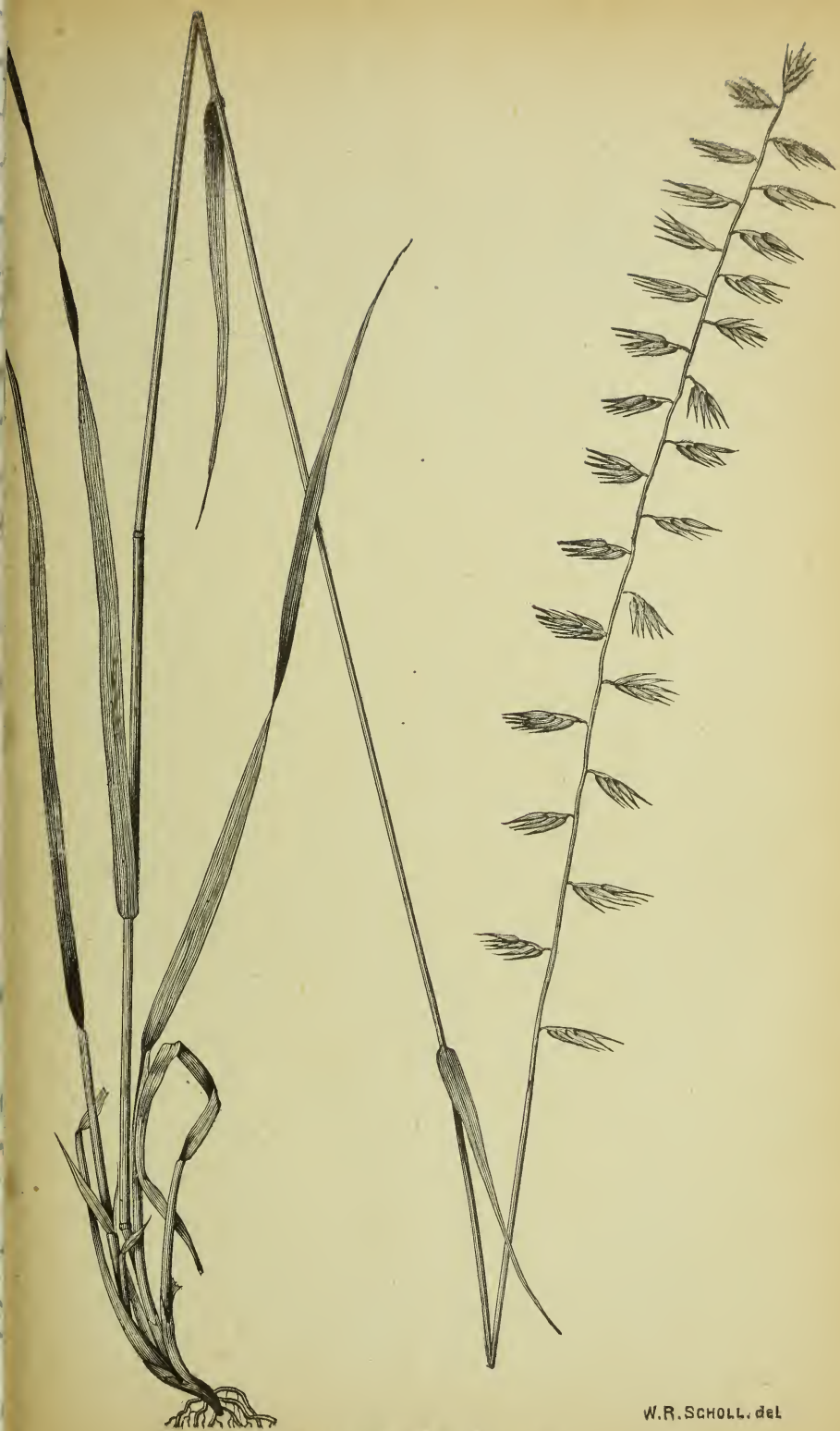


PLATE 30—Tall Grama,

W.R. SCHOLL, del

BUFFALO GRASS.

(Bulbilis dactyloides (Nutt.) Raf.)

Stems smooth, running along on the ground, rooting at the joints, forming close, broad mats which are often several yards in extent; leaves two to five inches long, smooth or with scattered, white hairs on the edges, more or less curled and twisted; flowers of two sorts, borne on the same or on different plants; staminate spikes one to three, whitish, about one-half an inch long, clustered at the end of slender, upright stems which are four to six inches long; pistillate spikelets one-flowered, in a loose head, at the end of a short (one to three inches) stem.

Plate 31 showing staminate plant on the left and pistillate plant on the right, both natural size.

Buffalo grass was formerly very common in all parts of the state. At present, it is exceedingly rare in the Sioux Valley; but as one goes further west it becomes more plentiful. In many parts of the James Valley it is still quite common. It is most abundant in the region west of the Missouri river, but furnishes a small amount of pasturage as compared with the blue grama. It is very nutritious and hence is much sought after by stock of all kinds. As a winter forage it is without an equal. As long as stock can get plenty of this grass they will keep in excellent condition without any other food. It is rapidly giving way to other stronger growing grasses and the probabilities are that within a comparatively short period of time, it will be very scarce throughout the entire Missouri Valley. In Nebraska it is already very rare except in the western counties. The specimens analyzed were collected at Iroquois the first of August, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.24	—
Ash	10.38	11.19
Ether Extract.....	2.28	2.46
Crude Fibre.....	26.66	28.74
Crude Protein.....	5.19	5.60
N.-free Extract.....	48.25	52.02
Total Nitrogen.....	.83	.89
Albuminoid Nitrogen.....	.67	.72

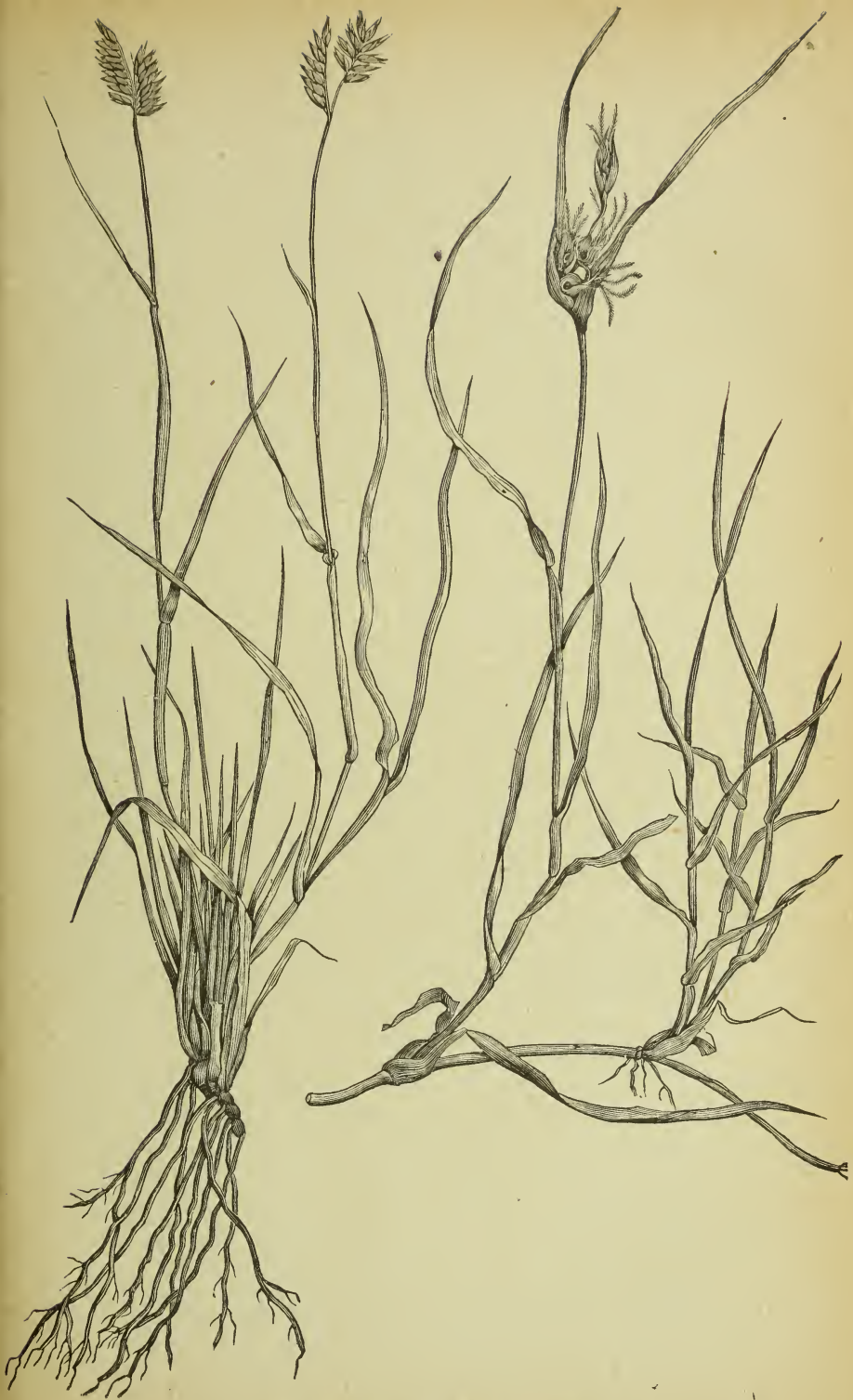


PLATE 31—Buffalo Grass.

SLOUGH GRASS.

(*Beckmannia erucaeformis uniflora* Scribn.)

Stems stout, erect or bent at the lower joints, usually tufted, one to four feet high, from perennial, fibrous roots; leaves broad and flat, four to eight inches long, with rough blades and smooth sheaths; panicle narrow, upright, one-sided, the short, crowded, spike-like branches densely flowered throughout; spikelets whitish, compressed, nearly circular in outline, abruptly pointed, one flowered; empty glumes boat-shaped, inflated; flowering glume acute.

This grass occurs throughout the state in sloughs and other wet marshy places. It is most plentiful in the Sioux and James Valleys. Though harsh and woody when old it is quite palatable when young and is readily eaten by stock. It often occurs in such quantities as to constitute an important part of the forage of low pasture lands. It may be easily recognized by the peculiar spike-like branches of the panicle, which remind one of the rattles of a rattle-snake.* For this reason it is sometimes called "rattle-snake grass." It often becomes very plentiful about artesian wells after they have been running for sometime and may yet prove to be of value under cultivation. The specimens analyzed were cut on the College farm, June 30th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.58	—
Ash	7.82	8.46
Ether Extract.....	1.94	2.10
Crude Fibre.....	35.61	38.53
Crude Protein.....	5.71	6.18
N.-free Extract.....	41.34	44.73
Total Nitrogen.....	.91	.99
Albuminoid Nitrogen.....	.81	.87

FALSE BUFFALO GRASS.

(*Munroa squarrosa* Torrey.).

Stems wiry, rough, prostrate and creeping, very much branched, (the branches coming out in clusters) rooting at the joints; roots annual, fibrous; leaves numerous, clustered, short, rigid, with very sharp, spine-like points, rough, strongly nerved, margins often whitish; spikelets three-flowered, in clusters at the ends of the branches and surrounded by a whorl of leaves; whole plant pale green and glaucous.

A weedy grass of little or no value agriculturally. It is found in sandy soil along the Missouri, Cheyenne and other streams in the western part of the state. It often occurs in the bare places about ant hills and the seeds are thought to be used by the ants for food. The grass may be readily recognized by its clustered, sharp-pointed leaves and matted habit of growth. The mats are often several feet in extent. The specimens analyzed were collected at Forest City the 1st of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.20	—
Ash	16.90	17.83
Ether Extract	1.74	1.84
Crude Fibre	29.34	30.95
Crude Protein	6.58	6.94
N-free Extract	40.24	42.45
Total Nitrogen	1.05	1.11
Albuminoid Nitrogen .....	.83	.88

REED GRASS.

(Phragmites vulgaris (Lam.) B. S. P.)

Stems very tall and stout, five to ten or more feet high and sometimes almost an inch in diameter, from very coarse fibrous roots and large, scaly creeping stems which are at or near the surface of the ground; leaves broad (one to two inches) and flat, smooth; panicle very large, loose, more or less nodding, about one foot long, reddish, becoming woolly at maturity. Plate 32.

This is the tallest and coarsest grass found in the state. It has a very wide distribution and grows in shallow water in ponds and sloughs and along the margins of lakes and larger streams. Stock seldom eat it except when it is young or when the better grasses are scarce. It is sometimes cut for early hay. In sandy soil along the Missouri River the creeping stems often grow to a great length. Each joint of the stem strikes root and gives rise to an upright stem bearing leaves and flowers. The large panicles are often used for decorative purposes. The specimens analyzed were obtained on the College farm the first of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.54	—
Ash.....	6.60	7.14
Ether Extract.....	2.65	2.87
Crude Fibre.....	36.08	39.02
Crude Protein.....	8.42	9.11
N.-free Extract	38.71	41.87
Total Nitrogen	1.35	1.46
Albuminoid Nitrogen.....	1.08	1.16



PLATE 32—Reed Grass,

Mark. del.

SPIKE GRASS.

(*Diplachne fascicularis* (Lam.) Beauv.)

Stems weak, branching, spreading, ascending from a decumbent base, smooth and soft, twelve to eighteen inches long, from annual fibrous roots; leaves smooth, long (often exceeding the stems in length), with long, tapering points, the uppermost at first sheathing the base of the paniculate spikes; spikes one to four inches long, loosely arranged on one side of the central axis, spikelets about one-half of an inch long, short-stalked, seven to eleven flowered, greenish or purplish; flowering glume hairy margined near the base, roughish on the back, toothed at the apex, with a short awn.

This grass occurs sparingly in the eastern and central part of the state. It grows only in wet places and in shallow water. It makes a soft and very palatable forage but is too scarce to be of much importance. The specimens analyzed were collected in Potter county in the early part of September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.55	—
Ash	9.08	9.73
Ether Extract.....	1.96	2.10
Crude Fibre.....	33.95	36.37
Crude Protein.....	8.89	9.52
N.-free Extract.....	39.47	42.28
Total Nitrogen.....	1.42	1.52
Albuminoid Nitrogen.....	1.01	1.08

SLENDER MEADOW GRASS.

(*Eragrostis pilosa* (L.) Beauv.)

Stems slender, upright or more often bent at the lower joints, branching, smooth, six to fourteen inches high, from annual fibrous roots; leaves narrow, flat, soft, pointed; panicle oblong, becoming more or less elongated, rather thickly flowered, the branches at first erect but spreading at flowering time; spikelets lead-colored, one-third of an inch or less in length, equalling somewhat shorter than the pedicels, five to twelve flowered; glumes obtuse; the flowering glume broadly ovate with a single nerve.

Slender meadow grass is a weedy annual, introduced from the Old World and found but sparingly in the Sioux Valley. It grows chiefly in waste places and along roadsides and is of no agricultural importance. The specimens analyzed were collected at Brookings in the early part of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.59	—
Ash	9.43	10.10
Ether Extract.....	2.28	2.44
Crude Fibre.....	26.89	28.79
Crude Protein.....	14.23	15.23
N.-free Extract.....	40.58	43.44
Total Nitrogen.....	2.28	2.44
Albuminoid Nitrogen.....	1.73	1.86

STINK GRASS.

(*Eragrostis multiflora* (Forsk.) Asch.)

Stems bent at the lower joints, diffusely spreading and ascending, smooth, internodes exceeding the sheaths of the leaves, eight to eighteen inches long, from annual, fibrous roots; leaves broad, flat, smooth, two to six inches long; panicle large, oblong or pyramidal, three to six inches long, loosely or compactly flowered; spikelets ten to fifty flowered, one-fourth to three-fourths of an inch long, lead-colored, whitish when old; flowering glume with a rough keel and conspicuous lateral nerves. Plate 33.

Stink grass or, as it is sometimes called, candy grass, is a native of the Old World that has become naturalized in many parts of the United States. It is quite common in South Dakota, particularly in the older settled portions. The grass is coarse and weedy and has such a disagreeable odor while fresh that animals do not relish it. This odor disappears upon drying the grass hence the hay is more palatable. Stink grass thrives on a variety of soils and under favorable circumstances often becomes a weed. As it is an annual, it is not difficult to keep in check with proper cultivation. It is scarcely to be regarded as of much importance either as a forage plant or as a weed. The specimens from which the analysis was made were collected at Brookings on the 8th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.76	—
Ash	10.09	10.82
Ether Extract.....	2.60	2.15
Crude Fibre.....	35.83	38.43
Crude Protein.....	13.41	14.38
N.-free Extract.....	31.91	34.22
Total Nitrogen.....	2.15	2.30
Albuminoid Nitrogen.....	1.55	1.66

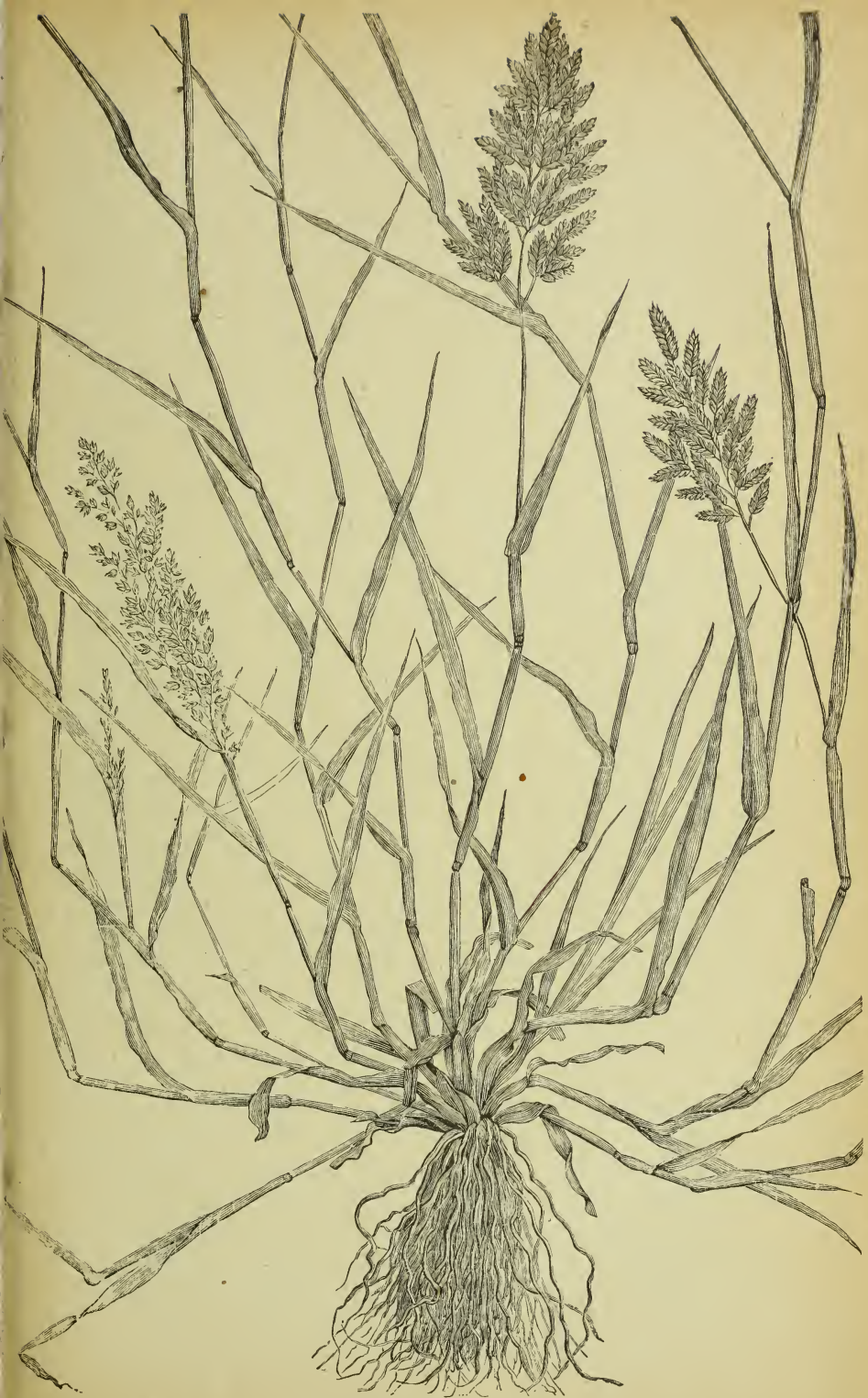


PLATE 33—Stink Grass.

SOUTHERN SPEAR GRASS.

(Eragrostis purshii Schrad.)

Stems slender, sparingly branched from near the base, bent at the lower joints, then upright, six inches to two feet high, smooth; roots fibrous; leaves narrow, pointed, flat, softish, smooth; panicle large, elongated, open, with widely spreading capillary branches; spikelets lead-colored, five to eighteen flowered, usually much shorter than the roughish pedicels; glumes acute; the flowering glume with three nerves.

This grass is not uncommon in the eastern and southern parts of the state. It is very close to the preceding species but is generally larger with larger and more spreading panicles, larger spikelets and three-nerved flowering glumes. Stock eat it readily as a forage but it is too scarce to be of much value. It usually grows in waste places and along roadsides. The specimens analyzed were collected at Brookings in August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.48	—
Ash.....	12.11	12.81
Ether Extract.....	1.73	1.83
Crude Fibre.....	25.61	27.10
Crude Protein.....	10.94	11.57
N.-free Extract.....	44.13	46.69
Total Nitrogen.....	1.75	1.85
Albuminoid.....	1.37	1.45

EARLY OR PRAIRIE BUNCH GRASS.

(Eatonia obtusata (Michx.) Gray.)

Stems erect, rather slender, unbranched, tufted, roughish, from fourteen inches to two and one-half feet high; roots perennial, fibrous; leaves numerous, flat, rough, two to six inches long; panicle dense, spike-like, interrupted, three to five or six inches long; spikelets small, crowded; upper empty glume, obovate, with a rounded obtuse apex.

Early bunch grass is quite widely distributed throughout the state but is most plentiful in the eastern and southeastern parts. It grows well on nearly all dry soils but does best on the moister prairies. It is one of the earliest of our native species, ripening its seeds in June or July. Wherever it occurs in any considerable quantity it is a valuable grass for both hay and pasture. This grass and wild June grass furnish a large amount of early pasturage in many localities in the eastern half of the state and are important elements in most of the upland pastures. The specimens analyzed were cut on the College farm on the 15th of July, 1891, and were just going out of bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.64	—
Ash	12.72	13.77
Ether Extract.....	2.38	2.58
Crude Fibre.....	30.22	32.72
Crude Protein.....	7.01	7.59
N.-free Extract.....	40.03	43.34
Total Nitrogen.....	1.12	1.21
Albuminoid Nitrogen.....	.97	1.05

EATON'S GRASS.

(*Eatonia pennsylvanica* (Spreng.) Gray.)

Stems erect, slender, simple, tufted, smooth and shining, one and one-half to three and one-half feet in height, from perennial, fibrous roots; leaves flat, rough, three to six inches long; panicle slender, elongated (four to eight inches long), loose, branched, often nodding; spikelets small, loosely arranged on the slender branches of the panicle; upper empty glume narrower than in the preceding species, often with a blunt point.

This grass is found throughout the state but is less common than the preceding species. It prefers low meadows and moist woodlands and is too rare to be of much importance as a forage plant. Whenever it does occur, stock eat it readily. The specimens analyzed were collected along the Sioux River, near Brookings, on the 16th of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.02	—
Ash	12.93	13.76
Ether Extract.....	2.78	2.96
Crude Fibre.....	32.31	34.38
Crude Protein	7.96	8.47
N.-free Extract.....	38.00	40.41
Total Nitrogen.....	1.25	1.33
Albuminoid.....	1.18	1.26

REED FESCUE.

(*Scolochloa arundinacea* (Lilj.) Macm.)

Stems robust, erect, smooth or roughish, three or four feet high, from perennial, creeping root-stocks; leaves narrow, about one-foot long, long-pointed, rough on the margins; panicle narrow, six to ten inches long, branches erect; spikelets about one-third of an inch long, usually three-flowered; empty glumes thin and papery, unequal, the lower three-nerved, the upper one five-nerved, ragged toothed at the apex; flowering glume rather rigid, seven-nerved, the obtuse apex as if gnawed; flowers with a tuft of hairs at the base of each.

This grass seems to be very rare in South Dakota, having been found in but one locality. It grows in shallow water and probably occurs throughout the Sioux Valley. It has little, if any, agricultural value. The specimens analyzed were collected at Brookings on the 20th of June, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.34	—
Ash	7.42	8.01
Ether Extract	1.19	1.28
Crude Fibre	35.30	38.10
Crude Protein	5.71	6.16
N.-free Extract	43.04	46.45
Total Nitrogen .....	.91	.99
Albuminoid Nitrogen .....	.69	.75

PRAIRIE JUNE GRASS.

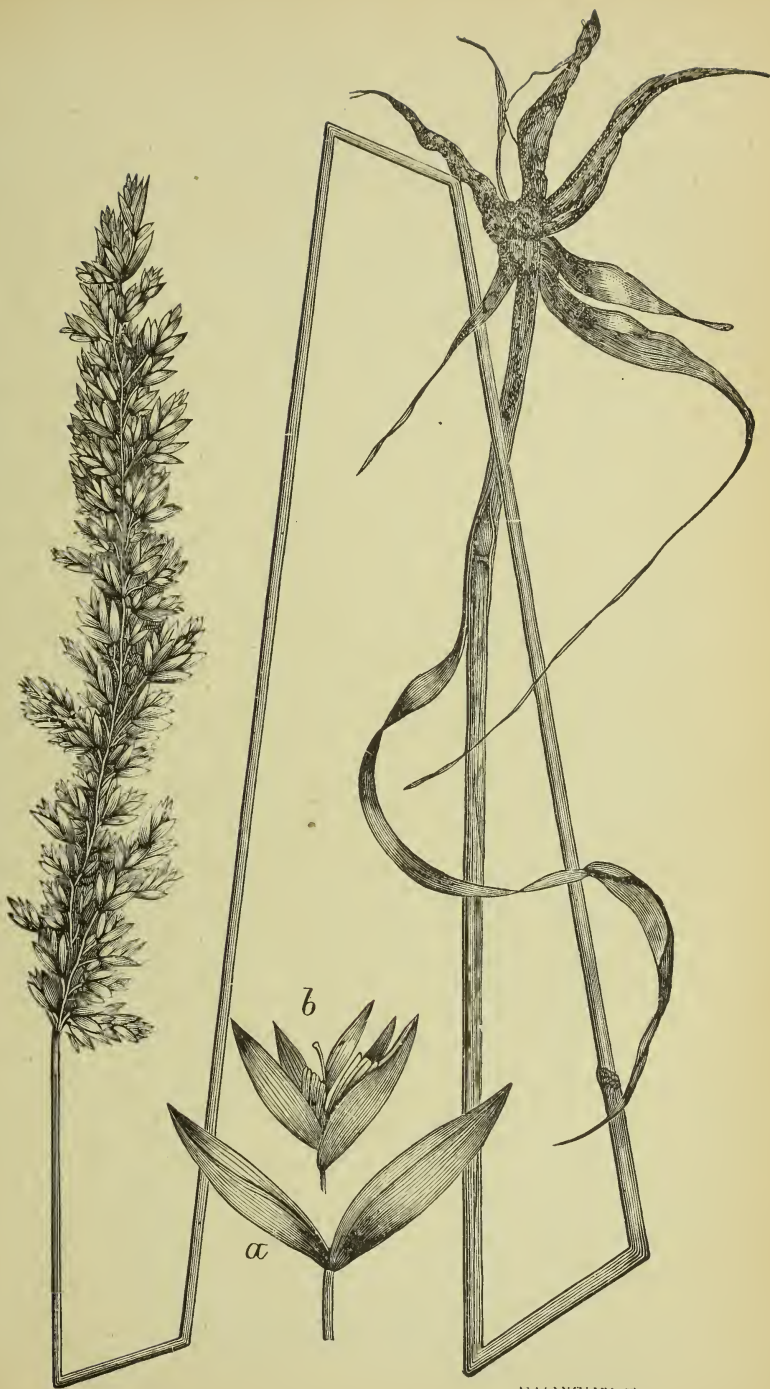
(Koeleria cristata Pers)

Stems erect, tufted, one to two and one-half feet high, from perennial, fibrous roots; leaves flat (or in very dry localities more or less rolled), the root leaves sometimes a foot or more long; whole plant often becoming glaucous and covered with short hairs; panicle narrow and spike-like, more or less interrupted at the base, densely flowered, two to six inches long (usually about three inches); spikelets small, two to four-flowered; glumes keeled, obscurely three-nerved; flowering glume acute or bristle-pointed. Plate 34.

Prairie June grass, wild June grass or prairie bunch grass is one of the commonest and one of the earliest grasses of our high prairies. The seeds are usually ripened early in July. The grass is a very valuable one in upland pastures as it thrives on dry hills and sandy prairies and is readily eaten by all kinds of stock. It produces a fine growth of root-leaves which are often a foot to eighteen inches long in favorable localities. Under such circumstances the grass is valuable for early hay. It promises to be of value for cultivation, the quality and yield of the forage being very much improved. The specimens analyzed were collected at Brookings on the 6th of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.89	—
Ash	9.95	10.80
Ether Extract.....	4.33	4.70
Crude Fibre.....	27.59	29.95
Crude Protein.....	7.23	7.84
N.-free Extract.....	43.01	46.69
Total Nitrogen...	1.16	1.26
Albuminoid Nitrogen.....	1.16	1.26



H.H.NICHOLS.

T.TAYLOR.DEL.

PLATE 34—Prairie June Grass.

SALT GRASS.

(Distichlis spicata stricta Thurber.)

Stems erect, tufted, branched, six to eighteen inches high, with wide spreading, perennial, scaly root-stocks, leafy, covered nearly to the top with the numerous, more or less overlapping sheaths; leaves two ranked, rigid, narrow and rolled, smooth, sharp-pointed, usually from three to six inches long; panicle short and spike-like or rather loose (especially on staminate plants); spikelets seldom numerous, straw-colored, ten to twenty flowered, flat, about one-half an inch long; flowering glumes sharply keeled, acute. Plate 35.

Salt grass as its name indicates, grows in saline or alkaline soils, and is plentiful throughout the greater portion of the state. It is usually the chief element of the vegetation about the so-called "burn-outs" or "poison spots" found in various parts of the state. The grass is often cut for hay in the drier regions. It is quite tough and woody and hence the forage is of an inferior quality. When it is fresh animals eat it but are not so fond of it as of most other grasses. The flowers are unisexual and the panicles of the staminate plants are usually somewhat loose and spreading while those of the pistillate plants are close and spike-like. The specimens analyzed were collected at Iroquois on the 1st of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.03	—
Ash.....	9.61	10.45
Ether Extract.....	2.47	2.69
Crude Fibre.....	27.57	29.98
Crude Protein.....	6.99	7.60
N.-free Extract.....	45.33	49.29
Total Nitrogen.....	1.12	1.22
Albuminoid Nitrogen.....	.89	.97

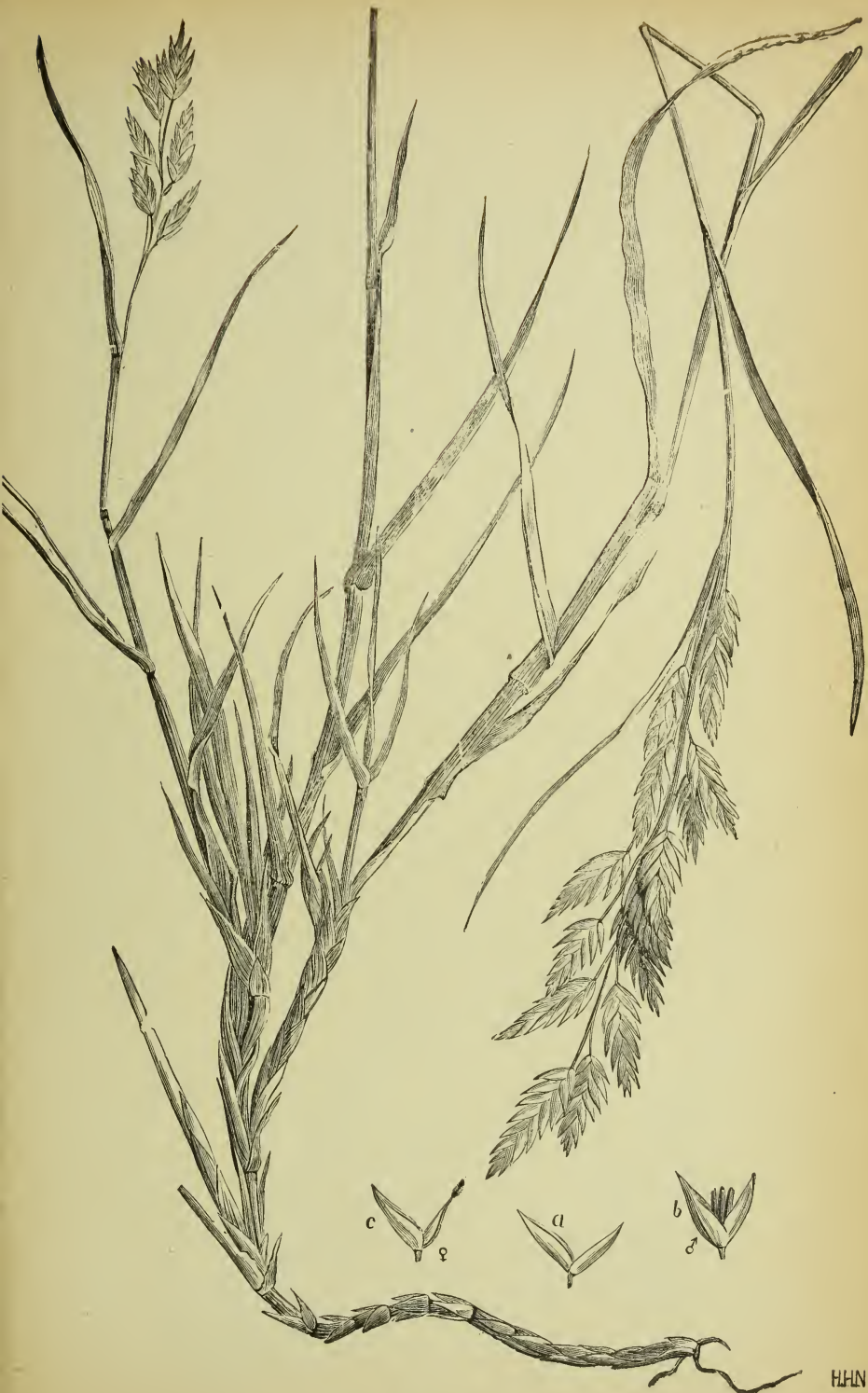


PLATE 35—Salt Grass.

H.H.N.

ORCHARD GRASS.

(Dactylis glomerata L.)

Stems erect, tufted, rough, two to three and one-half feet high, from tough, perennial, fibrous roots, leafy; leaves flat and broad, often eighteen inches long, rough on both sides, light green, often glaucous; panicle composed of compact clusters of flowers, the lower branches spreading, the upper ones short and crowded; spikelets three to four flowered, pale green, about one-fourth of an inch long, on short, rough stalks. Plate 36.

Orchard grass is a native of the Old World where it is a great favorite as a forage plant. It is also very highly prized in the eastern states. It makes a strong, rank growth, starts early in the spring, stands drouth better than timothy, gives rather a heavier yield, and is not so hard on the soil. As it ripens about the same time as clover, the two make an excellent mixture for hay. Orchard grass is readily eaten by all kinds of stock, sheep being particularly fond of it. The seed grows readily and should be sown thickly as the grass has a tendency to grow in clumps if thin on the ground. For this reason it is best to sow it in connection with clover or with other grasses. Under proper condition this grass has a long season of growth yielding a larger amount of forage throughout the year than most other common grasses. It should be cut while in bloom and when in pasture should be grazed closely and not allowed to seed very much. The specimens analyzed were cut on the College grounds on the 30th of June, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.51	—
Ash	10.00	10.58
Ether Extract.....	4.91	5.20
Crude Fibre.....	25.84	27.34
Crude Protein.....	13.78	14.58
N.-free Extract.....	39.96	42.29
Total Nitrogen.....	2.21	2.33
Albuminoid Nitrogen.....	1.56	1.67

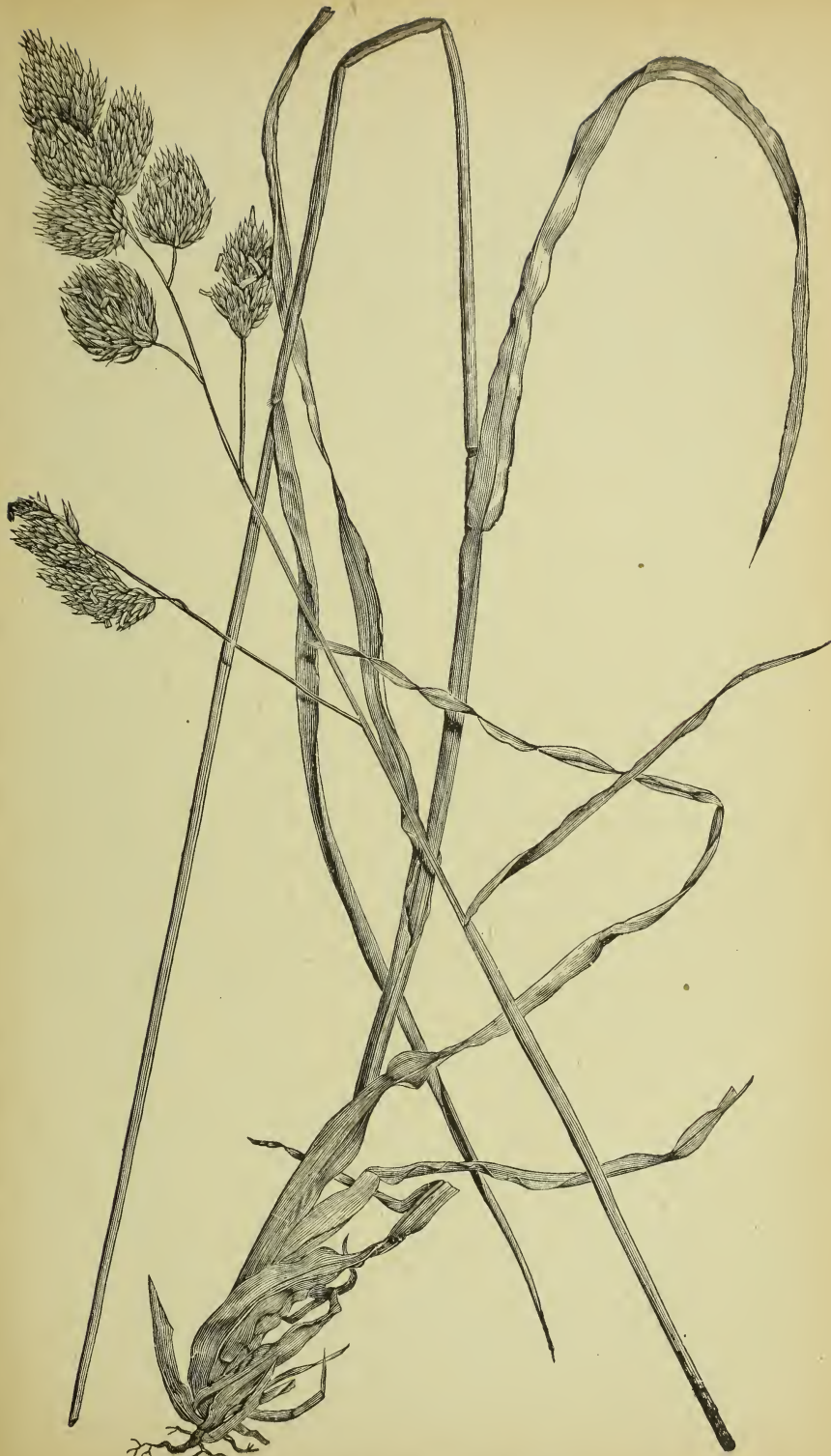


PLATE 36—Orchard Grass,

FALSE RED TOP OR FOWL MEADOW GRASS.

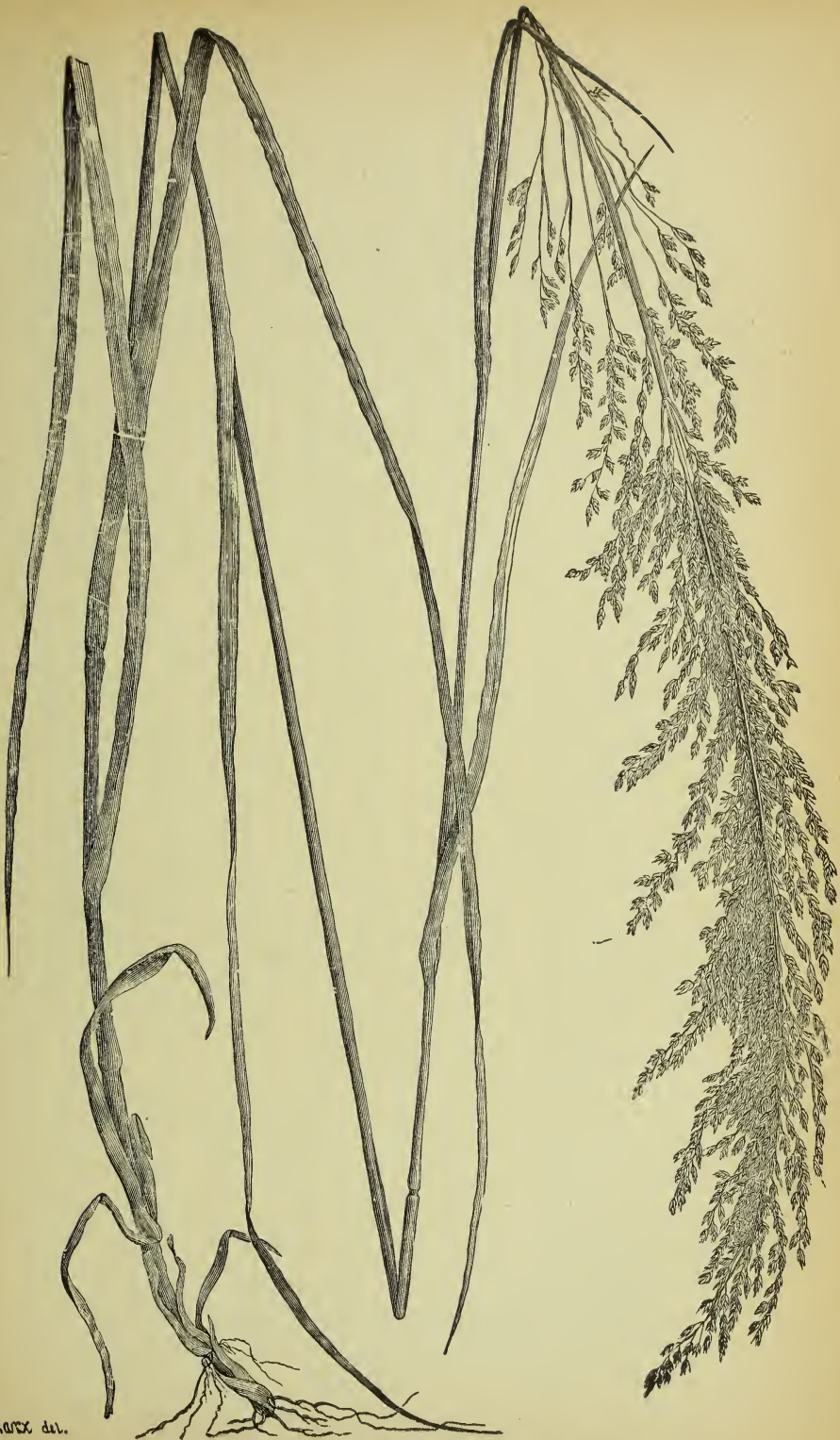
(Poa palustris L.)

Stems erect, tufted, one and one-half to three feet high, from perennial, fibrous roots, leafy; leaves narrow, three to six inches long, smooth, soft; ligule elongated; panicle large, oblong, five inches to one foot long, often nodding, the branches rather short and rough; spikelets small, green or purplish, two to four flowered; empty glumes narrow; flowering glume faintly nerved. Plate 37.

Fowl meadow grass is quite plentiful in low native meadows in the eastern part of the state. It also occurs in the Black Hills, but is found but rarely in the central regions. It affords an abundance of forage of a superior quality. In the eastern states this grass is valued very highly. It does not make a dense sod like that of Kentucky blue grass, hence is most satisfactory when used in mixtures. Seed is produced in abundance and catches readily making the grass an easy one to propagate. It is an excellent grass for meadows that are occasionally overflowed. Unlike many of our grasses it does not become harsh and woody as soon as the seeds are ripened, but remains so soft, pliable and nutritious that stock will eat it without waste. It does well under cultivation on suitable soil and is worthy of trial by all who are trying to establish good meadows. The specimens analyzed were cut on the College farm, July 15th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.55	—
Ash.....	7.39	7.99
Ether Extract.....	2.50	2.70
Crude Fibre.....	30.20	32.67
Crude Protein.....	8.69	9.40
N.-free Extract.....	43.67	47.24
Total Nitrogen.....	1.39	1.50
Albuminoid Nitrogen.....	1.17	1.26



Marx del.

PLATE 37—False Red-Top.

KENTUCKY BLUE GRASS.

(Poa pratensis L.)

Stems erect, smooth, tufted at first, but spreading rapidly by means of the strong, creeping, root-stocks and at length forming a firm even sod, usually from one to three feet high; perennial; root-leaves long, narrow, flattish, channeled, smooth, rough on the margins, rather abruptly pointed; stem-leaves short, otherwise like the root-leaves; ligule short and blunt; panicle pyramidal, usually three or four inches long, open; spikelets rather small, three to five flowered; flowering glumes distinctly five-nerved, hairy below. Plate 38.

This is one of the best pasture grasses grown in the United States. It usually thrives on almost any soil. It is not so good for hay as the heavier, ranker growing grasses. It is the basis of all lawn mixtures because of its hardness and because of its ability to crowd out weeds and form a dense sod. All kinds of stock eat it greedily. It is very nutritious and in time of drouth it dries retaining its nourishing properties, hence is still readily eaten by stock. It has done well on the College grounds as well as in many other parts of the state. It does not do so well on very dry, sandy, soils. Old, worn out pastures may often be reclaimed by being sown to blue grass. It makes an excellent sheep pasture, particularly when mixed with smaller fescues. The specimens analyzed were cut from the experimental plats on the College farm on the 7th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.70	—
Ash.....	7.17	7.77
Ether Extract.....	2.93	3.17
Crude Fibre.....	31.74	34.39
Crude Protein.....	7.65	8.29
N.-free Extract.....	42.81	46.38
Total Nitrogen.....	1.23	1.33
Albuminoid Nitrogen.....	1.23	1.33

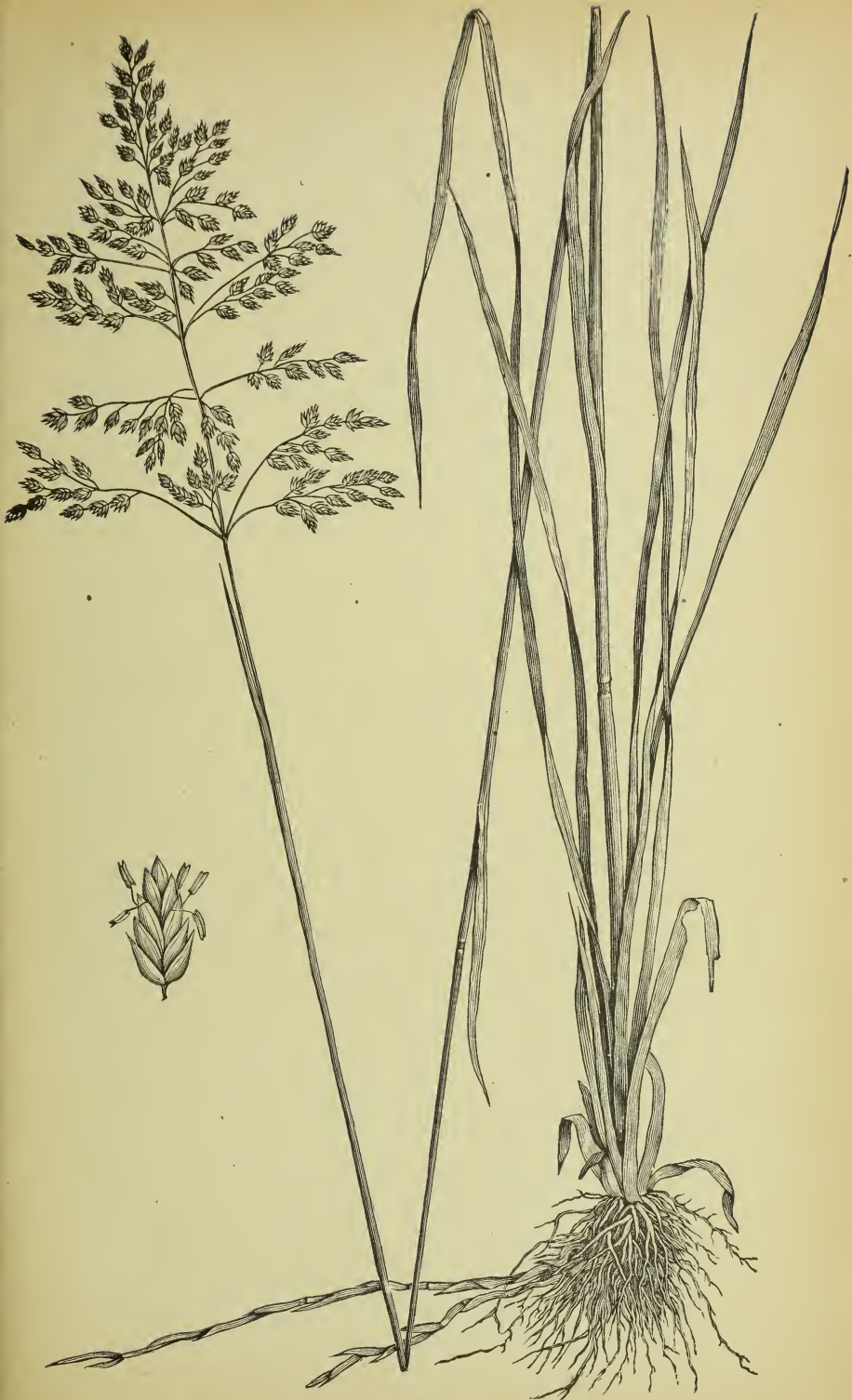


PLATE 38—Kentucky Blue Grass.

CREEPING SPEAR-GRASS, ENGLISH BLUE GRASS
OR WIRE GRASS.

(*Poa compressa* L.)

Stems flattened, bent below, then upright, usually a foot to eighteen inches high, rigid and wiry, from tough, perennial, running root-stocks; leaves short and narrow, rigid, bluish green; panicle short and narrow, one to three inches long, rather dense; spikelets very short stalked, flat, three to ten flowered; flowering glumes only slightly hairy on the margins and keel. Plate 39.

This is often found in cultivation as an introduced grass but is also found in many parts of the state growing naturally. It may be readily recognized by its flat stems and creeping habit. It is very hardy and makes a good pasture but does not yield as well as Kentucky blue grass. It thrives well on soil so poor that few other grasses would live upon it at all. Stock eats it readily and does well upon it. It is not so good for the lawn as Kentucky blue grass because it does not make a good growth of root leaves. It is perfectly hardy and is very persistent. The specimens analyzed were cut from the experimental plats on the Station grounds on the 13th of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.47	—
Ash	5.37	5.74
Ether Extract.....	2.78	2.97
Crude Fibre.....	31.55	33.73
Crude Protein.....	6.78	7.25
N.-free Extract.....	47.05	50.31
Total Nitrogen.....	1.09	1.16
Albuminoid Nitrogen .....	.95	1.01

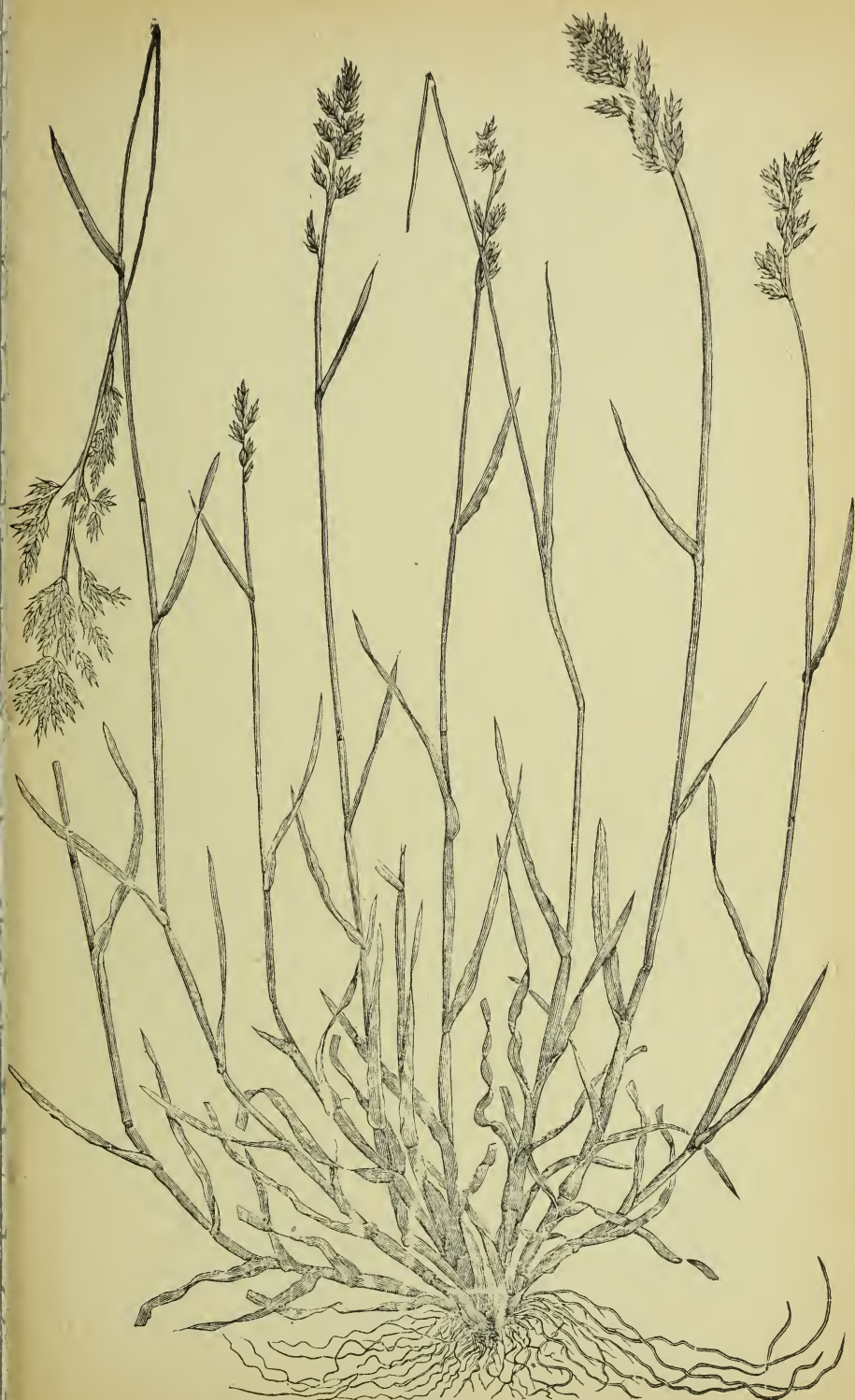


PLATE 39—Creeping Spear-Grass.

BUNCH SPEAR GRASS.

(Poa arida Vasey in litt.)

Stems slender, erect, densely tufted, rather rigid, usually eight inches to two feet high, smooth; perennial; root-leaves rather numerous, pointed, flattish, about half as long as the stem; stem leaves seldom more than two, short, rigid and pointed, the blade of the upper one often less than one-half of an inch long; panicle narrow, rather dense, usually one to three inches long; spikelets rather large, three to seven flowered, usually tinged with purple; empty glumes acute; flowering glume obscurely nerved, hairy on the back and on the margins, with a broad, dry, thin, obtuse apex. Plate 40. (Our specimens have more root-leaves than are shown in the illustration.)

This grass seems to be quite generally distributed throughout the state, though it is apparently most plentiful in the eastern part. It occurs in dry meadows and in the Sioux Valley it is often plentiful enough to afford considerable forage. It has something of the appearance of Kentucky blue grass but is generally smaller, with smaller panicle, shorter leaves, and without the strong, creeping root-stocks of that species. It seems to be worthy of more trial under cultivation. The specimens analyzed were cut on a native meadow, near Brookings, July 6th, 1892. This is the *Poa andina* of Nuttall and American authors generally but not that of Trinius which is a Chilean species.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.10	—
Ash	8.80	9.47
Ether Extract.....	2.17	2.34
Crude Fibre.....	34.63	37.28
Crude Protein.....	4.88	5.25
N.-free Extract.....	42.42	45.66
Total Nitrogen.....	.78	.84
Albuminoid Nitrogen.....	.78	.84



O. HEIDEMANN'S.
PLATE 40—Bunch Spear Grass.

WOOD MEADOW GRASS.

(Poa nemoralis L.)

Stems slender, erect, tufted, rigid, roughish, twelve to twenty inches high, from perennial, fibrous roots; leaves rather short, narrow, flattish or soon becoming rolled, rough; ligule short; panicle contracted, about three inches long, the branches very rough; spikelets very small, two to five flowered, usually purplish; empty glumes sharp-pointed; flowering glume hairy on the margins and keel, and rather obtusely pointed.

This grass is more or less common in rather moist woodlands throughout the state. It is quite abundant in the Sioux Valley, in the Black Hills, and in some localities along the James Valley. It sometimes yields considerable forage, particularly in wood-land pastures. The specimens analyzed were collected at Lake Hendricks the 1st of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.92	—
Ash	9.63	10.24
Ether Extract.....	2.27	2.41
Crude Fibre.....	27.75	29.50
Crude Protein.....	7.40	7.87
N.-free Extract.....	47.03	49.99
Total Nitrogen.....	1.18	1.26
Albuminoid Nitrogen.....	.87	.93

FLOATING MEADOW GRASS.

(*Panicularia fluitans* (L.) O. K.)

Stem smooth, upright, from a creeping, rooting base, two to four feet long; roots perennial; leaves six inches to a foot or more in length, roughish; panicle narrow, about one foot long, with simple, appressed branches; spikelets not numerous, seven to thirteen flowered, linear, one-half to one inch long, greenish; flowering glume oblong, obtuse or somewhat pointed, entire or sometimes toothed.

This grass occurs quite frequently in the Sioux Valley but has not, as yet, been found elsewhere in the state. It grows only in very wet and muddy places or in shallow water. It is readily eaten by stock but is not plentiful enough to be of much importance as a forage. It could be profitably grown in wet, boggy pastures and is a valuable grass in game preserves being a favorite food of all kinds of water-fowl. The specimens analyzed were cut from sloughs in pastures on the College farm on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.05	—
Ash	8.39	8.84
Ether Extract.....	1.72	1.81
Crude Fibre.....	29.36	30.92
Crude Protein.....	8.60	9.06
N.-free Extract.....	46.88	49.37
Total Nitrogen.....	1.38	1.45
Albuminoid Nitrogen.....	1.28	1.34

FOWL MEADOW GRASS OR NERVED MANNA GRASS.

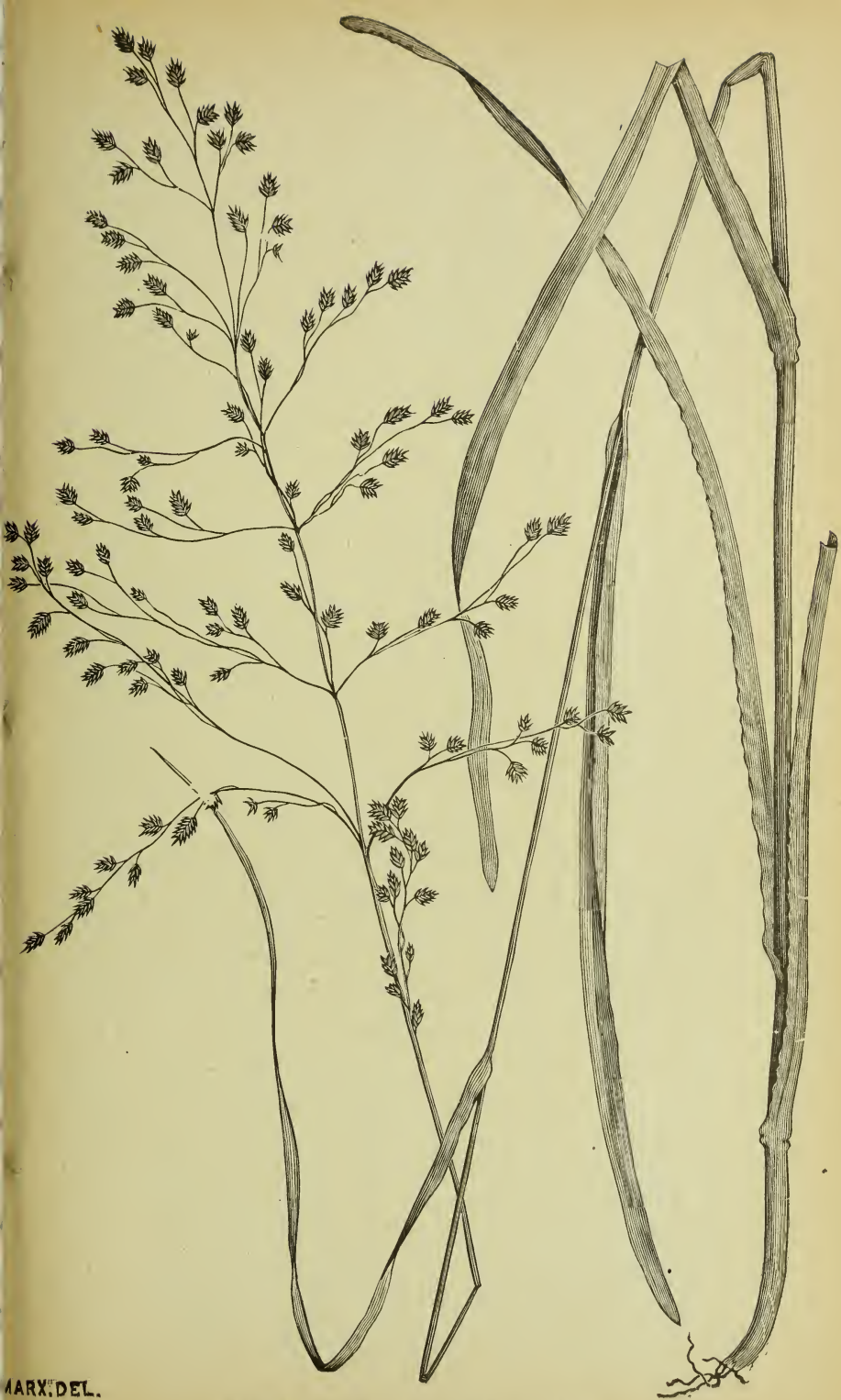
(Panicularia nervata (Willd.) O. K.)

Stems erect, smooth, eight inches to three feet high, from perennial, fibrous roots, often sending out a number of offshoots near the base, leafy; leaves roughish, usually flat, three inches to one foot in length; sheaths closed, rough; panicle four to eight inches long, loose, the branches slender and capillary and at length spreading and drooping; spikelets three to seven flowered, small, either green or purplish; flowering glume strongly seven nerved, more or less pointed. Plate 41.

This is a common grass in low, wet meadows, found generally throughout the state. In the more favored localities it often becomes plentiful enough to yield a large amount of forage. The quality of both hay and pasturage is excellent. In many parts of the United States this grass is thought to be of great value for use in moist pastures and meadows. It has been cultivated in England with good success. It would be a good grass to use in reclaiming some of our lake beds. The specimens analyzed were collected in the College pastures the 1st of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.64	—
Ash.....	8.69	9.31
Ether Extract.....	2.12	2.27
Crude Fibre.....	31.25	33.47
Crude Protein.....	4.32	4.63
N.-free Extract.....	46.98	50.31
Total Nitrogen.....	.69	.74
Albuminoid Nitrogen.....	.61	.65



MARX, DEL.

PLATE 41—Fowl Meadow Grass.

REED MEADOW GRASS.

(*Panicularia americana* (Torr.) MacM.)

Stems robust, erect, smooth, three to five feet high, from perennial roots; leaves large (often as much as two feet long and one-half of an inch wide), smooth beneath and rough on the upper side and on the margins; panicle very large, about one foot long, usually purplish, much branched, the branches more or less spreading; spikelets numerous, three to six flowered; flowering glume seven nerved, not toothed at the tip. Plate 42.

Rather a coarse grass occurring throughout the state in shallow water or in very wet soil. It often furnishes a considerable amount of forage in low, boggy meadows. It is readily eaten by stock and is useful in reclaiming sloughs and old lake beds. It is quite abundant in the Sioux Valley. The specimens analyzed were cut on the College farm June 30th, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.71	—
Ash	8.74	9.47
Ether Extract.....	1.71	1.85
Crude Fibre.....	31.54	34.18
Crude Protein.....	7.92	8.58
N.-free Extract.....	42.38	45.92
Total Nitrogen.....	1.27	1.37
Albuminoid Nitrogen.....	.98	1.07



PLATE 42—Reed Meadow Grass.

SHEEP'S FESCUE.

(Festuca ovina L.)

Stems slender, densely tufted, erect, six to eighteen inches high, from tough, perennial, fibrous roots; leaves short, narrow, usually rolled, sharp-pointed, very thickly clustered at the base of the stem; whole plant more or less glaucous; panicle short (one to three inches), narrow, rather one sided; spikelets three to eight flowered (usually about five flowered), one-fourth to one-half an inch long; flowering glume roughish, usually with a short awn. Plate 43.

Some forms of this grass are native to the state as well as to other parts of the United States but the common cultivated forms are introduced. It is one of the most valuable pasture grasses that has been tried on the Station grounds. It is perfectly hardy and is particularly well adapted to dry upland pastures, thriving on rocky and sandy soils. It is most useful as a sheep forage. The flowers open in June and July and the seeds soon ripen but the leaves remain green and fresh until late in autumn. The specimens analyzed were cut on the College grounds on the 2nd of June, 1891, and were then in bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.41	—
Ash	6.74	7.28
Ether Extract.....	2.83	3.06
Crude Fibre.....	33.13	35.78
Crude Protein.....	5.96	6.44
N.-free Extract.....	43.93	47.45
Total Nitrogen.....	.95	1.03
Albuminoid Nitrogen.....	.84	.91



PLATE 43—Sheep's Fescue.

H.H. NICHOLS. EN

TALL FESCUE.

(Festuca elatior L.)

Stems stout, erect, smooth, two to four feet high; roots perennial, fibrous or sometimes creeping; leaves large (six inches to a foot or more long) flat, pointed; panicle six to ten inches long, rather narrow, contracted, except during flowering, erect, somewhat one sided, with short branches; spikelets five to ten flowered, crowded, lanceolate, about half an inch long; flowering glume five nerved, either with or without short awn. Plate 44.

Tall fescue is an extremely variable grass, a native of the Old World which has been widely introduced into the United States. Throughout the Eastern and Southern States it is regarded as a very valuable grass. Besides the common form there are two others ordinarily found under cultivation. One of these is smaller than the type and is known as "Meadow fescue" (*Festuca pratensis*); the other is larger than the type and may be known as "Tall meadow fescue" (*Festuca elatior arundinacea*). On the Station grounds both meadow fescue and tall meadow fescue have proven of more value than tall fescue, and of the two the first is perhaps to be preferred. These fescues do best with us on low moist soil though in the East and South they thrive on all kinds of soil. They are very largely used in the South for winter grazing and are often called "Evergreen grass." They may be used in our state in meadow and pasture mixtures for the richer, moister soils. The specimens analyzed belong to tall fescue and were cut from the experimental plats on the Station grounds on the 30th of June, 1891, while in bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.22	—
Ash	7.48	8.15
Ether Extract.....	1.66	1.81
Crude Fibre.....	29.95	32.63
Crude Protein.....	6.82	7.43
N.-free Extract.....	45.87	49.98
Total Nitrogen.....	1.09	1.19
Albuminoid Nitrogen.....	1.00	1.10



PLATE 44—Tall Fescue.

NICHOLS

HARD FESCUE.

(Festuca duriuscula L.)

Similar to sheep's fescue but with larger, taller stems (one to two feet high); larger, more open panicles, flat leaves, usually hairy sheaths, larger spikelets and more numerous flowers. The plants are also less densely tufted and generally have a harsher feeling. Usually regarded as a variety of the preceding.

This fescue is occasionally cultivated and is probably also indigenous to some parts of the state. It forms a better sod than the sheep's fescue and is perhaps to be preferred as a general forage plant. Red fescue (*Festuca rubra* L.) is very similar to this grass and like it forms an even sod than sheep's fescue. It grows about the same size as hard fescue and may be distinguished from both that and sheep's fescue by its habit of spreading by slender creeping root-stocks, and by its generally more grayish color (often tinged with red). Both of these grasses have been grown along with sheep's fescue and are perfectly hardy. They will be useful in dry pastures. The specimens of hard fescue analyzed were cut from the experimental plats on the Station grounds the 1st of June, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.95	—
Ash.....	8.36	8.89
Ether Extract.....	1.85	1.97
Crude Fibre.....	32.58	34.64
Crude Protein.....	8.12	8.63
N.-free Extract.....	43.14	45.87
Total Nitrogen.....	1.30	1.38
Albuminoid.....	.97	1.03

SOFT CHESS.

(Bromus mollis L.)

Stems erect or bent at the lower joints, tufted, smooth or hairy where not covered by the sheath, one to two feet high, from biennial, fibrous roots; leaves numerous, both blades and sheaths more or less densely soft-hairy; panicle rather erect, contracted in fruit, three or four inches long, the branches short causing the spikelets to be more or less clustered; spikelets five to ten flowered, ovate, flattish, downy, one-half to three-fourths of an inch long; flowers closely imbricated; lower empty glume three nerved, the upper five nerved; flowering glume acute, seven to nine nerved, equalling its spreading awn.

Soft chess is a native of the Old World which is occasionally introduced, usually in the seeds of small grain or other grasses. It may be recognized by the soft, downy character of the whole plant and by its contracted panicle. It seems perfectly hardy and may prove to be of considerable value as a forage. In many parts of the East it is regarded as a troublesome weed and hence should be handled with care. The sample intended for analysis was lost. The analysis, probably, would not vary widely from that of an undetermined species of brome grass which follows:

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.86	—
Ash	7.62	8.36
Ether Extract	2.03	2.23
Crude Fibre.....	28.34	31.10
Crude Protein.....	6.82	7.48
N.-free Extract.....	46.33	50.83
Total Nitrogen.....	1.09	1.20
Albuminoid Nitrogen.....	1.03	1.13

ROUGH BROME GRASS.

(Bromus asper L?)

Stems erect, slender, rough or smooth, from one to two or more feet high, from perennial fibrous roots; leaves linear-lanceolate, rather long, pointed, rough, often with long spreading hairs; sheaths nerved, more or less hairy; panicle small; spikelets five to nine flowered, about an inch long; lower empty glume one nerved, upper three nerved; flowering glume rather indistinctly five nerved, acute with an awn shorter than itself; flowers not crowded.

This grass was introduced in other grass seed. It does not agree in all respects with the published descriptions of the European species but seems to come nearer to it than to anything else. It is very hardy and yields a large amount of forage. The growth of root-leaves is abundant, affording excellent pasturage. The grass will bear further experimentation. The specimens analyzed were cut May 20th, 1891, on the experimental plats on the College farm where it formed an excellent mixture with tall oat grass.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.33	—
Ash.....	8.90	9.71
Ether Extract	3.26	3.56
Crude Fibre.....	29.01	31.65
Crude Protein.....	8.98	9.80
N.-free Extract	41.52	45.29
Total Nitrogen	1.44	1.57
Albuminoid Nitrogen.....	1.20	1.31

SWAMP CHESS.

(Bromus ciliatus L.)

Stem stout, erect, smooth or somewhat hairy, three to five feet high, from perennial fibrous roots; leaves large (six to ten inches long and one-fourth to one-half of an inch wide), flat, smooth or some what hairy (especially on the sheaths); panicle large and compound, loose, the branches spreading and drooping; spikelets loosely seven to twelve flowered, one-half to three-fourths of an inch long; lower empty glume one nerved, the upper three-nerved; flowering glume seven nerved, silky hairy near the margins, longer than its awn.

This grass is quite common along river banks and in moist woods, occurring throughout the state but perhaps more plentiful in the Sioux Valley and Big Stone region. It is quite variable, being nearly smooth in the common form or quite uniformly hairy in variety *purgans*. Though so widely distributed it is of very little agricultural value. The specimens analyzed were collected near White on the 17th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.73	—
Ash	8.00	8.77
Ether Extract	3.00	3.29
Crude Fibre.....	30.75	33.69
Crude Protein.....	7.75	8.49
N.-free Extract.....	41.77	45.76
Total Nitrogen	1.24	1.36
Albuminoid Nitrogen.....	.92	1.01

SMOOTH BROME GRASS.

(Bromus inermis L.)

Stems erect, robust, smooth, one and one-half to four feet high, from slender, perennial, creeping root-stocks and fibrous roots, leafy; leaves large, six inches to a foot or more long and one-fourth of an inch or often more in width, long-pointed, rough; panicle erect or nodding, usually about eight inches long, rays simple or somewhat branched; spikelets five to ten flowered (usually about seven flowered), linear, usually an inch or more long; flowers loosely imbricated; flowering glume obtuse, seven nerved, awnless or rarely with a very minute awn. Plate 45.

This grass is a native of Europe and Asia. From the fact that it is said to have been introduced into this country from Austria and Hungary it is often called Austrian or Hungarian brome grass. It is easily distinguished from all other common brome grasses by its smooth, usually beardless glumes or "chaff." This is the best grass that has yet been tried at the Station. When properly sown it catches well, giving a good sod the first year; in favorable seasons a fair yield of hay may also be obtained. Up to the present, the best results have been obtained by sowing plenty of seed on well prepared ground as early as possible in the spring. From two to two and one-half bushels should be sown to the acre, depending somewhat upon the season and upon the condition of the soil. The forage, though coarse, is of excellent quality and under ordinary circumstances a large amount of early spring and fall feed may be obtained in addition to a good yield of hay. Thus far the grass has endured drouth perfectly and has never winter killed in the least. The specimens analyzed were cut from the experimental plats on the College farm, July 7th, 1892, and were then just going out of bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.21	—
Ash	7.58	8.08
Ether Extract.....	1.93	2.06
Crude Fibre.....	38.71	41.27
Crude Protein.....	10.12	10.79
N.-free Extract.....	35.45	37.80
Total Nitrogen... ..	1.62	1.73
Albuminoid Nitrogen.....	1.15	1.23



PLATE 45—Smooth Brome Grass.

SCHRADER'S BROME GRASS.

(*Bromus unioloides* Willd.)

Stems erect, smooth, six inches to three feet high, from annual fibrous roots, very leafy; leaves rather long and narrow, rough on the margins and more or less hairy on the sheaths; panicle open, the branches at length drooping; spikelets large (an inch or more long), broad and flat, six to ten flowered; flowering glumes large, many nerved, tapering into a very fine sharp point or short awn.

This is one of the so-called winter grasses of the South where it is considered to be very valuable. The name Rescue grass is sometimes applied to it. It produces a very nutritious, much relished forage. On the Station grounds it has not been a success, some years giving a fair yield, others producing scarcely any forage at all. The specimens analyzed were cut from the experimental plats on the College farm, July 9th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.13	—
Ash	9.03	9.72
Ether Extract.....	2.09	2.25
Crude Fibre.....	32.39	34.88
Crude Protein.....	9.97	10.74
N.-free Extract.....	39.39	42.41
Total Nitrogen.....	1.59	1.72
Albuminoid Nitrogen.....	1.35	1.45

SLENDER WHEAT GRASS.

(*Agropyrum tenerum* Vasey.)

Stems rather slender, erect or bent at the lower joints, tufted, smooth, one and one-half to four feet high, from perennial, fibrous roots, leafy; leaves flat, sharp-pointed, rough, three inches to one foot long; spike very slender, three to ten inches long, nodding; spikelets three to five flowered, a half inch or more long, closely appressed to the stem; empty glumes equal, conspicuously five to seven nerved, about as long as the entire spikelet, sharp-pointed; flowering glume rough, obscurely five nerved, with sharp point or awn.

Slender wheat grass is found more or less abundantly over the entire state. It prefers the moister lands of the bottoms along streams but also occurs on dry soils. It is one of the most promising native grasses grown on the Station grounds, improving rapidly under cultivation. On good, well tilled soil the yield is very heavy. The hay is of excellent quality. There is no danger of this grass ever becoming troublesome as a weed. It is not so valuable for pasturage as western wheat grass. It comes readily from the seed and may be sown either alone or in mixtures with other grasses. The seeds ripen in July. The specimens analyzed were cut on the College farm on the 1st of July, 1891, and were in bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.78	—
Ash	5.29	5.74
Ether Extract.....	2.55	2.77
Crude Fibre.....	29.92	32.44
Crude Protein.....	8.21	8.90
N.-free Extract.....	46.25	50.15
Total Nitrogen.....	1.31	1.42
Albuminoid Nitrogen.....	1.15	1.24

QUACK GRASS, COUCH GRASS.

(Agropyrum repens (L.) Beauv.)

Stems usually robust, erect, green, two to three or even four feet high, from stout, strong growing, creeping root-stocks; leaves numerous, green, rather thin, flat, long and pointed; spike narrow, three to six inches long; spikelets about half an inch long, four to eight flowered, green, smooth, rather closely appressed to the stem; empty glumes five to seven nerved, tapering into a sharp-point or sometimes short-awned; flowering glume usually with an awn of variable length proceeding from its apex. Plate 46.

This is a perennial, weedy grass which possibly occurs throughout the state though it has, as yet, been found in the eastern part only. It is one of the worst pests that can be had in an orchard or in a tree claim. Its greener color, strongly nerved glumes, appressed spikelets, and stronger, creeping root-stocks will serve to distinguish it from the other closely related species. When cut in proper season it affords a very nutritious hay. It is readily eaten by all kinds of stock unless allowed to stand until it has become too dry and woody. The specimens analyzed were cut on the College farm on the 29th of June, 1891 and were then just coming into bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.00	—
Ash	6.93	7.45
Ether Extract	1.93	2.07
Crude Fibre	33.02	35.51
Crude Protein	9.22	9.91
N.-free Extract	41.90	45.05
Total Nitrogen.....	1.48	1.59
Albuminoid Nitrogen.....	1.21	1.30



MARX.DEL.

PLATE 46— Quack Grass,

WESTERN WHEAT GRASS.

(Agropyrum glaucum occidentale Scribn.)

Stem slender or robust, erect, smooth, one to three feet high, from slender creeping root-stocks; whole plant glaucous, green; leaves rather thick, rolled, four to eight inches long, not so numerous as in the preceding species; spike seldom more than four inches long, often with more than one spikelet at each joint, densely flowered; spikelets five to ten flowered, half an inch or more long; flowering glumes rather obscurely five nerved, narrowed into a sharp, short-awned point. Plate 47.

This is one of the commonest grasses in the state. It is particularly plentiful on the "range" and is the most important native forage plant throughout the greater portion of the state west of the Sioux Valley. It is very valuable both for pasturage and for hay. In many parts of the west it goes by the name of Colorado blue stem on account of its bluish or glaucous appearance. This character, together with its more rigid stem and leaves, shorter, more densely flowered spike and more slender root-stocks will serve to distinguish it from quack grass. If this grass is cut too closely for several years in succession the yield becomes lighter each year, particularly if very dry weather prevails. This trouble can be obviated in a large degree by allowing the meadow an occasional year of rest and by occasionally going over it with a short-toothed harrow. The dragging breaks up the creeping root-stocks and then each piece produces a new plant. The specimens analyzed were cut on the College farm on the 12th of August, 1892, and were just past blooming.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.22	—
Ash	7.82	8.52
Ether Extract.....	2.67	2.91
Crude Fibre.....	32.03	34.90
Crude Protein.....	8.99	9.80
N.-free Extract.....	40.27	43.88
Total Nitrogen.....	1.44	1.57
Albuminoid Nitrogen.....	1.18	1.29



PLATE 47—Western Wheat Grass.

W. Schott, del

BEARDED WHEAT GRASS.

Aprogyrum caninum (L.) R. & S.)

Stems rather robust, upright or bent at the lower joints, smooth, from one and one-half to three feet high, from perennial, fibrous roots, leaves narrow, pointed, flat or somewhat rolled, rough and somewhat hairy above, smooth beneath; sheaths smooth; spike closely flowered, about five or six inches long, more or less nodding; spikelets three to five flowered; empty glumes five to seven nerved, sharp-pointed or with awns of variable length; flowering glume five nerved near the tip, awned.

This grass is quite common in the eastern part of the state. It does not agree in all respects with the species as found in the eastern United States, but approaches the next in many respects as also the western *agropyrum divergens* Nees. It often occurs in the meadows and hence is not infrequently found in hay but is probably the least valuable of all the wheat grasses found in the state. The specimens analyzed were collected on the College farm, July 18th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.09	—
Ash	8.00	8.52
Ether Extract.....	1.80	1.92
Crude Fibre.....	41.23	43.90
Crude Protein.....	4.67	4.97
N.-free Extract.....	38.21	40.69
Total Nitrogen.....	.75	.80
Albuminoid Nitrogen .....	.72	.77

BEARDED WHEAT GRASS.

(*Agropyrum unilaterale* Vasey and Scribner.)

Stems erect, sometimes bent at the lower joints, two to four feet high, from perennial fibrous root, leafy; leaves rather long, pointed, rough; spike somewhat one-sided, about six inches long, nodding; spikelets three to four flowered; empty glumes linear, very rough on the back, strongly four to six nerved, equalling or longer than their awns; flowering glume about six nerved above, two-toothed at the apex; awn from one to two inches long, rough and straight.

This is the commonest of the bearded wheat grasses and occurs throughout the state, usually on rather low, moist ground. It produces a good quality of hay and in some localities enters quite largely into the native forage. It may prove to be of value under cultivation. The specimens analyzed were cut near Brookings the last of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.30	—
Ash.....	7.34	7.75
Ether Extract.....	1.71	1.81
Crude Fibre.....	39.43	41.64
Crude Protein.....	5.75	6.07
N.-free Extract.....	40.47	42.74
Total Nitrogen.....	.92	.97
Albuminoid Nitrogen.....	.74	.78

PERENNIAL RYE GRASS.

(Lolium perenne L.)

Stems rather robust, erect or more or less bent at the lower joints, tufted, smooth, one and one-half to three or four feet high, from perennial, fibrous roots, very leafy; leaves narrow, flat, two to six inches long; sheaths smooth, nerved; spike erect, rigid, three to eight inches long; spikelets flat, about half an inch long, placed edgewise upon the zigzag axis of the spike, usually from one-fourth to one-half an inch apart, eight to fifteen flowered; flowering glume rather thick, obscurely nerved, sharp-pointed. Plate 48.

This grass is a native of the Old World which is extensively cultivated in many parts of the United States. In England it is regarded as one of the best hay grasses that can be grown. The variety known as Italian rye grass (*Lolium perenne italicum*) is the most valuable. It may be recognized by its greater growth of stem and leaves and by its bearded glumes. On the Station grounds Italian rye grass has done much better than perennial rye grass. It withstands the drouth of summer and gives a good yield of excellent hay, but it winter kills badly and hence can hardly be regarded as a success. Where irrigation can be had this grass would be well worth an extended trial. The specimens analyzed belong to this variety and were cut from the experimental plats on the College farm, August 8th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.56	—
Ash	10.91	11.93
Ether Extract.....	3.05	3.34
Crude Fibre.....	26.80	29.31
Crude Protein	13.36	14.61
N.-free Extract.....	37.32	40.81
Total Nitrogen.....	2.14	2.34
Albuminoid.....	1.59	1.74

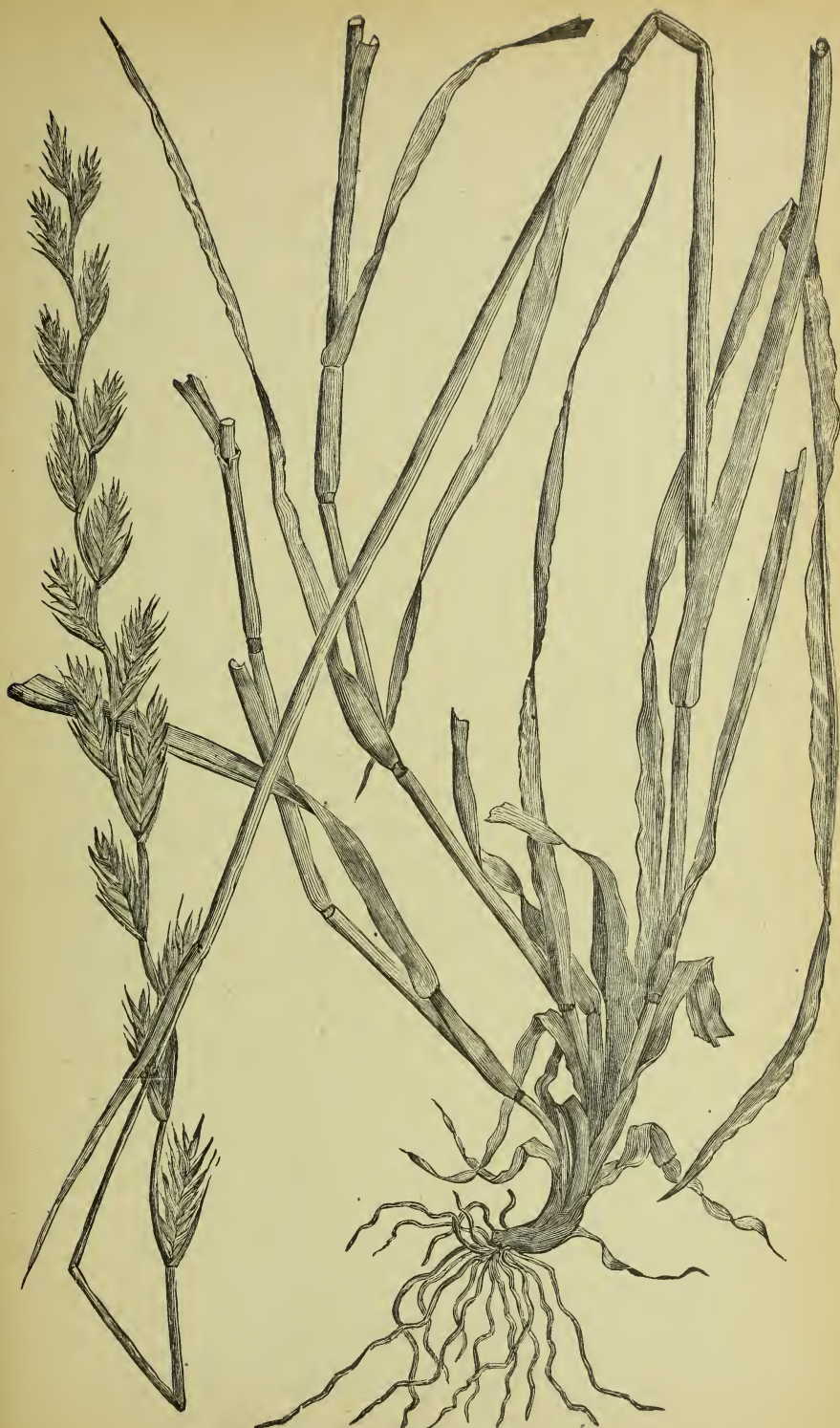


PLATE 48—Perennial Rye Grass.

SQUIRREL-TAIL GRASS.

(Hordeum jubatum L.)

Stems erect, smooth, tufted, eight to eighteen inches high, from annual, fibrous roots, leaves flat with more or less roughened blades and smooth sheaths; spikes erect or nodding, shining, pale green, straw-colored or sometimes purplish, two to four inches long, awns or "beards" one to two or more inches long, spreading, giving the spike a bushy appearance—hence the common name—squirrel-tail grass.

This grass is found more or less plentifully throughout the state. It grows on all kinds of soil. Although eaten by stock while it is young squirrel-tail is regarded as a most obnoxious weed. The rough beards get into mouths, throats and eyes of animals, and into the wool of sheep often causing very bad sores. When ripe the spikes or heads break up into small sections or joints each piece bearing one or more of the spikelets with their cluster of awns or beards. These attach themselves to the clothing, work in deeper and deeper causing the wearer considerable discomfort. Moreover, this grass is often badly affected by the same rusts that trouble the small grains and hence may become a source of infection unless carefully burned in autumn. It is usually found in waste places and along roadsides. As it is only an annual it can be readily destroyed by thorough cultivation. The specimens analyzed were collected at Brookings the 1st of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.73	—
Ash	8.22	9.11
Ether Extract.....	2.59	2.87
Crude Fibre	28.66	31.75
Crude Protein ..	9.84	10.90
N.-free Extract	40.96	45.38
Total Nitrogen	1.58	1.74
Albuminoid Nitrogen	1.23	1.36

WILD RYE OR LYME GRASS.

(Elymus virginicus L.)

Stems robust, tufted, erect, or sometimes ascending, smooth, one and one-half to three feet high, from perennial, fibrous roots; leaves six inches to a foot or more long, broad, flat, rough; the upper sheath often enclosing the base of the spike; spike erect, rigid, dense, two to five inches long and usually about one-half an inch thick; spikelets in twos or threes, two to three flowered, smooth; empty glumes thick and coarse, strongly nerved, bristle-pointed; flowering glume with a stiff straight awn usually one-half to three-fourths of an inch long.

This grass is about as common as the preceding species, having about the same distribution and similar to it in value though perhaps more useful as a pasture grass. In many parts of the United States, particularly in the South, this grass is a very important forage plant. The specimens analyzed were collected at Brookings the 1st of July, 1891. What has been said regarding early cutting of the last species is equally applicable to this grass.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.29	—
Ash.....	7.60	8.31
Ether Extract.....	3.04	3.31
Crude Fibre.....	27.20	29.66
Crude Protein.....	6.63	7.23
N.-free Extract.....	47.24	51.51
Total Nitrogen.....	1.06	1.16
Albuminoid Nitrogen.....	.92	.99

WILD RYE.

(Elymus canadensis L.)

Stem robust, erect, tufted, smooth, two to four or five feet high, from perennial, creeping roots; leaves large, broad and flat, sometimes smoothish but usually roughened; sheaths smooth; spike large, four to nine inches long, nodding; spikelets mostly in twos, three to five flowered; empty glumes very narrow, tapering into a rough awn; flowering glumes five nerved, rough, hairy, with long, spreading, rough awn. Plate 49.

Wild rye is more or less plentiful in all parts of the state, growing mostly in the moister soil of the valleys. In many localities it constitutes a considerable part of the native forage. It is frequently cut for hay, furnishing a good yield of fair quality. Cutting should be done early to get the best quality of hay and also to avoid ergot which often occurs on this and related grasses. In wood-land and bottom pasturages wild rye is often one of the most important grasses, particularly for early grazing. A larger, glaucous form (var. *glaucifolius*) is found in many parts of the state. The specimens analyzed were collected at Brookings on the 2nd of July and were then in proper condition for hay.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.54	—
Ash.....	8.61	9.31
Ether Extract.....	1.64	1.77
Crude Fibre.....	34.16	36.95
Crude Protein.....	5.28	5.71
N.-free Extract.....	42.77	46.26
Total Nitrogen.....	.85	.91
Albuminoid Nitrogen.....	.59	.64



PLATE 49—Wild Rye.

DENNETT GRASS.

(Elymus striatus Willd.)

Stems slender, tufted, upright, two to three feet high, from creeping, perennial roots; leaves rather thin, long, flat and roughish; spike rather slender but dense, more or less nodding, two to four inches long; spikelets usually in twos, one to two (rarely three) flowered; empty glumes very narrow, one to three nerved, with a long, bristle-like awn; flowering glume with a long capillary awn; whole plant more or less hairy.

This grass occurs throughout the eastern part of the state in rather dry or rocky woods. It is of little value for forage as it is too rare. It is very nutritious and is readily eaten by stock. It is difficult to save any seed as the spikelets drop off so easily. A form (var. *villosus*) with very hairy flowers and sheaths is occasionally found. The specimens analyzed were collected at Flandreau on the 12th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.25	—
Ash	7.91	8.62
Ether Extract	2.55	2.78
Crude Fibre.....	27.83	30.33
Crude Protein.....	8.37	9.12
N.-free Extract.....	45.09	49.14
Total Nitrogen.....	1.34	1.46
Albuminoid Nitrogen.....	1.15	1.25

FLAT STEMMED TUFTED SPIKE-RUSH.

(*Eleocharis acuminata* (Muhl.) Nees.)

Stems flat, striate, tufted, erect, from perennial roots and root-stocks, one to two feet high, leafless; spikelets ovate, oblong to lanceolate, pointed, about half an inch long or less; scales acute, dark purple with broad pellucid white margins; achene obvate, pen-shaped, obtusely triangular, yellowish, wrinkled, crowned with a small, conical, pointed, tubercle equalling or longer than the usual one to four very slender, fragile bristles.

Apparently rarer than either of the two succeeding species; known thus far only from the Sioux Valley and the Black Hills regions. It probably occurs elsewhere in the state. It may be distinguished from the other species given by its flat stems and tufted habit of growth. Probably of little importance as a forage plant. The specimens analyzed were collected at Brookings, July, 1892.

ANALYSIS.

	Air Dry Substance	Water Free Substance.
Water	6.27	—
Ash	9.89	10.55
Ether Extract.....	2.24	2.39
Crude Fibre.....	30.60	32.65
Crude Protein.....	6.47	6.90
N.-free Extract.....	44.53	47.51
Total Nitrogen... ..	1.04	1.11
Albuminoid Nitrogen.....	.85	.90

TUFTED SPIKE-RUSH.

(Eleocharis obtusa R. Br.)

Stems tufted, erect, eight inches to a foot and a half high, from annual, fibrous roots, nearly round, leafless; spikelets ovoid to ovate oblong, usually from one-fourth to one-half an inch long, obtuse, dull brown; scales very obtuse, densely crowded in many ranks, with a greenish keel and pale margins; achene much narrowed below, pale-brown, shining, with an acute flattened tubercle; bristles six to eight, longer than the achene.

Found quite commonly throughout the eastern half of the state in wet, muddy places and shallow water. Distinguished from the other spike-rushes by its large obtuse spikelets and its habit of growing in large tufts. Of little value for a forage plant except in places too wet for most other sedges or grasses. The specimens analyzed were collected near Bangor, Walworth county, September 1st, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.38	—
Ash.....	12.45	13.30
Ether Extract.....	2.56	2.73
Crude Fibre.....	27.53	29.41
Crude Protein.....	9.45	10.09
N.-free Extract.....	41.63	44.47
Total Nitrogen.....	1.51	1.62
Albuminoid.....	1.26	1.34

COMMON SPIKE-RUSH.

(Eleocharis palustris R. Br.)

Stems upright, terete, striate, usually slender, one to four feet high, more or less tufted, from perennial roots and running root-stocks; leaves none but represented by more or less well developed sheaths at the base of the stem; spikelet oblong, lanceolate, pointed; scales ovate, oblong, obtuse or the upper ones pointed, loosely imbricated, reddish brown with a greenish keel and broad, translucent, whitish margin; achene or "seed" flattish, somewhat shining, smooth, crowned with a short ovate or ovate-triangular tubercle, shorter than the bristles which are usually four in number.

The commonest of the smaller rushes, found in some of its many forms, throughout the entire state. In the drier regions it seldom becomes more than a foot or two high, but in the moist, boggy localities it frequently reaches four feet. Though a common plant it does not furnish much forage as the stems are leafless. In wet meadows it sometimes yields a considerable amount of early feed. The specimens analyzed were collected at Brookings the last of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.95	—
Ash	17.33	18.62
Ether Extract.....	1.99	2.14
Crude Fibre.....	25.07	26.94
Crude Protein.....	8.84	9.50
N.-free Extract.....	39.82	42.79
Total Nitrogen.....	1.41	1.52
Albuminoid Nitrogen.....	1.17	1.25

MEADOW RUSH.

(Scripus atrovirens Muhl.)

Stem rather stout, one and one-half to three feet high, erect, from perennial roots and root-stocks, triangular, smooth, very leafy; leaves broadly linear, bright green, smooth, softish but becoming more rigid with age; spikelets dull greenish-brown, darkening with age, thickly crowded into close, head-like clusters which are usually arranged in crowded, compound panicles; scales sharp-pointed; achene obovate-oblong, triangular, distinctly pointed, equalling the slender, straightish bristles which are downwardly barbed above and naked below.

Not rare in wet, boggy meadows throughout the state. It is readily eaten by stock but is not common enough to form any considerable portion of the forage except in a few of the moister localities in the state. The specimens analyzed were collected at Brookings the middle of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.54	—
Ash	6.78	7.25
Ether Extract.....	1.45	1.55
Crude Fibre.....	31.96	34.20
Crude Protein.....	3.54	3.79
N.-free Extract.....	49.73	53.21
Total Nitrogen.....	.57	.61
Albuminoid Nitrogen.....	.53	.56

RIVER CLUB-RUSH.

(*Scirpus fluviatilis* Gray.)

Stems stout, erect, three to five feet high, from perennial roots, with well developed root-stocks, sharply three angled; leaves large, broad, flat, gradually tapering to a sharp point, smooth except on the midrib and margins which are more or less roughened, upper leaves much exceeding the clusters of spikelets; spikelets in either sessile or stalked clusters of one to five each, ovate or oblong-cylindrical, more or less pointed, rusty brown; scales with edges more or less torn and with somewhat recurving awns; achene or "seed" obovate, pointed, sharply triangular, dull, almost as long as the usually six rigid bristles.

This rush, often called "slough grass" and "three cornered grass," is found generally over the state but is perhaps most plentiful in the eastern part along fresh water streams, lakes and ponds and in sloughs. Its very large, flat leaves, stout triangular stems, rusty brown spikelets and dull, sharply triangular achenes will serve to distinguish it. It is one of the most important of our rushes, furnishing a large amount of early forage which though coarse is readily eaten by all kinds of stock. It is often an important element in lowland hay, particularly that cut from dried up lake beds the first two or three years. The specimens analyzed were cut in wet meadows on the College farm the 1st of July, 1891, and were then just coming into bloom.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.12	—
Ash	9.51	10.24
Fther Extract.....	1.48	1.59
Crude Fibre.....	27.00	29.07
Crude Protein.....	10.13	10.91
N.-free Extract.....	44.76	48.18
Total Nitrogen.....	1.62	1.75
Albuminoid Nitrogen.....	1.44	1.55

SEA CLUB-RUSH.

(*Scripus maritimus* L.)

Stem rather stout, erect, one to three feet high, from perennial roots and root-stocks, sharply three-angled; leaves flat, linear, about as long as the stem, smooth; spikelets one to seven in sessile or more rarely stalked clusters, ovate or oblong-cylindrical, rusty brown; scales with torn edges and soon strongly recurved awns; achene compressed, flat on one side and convex or obtusely angled on the other, minutely pointed, shining, shorter than the one to six bristles. Plate 56.

Not uncommon in most saline soils throughout the state. It may be recognized by its triangular stems, large leaves, rusty brown spikelets and compressed, shining achenes or "seeds." It furnishes a considerable amount of forage chiefly in the form of a coarse hay which is of value mostly because it can be obtained early in the season before the best grasses are fit to cut. It with several other coarse rushes, sedges and grasses are often known indiscriminately as "slough grass."

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.20	—
Ash	9.22	10.04
Ether Extract	2.72	2.96
Crude Fibre.....	24.10	26.25
Crude Protein.....	9.04	9.85
N-free Extract.....	46.72	50.89
Total Nitrogen	1.47	1.61
Albuminoid Nitrogen.....	1.14	1.24

HALL'S RUSH.

(Scirpus hallii Gray.)

Stems slender, erect, tufted, six inches to one foot high, from annual, fibrous roots; leafless or the upper sheath rarely bearing a small leaf; spikelets one to seven (usually five) in a cluster, ovate-oblong to cylindrical, greenish; involucreal leaf much exceeding the cluster of spikelets; scales ovate, conspicuously keeled, with a tooth-like point; stamens two or three; style two-cleft; bristles wanting; achene obovate-orbicular, mucronate, obtusely angled, with very sharp, transverse wrinkles, brownish.

This rush has been found in but one locality in the state. It grows along the wet boggy shores and in the shallow water of lakes and streams. Though eaten readily by stock it is of but little importance as a forage plant because of its rare occurrence. The specimens analyzed were collected near Bangor, Walworth county, September, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.36	—
Ash	9.87	10.54
Ether Extract.....	3.27	3.49
Crude Fibre.....	20.84	22.26
Crude Protein.....	9.81	10.48
N.-free Extract.....	49.85	53.24
Total Nitrogen.....	1.57	1.68
Albuminoid Nitrogen.....	1.24	1.33

SHARP POINTED RUSH.

(Scirpus pungens Vahl.)

Stems rather stout, upright, one to three feet high, from long, stout, running root-stocks, smooth, rigid, sharply three angled; leaves one to three at the base of the stem, four to ten inches long, keeled and channelled; spikelets rusty brown, one to six in sessile clusters, ovoid, over-topped by the long involucre leaf which is a prolongation of the stem; scales ovate, more or less ciliate, with a small awn between the lobes of the two-cleft apex; achene or "seed" obovate, smooth, compressed, longer than the two to six bristles.

Common throughout the entire state along the borders of streams, lakes or ponds. The leaves are so few and the stems so tough and wiry that it is of no value for forage. Stock seldom eat it unless forced to do so. In some parts of the United States this rush is much used in making the seats of "rush-bottom chairs," and often goes by the name of "chair-makers rush." The tough wiry stems render it well adapted to this use. The specimens analyzed were collected near Brookings, July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.75	—
Ash	12.38	13.42
Ether Extract.....	1.56	1.69
Crude Fibre.....	28.42	30.81
Crude Protein.....	8.78	9.52
N.-free Extract.....	41.11	44.56
Total Nitrogen.....	1.41	1.52
Albuminoid Nitrogen.....	.96	1.04

CHESTNUT-COLORED SEDGE.

(Cyperus erythrorhizos Muhl.)

Stems upright, from annual, fibrous roots which are usually reddish in color, obtusely triangular, from six inches to two and one-half feet high, leafy at the base and with four or five leaves clustered about the inflorescence at the top; leaves smooth except the margins which are roughened with very minute spiny teeth, rather large, flat and long pointed; spikelets many, spreading horizontally and arranged in crowded, spike-like clusters at the ends of stalks of varying lengths—the clusters forming an umbel—usually bright chestnut-colored; scales rather closely imbricated in two opposite rows causing the spikelets to be flattish, lanceolate, minutely pointed.

This sedge occurs throughout the Sioux Valley region and possibly elsewhere though as yet not reported. It prefers the low, rich, moist banks of streams and lakes. Not plentiful enough to be of much importance. The specimens analyzed were collected in Brookings county the 1st of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	5.95	—
Ash	10.05	10.69
Ether Extract	1.89	2.01
Crude Fibre	28.48	30.28
Crude Protein	9.61	10.22
N.-free Extract	44.02	46.80
Total Nitrogen	1.54	1.63
Albuminoid Nitrogen	1.10	1.17

GIANT SEDGE.

(Carex aristata R. Br.)

Stem stout, erect, two to three and one-half feet high, sharply triangular, rough, from perennial roots and stout running root-stocks, leafy; leaves very long, about one-fourth of an inch broad, roughish, at least on the margins; staminate spikes two to four, usually an inch or more long; pistillate spikes two to six, cylindrical, one and one-half to three inches long, more or less stalked and drooping, the upper one often staminate at the top, usually compactly flowered, but sometimes fewer flowered at the base; fruit (perigynium) many ribbed, elliptic-lanceolate, narrowed above into a long beak bearing two long, spreading teeth; scales with a very rough awn-like point, shorter than the perigynium.

Very common, particularly in the Sioux Valley region. It is the most important of all the sedges as it makes a very large part of the growth in the moist, boggy places in the regions where it occurs. It thus furnishes a large part of the early pasturage and hay. In the spring it grows well in the shallow water of the more moist draws and is in good condition to cut when the water dries up in July and August. The specimens analyzed were cut on the College farm on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.79	—
Ash	8.83	9.58
Ether Extract.....	2.02	2.19
Crude Fibre	26.85	29.12
Crude Protein	10.57	11.46
N.-free Extract	43.94	47.65
Total Nitrogen	1.69	1.83
Albuminoid Nitrogen	1.54	1.67

LATE-FRUITED SEDGE.

(Carex retrorsa Schw.)

Stems stout, erect, tufted, one and one-half to three feet high, from a mass of coarse, fibrous roots, obtusely angled, smooth or slightly roughened above, leafy; leaves broad and soft, roughish—particularly on the margins, much longer than the stems; staminate spikes two, one large, an inch or more long, the other small, about half an inch long, and placed just below the first, their scales pointed, brownish with darker midrib and whitish margins; pistillate spikes three to five, clustered together near the top of the stem and below the staminate spikes, sessile, or the lowest with a short stalk, one to two inches long, very compactly flowered, erect or spreading; fruit (perigynium) yellowish or brownish, very thin and papery, inflated, distinctly nerved, becoming strongly reflexed at maturity, tapering into a long, slender, two-toothed beak; scales very short and small, seldom equalling the body of the perigynium in length.

This sedge is not uncommon in wet, boggy places along streams and lakes in the Sioux Valley. It has not yet been reported elsewhere in the state. It is very tender and juicy and is readily eaten by stock. It seldom appears in hay as it only grows in places usually too wet to be mowed. It is often an important factor in the forage furnished by many of our lowland pastures. The specimens analyzed were collected along the Sioux River near Brookings.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.11	—
Ash.....	20.61	21.95
Ether Extract.....	2.84	3.02
Crude Fibre.....	19.81	21.10
Crude Protein.....	14.74	15.70
N.-free Extract.....	35.89	38.23
Total Nitrogen.....	2.36	2.51
Albuminoid Nitrogen.....	1.51	1.60

SILVERY TOPPED SEDGE.

(Carex siccata Dewey.)

Stems erect, clustered, sharply three-angled, one to two feet high (usually taller than the leaves); spreading extensively by means of creeping root-stocks; perennial; leaves erect, narrow, taper-pointed, smooth, or roughish on the margins; spikes silvery brown, longer than the scale-like bracts, three to ten, loosely arranged in an oblong head which is seldom over an inch in length; the middle spikes (or sometimes the entire head) staminate.

This sedge is quite common in the eastern part of the state where it grows on rather dry bottoms and in swales. It may be known by its silvery brown heads and by its habit of forming extensive mats. In some instances it yields a considerable amount of forage. The specimens analyzed were collected in Brookings county, the last of June, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.03	—
Ash	9.47	10.30
Ether Extract.....	2.21	2.40
Crude Fibre.....	24.64	26.79
Crude Protein.....	13.66	14.85
N.-free Extract.....	41.99	45.66
Total Nitrogen.....	2.19	2.38
Albuminoid Nitrogen	1.53	1.66

STRAW-COLORED SEDGE.

(*Carex straminea* Willd.)

Stems erect, rather slender, clustered, one to three feet high, three angled, smoothish or rough above on the angles, sometimes nodding in fruit, from perennial, fibrous roots; leaves narrow, long-pointed, stiff, usually shorter than the stems but equalling them in some of the forms; spikes three to eight, usually distinct, globular or ovoid, tawny or straw-colored, clustered at the end of the stem; "seed" (perigynium) from narrowly to broadly ovate, wing-margined, nerved on both faces; about as long as the acute scales. Plate 57 is from a photograph of var. *brevior* Dewey.

This is one of the commonest sedges and is found in some of its many forms in all parts of the state. It thrives on a variety of soils, being found in dry places, swales or bogs. It furnishes a considerable amount of forage in many localities. The specimens analyzed were collected at Brookings on the 7th of July, 1892, and belong to the variety *aperta* of Boott.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.79	—
Ash	8.04	8.72
Ether Extract	2.14	2.32
Crude Fibre	31.50	34.16
Crude Protein	7.60	8.24
N.-free Extract.....	42.93	46.56
Total Nitrogen.....	1.22	1.32
Albuminoid Nitrogen.....	1.00	1.09

NARROW-FRUITED SEDGE.

(Carex sychnocephala Carey.)

Stems erect, slender, in large tufts, six to sixteen inches high, smooth, leafy, from a mass of tough, fibrous, perennial roots; leaves narrow, long-pointed, longer than the stems, rough on the margins; spikes green, oblong, densely crowded into an oblong head which is about three-fourths of an inch long and from which proceed several long leaf-like bracts; "seed" (perigynium) slender, faintly nerved, scarcely margined, usually somewhat longer than the sharp-pointed scale.

This sedge is found in boggy places along streams and lakes and is not uncommon in the Sioux Valley. It is quite palatable and produces an abundance of leaves but is too rare to be of much importance except in a few localities. It may be easily distinguished from all other sedges by its peculiar leafy heads. The specimens analyzed were collected near Brookings the last of June, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.78	—
Ash.....	11.25	12.20
Ether Extract.....	3.70	4.01
Crude Fibre.....	24.41	26.47
Crude Protein.....	8.48	9.20
N.-free Extract.....	44.38	48.12
Total Nitrogen.....	1.36	1.47
Albuminoid Nitrogen.....	1.27	1.38

UPRIGHT SEDGE.

(Carex stricta Lam.)

Stems erect, slender, tufted, or often in large clumps, sharply three-angled, rough above on the angles, one and one-half to three feet or more high; perennial; leaves long and narrow, pointed, roughened on the margins; spikes three to five, scattered, erect or rarely spreading, all sessile except the lowest one which is more or less stalked, dense flowered, varying from one-half to two inches in length, the upper one or two (rarely three) staminate, the remainder pistillate (or sometimes the upper ones staminate at the top); fruit (perigynium) small, flattened, ovate, rather faintly few-nerved, with a very short, mostly entire beak; scales narrow, usually bordered with purplish, acutish, about as long as the fruit.

This is one of the commonest sedges in the state and is found throughout in low wet meadows and along swales and margins of ponds, lakes and streams. It enters largely into most of the lowland forage. The specimens analyzed were collected at Brookings the 1st of June, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.10	—
Ash	10.23	11.13
Ether Extract	2.32	2.52
Crude Fibre.....	27.69	30.13
Crude Protein.....	10.33	11.24
N.-free Extract.....	41.33	44.97
Total Nitrogen.....	1.65	1.80
Albuminoid Nitrogen.....	1.21	1.31

FOX SEDGE.

(Carex vulpinoidea Michx.)

Stem mostly upright, stiff, sharply three angled, rough, especially above, one to two and one-half feet high; perennial; leaves usually longer than the stem, flattish, long-pointed, roughish on the margins; spikes numerous, densely flowered, arranged in an interrupted, more or less compound head which is from one to three or even four inches long, dull greenish brown, at least the lower spikes provided with slender, setaceous bracts; fruit (perigynium) small, rather narrowly ovate, nerved on both faces; scales with very sharp, rough points.

Fox sedge is exceedingly abundant throughout the entire west. It prefers low prairies and rather dry swales. It usually grows in rather large bunches and may be recognized by its large heads which have a more or less bushy appearance owing to the numerous bracts. It is readily eaten by stock and adds materially to the native forage. The specimens analyzed were collected at Brookings early in August, 1893.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	5.89	—
Ash.....	8.87	9.43
Ether Extract.....	2.05	2.18
Crude Fibre.....	29.11	30.93
Crude Protein.....	9.61	10.21
N.-free Extract.....	44.47	47.25
Total Nitrogen.....	1.54	1.63
Albuminoid Nitrogen.....	1.12	1.19

BUR-REED.

(*Sparganium eurycarpum* Engelm.)

Stems stout, erect, smooth, two to four feet high, from perennial, creeping root-stocks and fibrous roots, leafy; leaves thickish, equalling or exceeding the stem, linear, flat and keeled; flowers in separate, dense heads; the upper staminate, the lower pistillate; staminate flowers consisting only of stamens and minute irregularly placed scales; the pistillate ones consisting each of a sessile pistil surrounded by three to six scales; fruit, broad, sessile, often two-seeded, many angled, about one-third of an inch long; fruit heads a half a dozen or less on each plant, about an inch in diameter.

This plant is not uncommon in shallow water or in recently dried up ponds and sloughs. It often makes up a large part of the vegetation in lake beds and boggy pastures. It is not eaten a great deal by stock as long as other and better forage plants are plentiful but when pasturage is low it is often resorted to. The specimens analyzed were collected at Brookings in the College pastures on the 10th of July, 1891.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.78	—
Ash.....	6.73	7.22
Ether Extract.....	1.23	1.32
Crude Fibre.....	25.94	27.83
Crude Protein.....	6.15	6.60
N.-free Extract.....	53.17	57.04
Total Nitrogen.....	.98	1.06
Albuminoid Nitrogen.....	.88	.95

BIG HEADED BOG-RUSH.

(Juncus nodosus L.)

Stems erect, slender or somewhat robust, smooth, rather rigid, leafy, one to two feet high, from very slender, creeping tuber-bearing root-stocks; leaves slender, long-pointed; flowers arranged in one or more dense, many flowered, brown heads; calyx of six glume-like, awl-pointed sepals; stamens six, with the oblong anthers shorter than the filaments; capsule slender, triangular, pointed, longer than the sepals. The commoner form (var. *megacephalus* Torr.) has stout stems, often three feet high, thicker leaves and larger (thirty to eighty flowered) heads.

This bog rush is more or less common throughout the state, occurring in low, boggy places and along wet, gravelly banks. When young it is often eaten by stock of all kinds. It is of little importance as a forage plant except perhaps in pastures consisting largely of old lake beds or bogs. The specimens analyzed were collected at Brookings about the middle of July, 1893, and belong to the variety *megacephalus*.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.32	—
Ash	7.66	8.18
Ether Extract.....	1.78	1.90
Crude Fibre.....	36.57	39.04
Crude Protein.....	6.88	7.34
N.-free Extract.....	40.79	43.54
Total Nitrogen.....	1.10	1.18
Albuminoid Nitrogen.....	.92	.98

SLENDER BOG-RUSH.

(*Juncus tenuis* Willd.)

Stems erect, simple, tufted, wiry, leafy below; roots perennial; leaves flattish or rolled, pointed, about six inches long; flowers solitary, in loose panicles which are shorter than the involucre leaves; sepals greenish, very sharp-pointed, spreading in fruit; stamens six, with anthers nearly equal to the filaments; capsule greenish, ovoid, shorter than the sepals; seeds small, not conspicuously pointed.

This is a common plant found throughout the state, often on high prairies as well as on low ground. Though rather tough and wiry it is readily eaten by stock. The amount of forage yielded is so small, however, that the plant is of little value. The specimens analyzed were collected at Brookings, July, 1893.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.10	—
Ash	5.32	5.79
Ether Extract.....	1.67	1.82
Crude Fibre.....	34.07	37.07
Crude Protein.....	6.37	6.93
N.-free Extract.....	44.47	48.39
Total Nitrogen.....	1.02	1.11
Albuminoid Nitrogen.....	.73	.80

BECKWITH'S CLOVER.

(Trifolium beckwithii Brewer.)

Stems ascending, four to nine inches high, from strong, perennial, creeping root-stocks; leaves trifoliate; leaflets oblong to oblanceolate, conspicuously veined, obtuse or the upper ones acute, irregularly toothed, usually one to one and one-half inches long; stipules ovate to lanceolate, acute, entire; flowers about half an inch long, reddish, purple, in terminal heads which are an inch or more in diameter; calyx teeth linear-subulate, straight, equalling the tube in length; pod smooth, several seeded. Plate 58. (See plates at the end of Bulletin.)

This is the only species of the true clovers known to be a native of the state. It is common in low meadows along the upper Sioux Valley but has not been reported from the other regions. It is very persistent and endures excessive grazing very well. It is most too small to afford anything but pasturage. The flower-heads are very similar to those of common red clover but the plants are much smaller and the leaflets are much narrower. Efforts are being made to grow this clover on the Station grounds and there is a possibility that it may prove of value as a cultivated forage plant. The specimens analyzed were cut on the College pastures the middle of June, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.64	—
Ash	7.59	8.31
Ether Extract.....	2.71	2.97
Crude Fibre.....	25.11	27.48
Crude Protein	12.59	13.78
N.-free Extract.....	43.36	47.46
Total Nitrogen.....	2.01	2.20
Albuminoid.....	1.51	1.65

RED CLOVER.

(Trifolium pratense L.)

Stems ascending, more or less hairy, one to two feet high, from rather short-lived perennial roots; leaves trifoliolate, with usually rather long leaf-stalks; leaflets from half an inch to an inch and a half long, oyal or obovate, often notched at the apex, sessile, usually with a large pale spot on the upper side; flowers in large ovoid, sessile heads; pod small, one-seeded, included in the calyx; seed kidney-shaped, from greenish-yellow to pale reddish brown.

Red clover is a native of the Old World and is now extensively cultivated on both hemispheres. It is the best of the clovers, being an excellent hay grass as well as affording, under proper conditions, a large amount of pasturage. It makes an excellent pasturage for hogs. There is great difference of opinion as to its value in the Dakotas. On the Station grounds it has done fairly well one year with another. It seems to endure the drouth of summer better than the dry freezing of the winter. It does best when sown with timothy. In the Sioux Valley region there are a great many fields of these forage plants that are yielding excellent returns. Red clover has given the best results when sown in early spring on well prepared soil. Orchard grass may be sown with it instead of timothy. Clover is an excellent soiling plant and may be used to advantage on fields that have been worn out by wheat raising. The specimens analyzed were cut from the experimental plats on the Station grounds, July 16th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.15	—
Ash	7.02	7.64
Ether Extract	2.15	2.34
Crude Fibre.....	34.11	37.14
Crude Protein.....	10.79	11.75
N.-free Extract.....	37.78	41.13
Total Nitrogen	1.73	1.88
Albuminoid Nitrogen.....	1.32	1.44

CRIMSON CLOVER.

(Trifolium incarnatum L.)

Stems erect, tufted, soft, hairy, one to two feet high; annual; leaves trifoliate, soft hairy; stipules broad, with short, leafy tips, more or less toothed; leaflets broadly obovate or almost round; flowers about half an inch long, in oblong or cylindrical heads which are usually one or two inches long; calyx with narrow, subequal teeth, with copious long white hairs; corolla with bright scarlet or crimson, or rarely pinkish petals. Plate 50.

Crimson clover is a native of the southern part of Europe from whence it has been introduced into various parts of the United States. It is an annual and hence is of no value in permanent pastures. In Delaware and Virginia it has been grown with profit and is highly prized as a soiling plant. It is too tender for our climate. Plats of this clover grown on Station grounds were not a success. It suffered severely from late frost and dry weather and yielded very poorly. Similar results have been obtained in Michigan, Nebraska and other states of the North and West. The specimens analyzed were cut from the experimental plats on the Station grounds on the 13th of July, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.03	—
Ash.....	11.86	12.90
Ether Extract.....	2.15	2.34
Crude Fibre.....	29.96	32.58
Crude Protein.....	12.59	13.69
N.-free Extract.....	35.41	38.50
Total Nitrogen.....	2.61	2.19
Albuminoid Nitrogen.....	1.34	1.46



Cowing del.

PLATE 50—Crimson Clover,

ALSIKE.

(Trifolium hybridum L.)

Stems smooth, ascending, branched, one to two feet high, from perennial roots; stipules with long, sharp points and green veins; leaf-stalks long; leaflets ovate or oblong, toothed; heads globular, about three-fourths of an inch in diameter, on long stalks; flowers pinkish, on short pedicels, recurved after blooming; calyx whitish, smooth, with a few scattered hairs between the subequal, greenish teeth; pod about four-seeded. Plate 51.

Alsike is a native of the Old World. It was first cultivated in Sweden and derived its common name from a village of that country. It is often called hybrid clover because of the fact that it was originally supposed to be a hybrid between red clover and white clover. It is much prized by bee-keepers as the flowers contain an abundant supply of nectar which is easily reached by honey bees. It is an excellent plant for permanent pastures or meadows, yielding an abundance of seed and being much more persistent than red clover. As a rule it does not reach full development the first year but keeps improving with age. Tall fescue, timothy, smooth brome and other strong growing grasses are usually sown with this clover in meadows as its stems are rather weak and it does not stand up well when alone. On the Station grounds it has done better than any other clover being hardy and yielding well. Plats of it and timothy are doing well in every way. It promises to be of great value in this state particularly where irrigation is possible. The specimens analyzed were cut from the experimental plats, July 13th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.29	—
Ash	7.92	8.54
Ether Extract.....	1.87	2.02
Crude Fibre	29.17	31.46
Crude Protein	12.64	13.63
N.-free Extract	41.11	44.34
Total Nitrogen.....	2.02	2.18
Albuminoid Nitrogen	1.32	1.42



Cowing del.

PLATE 51—Alsike.

WHITE CLOVER.

(Trifolium repens L.)

Stems low, creeping, often rooting at the joints; smooth; perennial; leaves trifoliate, usually with rather long (two to four inch) leaf-stalks; stipules narrow and scale-like, long-pointed; leaflets obovate with notched apex or inversely heart-shaped, rather obscurely toothed on the margin; heads loosely flowered, an inch or less in diameter, on very long (three to eight inch) stalks; flowers white or tinged with rose, becoming reflexed with age; calyx smooth, pale, with greenish teeth; pod four to six seeded.

This clover has been introduced over the greater part of the state and is particularly common along the grades of the older railroads. It thrives on a great variety of soils and does better than red clover on very poor land. It is too low growing to be of much value as a hay producing plant, but it is excellent for pastures and lawns. It is very persistent enduring excessive grazing and tramping well. On the College grounds it has proven perfectly hardy and has done well even on the poorest of soils. It comes readily from the seed and soon makes a good sod which persists through seasons of extreme drouth or of severe freezing. For lawns or permanent pastures it should be sown in mixtures with the blue grasses, fescues, or other lawn or pasture grasses. Like all the rest of the clovers it should be sown in early spring. The specimens analyzed were cut from the experimental plats on the Station grounds the middle of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.50	—
Ash	10.89	11.77
Ether Extract.....	2.03	2.19
Crude Fibre.....	21.33	23.06
Crude Protein.....	13.20	14.27
N.-free Extract.....	45.05	48.70
Total Nitrogen.....	2.11	2.28
Albuminoid Nitrogen.....	1.54	1.66

FENUGREEK.

(Trigonella foenum-graecum.)

Stems erect, more or less branched, smoothish or somewhat hairy, a foot or more high; root annual; leaves trifoliolate; leaflets smoothish, wedge-oblong, obtuse, coarsely toothed above, one-half to one inch or more long; flowers one or two in the axils of the leaves, sessile or nearly so, yellowish; pod linear, more or less curved, veiny, long pointed.

A forage and medicinal plant introduced from Europe. It is an annual and is scarcely worth cultivating here as a forage. The yield is not very heavy and the forage is not relished by stock. The plant has a very strong scent which remains for a long time. The specimens analyzed were cut from the experimental plats July 9th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.45	—
Ash.....	10.66	11.64
Ether Extract.....	1.97	2.15
Crude Fibre.....	24.01	26.23
Crude Protein.....	18.24	19.92
N.-free Extract.....	36.67	40.05
Total Nitrogen.....	2.92	3.19
Albuminoid.....	1.66	1.81

YELLOW MELILOT, YELLOW SWEET CLOVER.

(Melilotus officinalis (L.) Lam.)

Stems upright, branched, smooth, two to six feet high; root biennial; leaves pinnately trifoliolate; stipules small, very narrow, sharp-pointed; leaflets obovate-oblong, smooth, obtuse, sharply toothed on the margins; flowers yellow, in spike-like racemes, becoming reflexed in fruit; pod small, ovoid, wrinkled, rather longer than the calyx, one to two seeded.

This is a very hardy plant, a native of the Old World, which occurs either under cultivation, or as an escape, throughout the greater part of the United States. The forage afforded is rather coarse and when fed alone is not relished by stock, owing, it is thought, to a bitter principle which is present in the plant. Mixed with other plants it may be used when better forage is scarce. It may, perhaps, be of value when used as silage since it is very hardy and yields heavily. It is an excellent bee-plant. In many parts of the East it is regarded as a weed but is also said to be valuable as a green manure. It is occasionally used in medicine. The specimens analyzed were cut from the experimental plats on the Station grounds, July 12th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.68	—
Ash	6.00	6.57
Ether Extract	1.57	1.72
Crude Fibre.....	38.78	42.47
Crude Protein.....	13.41	14.68
N.-free Extract.....	31.56	34.56
Total Nitrogen.....	2.15	2.35
Albuminoid Nitrogen.....	1.34	1.47

WHITE MELILOT, SWEET CLOVER.

(*Melilotus alba* L.)

Similar to yellow melilot but with the leaflets as if cut off square at the tips, the flowers white, and the standard of the corolla longer than the other petals.

This has about the same distribution as yellow melilot but is more common in South Dakota and is much more valuable as a forage plant. Though stock do not like it very well while green they eat it readily when cured with other forage plants. Both of the sweet clovers are fragrant while drying. White melilot is a valuable bee plant, producing an abundance of nectar. As it is only a biennial at most and grows so rank it may often be used as a nurse plant to shade the ground and protect certain of the slower growing forage plants. Like yellow melilot it is very hardy and may prove of value in silage mixtures. White melilot is often advertised in seed catalogues as "Bokara Clover." The specimens analyzed were cut from the experimental plats on the Station grounds, July 12th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	6.59	—
Ash.....	5.18	5.55
Ether Extract.....	1.52	1.63
Crude Fibre.....	42.55	45.55
Crude Protein.....	8.48	9.08
N.-free Extract.....	35.68	38.20
Total Nitrogen.....	1.36	1.45
Albuminoid Nitrogen.....	.97	1.04

GOATS' RUE.

(Galega officinalis.)

Stems erect, branching, smooth, one and one-half to two feet high, leafy; root perennial; leaves pinnate, with usually seven to thirteen leaflets which are smooth, oblong-elliptical to lanceolate, entire, the apex rounded abruptly into a slender spine-like point; stipules arrow shaped, sharp-pointed; flowers violet-purple, in loose, spike-like racemes which are borne on stalks equalling or exceeding the leaves; pods about an inch long, several-seeded. Plate 52.

This is a recent introduction and gives promise of value as a forage for this state. In Kansas it is said to be an excellent forage plant, resisting drouth well. On the Station grounds it makes a good growth, yields well and seems to be hardy. Some difficulty was experienced in getting a stand. It deserves a more extended trial. The specimens analyzed were cut from the experimental plats August 9th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.63	—
Ash	6.39	7.07
Ether Extract.....	2.57	2.84
Crude Fibre.....	30.38	33.62
Crude Protein.....	15.42	17.06
N.-free Extract.....	35.61	39.40
Total Nitrogen.....	2.47	2.73
Albuminoid Nitrogen.....	1.93	2.14



PLATE 52—Goat's Rue.

WILD VETCH.

(*Hosackia purshiana* Benth.)

Stems erect, branching, from smooth to silky-hairy, six to eighteen inches high, from an annual root; leaves nearly sessile, usually three-foliolate; leaflets rather narrowly ovate to lanceolate, one-fourth to nearly an inch long, the two lateral leaflets very short-stalked or sessile, the terminal one distinctly stalked; flowers small, solitary in the axils of the upper leaves, reddish; flowerstalks half an inch or more long, bearing a single small leaflet at the base of the flower; pod linear, compressed, about six seeded; seeds flattish, ellipsoid, smooth and shining, about one-sixteenth of an inch long. Plate 53.

This plant belongs to the same family as the cultivated vetches and clovers as may be seen by the flowers and seed-pods. It is very common throughout the entire state but is most plentiful in the Missouri Valley. The period of blooming is a long one and towards the end of the season flowers, young pods and mature or bursting pods may be found on the same plant. It is readily eaten by all kinds of stock and is regarded by stockmen as very important native forage. Even when grazed closely it will usually mature seeds enough to insure a sufficient stand the next season. It seems to be worthy of cultivation and should receive an extended trial in the drier parts of the state. The specimens analyzed were collected at Sand Lake, Brown county, July 23rd, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.73	—
Ash	8.35	9.05
Ether Extract.....	2.73	2.96
Crude Fibre.....	21.48	23.28
Crude Protein.....	17.57	19.04
N.-free Extract.....	42.14	45.67
Total Nitrogen.....	2.81	3.05
Albuminoid Nitrogen.....	2.28	2.47



PLATE 53—Wild Vetch.

ALFALFA, LUCERNE.

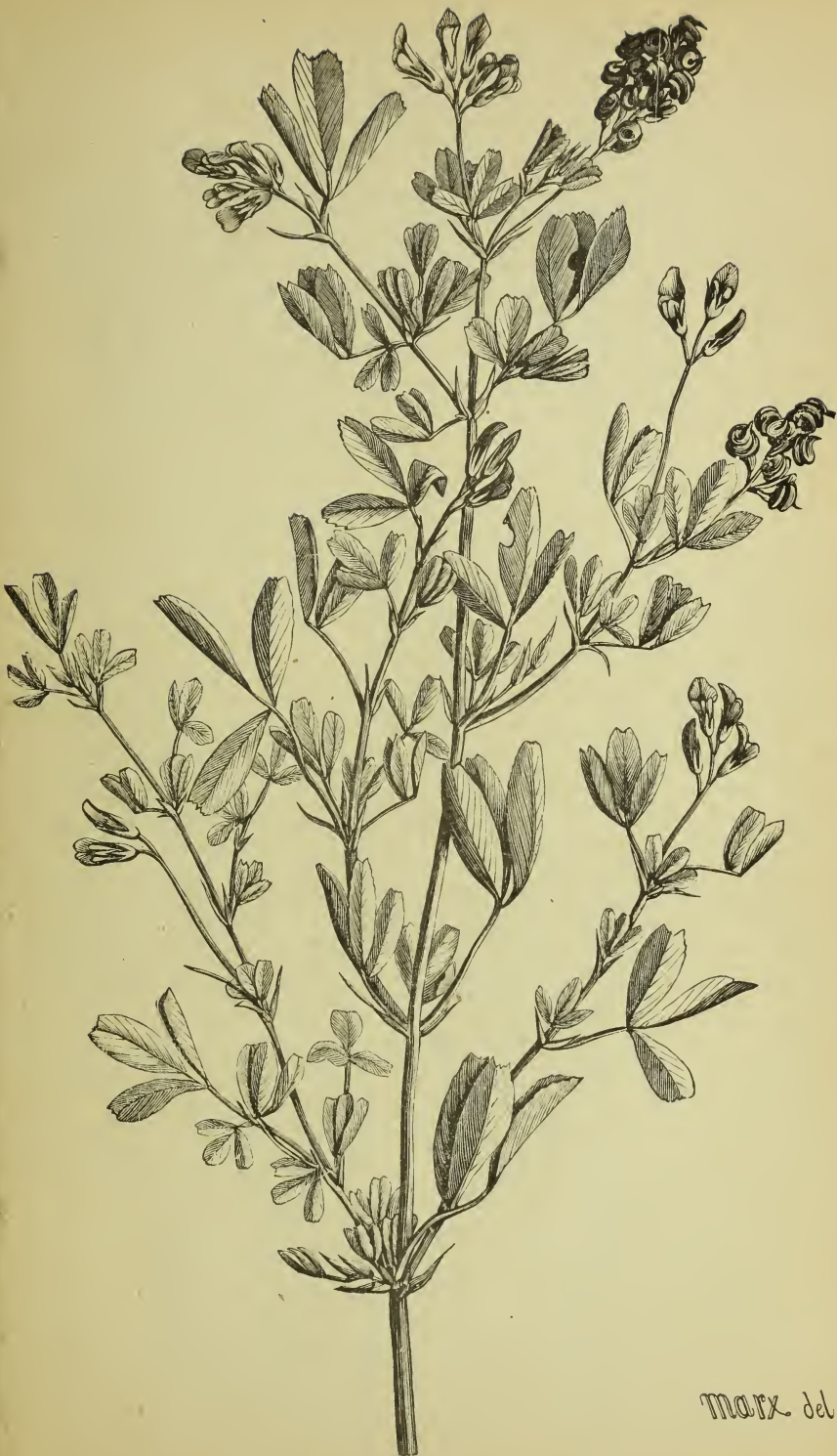
(Medicago sativa L.)

Stems erect, branched, smoothish, one to two and one-half feet high; root perennial, deep growing; leaves pinnately trifoliolate; leaflets obovate-oblong, toothed, notched at the tip, the lateral ones nearly sessile, the terminal one stalked; stipules rather narrow, pointed, adhering to the base of the leaf-stalk; flowers blue or purple, in short, dense racemes which are on stalks exceeding the leaves; pod spirally twisted in about two turns, finely reticulated, several seeded. Plate 54.

Alfalfa is an introduced plant from the Old World and is very widely cultivated throughout the United States. It is a very deep rooting plant and thrives best in a rich sandy loam with a deep porous subsoil. On the dry soil of the College campus the roots have been traced down ten feet or more. It is not a vigorous grower while young and hence a good sod is not always easy to get. After once well established, however, it endures drouth well and does not winter-kill easily. The yield of forage is good and of excellent quality if properly cut and cured. It should be cut as soon as it begins to flower. Alfalfa should be sown in the spring as soon as warm weather is assured, on clean, well prepared soil. On the Station grounds it has done best when put in with a drill. About eighteen or twenty pounds of seed should be sown to the acre. In regions where irrigation is practiced this is a favorite forage plant, giving four or five or even more cuttings in a year. It should be given an extended trial in South Dakota particularly in the artesian basin. The specimens analyzed were cut on the College farm, July 9th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	7.71	—
Ash	6.55	7.10
Ether Extract.....	1.30	1.41
Crude Fibre.....	42.61	46.17
Crude Protein.....	8.68	9.41
N.-free Extract.....	33.15	35.92
Total Nitrogen.....	1.39	1.51
Albuminoid Nitrogen.....	1.08	1.17



marx del

PLATE 54—Alfalfa.

SAINFOIN, ESPARSETTE.

(Onobrychis sativa.)

Stems upright, more or less straggling, branched, smooth, one to two feet high; root perennial; leaves pinnate; leaflets small, numerous, oblong, somewhat hairy on the under surface, entire; flowers pink, in rather loose, long-stalked spikes; pods short, flat, reticulately roughened and prickly, toothed on the back, one seeded. Plate 55.

This plant belongs to the clover family and is a native of Europe and Asia. In some parts of the Old World it is very highly prized as a forage, especially in regions where chalky or gravelly soils prevail. In Iowa and Kansas Sainfoin has given some promise of value but the experiments at our own Station give rather negative results thus far. It will be given further trial. The specimens analyzed were cut from the experimental plats on the Station grounds July 25th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	10.09	—
Ash	6.58	7.32
Ether Extract	1.74	1.94
Crude Fibre	33.38	37.13
Crude Protein	10.68	11.88
N.-free Extract	37.53	41.74
Total Nitrogen.....	1.71	1.90
Albuminoid Nitrogen.....	1.22	1.35



PLATE 55—Sainfoin.

Rowing del.

BURNET CLOVER.

(Poterium sanguisorba L.)

Stems upright, tufted, smoothish, angular, one to two feet high; root perennial; leaves pinnately compound, with seven to eleven ovate or roundish, deeply and coarsely serrate leaflets; flowers in heads, greenish or purplish, those in the lower part of the head staminate, with numerous, drooping stamens, those in the upper part of the head pistillate; "seeds" (achenes) dry, included in the calyx.

Burnet clover does not belong to the true clovers but is a member of the *Rose* family. The forage is of good quality but thus far we have been unable to get a satisfactory stand. After once started it seems perfectly hardy, neither winter-killing or suffering much from drought. The specimens analyzed were cut from the experimental plats on the Station grounds, August 5th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	8.94	—
Ash	9.26	10.15
Ether Extract.....	4.55	4.99
Crude Fibre.....	18.07	19.80
Crude Protein.....	14.23	15.59
N.-free Extract.....	45.15	49.47
Total Nitrogen... ..	2.28	2.50
Albuminoid Nitrogen.....	2.07	2.27

GIANT SPURREY.

(Spergula maxima.)

Stems weak and reclining, smoothish or glandular, hairy above, usually a foot or more high; annual; leaves numerous, whorled, linear and thread-like; flowers white, very numerous, arranged in a paniced cyme; petals rather shorter than the sepals; pod exceeding the calyx, smooth and shining, at maturity splitting into five valves which are opposite the sepals; seeds orbicular, blackish, rough, with a narrow, pale margin; flower stalks becoming more or less reflexed in fruit.

Giant spurrey is a native of the Old World which has become widely introduced throughout the United States. In Europe it is often used as a forage plant. Cattle and sheep are said to be very fond of it. On the Station grounds it makes a fair growth and is perfectly hardy but the yield is light and the crop is not an easy one to save owing to the habit of growth of the plant. The crop may be harvested in from eight to twelve weeks after sowing hence spurrey is a very good thing to use for a catch crop. On the whole it is not as profitable as millet and many other forage plants but it will be useful during short seasons or in case of failure of crops requiring a longer season to come to maturity. The specimens analyzed were cut from the experimental plats on the Station grounds, July 9th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	7.39	—
Ash	12.12	13.09
Ether Extract.....	2.71	2.93
Crude Fibre.....	27.50	29.69
Crude Protein.....	13.30	14.36
N.-free Extract.....	36.98	39.93
Total Nitrogen.....	2.13	2.30
Albuminoid Nitrogen	1.50	1.62

KNOT-WEED.

(Polygonum aviculare L.)

Stems slender, prostrate or ascending, branching, smooth, six to fourteen inches high, from annual, fibrous roots, leafy; leaves oblong to lanceolate, one-fourth to nearly an inch long, pointed at each end, bluish-green; flowers small, two or three together in the axils of the leaves; corolla wanting; calyx with five pinkish margined sepals; stamens usually eight; "seed" (achene) triangular, dull, minutely granular, usually included in the calyx.

This weed is common everywhere in door-yards, waste places and fields. As it is an annual it is not difficult to keep in subjection. It is very hardy and grows readily on the poorest of ordinary soils, even in times of severe and prolonged drouth. A tea made from this plant is sometimes used in cases of "summer complaint" among children. All kinds of stock eat knotweed greedily. It is a near relative of the buckwheat of cultivation and is thought to be of considerable value as a forage plant by many stockmen in the Northwest. The specimens analyzed were collected on the College farm, July 14th, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.90	—
Ash.....	5.46	5.86
Ether Extract.....	2.67	2.87
Crude Fibre.....	18.94	20.34
Crude Protein.....	17.57	18.87
N.-free Extract.....	48.46	52.05
Total Nitrogen	2.81	3.02
Albuminoid Nitrogen.....	2.40	2.58

UPRIGHT KNOTWEED.

(*Polygonum erectum* L.)

Similar to the preceding but with stouter, more erect, taller (one to two feet) stems, yellowish-green color, larger, oblong or oval, obtusish leaves, and larger, flowers which are borne on more or less exserted pedicels; stamens five or six.

This is perhaps more common than the foregoing, especially in the eastern part of the state. It prefers rather moister, richer soils than that species and is a better plant for forage purposes. It may be known by its larger size, yellowish-green color and more upright habit of growth. Both of the knot-weeds are often called "goose grass" and "door-yard grass," but as neither of them are at all like the true grasses these names are not appropriate. Several prominent dairymen in this and neighboring states speak very highly of this knot-weed as a milk-producing forage plant. Considering the fact that it is so hardy and yet is not likely to become a bad weed it certainly seems worthy a little more attention. The specimens analyzed were collected on the College farm on the 27th of August, 1892.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	6.82	—
Ash	5.94	5.59
Ether Extract.....	1.62	1.80
Crude Fibre.....	28.96	32.11
Crude Protein.....	10.27	11.39
N.-free Extract.....	43.39	48.11
Total Nitrogen.....	1.64	1.82
Albuminoid Nitrogen.....	1.39	1.54

Since many inquiries have been received at the Station for the analyses of millet seed and wheat bran, the following are given:

GOLDEN WONDER MILLET SEED.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	9.29	—
Ash	2.99	3.30
Ether Extract.....	4.51	4.97
Crude Fibre	9.14	10.08
Crude Protein	13.56	14.95
N.-free Extract	60.51	66.71
Total Nitrogen	2.17	2.39
Albuminoid Nitrogen	2.10	2.32

BROOM CORN MILLET SEED.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	10.18	—
Ash	2.33	2.59
Ether Extract	4.44	4.94
Crude Fibre.....	6.59	7.34
Crude Protein.....	13.50	15.03
N.-free Extract.....	62.96	70.10
Total Nitrogen.....	2.16	2.40
Albuminoid Nitrogen.....	2.16	2.40

ROLLER PROCESS WHEAT BRAN FROM SOUTH DAKOTA WHEAT.

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water.....	8.85	—
Ash	6.55	7.19
Ether Extract	5.58	6.12
Crude Fibre.....	9.74	10.69
Crude Protein.....	18.38	20.16
N.-free Extract.....	50.90	55.84
Total Nitrogen	2.94	3.23
Albuminoid Nitrogen.....	2.57	2.82

DWARF SEDGE.
(*Carex stenophylla* Wahl.)

ANALYSIS.

	Air Dry Substance.	Water Free Substance.
Water	4.85	—
Ash.....	8.31	8.73
Ether Extract.....	3.24	3.41
Crude Fibre.....	22.84	24.00
Crude Protein.....	13.56	14.25
N.-free Extract.....	47.20	49.61
Total Nitrogen.....	2.17	2.28
Albuminoid Nitrogen.....	1.83	1.92

ACKNOWLEDGEMENTS.

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PLATE 56—Sea Club-Rush.



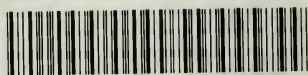
PLATE 57—Straw-colored Sedge.



PLATE 58— Beckwith's Clover.

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