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Forage Plants

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FORAGE PLANTS.

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CERTAIN GRASSES AND CLOVERS WORTHY OF CULTIVATION IN SOUTH DAKOTA.

THOMAS A. WILLIAMS, Botanist and Bacteriologist.

SMOOTH OR HUNGARIAN BROME GRASS.
(*Bromus inermis.*)

HISTORY.

Smooth or Hungarian brome grass is a native of southeastern Europe, and grows in the more sterile soils in waste places along roadsides, fields and pastures. It seems to have come into prominence as an agricultural grass only recently, though it was knowu to the earlier botanists, and many of them gave excellent descriptions of it. All speak of it as a very hardy grass, some calling it a weed, others praising it highly for its value as a forage plant.

The general cultivation of this grass was first begun in Hungary, where it soon became noted for its ability to withstand severe and protracted drouth.

Concerning the first introduction of this grass into our country, Professor Scribner* says: "From the records at hand it appears that Hungarian brome was first introduced into the United States from France by the agricultural experiment station at Berkeley, California. In Bulletin No. 22 of that station, issued November 15, 1884, the seed of this grass is offered for distribution, and the statement made that

*U. S. Dept. Agric. Div. of Bot., C. 1—B. 23 May, 1894.

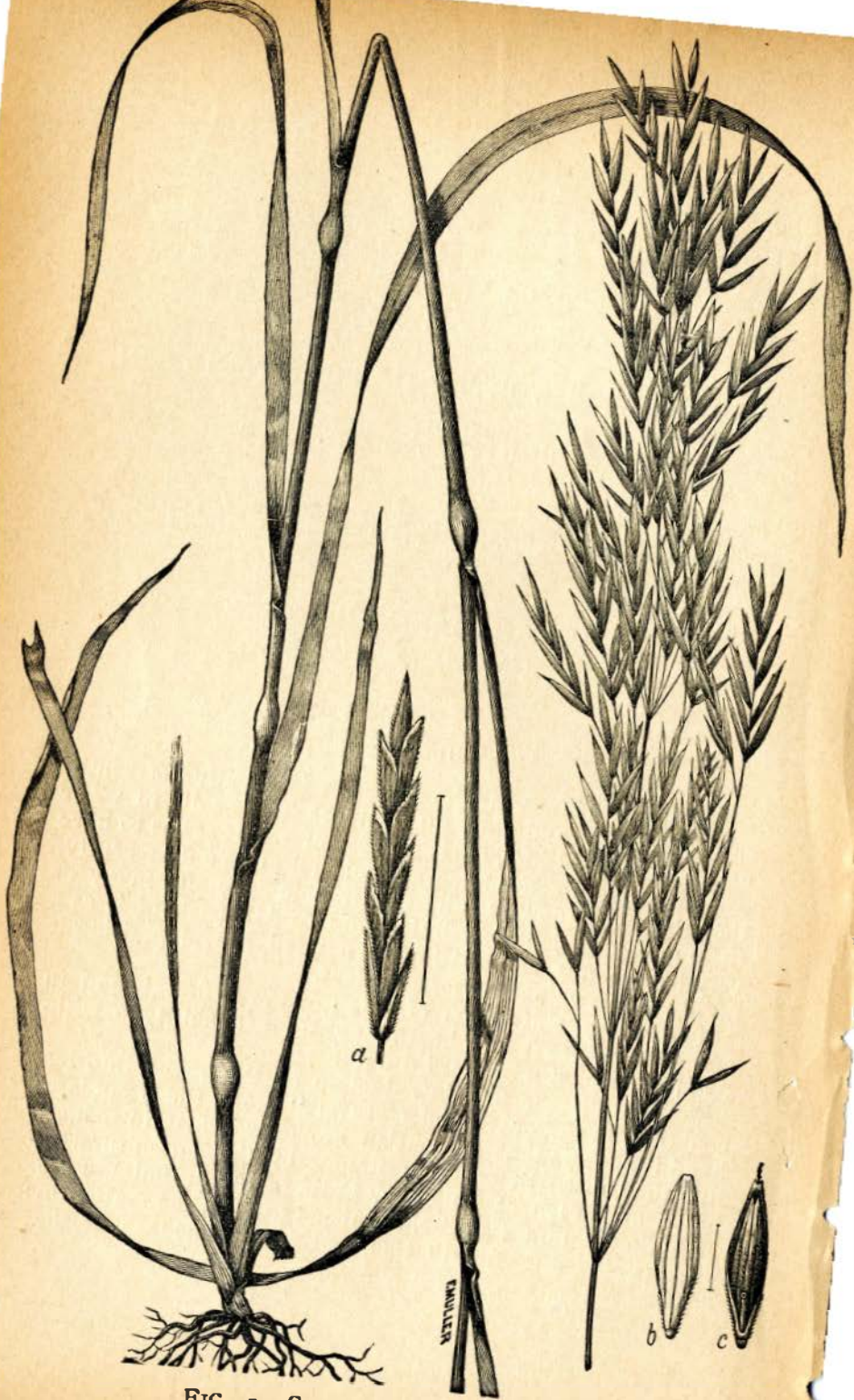

FIG. 1—Smooth Brome Grass.

'our experience indicates that it will do well here [California] either with or without irrigation.' During the past five or six years this grass has been cultivated at a number of the agricultural experiment stations in various parts of the country and also by farmers in many sections, particularly in California and Kansas."

HABIT OF GROWTH.

Smooth brome is a strong-growing perennial grass, with rather slender rootstocks, and smooth, leafy stems which are from one to three or even four feet high. It forms a tough even sod, soon crowding out other common forage plants and weeds. It is one of the first grasses to come up in the spring on the station grounds, and is ready for grazing before many other forage plants are fairly started. It blossoms in June and the seed ripens before the leaves dry up, hence with proper treatment the seed may be saved and still a large amount of forage of a good quality obtained. The fall growth is abundant and remains green and palatable well into the late fall or winter months.

HARDINESS.

It is quite probable that the reports of the excellent drouth-resisting qualities of this grass first called the attention of American experimenters to it, and since its introduction into the United States it has certainly maintained its reputation in this respect. It has been grown on the station grounds for the past five seasons and has proven very hardy indeed. It does not winter kill in the least and no fault can be found with its drouth-resisting powers. Professor Scribner speaks as follows of its hardiness:

While this grass will grow on lands too poor for the more valued agricultural grasses, and under conditions of climate which would entirely preclude the culture of these last, its productiveness depends, as in other cases, upon the amount and availability of the food supply. In other words, the better the conditions the better the growth. The reported yield is 1 to 3 tons to the acre. At the central experimental farm, Ottawa, Canada, the pure-plot culture gave at one cutting a yield of 3¼ tons of cured hay. As cultivated at the experiment stations this grass certainly presents a fine appearance, and the station reports, nearly without exception, praise it in the

highest terms. It is evident from these reports that the grass is little influenced by changes of climate. In Canada, in Mississippi, Kansas, Colorado, Wyoming and California it appears to do equally well. It is resistant to intense cold, to sudden and extreme changes of temperature, and withstands protracted drouth better than any other cultivated variety. In ordinary and poor soils the stems are only 12 to 18 inches high; under most favorable conditions they attain the height of 3 to 4 feet. The underground stems (rootstocks) grow most rapidly in light sandy loam, but they penetrate with apparent ease the stiffest clays, and in all cases form a dense, tough sod.

VALUE AS A FORAGE PLANT.

While there are other grasses that give a better quality of hay than does smooth brome grass, we have grown none at this station that has given as good returns one year with another. The grass has given paying crops every year for the past five seasons. The yield of seed is good, the hay is of good quality, though coarse when growth has been rank, and the grass promises well for use in permanent pastures. All kinds of stock eat it readily. Immediately after cutting a fine growth of aftermath springs up which with proper care affords excellent fall and early winter grazing. In fine it possesses more of the qualities necessary for a good all around plant for permanent pastures and meadows than any other grass grown on the station farm up to the present time. It should not be used where frequent rotation is desired, for it is likely to be quite as persistent as our native wheat grass.

CULTIVATION.

To get the best results the soil should be clean and worked up to a good depth in order that a good root bed may be obtained. We have secured best results from clean soil, prepared by thorough plowing the fall before seeding.

When sown alone, two to three bushels (28 to 42 pounds) per acre should be used. We have had better success when no nurse crop, as wheat, barley or oats, has been sown. The nurse crop keeps the young grass plants from making a good spring growth, *which is absolutely necessary if the drouth of the summer months is to be successfully endured.* This is true for any of our common forage plants under the conditions

prevailing during the average season in most parts of South Dakota.

Seeding should take place as soon as the ground is in good condition to work in the spring. The seed may be sown either broadcast or with a drill, preferably in the latter way. The chief advantage of drilling over broadcast seeding lies in the fact that the seed is more likely to be deep enough in the soil to secure the necessary moisture for germination and will not be dried up or blown out by the spring winds. There are still other advantages to be gained by drilling. The grass spreads very rapidly by means of its underground stems, and two bushels of seed, properly drilled in, will give as good a stand in the end as will three bushels sown broadcast and covered in the ordinary way. Again a drilled field will go from one to two years longer without becoming "hide bound" than will a field sown broadcast, since there is more chance for the rootstocks to spread.

As a rule the pasture or meadow should be given a thorough coating of well rotted manure once in every three or four years, and this should be followed by a thorough tearing up of the sod by means of a heavy drag or disk harrow. The dragging should be given in the spring while the manuring may be done in either spring or fall.

The best hay is obtained by cutting just as the grass is coming into bloom.

The seed can be procured from any of the larger firms dealing in farm and garden seeds, but it is still quite expensive owing to the great demand for it. Where one is desirous of sowing a pasture or meadow and is limited as to means the following method is recommended. Purchase enough seed to sow a small parcel of land, say an acre. Use good, clean land, and keep out all weeds. Save the seed grown on this piece of land and sow it the next spring. In a few years a field of the desired size can be obtained at a comparatively small expense. By mixing red clover, alsike, alfalfa, millet or other shorter lived, or tenderer forage plants with the smooth brome a larger piece of land can be sown, and then as these die out the brome will spread and finally fill up the field.

THE SMALLER FESCUES.

SHEEP'S FESCUE.

(*Festuca ovina.*)

This is a small grass a foot or more high, with narrow pointed leaves, and a mass of tough fibrous roots. It usually grows in bunches, and for this reason does not form an even sod. It thrives well on dry, rocky or sandy soils. On the station grounds it has given excellent results, being perfectly hardy so far as the cold of winter and heat and drouth of summer are concerned.

Sheep's fescue is of no value for hay on account of its small size. The abundance of root leaves produced makes it an excellent pasture grass, however. The tough fibrous roots penetrate deeply into the soil enabling the grass to obtain plenty of nourishment where most other varieties could scarcely, if at all, exist. The sod formed, though broken, is tough and endures severe trampling without serious injury. The forage produced is somewhat tough and harsh and hence is not so readily eaten as are the more succulent grasses; nevertheless, stock, particularly sheep, eat it quite greedily and do well on it, for it is very nutritious.

Sheep's fescue and the two following fescues are the most promising grasses yet tried at our station for use in dry, upland pastures, especially if the soil is poor, thin and sandy. They should be sown extensively in sheep pastures.

HARD FESCUE.

(*Festuca duriuscula.*)

This fescue is very much like sheep's fescue, but has a harsher foliage and is less densely tufted, forming an evener sod. It is usually rather taller and more robust in every way. Like sheep's fescue it is perfectly hardy and thrives on poor soils, but the forage is perhaps of less value because of the harsher nature of the plants.

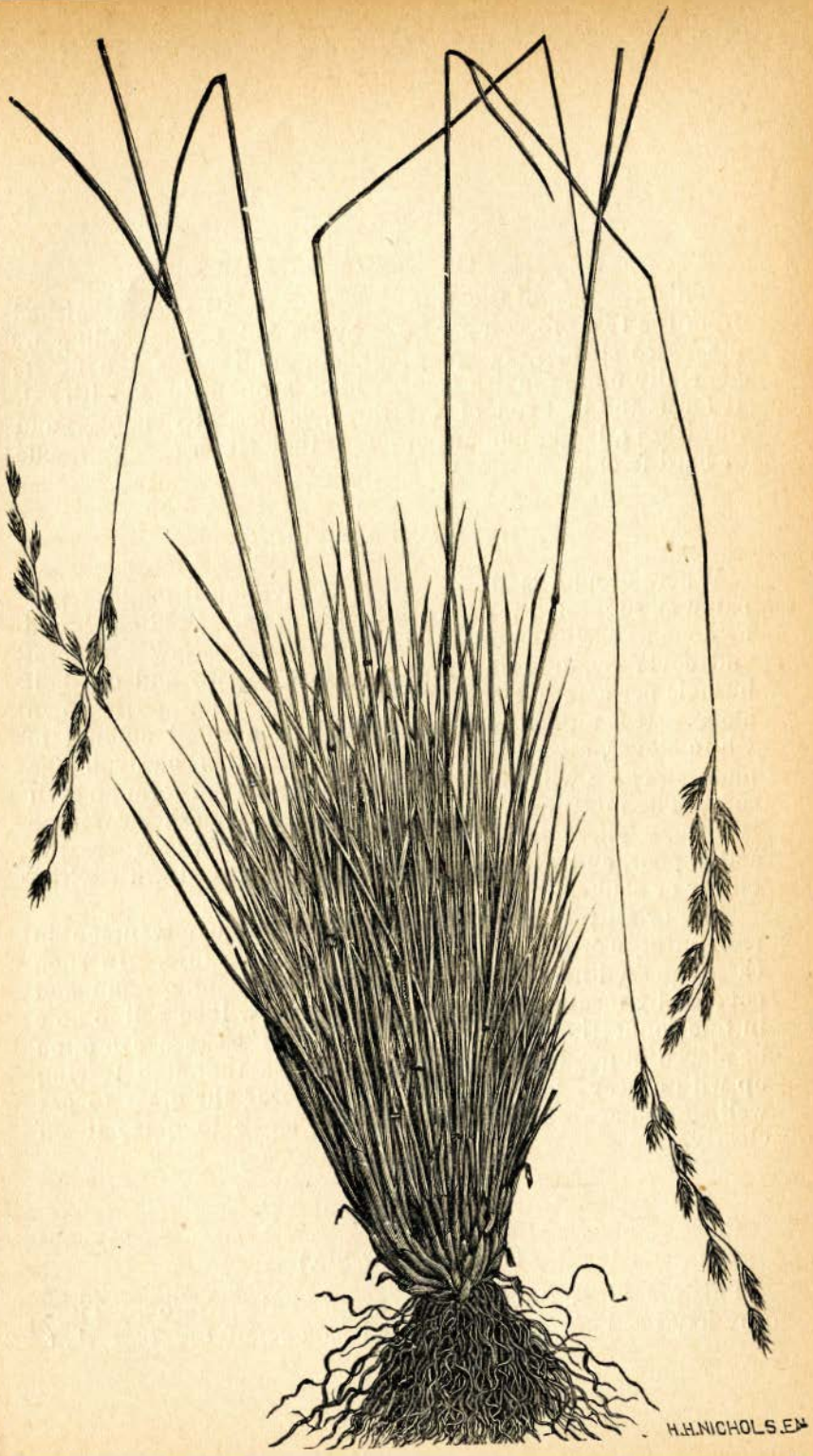

FIG. 2—Sheep's Fescue.

RED FESCUE.

(*Festuca rubra.*)

This, the best of the three fescues, may be distinguished from the two preceding species by its habit of spreading by means of slender, creeping, underground stems and by its generally more grayish color, which is often tinged with red. It forms the best sod of the three, is perfectly hardy, and furnishes a larger amount of forage than either sheep's fescue or hard fescue.

METHODS OF SEEDING.

Where ground is already under cultivation it may be prepared as suggested for smooth brome grass. Seeding should be done as early as possible in the spring. Sow broadcast and cover by dragging lightly. Two to two and one-half bushels per acre will be sufficient when the grass is sown alone. It is a good plan to mix with it a small amount of white clover, alsike, blue grass, or some other hardy forage plant. These will fill in the broken places and form an even sod. The mixture is especially desirable when sheep's fescue is sown. These grasses may be sown on lawns where the soil is poor, and when so used should be mixed with white clover or alsike.

Any or all the small fescues can be used to advantage in reclaiming worn out spots in the native pasture. In such cases the seed may be sown on the unbroken ground and covered by means of a heavy harrow. It will be well to note in this connection that a run-down native pasture can often be placed in good condition by giving it a thorough tearing up with a heavy harrow, and then allowing the grass to get well started again before allowing the stock to graze it off closely.

TIMOTHY.

(*Phleum pratense.*)

This grass is too well known to need description. Timothy hay has long been recognized as one of the best that

can be raised, and a region that can grow it successfully is sure to be well supplied with stock.

Timothy prefers a rich, moist, loamy soil, and does not thrive on light sandy soils. When grown on rich bottom lands, with an abundant supply of moisture, it will stand a large amount of grazing, but in the dry regions of the west stock should only be allowed on the timothy meadow to a limited extent. It is primarily a hay grass and should only be pastured when growing under the most favorable conditions. Sheep are particularly injurious to timothy because of their habits of close grazing and excessive trampling.

Throughout the Sioux valley and the Big Stone basin timothy is a paying crop if properly handled. Wherever irrigation is practiced there will be no difficulty in making it pay if the soil is not too light and sandy. It has done well at the experiment station, particularly when mixed with alsike or other clovers. It will not stand much pasturing, however, one field of timothy was almost entirely killed out in three years by sheep. It endures the cold and dry freezing of the Dakota winters without injury, but often suffers badly from the hot sun of July and August. It receives most injury when the soil is allowed to become hard and baked.

As timothy does not root deeply enough to obtain much nourishment from the subsoil it soon exhausts the surface soil. To overcome this trouble the meadow should be given a good coat of well rotted manure once in every two or three years. This can be done either in fall, winter or early spring. In the spring following this treatment the ground should be given a thorough tearing up with a harrow. This breaks up the surface of the soil which may have become baked or packed, lessens the loss of moisture by evaporation, and works the manure into the soil. A single treatment of this sort will often increase the yield of hay two or three fold, besides adding several years to the life of the meadow.

The timothy meadow will keep in better condition if a considerable amount of red clover or alsike is mixed with it. Besides adding materially to the forage obtained the clovers keep the soil in better condition and thus have a beneficial effect upon the timothy. It is also a good plan to mix with the timothy a small quantity of either red-top or creeping

bent, as they are both good forage plants and add firmness to the sod.

Timothy should be cut for hay about the time the "blossoms are falling". If cut much before this time the requisite amount of nourishment for the next season's growth will not be stored up in the bulbs and roots, and the field will be endangered more or less. If cut after the seeds begin to harden the hay is likely to be damaged in quality because of the development of woody tissue in the stems. Again timothy should not be cut too close. The hot sun of July and August is likely to do serious injury to the roots if these are left without the protection of some of the lower leaves. As a rule three or four inches of stubble should be left.

METHOD OF SEEDING.

The preparation of the soil for a timothy meadow should begin the season before the seed is to be sown. The field should be given a good coating of stable manure which will be worked into the ground during the cultivation of the crop for that year. The field should be thoroughly cleaned of weeds. Let the ground be prepared in the fall so that it will be in a fine condition of tilth; firm, yet mellow enough to allow the roots to penetrate it readily. This condition is generally best obtained by plowing late in the summer or early in the fall when the soil is moist enough to settle readily. However this will depend somewhat upon the past history of the land. If it has been plowed deep and often for a number of years and is clean it will usually be loose enough without another plowing.

I have seen excellent stands of timothy and clover obtained in the west by sowing in the spring directly on a millet stubble. In such instances the land had been heavily manured and plowed deeply before the millet crop had been planted. The plowing was done late enough to allow the weeds to get started and consequently these were mostly killed. Those that came up in the millet were cut before seeding so that the ground was left clean and in excellent condition at the end of the season. The timothy and clover was then sown early the following spring and covered with a harrow. This method would not prove successful, however,

unless the land had been in a high state of cultivation for several years previous to the sowing of the forage plants.

Timothy may be sown either with or without a nurse plant. Both methods seem to have been successful in many instances and unsuccessful in others. From our experience here at the station it seems to depend very largely upon the character of the season. If the season is a moist one, with occasional rains through July and August, a good stand of the grass may be obtained by sowing with some nurse plant, as for example, barley. If on the other hand the season is dry the barley will keep the grass back so much that when the crop is taken off the young timothy plants will not be strong enough to endure the drouth of late summer and early autumn. Consequently on dry seasons a better stand of the grass will be obtained if no nurse plant is used. For a season such as that of the average for the past five years the latter method would prove the better one. When the forage plants are sown without a nurse plant they get all the benefit of the spring moisture and are usually able to make sufficient growth before the dry weather of mid-summer to shade the ground and protect the roots from the heat of the sun's rays. They are also in better condition to pass through the extremes of the winter.

While in most of the northern and eastern states fall sowing seems to be the best, this is not true for most parts of the northwest—particularly in the drier, prairie states. Here, though an occasional fall sowing proves successful, it more often fails because of the lack of sufficient moisture in August and September. It is therefore best to sow in the spring as early as the ground is in a fit condition to work and as soon as the danger of protracted freezes is over. When timothy is sown alone from 12 to 20 pounds per acre will be sufficient, the exact amount depending somewhat upon the character of the soil or upon the season. If timothy and clover are sown together eight quarts (11 pounds) of timothy to one quart (2 pounds) of clover makes a very good mixture; but the proportion may be varied if occasion demands.

A light harrow or a brush drag may be used to cover the seed and the ground should not be rolled as this breaks up the small clods and the wind is more likely to blow the dirt off and uncover the seed.

CLOVERS.

Clovers have a two-fold value and hence are among the most profitable forage plants that can be grown. While they afford excellent forage, they at the same time possess great value as soil renewers. They put back into the soil much that wheat takes from it and hence may be used to advantage on land that has been exhausted by continued wheat growing.

It has been demonstrated very clearly during the past five years that certain of the clovers can be grown profitably in many parts of the state, and it is more than likely that the next five years will show the same thing to be true of many other localities. While it is true that our soil is not as well adapted to many of the clovers as are the stiff, clay and lime soils of some of the eastern states, yet it is also true that it is possible to make some of these clovers pay well on many of our Dakota farms.

RED CLOVER.

(*Trifolium pratense.*)

This is one of the most valuable of the clovers, particularly for use in the hay meadow. There are several different forms in common cultivation, some having biennial roots, others having perennial roots. Some of these forms are quite hardy in the west; others are too tender, either winter killing badly or suffering severely from the drouth of summer. This is probably the reason why many have failed to grow clover successfully. As a general thing the longer lived or perennial clover has been the hardiest in our experience.

In a number of instances complaints have been made that clover sowed with timothy died out in two or three years. This is not at all surprising since the natural life of the bi-

ennial clovers can be but two years, and unless the clover is able to reseed itself it will of necessity "die out." Since the clover is often not allowed to reseed itself, or is unable to mature seed from any natural cause, it is necessary to sow new seed every two or three years if the biennial sorts are used. This same thing would happen, however, in any region. In other words we cannot have a permanent clover field without reseeding. Nevertheless the clover pays well for the trouble, for, in addition to the one or two crops of forage yielded it livens up the soil and induces a better growth of timothy.

Red clover is being profitably grown on many farms in the eastern part of the state, especially in the lower Sioux valley and in portions of the Big Stone basin.

ALSIKE.

(*Trifolium hybridum.*)

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. It has not winter-killed in the least and has made a good growth every season. Plats of this clover mixed with timothy have given a good yield of hay every year since 1892 and have had no manuring nor extra treatment during the entire period. When plowed up this fall the sod was in excellent condition.

It certainly promises well for this region and should be given an extended trial, especially wherever irrigation is possible.

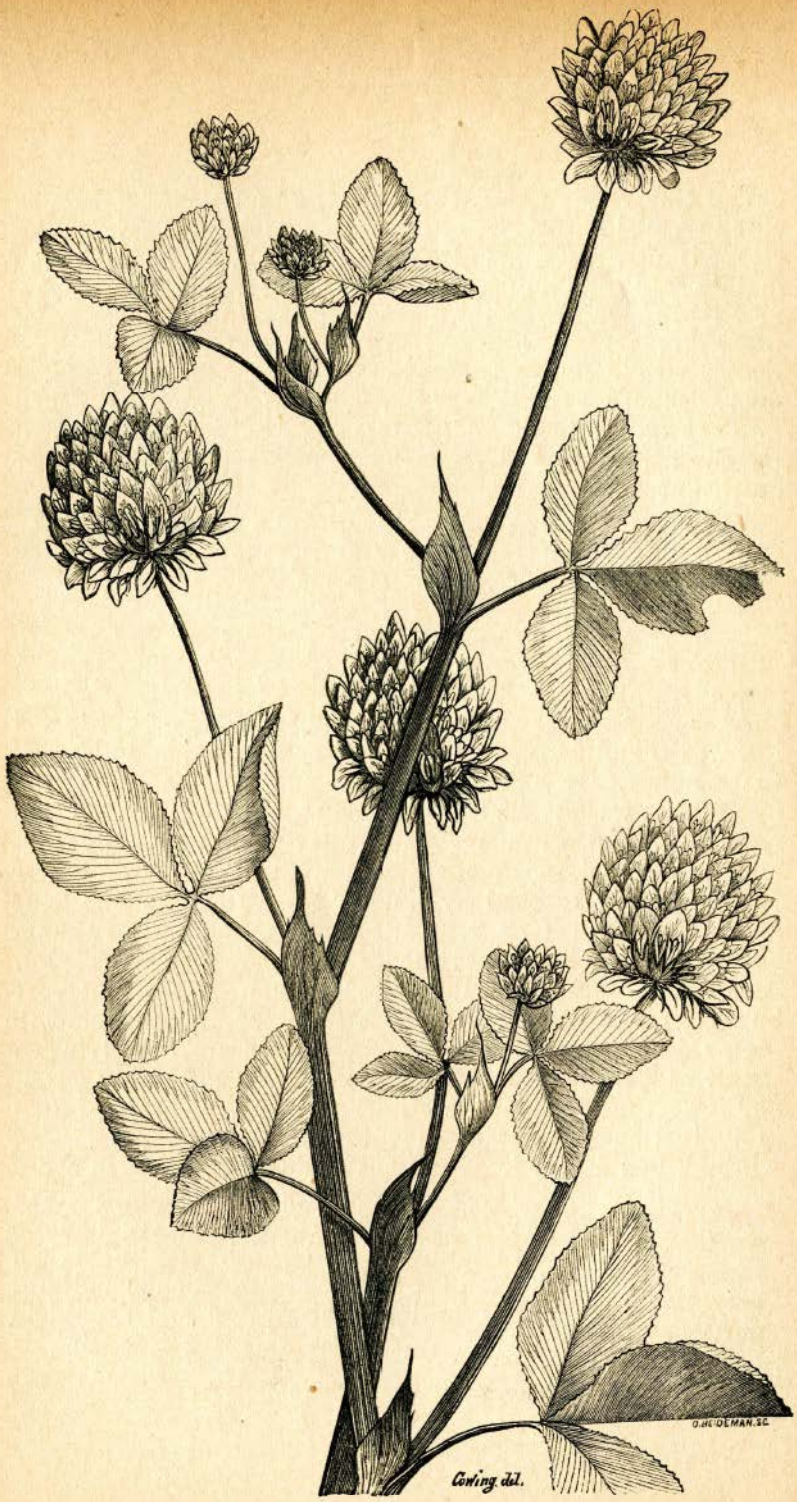

FIG. 3—Alsike.

WHITE CLOVER.

(*Trifolium repens.*)

This is the smallest of the common clovers. It spreads rapidly by means of its creeping stems which root at the joints. It produces an abundance of blossoms rich in nectar and hence is an excellent honey plant.

Because of its small size it is of no value for hay. It is, however, an excellent clover for sowing in pastures. Stock eats it readily, especially when it is mixed with the common pasture grasses. It is of more value as a flesh producer than for the production of milk. It is very valuable for fattening sheep. It should be given a prominent place in all mixtures for permanent pastures.

White clover is also a good plant for use in lawn mixtures. It forms a close matted growth and is not injured at all by close cutting with the lawn mower. The foliage makes a fine appearance when mixed with that of blue grass or fescue.

This clover has made a very good showing on the grounds of the experiment station. It has not winter-killed in the least and seems to be able to go through the drouth of the ordinary Dakota summer with little or no injury. It does not start very early in the season but when once started, grows rapidly and furnishes a large amount of forage for so small a plant. It will undergo a large amount of trampling without injury and hence is a good plant for sheep or hog pastures. It is wonderfully persistent on good soil and often when apparently all killed out from excessive drouth or some other cause it will come up plentifully after a heavy rain and with favorable conditions will soon be as thick as ever.

SOWING CLOVERS.

For forage purposes clovers can be most profitably grown when sown with one or more of the various meadow or pasture grasses. The amount of seed used per acre will depend very much upon the character of the mixture used and the purpose for which it is intended.

To get best results the ground should be clean and in good tilth to a depth sufficient to make a good root bed. Sow in

spring as soon as the ground is warm and danger from severe freezing is over. In the average Dakota soil the seed should be covered to a depth of one and one-half to two inches except in the case of white clover which should not be covered quite so deep. The seed may be drilled or sown broadcast.

MIXTURES.

When a permanent pasture or meadow is desired it is usually best to sow more than one kind of grass or clover. The advantages gained by using well selected mixtures are obvious. As a rule the long lived perennials require more than one year in which to reach their best development while on the other hand the shorter lived plants soon attain perfection and then die out. By making a judicious selection of varieties for a mixture it is possible to obtain a succession of plants in which one or more will always be in the best possible condition. Again it is not a good plan to be obliged to depend upon a single kind of forage plant. The seed may be poor, the season unfavorable, or some insect or other pest may cause a partial or total failure to get a good stand. If several varieties are used in a well proportioned mixture the chances for success are multiplied several fold. The following are mixtures that may be recommended for use in South Dakota:

I—MIXTURE FOR A PERMANENT PASTURE ON AVERAGE PRAIRIE SOIL.

Smooth Brome (*Bromus inermis*)	7 pounds
Meadow Foxtail (*Alopecurus pratensis*)	3 pounds
Wood Meadow Grass (*Poa nemoralis*)	3 pounds
Creeping Bent (*Agrostis stolonifera*)	3 pounds
Kentucky Blue Grass (*Poa pratensis*)	5 pounds
Timothy	3 pounds
Red Fescue (*Festuca rubra*)	3 pounds
Red Top (*Agrostis vulgaris*)	3 pounds
Orchard Grass, or Tall Meadow Oat Grass	2 pounds
Creeping June Grass (*Poa compressa*)	4 pounds
Alsike or White Clover	6 pounds
Total per acre	42 pounds

II—MIXTURE FOR LAND LIABLE TO OCCASIONAL OVERFLOWING.

Red Top	3 pounds
Tall Fescue	3 pounds
Reed Canary Grass (*Phalaris arundinacea*)	6 pounds
Creeping Bent	5 pounds
Timothy	5 pounds
Fowl Meadow Grass (*Poa serotina*)	9 pounds
Meadow Fescue (*Festuca pratensis*)	3 pounds
Alsike	7 pounds
Total per acre	41 pounds

III—MIXTURE FOR DRY, ROCKY OR GRAVELLY SOIL.

Smooth Brome Grass	7 pounds
Sheep's Fescue	5 pounds
Red Fescue	5 pounds
Creeping June Grass	5 pounds
Red Top	3 pounds
Kentucky Blue Grass	5 pounds
Creeping Bent	4 pounds
White or Alsike Clover	8 pounds
Total per acre	42 pounds

These mixtures are designed for use without nurse plants of any sort. The proportions can be varied more or less if circumstances render it necessary. Mixture No. 1 is recommended for the rich, loamy land of the prairies and valleys, and will be found the best for all general purposes. Number 2 can be used to advantage on low bottoms and old lake beds that are likely to be overflowed in the spring. Number 3 will prove valuable on the dry, hilly farms where the soil is more or less rocky or gravelly. It is a good mixture for sheep pastures.