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EC32-134 Sweet Clover Management

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Extension Circular 134 May, 1932

Sweet Clover Management

The University of Nebraska Agricultural College Extension Service
and United States Department of Agriculture Cooperating
W. H. Brokaw, Director, Lincoln

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(5-32-10M)

Sweet Clover Management

P. H. STEWART AND D. L. GROSS

Sweet clover has made a phenomenal growth in popularity and acreage during recent years. In Nebraska, the production increased from 30,000 acres in 1920 to 1,126,000 acres in 1930, an expansion of over one million acres in a 10-year period. Just a few years ago, when sweet clover was classified as a weed, it was the subject of proposed state legislation to prevent its production and spread. Today sweet clover has a recognized place among standard crops and in rotation systems. The acreage of sweet clover in Nebraska is now practically equal to that of alfalfa and is more than ten times that of red clover. Some Nebraska counties grow more than 40,000 acres of sweet clover annually.

This extraordinary increase in sweet clover production has been due to the excellent results secured from the crop when used for soil building and pasture and to a less extent to its value as a seed and hay crop. The cheapness of seed, the ease of getting stands, and the suitability of the crop for short rotations have added also to its popularity.

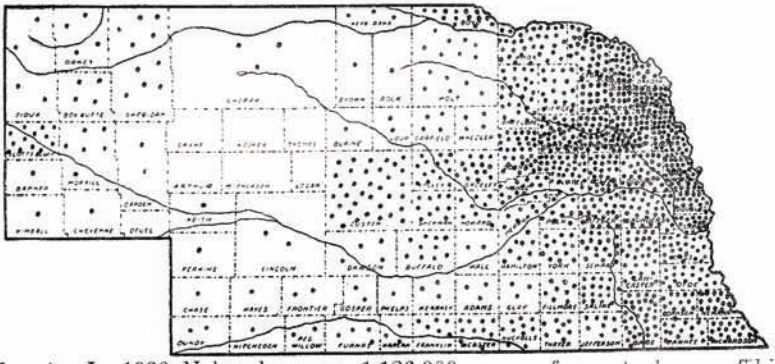

FIG. 1.—In 1930 Nebraska grew 1,126,000 acres of sweet clover. This shows the distribution by counties. Each dot equals 1,000 acres.

KINDS OF SWEET CLOVER

There are four kinds of sweet clover available commercially in Nebraska. Each of these has distinct characteristics, growth habits, and values.

SMALL YELLOW ANNUAL SWEET CLOVER (Melilotus Indica)

This species is not common in Nebraska and is of no economic value in the state. Due to the cheapness of the seed, it is sometimes sold under the general name of sweet clover as a substitute for common sweet clover. It can be identified from other sweet clovers by the patchy, broken, grayish-white coat or pod which sticks to the threshed seed.

ANNUAL WHITE BLOSSOM SWEET CLOVER (Hubam)

Hubam sweet clover is an annual variety with a white blossom. It starts from seed, blooms, produces seed, and dies in one year. Hubam sweet clover has received considerable publicity during recent years but it has not become popular. Experience with it in Nebraska indicates that it is inferior to the biennial species when considered from the standpoint of soil building, hay, or pasture. Since Hubam is an annual, it can be plowed in the fall and has some value on heavy, clayey land which should be fall plowed. Eastern Nebraska farmers who fall plow a part of their stubble land in order to avoid a rush of labor in the spring or for other reasons may find it advantageous to grow some Hubam sweet clover.

BIENNIAL SWEET CLOVERS

The yellow and white blossom biennial species make up approximately 98 per cent of the sweet clover acreage of the state. This is the kind of sweet clover referred to in the rest of this circular. Biennial sweet clover plants bloom, produce seed, and die during their second year. The first year's growth is leafy and not unlike that of alfalfa.

Biennial white blossom sweet clover (*Melilotus alba*).—There are on the market a number of selections or varieties of white blossom sweet clover. Grundy county, Arctic, and Essex are small and early maturing varieties of the common biennial white species. Probably 75 per cent of the sweet clover in Nebraska is the white blossom biennial species, most of this being the common biennial altho some Grundy county white is grown. Since the Grundy county variety makes a less rank second year growth, it is somewhat easier to handle as a seed crop than the common white biennial. The common white blossom biennial sweet clover is preferred where the maximum amount of hay, pasture, and soil improvement is desired.

Biennial yellow blossom sweet clover (*Melilotus officinalis*).—The first year's growth of yellow blossom biennial sweet clover may be less than that of the common white biennial, while the second year's growth is shorter, finer stemmed, and inclined to be more prostrate. It blooms from 10 days to two weeks earlier than the common white biennial and therefore has a shorter pasture season during its second year. Because of its smaller growth, yellow blossom sweet clover often can be harvested for seed more easily than the common white blossom sweet clover. The

yellow biennial sweet clover seems to set seed more heavily and uniformly than the common white blossom sort; at least the amount of seed actually harvested per acre is likely to be greater.

There are some indications that yellow biennial sweet clover is more certain than the white biennial to make a stand under adverse soil moisture conditions. Nebraska surveys indicate that from 20 to 25 per cent of the sweet clover now being grown is the yellow biennial species. In some localities, however, this species predominates and is preferred by farmers.

There are a number of varieties or selections of yellow blossom biennial sweet clover which differ somewhat from the common yellow. The Switzer variety, which is still finer stemmed and more prostrate than the common yellow biennial, is grown to a considerable extent in Madison and other counties of the state. The Albotrea is also a yellow variety, seed of which is available commercially.

TIME AND METHOD OF SEEDING

There are a number of ways in which sweet clover may be seeded depending on the location in the state, the condition of the land, and the purpose for which the crop is grown. Regardless of the method of seeding that is used, one of the most essential things in getting a stand is to provide a firm, well packed seedbed.

SEEDING WITH SPRING GRAIN

Most of the sweet clover is seeded in the spring with oats or barley as a nurse crop. Ordinarily the seeding is done on disked corn stalk land altho the land may be plowed. In northeastern Nebraska, where a large amount of sweet clover is grown (Fig. 1), a common way of seeding small grain is to broadcast it on stalk land and then disk it in. Usually the sweet clover is then broadcast with an endgate or hand seeder and harrowed in, altho some farmers broadcast the spring grain and sweet clover together, disking both in at the same time. This may cover the sweet clover somewhat too deep for best results, particularly on heavy soils. Under unusually favorable conditions, sweet clover seeded with spring grain may be so tall and rank by harvest time that it molds in the bundles and interferes with threshing. Under such conditions, sweet clover sometimes is seeded from two to three weeks later than the small grain, being drilled crosswise to the grain or broadcast and covered with a roller or light harrow. Altho it may be troublesome, the presence of a considerable amount of first year sweet

FIG. 2.—Seeding sweet clover with spring grain is a common and satisfactory method in eastern Nebraska.

clover in small grain adds materially to the value of the straw as a feed.

In some localities farmers prefer to plow rather than disk stalk land for oats and barley. Sweet clover is not likely to make as satisfactory a stand on plowed land as on disked land, unless special care is taken to pack the seedbed. Plowing for spring grain is confined largely to areas where winter wheat is grown. In such localities, the spring grain is usually drilled and the sweet clover seeded by means of a grass seeder attachment on the drill. Care should be taken not to cover the sweet clover too deeply when using a drill. It is a common and advisable practice to broadcast the sweet clover ahead of the disks rather than to put the seed directly into the drill row with the small grain. Sometimes the small grain is drilled in, after which the sweet clover is broadcast and covered with a roller or harrow.

Sowing sweet clover with a full seeding of spring grain is most likely to succeed in eastern Nebraska and in valleys and irrigated areas where moisture conditions are favorable. Even in eastern Nebraska during dry seasons the clover may fail to make a stand. It is advantageous to the sweet clover to reduce the rate of seeding of small grain from one-third to one-half. The small grain tends to keep down weed growth; yet a light nurse crop does not shade the sweet clover excessively. An early maturing oat or barley variety makes a better nurse crop than a late one. Under certain conditions it may be advisable to cut the nurse crop early for hay, thus favoring the sweet clover by removing the small grain before it has dried out the soil excessively and before the hot harvest season comes on. Pasturing the nurse crop moderately rather than cutting it for hay or allowing it to mature seems to be even more favorable to the clover.

SEEDING WITH WINTER WHEAT

In eastern Nebraska, particularly in Missouri river counties, sweet clover is sometimes seeded on winter wheat. Winter wheat and winter rye are more severe nurse crops

than spring grains and it is only in the most favorable parts of Nebraska and during favorable seasons that winter grains can be used successfully. Sweet clover is usually broadcast on winter grains during January, February, or early March. Often no attempt is made to cover the seed, dependence being put on frost action, rains, and snows to do this. Observations indicate that when sweet clover is seeded on winter grain during dry winter and spring seasons, better stands are secured where the seed is covered in some way, such as by light harrowing or rolling. Sometimes sweet clover is sown on winter wheat in the spring by using the grain drill set to run over the land very lightly and drilling at right angles to the wheat rows.

FIG. 3.—An eastern Nebraska field of sweet clover seeded alone in late March on a firm, well prepared seedbed. The field was ready to pasture on June 10 on which date this picture was taken.

SEEDING ALONE

Although not a great deal of sweet clover is seeded alone, there are conditions where this practice is advisable.

In the drier parts of Nebraska, stands of sweet clover can usually be secured with greater certainty if the sweet clover is seeded early in the spring without a nurse crop. Altho hard spring freezes may occasionally injure early seedings of sweet clover just emerging from the soil, it seems advisable to risk this in order to start the sweet clover early and thereby avoid, so far as possible, later damage from weeds and hot, dry, summer weather.

On relatively weedfree land, where one is particularly anxious to have summer and fall pasture for the current season, excellent results usually can be secured by seeding sweet clover without a nurse crop in late March or in April. It may be seeded on well prepared fall plowing, on well packed shallow spring plowing, or on disked corn land. Special care should be taken to secure a firm seedbed, particularly if the land is plowed. It is usually necessary to clip the weeds from fields of sweet clover seeded alone. The sickle bar of the mower should be raised by means of

special shoes so as to clip both weeds and sweet clover high. Sweet clover seeded alone early in the spring usually can be pastured from mid-June or early July until late in the fall.

SEEDING ON PASTURES AND WASTE LANDS

Often thin unproductive pastures can be improved greatly by seeding sweet clover into them during late winter and early spring when the ground is not frozen. It is usually advisable, if the land is not too rough and steep, to disk the pasture so as to afford a better covering for the seed which should either be drilled or broadcast and harrowed in. When pastures are too rough for the use of

FIG. 4.—Thin, weedy pastures often may be improved by drilling sweet clover in them in the early spring.

machinery, sweet clover may be broadcast over them during the winter months allowing rains and snows and freezing and thawing to cover the seed. Keeping livestock off such reseeded pastures until the sweet clover is well established and then pasturing moderately will help very materially in securing stands.

SEEDING IN CORN IN JULY

Occasionally satisfactory stands of sweet clover are secured by seeding into corn fields at "laying by" time. Stands are most likely to be secured when moisture conditions are very favorable and where the stand of corn is thin. A rank stalk growth is likely to shade the ground so much that but little growth is made by the sweet clover.

FALL SEEDING OF SWEET CLOVER

Altho sweet clover can be seeded in August or early September in eastern Nebraska, very little is actually sown in that way. Sweet clover must be seeded early enough to become well established before winter, otherwise it may kill out. When the plants make considerable growth in the fall, they may be expected to bloom, produce seed, and

die the following season. Fall seeding is practical when one is particularly anxious to have sweet clover pasture for the early part of the following season.

KINDS OF SEED AND RATES OF SEEDING

Sweet clover seed from threshing machines and particularly that harvested by strippers is likely to contain a considerable per cent of unhulled seed. Such seed is commonly used for winter and very early spring seeding on wheat land, pastures, and waste lands. Sweet clover is likely to have a considerable per cent of so-called "hard seed" which does not germinate promptly. Special scarifying machines, for the purpose of removing the hull and overcoming the "hard seed" condition by scratching the seed coat so as to permit the absorption of water, are commonly used by seedsmen and others. Sweet clover seed which has been run thru a scarifying machine is known as scarified seed. Practically all of the sweet clover seed handled by seedsmen is scarified. It is commonly recommended that scarified seed be used for late spring and summer seeding. However, due to the extra cost of scarified seed, it is sometimes practical and economical to sow local or home grown unscarified seed for all conditions, even tho it may be necessary to sow more seed per acre.

There is considerable variation in the amount of sweet clover seed sown per acre. From 8 to 20 pounds of hulled seed are used, 12 to 15 pounds being about an average amount. Less seed is usually required on land which has been in sweet clover before than on fields seeded for the first time. It is probably better to sow at a heavy rate and thereby help to keep down weed growth than to sow too little seed. When unhulled seed is used, about one-third more by weight should be used.

LIMING AND INOCULATION

Sweet clover is the most sensitive of our important legume crops to a lack of lime in the soil. Fortunately most Nebraska soils are plentifully supplied with lime. However, in some local areas of southeastern Nebraska and in parts of the more or less sandy areas of northeastern Nebraska, the soil is deficient in lime to the extent that it is difficult to establish satisfactory stands. In such areas, the application of ground limestone at the rate of about two tons per acre may be worth while. Lime should first be tried on a small area in order to test its value. The application of well rotted manure a year or so in advance of seeding often helps very materially to secure good stands on fields where sweet clover is hard to establish.

Sweet clover plants make use of the nitrogen of the air by means of bacteria which live on the roots in whitish growths known as nodules. Unless such bacteria are present, sweet clover is unable to supply its own nitrogen and must depend on that in the soil. The same kind of bacteria that live on sweet clover also live on alfalfa. Tests indicate that most Nebraska soils are well supplied with bacteria of this kind and artificial inoculation is usually unnecessary. Should the behavior of sweet clover and the absence of nodules on the roots of the plants indicate that natural inoculation is lacking, bacteria can be supplied by commercial products.

It is a common experience that once sweet clover is grown on a field it is then much easier to establish later seedings. For this reason, where sweet clover is hard to start, it is sometimes well to leave partial stands. Later seedings are then likely to be much more satisfactory due in part probably to thoro inoculation of the land and to improvement in the fertility of the soil.

Spring seeded fields of sweet clover which in the fall appear to be too thin to be satisfactory should not be plowed up too hastily, as such stands are often much better the following spring than one expects.

GROWTH HABITS OF SWEET CLOVER WHICH INFLUENCE ITS MANAGEMENT

Common sweet clover is a biennial or two-year crop. The first year's growth is commonly spoken of as first year sweet clover in contrast to that of the second season, commonly known as second year sweet clover.

Sweet clover plants, in the fall of their first year, develop buds on the roots about one inch below the surface of the soil. Plowing first year sweet clover in the fall ordinarily does not kill the crop because these buds grow the next spring, even tho the plants are cut off. Because of this fact, it is not wise to fall plow first year sweet clover since the plants are likely to grow the following spring and cause much trouble in the succeeding crop.

The spring growth of second year sweet clover is produced by buds formed in the fall of the first year. However, the second growth comes from buds along the stem and not from additional crown buds as is the case with alfalfa. Therefore, if second year sweet clover is cut for hay, with the expectation of securing a second growth, the plants must be clipped high enough to leave live buds on the stubble, otherwise the crop is killed. The dense shade produced by thick stands of second year sweet clover tends

FIG. 5.—A first-year sweet clover plant showing the collar of buds formed on the root which start the second year growth.

to kill the buds along the stems of the sweet clover plants. The heavier the stand of sweet clover, the shorter it is mowed, and the later it is cut, the greater the likelihood of killing the plants by mowing. Where a second growth of two-year sweet clover is desired, the crop should be clipped high not later than when the first blossom buds appear.

Experiments indicate that sweet clover normally develops most of its root system in the late fall of its first year and during the following early spring months. If first year sweet clover is kept closely pastured off or if cut for hay in late summer or early fall, there is but little opportunity for the plants to develop a large root system and food reserve. This results in a slower and less vigorous growth the following spring. This condition may often be observed on farms where a part of a spring seeded field was heavily pastured or cut early for hay. The following spring the mown or pastured portion may be expected to start later and have a smaller root development than the rest of the field. When the maximum amount of early spring growth of second year sweet clover is desired, the first year sweet clover should not be cut for hay or pastured off until late in the fall.

UTILIZATION OF SWEET CLOVER

Sweet clover in Nebraska is grown chiefly for pasture and soil building purposes and to a less extent for seed and hay.

Sweet clover for pasture.—It is estimated that in Nebraska more than one-half million acres of sweet clover are used for pasture for at least a part of each year. One now seldom hears the once common complaint that cattle will not eat sweet clover. When stock, for the first time, are turned into coarse, stemmy second year sweet clover, they may refuse to eat it but there is little difficulty in getting them to graze tender, succulent plants.

Surveys and observations indicate that sweet clover will pasture at least twice the number of stock that can be carried on blue grass or native grass pastures.

PASTURING FIRST YEAR SWEET CLOVER

First year sweet clover, when seeded early and without a nurse crop, may ordinarily be pastured by about June 15 or July 1 in eastern Nebraska. It should be allowed to become well established before being pastured heavily. If

FIG. 6.—The sweet clover plant at the left was cut 10 days later than the one on the right. Note the height at which it was necessary to cut this plant so that a second crop would develop. When the stand is thin, the lower buds will survive as they did on the right, even though the sweet clover is cut later. From U. S. Dept. of Agriculture.

seeded with a nurse crop a reasonable amount of pasturing to hold the small grain in check does not injure the sweet clover.

Sweet clover seeded with small grain often makes excellent pasture in the fall after harvest, and such fields, supplying feed as they do when permanent and second year sweet clover pastures are likely to be short, are very valuable in supplying grazing until late in the year. It is possible to graze first year sweet clover closely in the fall without killing it. Close grazing, however is likely to retard the root development due to insufficient foliage for the manufacture of food. Sweet clover seeded with small grain is often allowed to grow until it has practically completed is fall growth and is then used for late fall and winter pasture.

PASTURING SECOND YEAR SWEET CLOVER

Second year sweet clover begins its growth very early in the spring of the second year and may be pastured as soon as it is tall enough to furnish a good bite. Reports from eastern Nebraska farmers show that such pastures will graze from two to three cows per acre for a period of about 110 days. Second year sweet clover ordinarily does not make much pasture after about July 25 or August 1.

The best results from second year sweet clover pasture are secured if it is kept pastured down reasonably close. If sufficient livestock is not available to hold the growth in check, it may be clipped high with a mower. An effort should be made to adjust the number of livestock to the amount of sweet clover that is to be pastured. This, however, is difficult to do unless the sweet clover is used in conjunction with permanent pasture or sudan grass, which can be grazed alternately with the sweet clover. This method works very well, as the sweet clover can be pas-

FIG. 7.—Figures show that second year sweet clover in eastern Nebraska will graze from 2 to 3 cows per acre for a period of about 110 days.

tured sufficiently to keep it down while in the meantime the other pasture may be allowed to produce as much growth as possible for later grazing. A few men have reported that cattle do not relish the sweet clover under this system but the experience of others indicates that this change of feed is not a serious factor.

Since first year sweet clover ordinarily can not be pastured heavily until in July and second year sweet clover pastures fail to make much growth after about August 1, a combination of the two makes a long pasture season. This can be accomplished by seeding sweet clover each year, thus providing a pasture of first year seeding for use when the second year pasture becomes worthless. Fall rye and sudan grass can also be used to supplement the sweet clover pastures.

Sometimes an effort is made to provide a permanent pasture of sweet clover by seeding two years in succession, the idea being to have both first and second year plants in the field the second season. The plants from the second year's seeding thus hold over for a third year. If a good stand of sweet clover is secured from the first year's seeding, it is doubtful if the young plants from the second seeding can survive. Moreover, it is difficult to pasture second year sweet clover so closely that sufficient seed is not produced to reseed the field for the third time. However, unless the land is very poor, or too rough to cultivate, it is generally advisable to crop land which has been in sweet clover for two seasons, thus rotating the sweet clover land with grain crops and thereby maintaining the fertility of the entire farm rather than to build up, to an excessive extent, the fertility of any certain field.

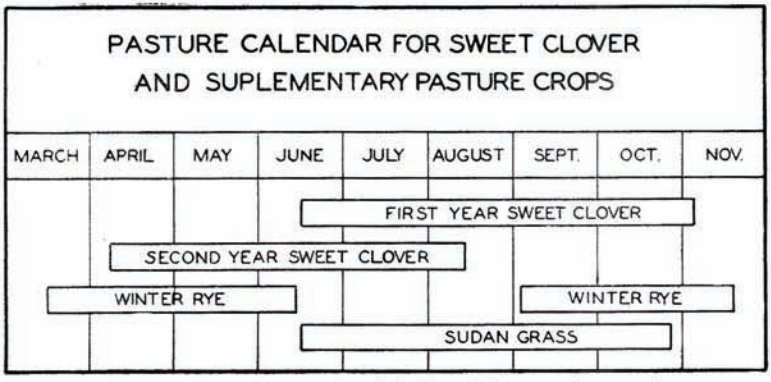

FIG. 8.—More use should be made of fields of first and second year sweet clover, together with Sudan grass and winter rye, to make a long pasture season.

BLOAT

Whenever sweet clover is pastured with cattle and sheep there is danger of bloat. The danger is greatest when hungry animals are pastured on the rank, succulent second year growth during early, wet spring months. Dr. L. Van Es, in Extension Circular 231 on Bloat, makes the following suggestions for the prevention of this trouble:

> "For the prevention of bloat, consideration should be given to a number of useful measures.
>
> "Special care is needed when animals accustumed to dry feed are to be turned into green pastures, especially if those contain clover, alfalfa, or sweet clover in considerable abundance. For such animals luscious vegetation is often dangerous and if at all possible, they should be pastured for a while on leaner vegetation such as natural prairie and the like, until their digestive organs become more accustomed to green feed.
>
> "When first turned into pastures, cattle and sheep should be fed with some dry forage in order to render them less greedy for the green plants. It is also advisable to keep a close watch on them for a time so that in the event of bloat appearing, the animals can be at once removed from the pasture and, if necessary, be given treatment.
>
> "The practice of leaving the animals in clover pastures only for a short time is a sound one, especially so during the beginning of the pasture season.
>
> "Under no circumstances should hungry animals be permitted to gorge in clover, alfalfa, or sweet clover when the foliage is wet with dew or rain water, and generally prudence is required in watering them when they have filled themselves with green food.
>
> "As other measures for the prevention of bloat, the presence of a hay or straw stack in the pasture, and the growing of such aromatic plants as caraway among the forage have been mentioned. They are worthy of consideration, altho their value has not been definitely proven."

SWEET CLOVER FOR SOIL BUILDING

Sweet clover is the outstanding crop for soil building purposes and all of the sweet clover grown in the state is grown at least in part for its beneficial soil effects. The ease of getting stands and the ability of sweet clover to

grow vigorously on thin, eroded hillsides makes it an ideal crop for land improvement and reclamation. The large, fleshy sweet clover roots penetrate the soil to a depth of four to five feet, leaving a large amount of organic matter. The soil following two years of sweet clover is greatly improved in tilth, being loose and mellow. Crops which follow sweet clover are less likely to suffer from drouth than those following alfalfa. Growing sweet clover on a soil not only adds nitrogen and organic matter, but other plant foods such as phosphorus seem to be made more available.

It is not at all unusual to have the yield of grain crops doubled or even trebled following a crop of sweet clover. The increase in yield is greatest, of course, on thin land which has become badly run down. A survey of 40 farms scattered well over Nebraska indicates that corn on the average will yield 64 per cent more after sweet clover than on similar soil not seeded down. Likewise, these reports indicate a 56 per cent increase in the yield of oats after sweet clover and a 50 per cent increase in winter wheat. These increased yields are probably somewhat greater than can be expected on all land, since the farmers who reported naturally seeded sweet clover on the thinnest land on the farm and the estimates of increased yields were based on results secured from these fields.

The U. S. Department of Agriculture in Farmers' Bulletin No. 1653 gives figures based on surveys in the corn belt which should hold fairly well under normal eastern Nebraska conditions. These figures show that sweet clover plowed under green on poor to medium soils increased the yield of corn 64 per cent. Green sweet clover plowed under on good fields resulted in an increase of 36 per cent in the yield of corn. Corn following two years of sweet clover on poor to medium soil averaged 115 per cent increase, while on good soil corn averaged 37 per cent more than on similar soil not seeded to sweet clover. As an average for all soils, the growing of sweet clover increased the yield of corn 62 per cent.

Sweet clover, as a soil builder under irrigation, gives wonderful results. Survey figures show an increase of sugar beets of 4.75 tons, or 37 per cent, per acre on land where sweet clover was plowed under the second season as a green manure or used as a pasture crop. Similar figures for potatoes show an increase of 96 bushels, or 56 per cent, following sweet clover. These survey figures are substantiated by the results from the Scottsbluff Experi-

ment Station where experiments show a yield of 19.3 tons of sugar beets following alfalfa and 21.2 tons following pastured second year sweet clover, as compared to 12.1 tons on land neither manured nor seeded to legumes. Sweet clover seeded with small grain and pastured off the second year seems to have about the same soil building value as four years of alfalfa when measured by the yields of succeeding crops.

From the standpoint of organic matter and nitrogen, a good second year sweet clover crop is estimated to be equal to 20 tons of average barnyard manure per acre. Even when plowed under in the spring of its second year, a normal sweet clover crop will add from 100 to 150 pounds of nitrogen per acre which is equal to that contained in 10 to 15 tons of manure. This would be enough nitrogen to produce two or three 35-bushel corn crops.

In eastern Nebraska sweet clover is commonly seeded with small grain and plowed under the following spring for corn. This practice can be carried on successfully only when moisture conditions are reasonably satisfactory. The question arises as to what benefit sweet clover is to the soil when plowed under in the spring of its second year as compared to leaving the crop on the land for the full two seasons of growth. It has been shown that sweet clover, to

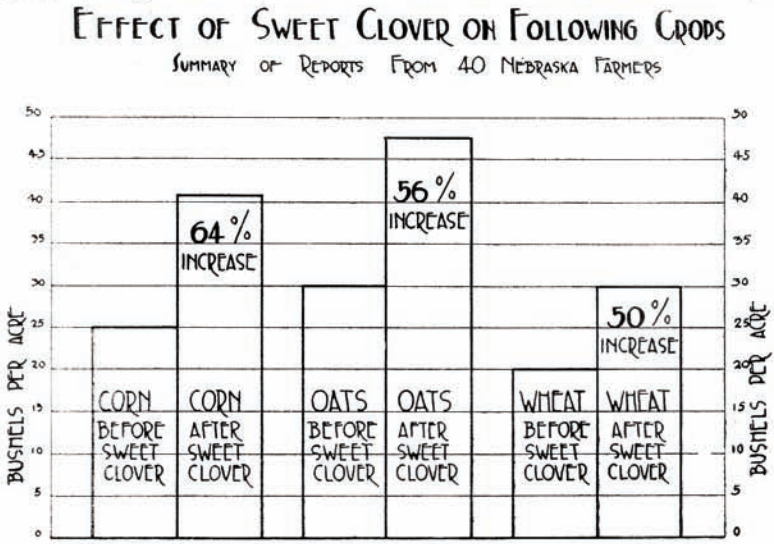

FIG. 9.—Sweet clover, on the average, increased the yield of corn 64 per cent, oats 56 per cent, and winter wheat 50 per cent, according to reports from 40 Nebraska farmers.

a great extent, develops its root system and nitrogen in the late fall of the first year of growth and in the early spring of the second season. Sweet clover contains the maximum amount of nitrogen when it reaches a height of about 20 to 24 inches which in eastern Nebraska during normal seasons is in late May. Altho the growth of sweet clover increases after this time, the total amount of nitrogen per plant or per acre does not materially increase. When a six- to eight-inch growth of second year sweet clover is plowed under during the early part of May, it is estimated that 75 to 80 per cent of the nitrogen is added to the land that is supplied if the crop were left until it had made its full growth.

It has been shown that mowing or heavy pasturing first year sweet clover during the late summer and early fall decreases very materially the rate and amount of growth the following spring. Where one is primarily interested in getting a heavy spring growth for plowing under in May, care should be used in managing the crop the previous fall. In this case, it would be well to delay pasturing or cutting until the growth has practically ceased in the fall.

Many farmers make the mistake of allowing the sweet clover to become 20 to 30 inches high in the spring of its second year before turning it under for corn. This heavy growth is very likely to dry out the soil excessively, making it difficult to get a satisfactory seedbed and stand. When handled in this way, the corn crop is more likely to suffer from drouth than where the sweet clover is plowed under when six to eight inches high.

A growing practice among eastern Nebraska farmers is to plow sweet clover under shallow in early May and then list the field to corn, setting the lister to run somewhat deeper than the plow. Listing tends to reduce the damage from hot, dry weather, since the corn does not grow so rank as when surface planted. Listed corn also stands up better. Where listed corn machinery is available and where the land is not so rolling as to wash excessively, this is a good practice to follow. In parts of the state where normal moisture conditions are likely to be unfavorable to the practice of plowing the sweet clover under in the spring of its second year, it is advisable to allow sweet clover to stay on the land for two seasons.

When the soil is reasonably high in fertility and in good tilth, the plan of plowing under the second year growth in early May is very practical. However, where one has a badly run down, sticky soil which is difficult to manage, it

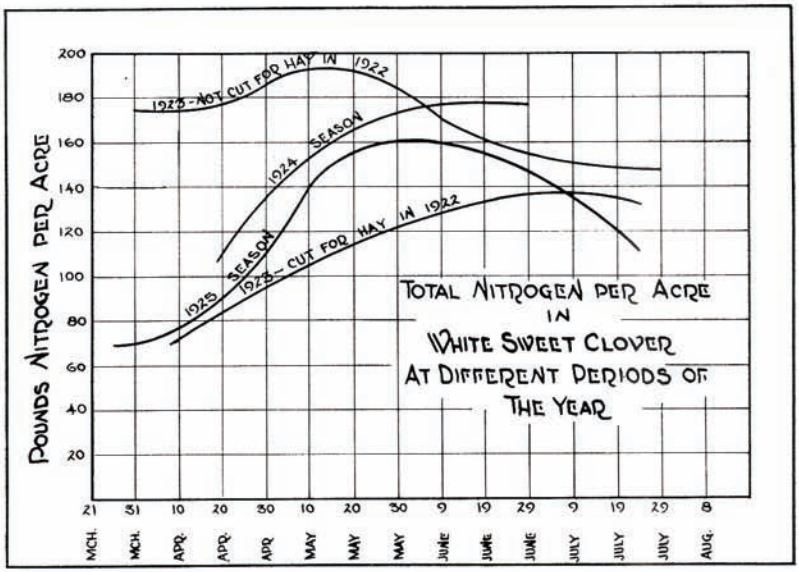

FIG. 10.—Note the amount of nitrogen in an acre of second year sweet clover during different seasons and following the first year crop handled in various ways. (Prepared from Ohio Exp. Sta. data.)

is very desirable to allow the sweet clover to remain on the field for the full second year's growth. This will improve the soil greatly in tilth and organic matter as well as in its nitrogen content. On sandy lands where stands are difficult to establish, it is well to allow the sweet clover to grow for two full seasons so as to add the maximum amount of both nitrogen and organic matter.

Sweet clover left on the land for two full seasons without pasturing or mowing often results in an extremely heavy growth of tall, coarse stemmed material. The disposal of this growth in preparing the land for a succeeding grain crop often presents quite a problem. If this material is not broken down and thoroly pulverized before the land is plowed, it is nearly impossible to prepare a satisfactory seedbed. Disking this growth when it is dry usually is satisfactory. A tractor and a heavily weighted disk are perhaps the best tools to use for this purpose. Where it seems impractical to thoroly break up this growth before plowing, burning may be the practical solution. It must be understood, of course, that when the sweet clover plants are mature, only about 10 per cent of their total nitrogen is in the roots. The remaining 90 per cent is in the stems and leaves except that which has been leached out and

FIG. 11.—Disking a growth of second year sweet clover when it is dry and brittle will ordinarily break it up and mix it with the soil so that the field can be handled satisfactorily.

into the soil. The extent of this leaching has not been determined, but is no doubt considerable where the plants are left standing until the spring following maturity. One might roughly estimate that burning at this time destroys not to exceed 40 per cent of the total nitrogen produced by the plants during their two years of growth. On farms where sweet clover is sown frequently in the rotation, the loss of a goodly portion of the nitrogen by burning may not be serious. On soils badly depleted of their nitrogen and organic matter, and especially on those subject to erosion, it is wise to make every effort to incorporate all the top growth into the soil rather than to burn it. On the other hand, experience has shown that during some seasons the plowing under of a heavy growth increases the danger of damage from cut worms, should corn be the following crop.

SWEET CLOVER FOR HAY

First year sweet clover makes excellent hay. Normally in eastern Nebraska, thousands of acres are cut in the late fall from fields where sweet clover was seeded with small grains. Such sweet clover hay, while it contains the small grain stubble and usually a considerable per cent of corn stalks, is fine stemmed and leafy and makes very satisfactory feed, being commonly considered equal to alfalfa which it has replaced to some extent in certain eastern Ne-

braska localities. During dry seasons, however, there is not a sufficient growth of sweet clover following harvest to be of importance as a hay crop.

Mowing first year sweet clover for hay should be delayed as long as weather permits as this not only results in the maximum tonnage but also tends to produce an extensive fall root development and an early, vigorous growth the following spring.

Second year sweet clover is difficult to handle as a hay crop. It is inclined to be coarse, stemmy, hard to cure, and if mowed too close or too late there is danger of killing the plants. Ordinarily second year sweet clover in eastern Nebraska reaches the flower-bud stage in the latter part of May or early June at which time it should be cut. It may be cut even before the first blossom buds appear. Usually hay curing conditions at that time of the year are not very satisfactory.

When cut with a mower, the sickle bar should be raised as high as possible so as to leave a tall stubble from which the second growth may start. Special shoes on each end of the sickle bar are usually necessary.

FIG. 12.—A Madison county field of second year sweet clover which was cut for hay and now has a second growth coming on for seed.

Some farmers have successfully cut second year sweet clover with a binder by tying the crop into bundles which are shocked for curing. There may be a tendency for some moldy hay to develop under the bands, especially during adverse weather, but ordinarily a fairly good quality of hay may be produced in this manner. The cost of labor and twine makes the expense of harvesting in this way rather high.

There has been some loss of livestock, particularly young cattle, fed on second year sweet clover hay, the cause of which is thot to be associated with a moldy condition of the

forage. The blood of afflicted animals seems to lose its clotting properties and the animals may bleed to death from wounds or internal hemorrhages. When second year sweet clover hay is fed, it is suggested that other forage be used at intervals extending over three of four weeks, thus avoiding feeding sweet clover continuously for a considerable period.

FIG. 13.—A sample of good sweet clover seed.

SWEET CLOVER SEED PRODUCTION

The amount of sweet clover seed produced in Nebraska depends largely on the market price. Normally about 100,000 bushels are grown, according to the State Department of Agriculture. The average yield of seed is about four bushels per acre with yields ranging as high as 15 to 18 bushels in exceptional cases. Much of the seed grown in Nebraska is produced in the north central part in Custer, Valley, Buffalo, Sherman, Holt, Boone, Nance, Platte, and Madison counties, altho practically every county in the state produces some seed (Fig. 14).

Sweet clover seed is difficult to harvest. There is no machine available which is entirely satisfactory for the purpose. A part of the difficulty in harvesting is due to the fact that the seed ripens unevenly, as a plant produces

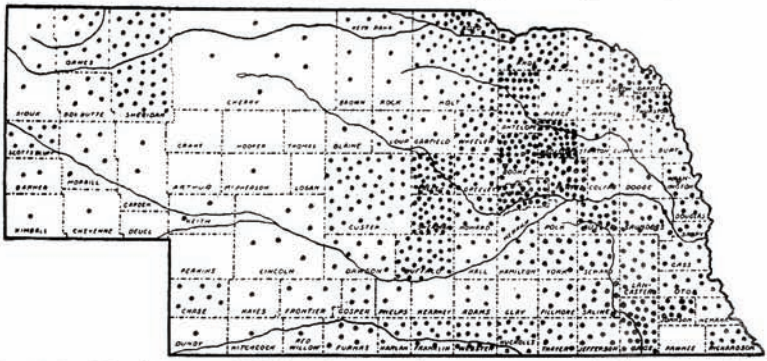

FIG. 14.—North-central Nebraska counties grow most of the sweet clover seed produced in Nebraska. (One dot equals 100 bushels of seed, 3-year average.)

TABLE 1.—*Sweet clover seed production in the United States and the average price paid Nebraska growers during 1926-31.*

Year	Total Production of Sweet Clover Seed in the United States in pounds	Average Price per Cwt. Paid to Nebraska Growers
1926	68,400,000	$8.40
1927	73,400,000	5.85
1928	54,600,000	5.70
1929	57,700,000	5.20
1930	41,640,000	5.70
1931	39,258,000	3.45*

* Preliminary.

flowers, green seed, and ripe seed at the same time. Judgment must be used in determining when to cut sweet clover for seed. The time selected for harvesting should be when the largest amount of ripe seed is present or when about three-fourths of the pods have turned brown. At this time the sweet clover field develops a faint brownish cast.

Most of the sweet clover harvested for seed is cut with an ordinary grain binder. Unless second year common white blossom sweet clover is cut or pastured the first part of the season, it is likely to grow so tall and rank that it cannot be handled easily, if at all, with a grain binder. When a grain binder is used, a long wooden or metal pan placed beneath the binder where the platform and elevator canvas meet will save considerable seed. Likewise, pans placed under the packers of the binder will also catch much seed which would otherwise be lost.[1] It is a good plan to cut sweet clover for seed if possible when the weather is damp as there will be materially less shattering of seed under such conditions. Ordinarily sweet clover cut with a binder is shocked for a few days and then threshed with an ordinary threshing machine. Tight bottomed racks should be used for hauling the bundles to the machine.

A fairly satisfactory sweet clover seed harvester may be made from an old binder. The binder head, sickle, rollers, and driving mechanism are removed and the essential parts which remain are the frame, bullwheel, and platform.

As shown in Figure 15, a sheet metal housing is constructed around the platform and in front of it is placed a heavy reel driven by the bullwheel sprocket with a heavy chain. The speed of the reel is four to five times as fast as that of the bullwheel. As the machine is drawn forward,

[1] For full details as to how to construct these pans and for additional information on harvesting sweet clover for seed, see U. S. D. A. Farmer's Bulletin No. 836.

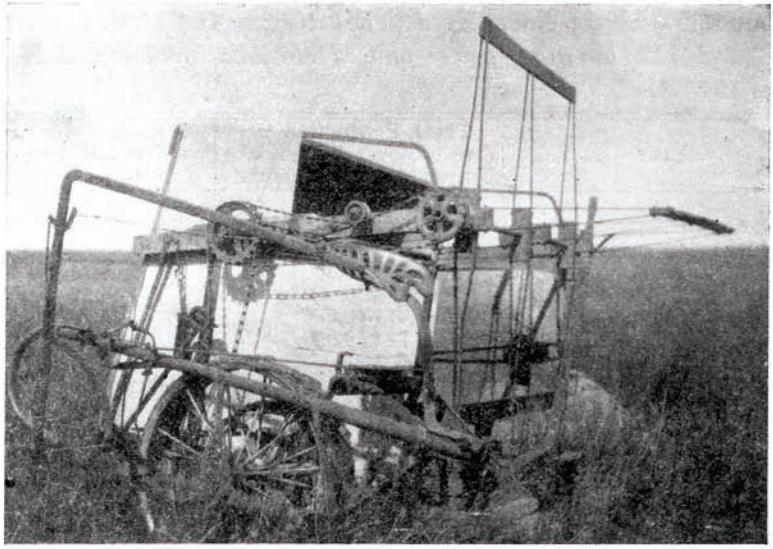

FIG. 15.—An old binder rebuilt into a seed stripper makes a fairly satisfactory machine for harvesting sweet clover seed.

the beater or reel strikes the standing clover, knocking the seed to the platform. The metal housing serves as a protection from wind and keeps the seed from becoming scattered. Some who have built the machine place a screen of ½-inch mesh hardware cloth back of the reel. This allows the seed to go thru but keeps the stems out. A roller placed where the sickle used to be allows the machine to pass over the heavy clover easily and reduces the draft so that one less horse may be used. A door at the back of the metal housing allows the operator to scoop out the seed when a load has been harvested.

When a stripper of this sort is used, facilities must be at hand for drying the seed, since green seed, sticks, and leaves are mixed with the ripe seed. Usually the seed crop is piled in a thin layer on the floor of a corn crib or barn. It must be stirred frequently in order to prevent it from heating.

SWEET CLOVER IN WILD HAY MEADOWS

Sweet clover often volunteers in native hay meadows where it proves to be a nuisance. By the time the native grasses are ready to be cut the sweet clover, particularly the second year growth, is rank, coarse, and objectionable in the hay. Mowing the meadows early enough for several seasons to prevent seed formation by the two-year-old plants is of value in eradicating the sweet clover.