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**Urbana, Illinois**

Cooperative Extension Work in Agriculture and Home Economics: University of Illinois, College of Agriculture, and the United States Department of Agriculture cooperating.

H. P. Rusk, Director. Acts approved by Congress May 8 and June 30, 1914.
Sweet Clover for Illinois
ITS CULTIVATION AND USE

By O. H. Sears, Chief in Soil Biology; and W. L. Burlison,
Chief in Crop Production

EXCELLENCE of sweet clover as a soil builder and its popularity
as a pasture crop have brought it into wide use during recent
years. Its ability to withstand both high and low temperatures
and to grow on almost any sweet soil when nodulated are other desir-
able characteristics. Among the legumes, it is second only to soybeans
in acreage in Illinois and is believed to be near the top in the United
States, altho definite figures are lacking.

A large proportion of Illinois farmers use sweet clover for both
pasture and soil improvement, and probably for many there is no
better way. It is also used as bee pasture and for hay and seed.

This circular discusses particularly the various methods of han-
dling sweet clover and some of the problems involved. The best method
in a particular situation depends on (1) whether livestock or grain
farming is practiced, (2) what rotation is used, (3) kind of soil,
(4) amount and kind of power available, and (5) purpose for which
crop is grown.

VARIETIES FOR ILLINOIS

Almost all the sweet clover grown in Illinois is either common white
(Melilotus alba) or common yellow (Melilotus officinalis). The bienn-
ial form, which produces seeds in the second year of growth, is by far
the more popular, the annual form being used only where it is desir-
able to plow under sweet clover in the fall of the first year.

Hubam sweet clover is an annual form of M. alba. The annual
form of a third species, M. suaveolens, has been sold in the corn belt
as "Golden Annual." There has been no indication that this type has
advantages over Hubam.

Biennial forms of M. suaveolens plantings made at Urbana proved
less desirable than biennial forms of M. alba, but several of them are
gaining popularity in the northwestern states and western Canada.
Both forms are extremely stemmy, and, compared with forms of M.
alba and M. officinalis, are weak growers.
Biennial Sweet Clovers

White-flowered. By far the most important sweet clover in Illinois is the biennial white-flowered species, *Melilotus alba*, which makes up about 80 percent of all sweet clover grown in the corn belt. The

*Sangamon sweet clover* (left) is better for pasture than the commercial strain shown in bloom on the right. Both are white biennials. Sangamon blooms two weeks to 10 days later than the commercial strain. The photograph was taken June 17, when the plants were about 6 feet high.

best forms of this species for pasture are, of course, those that are late maturing, most productive, and disease resistant.

The common commercial seed of *M. alba* contains a wide diversity of forms, including a mixture of white- and yellow-flowered sweet clover. These types come into full bloom in early to late June.

More desirable types, including Sangamon, Evergreen, and Wisconsin Late, have been developed which grow larger and do not reach the full-bloom stage until about mid-July, but seed supplies of these types are limited. Sangamon was developed at the Illinois Station from late wild plants growing along the Sangamon river. Evergreen was developed at the Ohio Station from late-maturing roadside plants, and Wisconsin Late at the Wisconsin Station from late roadside plants growing in southern Wisconsin.
Yellow-flowered. All biennial yellow sweet clovers grown commercially in Illinois belong to the species *Melilotus officinalis*. The best-known is probably *albotrea*. Altho this variety has been grown in Canada and the northern states for some time and is gaining in popularity, it is still considered inferior to the white sweet clovers under Illinois conditions.

Biennial yellow sweet clover usually grows in a more prostrate position the first year than the biennial white sweet clover. It grows erect the second year. It usually reaches 3 to 5 feet in height and matures 10 to 14 days earlier than the white species.

**Annual Sweet Clovers**

White-flowered. Hubam (*Melilotus alba* var. *annua*) is the only important variety in the group of annual white-flowered sweet clovers. The strains within this group vary widely.

Hubam grows 2 to 7 feet high. The plant has numerous strong stems with few leaves; the roots are small without crown buds. It blooms from the middle of July to the middle of September. The seeds (which cannot be distinguished from those of the biennial species) are matured the first year.

Advantages of Hubam are that it usually produces more top growth the first year than does the biennial white sweet clover; it is excellent as a bee pasture and is a good seed producer. Where sweet clover is to be fall-plowed, Hubam has some advantages because it does not grow again the second year, as does the biennial when it is plowed in the fall of its first year. The biennial frequently grows enough the next spring to make it hard to eradicate quickly.

Disadvantages of Hubam are that root growth is much less than that of the biennial white sweet clover, and under most conditions it is not so good for green manure or forage because of its lower yield of dry matter and total protein.

Yellow-flowered. Of the several species of annual yellow-flowered sweet clovers, *Melilotus indica* is the most important, but even it has no value in Illinois. It is very small and very early.

**CLIMATE AND SOIL**

**Adapted to Wide Range of Climate**

Sweet clover thrives under many different conditions of climate and soil. Its climatic range is wider than that of any of the other clovers
or of alfalfa. It is more drought-resistant than red clover and alfalfa, yet it grows well in the more humid regions. It is equally well adapted to high or low temperatures and under proper cultural conditions is seldom winterkilled in Illinois.

When inoculated, sweet clover can grow in almost any nonacid soil in Illinois. Altho it frequently grows well on badly eroded hill lands so unproductive that general farming is unprofitable, it is at its best on soils suited to the growing of corn, wheat, red clover, and alfalfa. Good drainage, enough limestone, an adequate amount of available phosphate and potash, and a plentiful supply of active organic matter contribute to an excellent growth of sweet clover on Illinois soils.

Responds to Sweet, Fertile Soil

Sweet soil is essential. To sow sweet clover on soils of high acidity is to throw away both seed and money. Because of its high calcium content and its rapid and extensive growth, sweet clover must have a large amount of lime in a short time. The plants may grow for a short period on sour land, but unless the soil near the surface is less acid than the soil at the surface, the plants soon sicken and die.

Under Illinois conditions more lime is required by sweet clover

Limestone's effect on sweet clover is illustrated above. The vigorous growth of sweet clover at the right is on land where limestone had been spread nine years before. No limestone was applied on the land at the left, and no sweet clover and only half a crop of red clover grew on it.
than by any other crop. Even on soils that have enough lime for a mediocre stand of alfalfa, sweet clover frequently fails completely.

**Potash and phosphates helpful.** While fair or good sweet clover can be grown on most Illinois soils without the application of potash salts, on some soils the best results are likely to be obtained where fertilizers are used that contain these salts. On the light-colored soils in particular, the benefits from potash salts are marked. This need for potassium is not necessarily due to a low total supply in the soil, but is due at least partly to the low availability of the potassium that is already there.

Where the available supply of phosphorus in the soil is low, applications of a phosphate fertilizer will improve the growth of sweet clover.

**Inoculation Is Necessary for Success**

Alfalfa was a failure in Illinois until the importance of inoculation was discovered. Neither can sweet clover, which is somewhat similar to alfalfa in its growth habits and which is infected by the same nodule organism, be grown successfully unless the soil is properly inoculated. Natural inoculation occurs in some soils, particularly in those where alfalfa or wild sweet clover has grown. On most land, however, where neither of these crops has grown previously, lack of nodulation results in crop failure.

It is always good insurance to inoculate sweet clover. Good commercial inoculants are inexpensive and they are easy to use and highly effective, especially if the directions for using them are followed exactly.

**A GOOD SOIL BUILDER**

Wherever sweet clover has been grown in the corn belt, its value as a soil improver has been generally recognized.³

**Increases corn yields.** The value of sweet clover as a soil improver is illustrated by the results of experiments on the Dixon soil

³The first recorded use of sweet clover for soil improvement, according to A. J. Pieters in his book "Green Manuring," was on abandoned tobacco fields of Kentucky. He states: "These limestone soils were cropped out and many of the farms were abandoned; washing of the slopes became serious and the land was practically useless. As the farmer moved out, the wild sweet clover moved in, covered and protected the surface, opened the subsoil, and in dying left new stores of humus and nitrogen in the impoverished surface soil. One generation of sweet clover followed another, until someone discovered that the once barren soil was rich again."
experiment field in northern Illinois, where a rotation of corn, oats, and wheat is used. On some plots sweet clover is seeded in the wheat and plowed under the following spring as green manure. On other plots no sweet clover is seeded. Where clover was used as a green manure, the corn yielded 5 to 19 more bushels an acre than where clover was not used. These figures are an average for eight years. The largest increase in corn yields due to the use of sweet clover as a

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**Sweet clover as a soil builder** demonstrated its value on the Dixon experiment field in northern Illinois (1930-1941). In a rotation of corn, oats, and wheat it increased corn yields 21 bushels an acre when plowed under with corn stover and wheat straw, 17 bushels when plowed under with corn stover alone, and 10 bushels when used with corn-stover ash.

green manure was obtained where the straws and stover were returned to the land, and the smallest increases where they were removed.

The beneficial effects of sweet clover have been shown on many other experiment fields thruout the state and on hundreds of farms.

This desirable effect on corn yields is the result of several interacting factors—improved soil tilth, nitrogen fixation, addition of active organic matter to the soil, an increase in the microorganic life in the soil, and a gain in available plant nutrients. All these benefits must be taken into account in any true evaluation of a system of sweet-clover management.

**Phosphate and potash supplement sweet clover.** Even tho sweet clover usually increases the productive capacity of soils, the addition
of phosphates and potash where sweet clover is grown usually has produced further pronounced benefits. In fact when used in addition to sweet clover and other residues, these two minerals usually have a more beneficial effect than when employed in a system of livestock farming where manure is conserved and applied. It is not known whether the lower returns for the phosphate in the manure system are due only to the fact that manure serves as a source of phosphorus, or whether there is some additional reason.

The importance of potassium as a supplementary treatment where sweet clover is grown repeatedly on the land is becoming more apparent each year as the number of rotations increases. It was believed earlier that most Illinois soils had enough potassium for maximum yields and that sweet clover would help to increase the availability of this element. But it now is clear that the need for potassium increases with the repeated growing of sweet clover.

**HANDLING THE CROP**

**Problems With Second-Year Sweet Clover**

An increasing number of grain farmers are for various reasons letting sweet clover stay on the land for a second year. With this practice new problems arise.

If the crop is allowed to mature, there will be trouble in plowing under the dead material. Sweet clover decays readily, and the roots are rotted within a few weeks. Then it is hard to plow under the dry tops. Some farmers have therefore preferred to burn it even tho this means losing much of its value. Others plow under dead sweet clover satisfactorily, either late in the fall or in the following spring, by first rolling it in the direction it is to be plowed. Others have had success by using a sharp disk before plowing it under.

Where sweet clover is pastured heavily, there is no difficulty in plowing it under late in the fall of the second year.

Second-year sweet clover can be easily plowed under in July while it is still green, but then there is one disadvantage. Bacteria in the soil are very active at this time, and they change the nitrogen in the clover into a form which may be readily carried off in the soil water by way of the tile drains. This loss of nitrogen can be partly prevented by seeding oats on the land at the rate of a bushel an acre, for the oats die in the fall, when there is little bacterial activity, and do not give much trouble when the land is prepared the following spring.
Sweet Clover as Green Manure

Early spring plowing desirable. It was formerly believed that where sweet clover was to be used as a green-manure crop, it should be allowed to grow as late in the spring as possible in order to provide a large amount of organic material to plow under. It has been found, however, that little advantage may be expected from postponing plowing beyond the time when the sweet clover is 4 to 6 inches high. When plowed before this time, the sweet clover is sometimes hard to kill.

There are three reasons why late spring plowing does not increase soil fertility any more than early spring plowing:

1. The spring growth of sweet clover depends largely on the transfer of material from the roots of the plants to the tops, so very little nitrogen is added by delaying plowing.

2. At best only a comparatively small part of the green material plowed under is still in the soil a few weeks later, for it decays rapidly.

3. The amount of available nitrogen supplied by the sweet clover at the earlier date is already greater than needed by the crop that follows.

A highly recommended practice is to plow sweet clover at least ten days before planting corn.

Difficulties with first-year fall plowing. Some farmers use biennial sweet clover regularly as green manure by plowing it under in the

Late fall plowing of second-year sweet clover is not difficult where the sweet clover has been pastured heavily. Where it has not been pastured, good coverage is sometimes helped by rolling the sweet clover in the direction it is to be plowed.
fall of its first year. Others object to this practice because they have had difficulty in getting rid of the spring growth the following year. The spring growth is more pronounced in some years than in others. In keeping it down, two practices are important—the thorough cutting of the sweet-clover roots and a well-turned furrow slice, which can be obtained by using a jointer with the colter.

Because unexpected problems may arise, fall plowing is not recommended unless the farmer is experienced in using sweet clover for soil-building purposes. Where the land can be kept clean, fall plowing of the first year's growth appears to be satisfactory from the standpoint of corn yields. In some counties fall plowing is popular because the soil in the spring is too plastic to be plowed successfully.

**Sweet Clover as Pasture**

In addition to its value as a soil-improvement crop, sweet clover when properly managed has some definite advantages on Illinois farms as a pasture crop. The advantages are these:

1. **It is readily available.** Sweet clover is grown extensively for soil improvement in this state and so is at hand for the farmer to use for pasture purposes also.

2. **High yields when needed.** Sweet clover has a higher yield of dry matter than bluegrass, timothy, or redtop, altho it does not usually produce more forage than alfalfa. One important advantage is that it yields well at a time when permanent pastures, including bluegrass, do not provide much feed.

3. **Long grazing period.** Second-year sweet clover used wisely in favorable years will furnish grazing continuously during the pasture season. The pasturing season lasts from the middle of April or the first of May to early August, but during the first four to six weeks is not so good a pasture as bluegrass, because of its low dry-matter content at this time. First-year sweet clover can be grazed from the middle of August until freezing weather (about 40 days) altho it should not be grazed heavily if maximum yields are to be obtained the following year. Sweet clover alone is likely to cause digestive difficulties; it is therefore necessary to supplement it with a generous amount of dry feed.

Altho sweet clover has certain advantages as a pasture crop, the following shortcomings should be noted:

1. **Sweet clover is not palatable to livestock at the first feeding.** A liking for it must be developed by giving the animals no other kind of feed. However, once accustomed to it most animals will eat it readily.

2. **So much of the sweet-clover growth is produced during the second summer and at such a rapid rate that it is difficult to balance grazing.** If enough animals are maintained to consume all the growth during this
period, it is difficult to provide crops to support them during early spring and fall. If enough animals are not maintained, the sweet clover becomes large and stemmy.

The number of animals that sweet clover can carry varies with the soil, the season, and management practices. On the average, sweet clover will carry one mature horse or cow an acre in the fall of the first year and one to three during the grazing period of the second year.

**Pasture management.** Sweet clover requires good management when used as pasture. It can usually be pastured satisfactorily the year it is sown if it is pastured lightly, beginning about the middle of August and continuing until freezing weather. Heavy grazing of the first year’s growth results in considerable winterkilling.

When sown alone and in mixtures, sweet clover can be grazed earlier the first year than when sown with a nurse crop. When sown in bluegrass sod, it should not be pastured at all the first year unless it has become well established, and then only very lightly.

![Too few animals are being pastured on this sweet clover the second summer. One to four head of cattle to the acre are needed to keep the plants from becoming coarse.](image)

As mentioned above, during the second year sweet clover has a very high carrying capacity. Where only a few animals are to be pastured on a large field, it is sometimes necessary to limit the animals to part of the field and plow under the rest for green manure. Otherwise some of the clover will grow too large and become stemmy.

For best results, sweet clover should be pastured close the second year. Animals can be turned onto it after the plants are 6 to 8 inches
high, but such young pasture alone will usually scour them, so it is
necessary to give them a liberal allowance of dry feed at this time.
Cattle can be kept on sweet clover until the middle of August. If they
cannot eat all the forage, the plants should be cut high enough to leave
some shoots on the stubble. Mowing sweet clover after it begins to
bloom is of little value; and unless it is mowed high, a large share of
the plants may be killed.

First-year sweet clover grazed in September should be pastured lightly.
Heavy pasturing often results in winterkilling, thus reducing the second-
year crop. This field has been correctly grazed.

Feeding problems. Prevention of bloat is one of the first prob-
lems in pasturing animals on sweet clover, tho there is less danger of
bloat from this plant than from alfalfa and red clover. Among young
stock, bloat is likely to occur during the early grazing period. It can
usually be prevented by giving stock a full feed before turning them
onto sweet clover and by keeping them in the pasture once they have
started grazing. Water, minerals, and dry roughage should be available
at all times.

Sweet Clover in the Rotation

No definite statement can be made as to the best place for sweet
clover in the rotation. Corn is the logical crop to follow sweet clover
because of its importance in this state and its ability to utilize the large quantities of plant-food elements supplied by sweet clover.

If the soil is low in available nitrogen, there may be an advantage in having winter wheat or spring grains such as spring wheat, oats, or barley follow one or two crops of sweet clover. But such a plan cannot be practiced continuously in any one field because the small grains tend to lodge when sweet clover is repeatedly grown. This lodging is a result of the formation of an excessive amount of nitrate-nitrogen.

Where alfalfa is to be grown on land that is in a rundown condition, sweet clover may well precede it. Three considerations commend this practice:

1. If the sweet clover grows well, it is certain that the soil is not too sour to grow alfalfa.
2. Since these crops are infected by the same nodule bacteria, the sweet clover aids in establishing a good flora of nodule organisms for the alfalfa.
3. The decaying sweet clover furnishes a supply of available food material that will start the alfalfa off in a flourishing condition.

When plowing sweet clover under ahead of alfalfa, it is important to do it early enough to prevent excessive amounts of water from being lost by transpiration from the sweet-clover plants, and to allow the sweet clover to decay before the alfalfa is sown. Sweet clover should be plowed under in May or early June for an August seeding of alfalfa or in October or November for a spring seeding.

**Best Not to Clip Sweet Clover in Fall**

Unlike red clover, sweet clover should not be clipped in the fall of the first year if maximum yields are wanted the following year. Clipping the sweet-clover crop at this time will reduce the amount of organic material and nitrogen that can be returned to the soil and increases the hazard of winterkilling thru heaving. Close clipping is more detrimental than high clipping (10 inches). Heavy pasturing has practically the same effect as clipping. The greatest injury is caused by clipping sweet clover from mid-August to mid-September.

The purpose of clipping sweet clover in the spring is to reduce the top growth and thereby make seed harvesting easier. It is believed to bring about a more uniform blooming of the plants and ripening of the seed. Spring clipping, to be most effective and at the same time not to kill the plants, should be done early enough for the stubble to retain some branches or stem buds. Sweet clover clipped at the Illinois Station on May 23 leaving a 6-inch stubble suffered a 50-percent
killing; where an 8-inch stubble was left, 33 percent of the plants were killed; with a 10-inch stubble, only 20 percent were killed.

If the seed is not to be harvested, sweet clover should not be clipped.

**When to Harvest Sweet-Clover Hay**

Less than 5 percent of the Illinois sweet-clover acreage is harvested for hay, and the average annual yield is 1 3/4 tons an acre. Quality and yield vary markedly with time of harvest.

**Excellent hay the first year.** Excellent hay is often cut in September from the first year’s growth, but such clipping will reduce the next year’s yield. Dairymen and others who need high-quality hay for their animals may be willing to sacrifice maximum yields the second year to harvest fine-stemmed, leafy hay the first year. Good yields of this kind of hay can be had then. The yield at the Urbana experiment field, as an average of three years, was 1.84 tons an acre. Fall cutting reduced the spring hay crop. In these experiments sweet clover was seeded in early oats, and after the grain was harvested the clover was permitted to grow late in the season, when it was mown close to the ground.

In general, where the maximum growth during the second year is to be obtained, the hay should be cut after October 1. However, at this late date the quality of the hay will be low. Earlier cutting gives

**One way to harvest sweet-clover hay** is to cut it with a mower and thresh it with a combine having a “pickup” attachment. Where the growth is not too rank, it can be combined without cutting with a mower.
hay of better quality but it also frequently reduces the stand and growth the following year.

**Second-year hay of low quality.** Sweet clover makes hay of low quality the second year. This is because (1) it is difficult to cure the large succulent plants completely if the weather is unfavorable for hay-making; (2) there is such a large proportion of coarse stems and small proportion of leaves that the hay is low in palatability and in nutrients; (3) occasionally it causes a disease known as "sweet-clover poisoning." The blood of the affected animal can no longer clot; unless the animal is injured, the disease progresses without showing any external symptoms until internal hemorrhages cause death. The disease is confined almost entirely to cattle and especially to young stock. Recent studies indicate that this poisoning is associated with the coumarin contained in sweet clover.

For dairy cattle, hay made from other legume crops is better than sweet-clover hay cut the second year.

### Harvesting Sweet-Clover Seed

Less than 2 percent of the sweet-clover acreage sown in Illinois is finally harvested for seed.

The harvesting of sweet-clover seed in Illinois has not been a general practice, partly because North Dakota, South Dakota, Minnesota, and Nebraska seem better adapted for seed production. With lower seed prices, the harvesting of sweet-clover seed from cheaper land became more common. Whether the northern regions, with their short seasons can produce seed of the medium and late strains is, however, questionable. Seed production on some of the cheaper land of Illinois may be worth while because of the demand for seed of the later strains and for pure strains free from certain weed seeds.

Because of the uneven ripening and shattering of seed and the large size of the plants, no thoroly satisfactory method has been worked out for harvesting sweet-clover seed. The best time depends on the method used. In general, harvesting should start before serious shattering begins, even tho some green seeds and flowers may still be present. If methods are used which require considerable handling of the seed, the crop must be cut when it is somewhat immature and the operations carried on while the plants are damp with dew or rain. There are three methods of harvesting sweet-clover seeds, as follows:

**Binder-thresher method.** The sweet-clover crop when grown for seed may be cut with a grain binder or corn harvester, and then
shocked and threshed like small grain, but by this method there is great loss because of the shattering of seed. Adjustment of the thresher concaves, riddles, and the speed of the fan is necessary to hull any large percentage of the seed. If a binder is used, 15 to 20 percent of the seed that would ordinarily be shattered can be saved by attaching a box beneath the platform of the binder at the junction of the platform and the elevator and another below the outer extremity of the binder deck. After the seed is threshed, it can be cleaned further with a clover huller, a scarifier, and a fanning mill.

This method of harvesting is wasteful and expensive, but it has the advantage of using equipment which is common in grain harvesting. The clover huller is not well adapted to the threshing of sweet clover, principally because of the difficulty of feeding the large plants thru the machine.

Sweet-clover seed harvester. A harvester designed to beat off the sweet-clover seed in the field has been used to some extent in this state. It is a homemade machine built from an old grain binder and has a screened-in platform and a heavy reel driven directly from the bull wheel. As the machine is drawn thru the field, the reel knocks the seeds off onto the screened platform. Green seeds, stems, and leaves, as well as insects, accompany the ripe seed. This material is removed from the platform, dried, and then threshed. This harvester has the advantages of being cheap, easy to construct, and inexpensive to operate. All the sweet-clover straw remains in the field to be plowed under for manure. Some believe that harvesting with this machine tends to increase the uniformity in a strain of sweet clover.

Such a machine has certain disadvantages: (1) much of the seed is shattered on the ground when hit by the reel, tho probably not so much as is lost when a grain binder is used; (2) the moisture content of the crop is high because of the inclusion of green seeds and foreign material, and the crop therefore heats readily if not cured properly; and (3) it is still necessary to hull and clean the seed after it is gathered.

Combine-harvester. The combine-harvester appears to be a good machine for harvesting sweet-clover seed. It causes only a small amount of shattering.

The seed as it comes from the combine is fairly clean but only partially hulled. Another machine is required to complete the hulling process.

A combine can be used effectively in harvesting seed from large plants while they are still tough from rain, but this seed must be dried
carefully because of excess moisture. In fact, much labor and care are necessary in drying all combine-harvested sweet-clover seed in order to prevent heating.

When a combine-harvester is used, all the straw is left in the field to be plowed under. With a heavy growth of sweet clover these machines are not always able to take a full swath.

Sweet Clover as Bee Pasture

As a honey plant, sweet clover is excellent. Not only is the yield of honey large but the quality is high. Sweet clover normally blooms after white and alsike clovers and thus meets a definite need for bee pasture. By mixing strains of sweet clover which bloom at different dates, the nectar-gathering time can be greatly extended.

In order to maintain pure varieties, seed from mixed strains should not be harvested and offered for sale.

CULTURE OF SWEET CLOVER

It is easier to secure and maintain a stand of sweet clover than of other common legumes, but it is more difficult to harvest the seed or the hay. Sweet clover is usually sown in the small grains, but occasionally it is seeded in a cultivated crop such as corn or sorghums or, like alfalfa, seeded alone during late summer. It is also sown on permanent pastures and in pasture and hay mixtures.

Time of Seeding

About 75 percent of the sweet clover grown in Illinois is sown at the time of seeding the spring grain. Where the clover will grow too large and interfere with the harvesting of the grain crop if seeded at the same time as the grain, it should be sown ten days to three weeks later.

When sown in winter grain, sweet clover should be seeded late in February or early in March in southern Illinois; in northern Illinois late March or early April is best. The importance of early seeding is shown by the results from the Virginia Station, where the highest yield of clover was obtained by seeding on February 15 altho the March 1 seeding also gave good yields. This region is in the same latitude as the extreme southern part of Illinois.

Early seeding lets the clover germinate and grow as soon as the winter grain starts its spring growth. With early seeding, however,
there is always danger of the clover seeds germinating with the first period of warm weather and later being killed by a hard freeze. But if sweet clover is sown too late, it is often smothered out by the grain crop. Unhulled seed may be sown as early as December or January.

It is not advisable to sow sweet clover in a cultivated crop such as corn after the last normal cultivation because there is little chance of getting a good stand. Occasionally, however, a stand is secured.

When other considerations make it desirable, and when the land is free from weeds, sweet clover may be seeded alone any time between early spring and late summer as one would seed alfalfa. It is well to do this two to three months before killing frosts in order to insure enough growth to prevent winterkilling.

Occasionally sweet clover is seeded in permanent bluegrass pasture in late winter or early spring, the time depending on the amount of seedbed preparation needed to put the seed in contact with the soil. When used in mixtures, sweet clover is seeded when the mixture is sown. This is usually done in early spring or late summer so that early growth will take place during the cool season.

**Method of Seeding**

Sweet clover is usually seeded on winter grain by broadcasting. Sometimes a grass-seed drill is used, but broadcasting appears to be about as good as drilling when there is enough freezing and thawing to cover the seed.

If sweet clover is seeded somewhat later than the spring grain (to keep it from interfering when the grain is harvested), or if the spring grain is broadcast, the clover seed is also broadcast. If the spring grain is drilled, the clover is usually seeded at the same time with the grass-seed attachment of the grain drill.

When seeding sweet clover in bluegrass sod, a disk drill is often recommended as a way to bring the seed in contact with the soil. When used in mixtures with other legumes or grasses, sweet-clover seed may be drilled or broadcast, depending on the mixture, the time of seeding, and the preparation of the seedbed.

**Rate of Seeding**

The rate of seeding sweet clover may be varied considerably. Ordinarily 8 to 12 pounds an acre of hulled scarified seed is recommended. If unhulled seed is used when sowing sweet clover on winter grain or on permanent bluegrass pastures, the rate of seeding should be 20 or
25 pounds an acre. Because of hulls and other foreign material, this seed weighs only about 33 pounds to the bushel. Where there is danger that the sweet-clover weevil will injure the stand, the rate of seeding should be increased.

On winter grain it is better to use unhulled seed than hulled scarified seed regardless of the time of seeding. When sweet-clover seed is sown during freezing weather, frost action increases the germination of the unhulled or unscarified seed. Where sweet clover is to be seeded after freezing is over, the scarified seed is, however, usually recommended. This is because the unscarified seed may not germinate well, since it cannot take up moisture thru the hard seed coats. Scarifying frequently doubles the germination of such seeds.

**Nurse Crops for Sweet Clover**

Barley is probably the best nurse crop for sweet clover, but early oats and spring wheat are also very good. Under normal conditions good stands of sweet clover can be obtained in late oats. Winter wheat also is a good nurse crop for sweet clover when the clover is seeded

**A poor stand of sweet clover** often results when the nurse crop grows so thick and large that it keeps moisture and plant food from the clover seedlings and lodges so that it shades and smothers them. The spotted stand above was the result of a heavy growth of oats having lodged.
early enough to compete with the grain plants. Of all the small grains, winter rye usually makes the poorest nurse crop for clover. Where it is hard to get a stand of sweet clover because of the rank growth of the nurse crop, a lighter seeding of the nurse crop is recommended.

Where there is not enough rainfall to use a nurse crop successfully, sweet clover can be seeded like alfalfa in late summer without a nurse crop.

The kind of nurse crop to use is not so important a question with sweet clover as it is with red clover and alfalfa. Sweet clover is a more vigorous crop and is better able to compete successfully with the grain crops.

DISEASES OF SWEET CLOVER

Losses from sweet-clover diseases have increased in recent years. Mosaic, black stem, and root rot are all common throughout Illinois. There is no way to rid a field of these diseases. The best prospect for control lies in the development of clover strains that are resistant to them. While the development of superior strains is still in its early stages, progress is being made.

Mosaic. More than half the plants in an Illinois sweet-clover field often show direct symptoms of this disease. It is easily identified by a light green mottling of the leaves alternating with the normal green color. The pattern is rather small and irregular.

Altho many clover plants infected with mosaic disease attain normal size, a considerable number usually are stunted, so there is little doubt that the disease results in considerable loss. This disease is caused by a virus.

Black-stem disease. A very black discoloring of the stems of second-year plants is a symptom of this disease. The black area spreads upward from the base of the stem and under some seasonal conditions nearly all the stem may finally be completely discolored. Buds and leaves may be killed. The cause of the disease is a fungus, Ascochyta.

Root rot. Sweet-clover root rot, caused by a fungus, Phytophthora, wilts the leaves and may kill second-year plants during the spring. Usually a few stems of a plant show the symptoms first, and later the entire plant may succumb. Close examination reveals a soft rot of the crown and upper parts of the root. In advanced stages of the disease the root is often so completely decayed that it falls apart when it is dug up.

There are seasonal variations in the severity of root rot; it is usually most troublesome in wet weather. While it is most prominent in the

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1This material on diseases of sweet clover was prepared by Benjamin Koeher, Chief in Crop Pathology.
spring, sweet clover plowed under early for soil-building purposes usually shows little injury because most of the damage occurs a little later in the season.

Other diseases. Several different kinds of leaf spots occur on sweet clover, but none of them has been observed to cause any considerable loss in Illinois.

"Goose-neck" disease causes the leaves of second-year sweet-clover plants to wither and the upper part of the stems to bend over in a crooked manner. Large areas of the stems turn a pale brownish-gray with dark brown to black mottlings, the discoloration being more conspicuous in the upper part of the stems than in the lower. The plants appear very unthrifty and die prematurely.

FEW INSECT PROBLEMS

Only One Serious Pest

The sweet-clover weevil is the only insect that seriously injures sweet clover in Illinois, tho the three others described here do some damage.

Sweet-clover weevil (Sitona cylindricollis Fabr.) inhabits the northern two-thirds of Illinois wherever sweet clover is grown. Feeding by the adult weevil destroys some first-year seedlings. Altho the weevil feeds extensively on second-year sweet clover, the plants usually outgrow the injury. No methods for controlling this pest are known. Mixed seeding with red clover or other small-seeded legumes is suggested as a way to assure a legume crop where there is danger that the sweet-clover stand will be destroyed. Heavy seedings of sweet clover are preferable to light seedings.

Grasshoppers (Melanoplus) frequently feed on the leaves of the sweet-clover plant during summer and fall, causing a ragged appearance. The attack is not serious, and there are few records of real economic damage to sweet clover by grasshoppers under Illinois conditions.

Grape colaspis (Colaspis brunnea (F.)) is not a serious pest of sweet clover. Larvae feed on the surface of the main root and to some extent on the small roots but do not prevent the growth of the plant.

Clover stem borer (Languria mozardi Latr.) can infest a plant without interfering with its growth. Larvae are ordinarily found tunneling in the stem of second-year sweet clover during the middle of the summer. Forty to 50 percent of the stems in a field may be infested. Even this amount of infestation, however, is not noted by casual observation. At a distance of 4 to 5 feet the infested stems cannot be distinguished from uninfested stems.

3This name was first used by David Heusinkveld, U. S. Department of Agriculture, working at the Illinois Station, and is used here provisionally.

3This section was contributed by M. D. FARRAR, Research Entomologist, and J. H. BIGGER, Associate Entomologist, Illinois State Natural History Survey.
Pollinators

Sweet clover does not depend for its pollination on the long-tongued bees. The flowers are small, with a short corolla tube, and are easily pollinated by many species of bees, wasps, and flies. The need for pollinators, therefore, is not a limiting factor in the production of sweet clover.

OTHER PUBLICATIONS

The farmer who plants sweet clover will be interested in the following publications on soil management:

**Good Soil Management Is Essential for High Wartime Production. C535**
**Testing Soil for Available Phosphorus. C421**
**Test Your Soil for Acidity. C346**

These may be obtained free from the **College of Agriculture, University of Illinois, Urbana.**
SWEET CLOVER HAS NO SUPERIOR as a soil builder. When used as green manure, it should be plowed early in the spring of the second year when it is 4 to 6 inches high. Used as a pasture crop, sweet clover provides a long period of grazing during the second year. It yields abundant forage, and it is readily available to Illinois farmers because they grow it so extensively for soil building.

Seeded on sour soil, sweet clover is almost certain to fail.

It is a mistake to clip or pasture sweet clover heavily in the fall of the first year.

Early seeding is important. Usual dates for southern Illinois are late February and early March; for northern Illinois, late March and early April.

When properly inoculated, sweet clover can be grown on almost any nonacid soil in Illinois. It thrives under a wide range of climate.