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# SWEET CLOVER

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*Sweet Clover is an ideal green manure crop*

**MICHIGAN STATE COLLEGE :: EXTENSION DIVISION**

**EAST LANSING**

Michigan State College of Agriculture and Applied Science and U. S. Dept. of Agriculture cooperating. R. J. BALDWIN, DIRECTOR EXTENSION DIVISION, Michigan State College, East Lansing. Printed and distributed under acts of Congress, May 8 and June 30, 1914.

### SUMMARY

Sweet clover is one of the best crops for adding nitrogen and organic matter to the soil. It provides an abundance of succulent high-protein pasture during the first half of the summer and a less amount during July and August. High quality sweet clover hay has about the same feeding value as alfalfa hay of the same quality. However, sweet clover is more difficult to cure than alfalfa and is not usually considered so desirable a hay crop. Beekeepers prize sweet clover highly for bee pasture. Seed yields ranging from two to six bushels per acre are often obtained and considerably higher yields have been reported.

Sweet clover has a very wide range of climatic and soil adaptation provided the soil is well supplied with lime. Essential considerations for obtaining a successful seeding are inoculation, fertilizer and lime requirements, and a firm seedbed.

# SWEET CLOVER

C. R. MEGEE

The acreage of sweet clover is of secondary importance in Michigan when compared with that of alfalfa and clover-timothy mixtures. Nevertheless, the sweet clover crop occupies an important place on many farms for soil improving purposes, for pasture or hay, as a seed crop and for bee pasture. Many farmers have found, through experience, that sweet clover must be handled just a little differently from most crops if they expect to obtain the most benefit from it.

## USES OF SWEET CLOVER

### A Soil Improving Crop

Sweet clover is a biennial legume having the ability, when inoculated and bearing nodules on the roots, of using the free nitrogen of the air. Not all legumes are of equal value for adding nitrogen and organic matter to the soil. Sweet clover, alfalfa, and red clover are among the best for Michigan conditions. Legumes such as soybeans, vetch, and peas have considerable value when the entire crop is plowed under or when the crop is harvested for hay and the hay fed and the manure is carefully returned to the soil without undue loss; but when the crop is harvested and nothing returned to the soil, a considerable amount of nitrogen is removed from the soil.

In general, approximately two-thirds of the total nitrogen of the sweet clover plant (when it is well inoculated) comes from the air. Approximately two-thirds of the nitrogen of the entire sweet clover plant is contained in the parts of the plant above ground. Cutting the sweet clover crop for hay, removing the hay, and not returning the manure to the field where the hay was grown does not result in either an appreciable decrease or increase in the nitrogen content of the soil. If the sweet clover is used for pasture or fed as hay and the manure carefully handled so as to prevent undue loss and then returned to the field where the sweet clover was grown or the sweet clover crop is plowed under, then it is possible to obtain a very material increase of nitrogen and organic matter in the soil.

The total amount of phosphorus, potassium, calcium, and other mineral nutrients in the soil is diminished to some extent when the sweet clover is fed, since the animal body retains a portion of these materials. The only way these mineral elements can be supplied to the soil is by the addition of fertilizers and lime. However, in many instances decay of the sweet clover makes the elements that are already in the soil more readily available for plant use.



Fig. 1. Sweet clover provides an abundance of organic material to plow under.

In many cases sweet clover benefits the soil physically. The large fleshy taproots which decay very readily after the plants die add organic matter which greatly benefits the tilth of the soil as well as increases the amount of mineral nutrients available for the following crop. Thus sweet clover is highly valuable in starting the upbuilding process in depleted soils, thereby paving the way for other crops. This increase in decaying organic matter also makes conditions favorable for a marked increase in the number of soil microorganisms and this increase is considered beneficial to crop production.

The presence of the bacteria that cause nodules to be formed on the roots, which enable the sweet clover plant to make use of the free nitrogen of the air, is essential for best results in soil improvement. If the proper bacteria are not present, the sweet clover plant draws upon the soil nitrogen the same as corn, wheat and other non-leguminous plants and does not make use of the free nitrogen of the air. Often the nitrogen supply in the soil is very low and nitrogen becomes the element limiting plant growth. The addition of the proper bacteria that enable the plant to use the free nitrogen of the air greatly increases the nitrogen available to the sweet clover plant, enabling the plant to make a much greater growth. In case phosphorus, potassium, or calcium are the limiting elements for growth it will be necessary to add these in the form of fertilizers and lime.

Sweet clover contains approximately as much nitrogen in the fall of the first year and the spring of the second year as at any time during the life of the plant; therefore, it is desirable to obtain as much growth as possible the first year. The practice of sowing sweet clover with a small grain crop during the spring and of plowing the sweet clover under the next spring, just after growth has started but in time to prepare a suitable seedbed for corn or some other crop, is one of the most economical and beneficial ways of adding nitrogen and

organic matter to the soil. At this stage of growth the sweet clover is succulent, high in nitrogen and decays rapidly when turned under. The sweet clover roots being succulent and not having depleted the soil of its moisture at this early date leave a supply of moisture in the soil for the crop soon to be planted. The roots are also high in nitrogen, and their decay does not tie up the soil nitrogen for an indefinite period, as is the case when carbonaceous material, such as a crop of rye approaching maturity, is plowed under. When a crop of rye approaching maturity is plowed under, the nitrogen tie-up may be only temporary. However, it may extend over the time the following crop is making its initial growth, thereby reducing the yield. If sweet clover is needed for pasture, hay or seed the residue remaining after harvest may be plowed under with considerable benefit.

#### Sweet Clover for Pasture

Sweet clover produces an abundance of succulent high-protein pasture during the late spring and early summer. The carrying capacity at this time of the year ranges from one to three head of livestock per acre. Sweet clover comes into full bloom during mid-summer, and from this period on the carrying capacity diminishes rapidly. The decrease in carrying capacity at this time of the year will be checked somewhat if orchard grass seed (5 lb. per acre) has been sown with the sweet clover at the time of seeding. If the more palatable grasses such as smooth brome or timothy are used the stock will graze on



FIG. 2. Sweet clover provides an abundance of pasture during the first half of the summer but is not so productive as alfalfa during July and August.

these during the early part of the season in preference to the sweet clover and the grasses will be too short to be of value when needed. A second crop of alfalfa is often considerably superior in carrying capacity to sweet clover for late July and August pasture. Sudan grass may also have a higher carrying capacity during July, August, and September. On some of the heavier soils, well supplied with lime and available plant nutrients and retentive of moisture, sweet clover provides some pasture the same year it is sown, after the small grain crop is removed. On the lighter soils and on soils rather low in productivity, the seeding should not be pastured the first year. Under these conditions, the removal of top growth either for pasture or for hay, especially during September, is likely to result in increased heaving and winter-killing and a reduced stand and reduced yield the second year.

The quality of sweet clover pasture is greatly increased by having sufficient livestock and by turning them on to the pasture sufficiently early to keep the growth subdued. Grazing should begin when the plants are about 8 inches high and sufficient livestock should be maintained on the pasture to keep the growth at about this height. If the plants become rank in growth the bitterness increases and palatability and carrying capacity decreases. Clipping may be practiced if the growth becomes too rank; however, care must be exercised in not clipping too close, else no second growth will be produced. For further information concerning height of cutting refer to the portion of this publication on sweet clover hay production.

Bloat of cattle and sheep on legume pasture is not uncommon, and sweet clover pasture is no exception. However, it is not so prevalent on sweet clover pasture as on some other legume pastures. Precaution should be exercised to prevent bloat. The stock should be given a full feed before being turned on sweet clover pasture. After being turned on they should be kept on the pasture continuously. Salt and water should be available. Sweet clover is succulent, especially during the early stages of growth, and during a wet season the livestock may develop a craving for dry feed.

### **A High-protein Hay Crop**

Sweet clover cut at the proper stage and cured under favorable conditions produces a hay that is about equal to alfalfa in protein content and is readily eaten by all classes of livestock. When conditions are unfavorable it is much more difficult to cure than alfalfa and consequently considerable poor quality sweet clover hay is produced. The proper time to cut the first crop of the second year is just before the plants come into bloom. If cut earlier, the hay is difficult to cure and the yield is low. If cut much later, the palatability is greatly reduced and it is necessary to cut very high if a second crop is to be obtained. The second crop of the second year is produced from the buds in the axils of the branches and leaves. When the stand is thick or the plants have started to bloom it is necessary to cut the first crop 10 or 12 inches high in order that buds will be left on the stubble to produce a second crop. If cut before bloom, a height of 8 inches is usually sufficient to leave active buds on the stubble.

Harvesting with the grain binder is one of the most satisfactory

methods of making sweet clover hay. The bundles should be relatively small and loosely tied and cured in long shocks. This method prevents excessive loss of leaves which so frequently happens when the windrow method is followed. If the binder is used the sweet clover may be cut just as the earliest flowers open, which is a little later than is advisable when cut with the mowing machine. If the mowing machine is used the leaves are allowed to wilt somewhat but should not be allowed to dry sufficiently to shatter before being raked into a windrow. Curing may be completed in the windrow if weather conditions are favorable or may be completed in the cock. In either case handle as little as possible because handling causes a heavy loss of leaves.

It is only under favorable conditions such as an abundance of moisture, lime, and plant nutrients that sweet clover produces sufficient growth the first season under Michigan conditions to warrant one's cutting the crop the first year for hay. Harvesting a crop of hay during September from the first season's growth is likely to reduce the yield and earliness of growth the following season and also increase winter-killing. Harvesting after the middle of October is less likely to cause injury. Unless the hay is badly needed it is better not to cut during the first season.

The so-called "sweet clover poisoning" is reported sufficiently often that precaution should be exercised to prevent it. Cattle, especially young stock, are most likely to be affected. The blood of the affected animals loses the ability to clot. Internal hemorrhages may cause death or, if the animal is injured or a surgical operation is performed, external bleeding may cause death. One of the safest precautions is to feed sweet clover hay about three weeks and then change to some other kind of hay. After the other hay is fed for about a month it is safe to feed sweet clover hay again for another three weeks period. Sweet clover hay may be tested by feeding some of the hay to rabbits as it is being fed to the cattle. If the hay is dangerous it will kill the rabbits before it injures the cattle.

### Sweet Clover Silage

Such crops as sweet clover, alfalfa and soybeans may be made into silage. Often the quality of the silage obtained is excellent. However, there are some difficulties more pronounced in making legume silage than in making corn silage. There are conditions under which it may be desirable to attempt to make sweet clover silage. One of these conditions is when the weather is adverse for curing sweet clover for hay and it is more practical to make the sweet clover into silage than to lose the crop in attempting to make it into hay. Another condition refers to a soil well supplied with lime and rather low in organic matter and available plant nutrients; under such conditions sweet clover would be a very desirable soil-improving crop and would likely yield as great a tonnage of silage as corn. In those sections of Michigan where high yields of corn can be obtained, corn is a more desirable silage crop because it yields more tons of silage per acre and because most farm equipment is adapted to handling corn and the risk of making corn into silage is less than that of making sweet clover into silage.

Should it be advisable to put sweet clover into the silo certain precautions should be considered. The addition of from 40 to 60 pounds

of molasses to each ton of green sweet clover may aid in obtaining a higher quality of silage. When sweet clover silage is made under favorable conditions it is not likely that there will be any apparent difference in quality between the treated and untreated silage. Very succulent sweet clover produces a wet unpalatable silage unless the excess juice drains off at the bottom of the silo, in which case a high quality of silage may be obtained. Should the sweet clover become too mature or dry a better quality of silage will be obtained by adding water and by cutting the sweet clover into as short lengths as possible. Silage made from sweet clover containing insufficient water is fluffy, does not pack well, and often molds. Sweet clover contains between 20 and 25 per cent dry matter when cut, the amount depending upon the maturity of the plant. In order to make the best quality of silage, sweet clover should contain from 30 to 40 per cent dry matter when put into the silo. If the plants are allowed to wilt slightly in the swath just after cutting the dry matter content is increased and the chances are greater for obtaining a good quality of silage.

If a windrower is attached to the cutting bar of the mowing machine the use of a side delivery rake may be avoided. Green sweet clover is sometimes difficult to rake. The hay loader must be in good condition; otherwise breakage is likely to result. The green sweet clover is heavy and too large a load should not be placed on the wagon or truck. The silage cutter should be sharp and in good mechanical condition and set to cut from one-eighth to one-fourth inch.

#### A Seed Crop

No entirely satisfactory method for harvesting sweet clover seed has been devised. The plant is indeterminate in growth; consequently



Fig. 3. Sweet clover may be harvested for hay with the grain binder just as it comes into bloom.



Fig. 4. Harvesting sweet clover seed with the grain binder.

the lower branches will contain mature seed when the upper ones are in bloom. If the growth is not too rank and the harvesting is done when the plants are slightly toughened the binder may be used satisfactorily. Harvesting usually takes place when two-thirds to three-fourths of the pods have turned brown. If delayed much later, the early maturing pods shatter badly, while if harvested earlier the large amount of immature shriveled seed will cause reduced yields. The combine may be used when the growth is not too heavy and maturity is relatively uniform. It is often necessary to clean out the immature seed immediately after harvesting in order that the mature seed will not be injured by heating. At best, sweet clover is much more difficult to combine than small grain crops such as oats, wheat, or barley. The dwarf and early maturing strains are easier to handle for seed than are the late maturing ones. Yields of from 4 to 6 bushels of seed per acre are frequently obtained and yields of 10 to 12 bushels per acre are sometimes reported.

#### **A Valuable Honey Crop**

Sweet clover has long been recognized by beekeepers as one of the most valuable sources of nectar. The period of nectar secretion usually follows that of white and alsike clover and extends for a comparatively long time because of the indeterminate blossoming of the sweet clover plant. Beekeepers sometimes sow sweet clover along roadsides and other waste places where it will be available for the bees. The interest taken in sweet clover by beekeepers has done much to establish the sweet clover crop in many sections.

## GROWING THE CROP

### Kinds of Sweet Clover

There are many species of sweet clover grown in various sections of the world but only three have attained prominence in Michigan. These are the biennial white usually known as common or white blossom sweet clover, biennial yellow known as yellow blossom sweet clover, and the annual white blossom known as Hubam. There is an annual yellow blossom sweet clover but it does not produce well under Michigan conditions.

The biennial white blossom and the biennial yellow blossom are the two species used most extensively in Michigan. The biennial yellow is from 10 to 14 days earlier in maturity and has finer stems and leaves and does not produce so much top growth as the biennial white. For pasture purposes the biennial white is often preferred because of the longer growing season the second year. On sandy soils it is also preferred because of the larger amount of growth produced to plow under. On heavy productive soils well supplied with lime and retentive of moisture the finer stemmed strains are preferred for hay and seed production because the rank-growing ones become too coarse and woody and are difficult to harvest. It is not uncommon for commercial lots of sweet clover seed to contain both the biennial white and the biennial yellow strains and also to contain some of the dwarf varieties.

The Grundy is a dwarf variety of the biennial white blossom species. It matures from ten days to two weeks earlier, ripens its seed much more uniformly, and produces a finer but lower yield of top growth than does the common biennial white blossom sweet clover. It resembles the biennial yellow in its earlier maturity, is more uniform in ripening, and is of finer growth. The Crystal Dwarf is similar to the Grundy variety while the Arctic is earlier. There are varieties of the biennial yellow blossom sweet clover such as Albotrea, Redfield Yellow, and Erector. These are grown mostly in Canada and the Northern Great Plain states and do not possess characteristics superior to the ordinary yellow blossom sweet clover insofar as adaptation to Michigan is concerned.

The annual white blossom or Hubam is a one-season crop producing about the same amount of top growth that the biennial white produces the first season. The root growth of the Hubam is very much less than that produced by the biennial white the first season.

### Adaptation

Sweet clover is adapted to a very wide range of moisture and temperature conditions and will grow on soils low in organic matter and available plant nutrients, provided the soils are well supplied with lime. This crop is often seen growing along cuts and railroad banks where the surface soil has been removed and where the soil now exposed is low in organic matter and plant nutrients available for most crops, but invariably this soil is well supplied with lime, else the sweet clover is absent. For abundant production, however, it is necessary that the soil be well drained to minimize heaving, well supplied with lime, and contain ample phosphorus and potassium.

### **Lime is Essential**

Satisfactory yields of sweet clover are very seldom obtained on soils low in lime. The lime requirement is equal to if not greater than that of alfalfa. These two crops have the highest lime requirement of the field crops usually grown in Michigan. The entire cost of liming should not be charged to these crops since lime is beneficial to many other crops in the rotation. Cost is an important consideration when liming and this varies greatly depending upon the materials available, transportation to the farm, and equipment available for distribution in the field. These and other considerations concerning liming are discussed in detail in Michigan Extension Bulletin E57.

### **Fertilizers**

On the loams, silt loams and clay loam soils of Michigan, fertilizers high in phosphorus such as an 0-20-0 should be used when a fertilizer is needed. If legumes have not been grown for some time nor manure applied recently it may be advisable to apply an 0-14-6. Sands and sandy loam soils require heavier application of potassium such as an 0-12-12 or an 0-8-24. Since sweet clover is usually seeded with a small grain crop the formula may be changed slightly. Further information concerning the time, method and rate of application and benefits derived from the use of fertilizers may be obtained from Michigan Extension Bulletin E159.

### **Inoculation**

The material for inoculation should be used if neither sweet clover nor alfalfa has been grown on the field with an abundance of nodules on the roots. Since inoculation enables sweet clover to make use of the free nitrogen of the air it is especially important to inoculate when seeding on soils low in nitrogen and decaying organic matter. Under such conditions the yield as well as the nitrogen content of the plants is materially increased by inoculation when the soil does not contain the proper bacteria to form nodules on the roots. There are several methods of inoculation but in this state the pure culture method is used almost exclusively. It is cheap, easy to apply, there is no danger of spreading weed seeds or diseases, and when the inoculating material is fresh this method is relatively efficient. Complete directions for the use of the material are printed on the container.

### **Seeding Sweet Clover**

Sweet clover is a biennial or two-year crop and is usually sown during the spring with a small grain nurse or companion crop. Occasionally it is sown alone during the late spring or summer but this method of seeding is not so economical as in the case of alfalfa since the alfalfa may last several years. It may be advisable to seed sweet clover alone on light sandy soils not sufficiently productive to grow both the sweet clover and the small grain crop. Occasionally sweet clover is sown just before the ground freezes in the fall and the seeds germinate early the next spring. Sweet clover is sometimes sown with wheat at wheat sowing time but the young seedlings that start that fall are likely to winter-kill. The hard seeds that fail to germinate during the fall germinate the next spring and if sufficiently abundant



Fig. 5. Seeding sweet clover during the early spring on fall-sown wheat.

produce successful seedings in the wheat. On loamy soils sweet clover may be sown during late March and early April while the ground is freezing and thawing. On light soils and on soils that puddle easily this practice frequently fails. Sweet clover may be sown broadcast on wheat in the spring and covered with the spike-tooth harrow or may be sown with the disk drill. Seedings made in corn at the last cultivation are dependent for their success largely upon the presence of a suitable supply of soil moisture and the absence of weeds in the corn field. Unless these conditions can be met the chances of obtaining a seeding are not good.

A firm seedbed is essential so that the soil will be in close contact with the seed. Sweet clover seed is slow to absorb moisture and when dropped in the air pockets of a loose seedbed the seed is very slow to germinate. A disk harrow is excellent to firm the lower part of the furrow slice and a cultipacker excellent to firm the upper part. Covering the seed at a depth of from one-fourth to three-fourths inches is advisable.

It is customary to sow from 15 to 18 pounds of hulled seed or 25 pounds of unhulled seed per acre. Occasionally sweet clover is sown in mixtures with other legumes or grasses. If sown with crops with high palatability such as brome grass or alfalfa and then pastured, the stock is likely to pasture the very palatable crops heavily and to their detriment and allow the sweet clover to grow so rank that it becomes very unpalatable. If sweet clover is sown with orchard grass both crops make a fairly quick rank growth and both are pastured more uniformly without great injury to either. Five pounds of orchard grass together with from twelve to fifteen pounds of sweet clover seed per acre are sufficient for a seeding.