It's Important As a Pasture Crop and for Keeping Up Fertility

During the past 30 years sweetclover has changed from its lowly position as a roadside weed to a respectable place among farm crops. The rise in importance of this crop has been the direct result of the realization that sweetclover fills a most important role in building and maintaining our soils—making possible large yields of corn, soybeans and other crops.

Sweetclover during recent years has won a definite place in the cropping system on many farms, especially in 45 counties in north central and western Iowa. Two reasons for its popularity in this area are: (1) Its ideal adaptation to the high lime soils which prevail and (2) the speed with which sweetclover can recharge the fertility of the land in this region of high corn acreages.

We are now entering upon the fifth year of intensive food production. Last year many fields of corn showed signs of nitrogen deficiency due, in part at least, to the record corn crops which have been using up soil nitrogen faster than it is being returned to the land. This situation will be increasingly evident in the years ahead, as we get farther and farther away from the effects of plowed-down soil improving crops. To correct the situation we need to use sweetclover more extensively.

Soil Building Crop

As a soil building crop, sweetclover is especially desirable because of the ease with which stands are obtained when seeded with small grains or flax, the low cost of seed, the wide adaptation of the crop to the non-acid soils in the state, and the large amount of nitrogen and organic matter contained in its tops and roots.

Sweetclover is a biennial crop, making a considerable root growth in the seedling year, living over winter, and making a large top growth the second year. As a legume it obtains a large proportion of the nitrogen required for its growth from the air, if properly inoculated. Studies on the chemistry of sweetclover show that it gathers great quantities of nitrogen the first year, stores it in the root system over winter and uses this plant food to start the early spring growth the following year.

Since nitrogen is the element most likely to limit corn production on heavily cropped soils, it's the element in which we are most interested from a soil improvement standpoint. There is no practical advantage in letting sweetclover grow to maturity in the second year unless one needs spring and early summer pasture, or unless there is special need for an increased amount of organic matter in soils relatively low in fertility.

When to Plow

When should you plow your sweetclover? Our answer is: “Plow when the maximum amount of nitrogen will be added and so that it will not interfere with the proper seedbed preparation for planting corn at the normal time.” This answer takes into account various factors such as the amount and type of organic matter added to the soil, the increase in soil nitrogen, the ease of killing the crop, and the effect upon soil structure and tilth. Fall plowing is practiced by many experienced sweetclover growers, but if done late enough to obtain maximum benefit to the soil, from the standpoint

Sweetclover plowed under in the spring of the second year when the top has made a growth of approximately 6 inches insures a nearly complete kill, and it should add from 100 to 125 pounds of nitrogen to the acre.

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Second-year growth of sweetclover comes from buds below the surface of the soil and draws on nutrients in the roots. The large tap roots to a depth of about 8 inches contain by the end of the first year nearly half of the nitrogen which the crop supplies.

Twenty plants make up each of the three sweetclover bundles above. The tiny bundle grew on acid soil without inoculation; the center bundle was inoculated but the soil wasn’t limed. The large one was from limed soil and seed that had been inoculated.

of nitrogen added, there usually is enough survival of sweetclover in the second year to create something of an eradication problem.

Everything considered, plowing in the spring when the sweetclover has made a growth of about 6 inches is to be preferred.

Very early spring plowing should be avoided because this results in about the same amount of volunteering as when fall plowed. Generally, the plant is easier to kill after it has made about 6 inches of growth.

The last week in April is the most suitable time for plowing in most seasons. Plowing after the first of May might increase a little the total gain in organic matter, but it is hazardous in event of a dry season, as the growth of sweetclover uses up the winter store of subsoil moisture and makes the corn crop depend almost entirely upon current rainfall for its growth.

A normal stand of sweetclover can be expected to add from 80 to 100 pounds of nitrogen per acre under farm conditions. With a good stand and growth it may be considerably more. But this is as much nitrogen as is contained in 8 to 10 tons of barn manure, or in 400 to 500 pounds of ammonium sulfate. A clue to the importance of nitrogen in making corn can be gained from chemical tests which show that the ears and stalks of a 100-bushel corn crop contain about 150 pounds of nitrogen.

The response of corn to sweetclover depends, in large part, upon the extent to which lack of nitrogen has limited production.

Effect on Corn Yields

We compared biennial sweetclover, hubam and red clover as green manure crops in a corn-oats rotation on Clarion loam at the Iowa Station, Ames, from 1923 to 1939. The experiment was so arranged that one-half of the total area was planted to corn and one-half to oats each year, with the legumes seeded in the oats. Yields of corn and oats were determined each year, and the legumes were sampled for yield of dry matter and nitrogen.

Yields of top and root growth were obtained from the plots of hubam and red clover in the fall when the growth had practically ceased. Biennial sweetclover plots were sampled in the spring of the second year just prior to seedbed preparation for corn. The legume growth and the crop residues from the oats and corn were returned to the soil. A summary of corn yields, expressed both in bushels per acre and in percentage of the yield of untreated check plots, is given in table 1.

Recent work at Albia, Iowa, on Putnam silt loam has indicated a greater response from plowing under sweetclover than was obtained on the Clarion loam at Ames. In 1942, a year favorable for corn as shown by an 85-bushel crop on the check plots, the yield following sweetclover was increased from 6 to 17 bushels, depending on how the sweetclover was handled. In 1941, a year of poor corn yields, the check plots averaged about 36 bushels while on the spring-plowed sweetclover plots corn yielded 63 bushels, an increase of 27 bushels per acre.

Sweetclover green manure tests at the Illinois and Ohio stations

<table>
<thead>
<tr>
<th>Legume</th>
<th>Bushels of check per acre</th>
<th>Percentage yield</th>
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</thead>
<tbody>
<tr>
<td>Biennial sweetclover</td>
<td>60.1</td>
<td>113.8</td>
</tr>
<tr>
<td>Hubam</td>
<td>57.1</td>
<td>108.1</td>
</tr>
<tr>
<td>Red clover</td>
<td>55.7</td>
<td>105.4</td>
</tr>
<tr>
<td>None (check)</td>
<td>52.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

TABLE 1. YIELDS OF CORN IN A 2-YEAR CORN-OAT ROTATION ON CLARION LOAM AT AMES, IOWA, WITH DIFFERENT LEGUMES SEEDED IN OATS AND FALL OR SPRING PLOWED. 1923 TO 1939, INCLUSIVE.
TABLE 2. POUNDS OF NITROGEN AND TONS OF DRY ROOTS AND TOPS PER ACRE IN SWEETCLOVER VARIETIES HARVESTED IN OCTOBER OF THE YEAR SOWN.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Pounds of nitrogen in roots and tops</th>
<th>Tons of dry matter in roots and tops</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1940 and 42</td>
<td>1942-43</td>
</tr>
<tr>
<td>Iowa Late White</td>
<td>140</td>
<td>117</td>
</tr>
<tr>
<td>Madrid</td>
<td>155</td>
<td>116</td>
</tr>
<tr>
<td>Willamette</td>
<td>145</td>
<td>111</td>
</tr>
<tr>
<td>Wis. Late White</td>
<td>134</td>
<td>91</td>
</tr>
<tr>
<td>Spanish</td>
<td>133</td>
<td>92</td>
</tr>
<tr>
<td>Grundy County</td>
<td>134</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td>Evergreen</td>
<td></td>
<td>109</td>
</tr>
<tr>
<td>Sangemon</td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>Average</td>
<td>141</td>
<td>105</td>
</tr>
</tbody>
</table>

show larger increases in corn yields than were obtained in the tests at Ames. On a dark colored soil at Dixon, Illinois, sweetclover in the rotation increased the yield of the following corn crop from 10 to 21 bushels as a 12-year average, the largest increase being obtained when all cornstalks and wheat straw were returned to the soil. An 8-year test at Wooster, Ohio, showed similar results.

Such great increases from plowing down sweetclover would not be expected on land capable of producing in excess of 75 bushels of corn in ordinary seasons, but the use of the crop to help maintain this level of production is worth considering until we are able to get back to more normal acreages of hay and rotation pasture crops.

Varieties' Fertility Values

Because of the value of sweetclover as a green manure crop, a study has been under way to determine differences among several varieties in respect to their nitrogen content and yield of organic matter at the end of the first year of growth.

During the 3 years 1940, 1942 and 1943, nine varieties were compared. These ranged from the early blooming Grundy County to the late flowering varieties such as Iowa Late White and Evergreen. One variety of biennial yellow, Madrid, also was included.

The data presented in table 2 show that for the 2 years 1940 and 1942, Madrid, the relatively new variety of biennial yellow, was somewhat higher in pounds of nitrogen per acre at the end of the first year of growth, as determined by harvesting in October, than any of the others, although the differences were not significant. In tons of dry matter per acre, Madrid, together with the later flowering varieties, Iowa Late White, Willamette and Wisconsin Late White, were superior to the earlier flowering white blossomed varieties, Grundy County and Spanish.

In the 2-year period 1942 and 1943, two additional late flowering varieties, Evergreen and Sangemon, were included in the tests. In most respects these two varieties resemble Iowa Late White. The data from this period show that late flowering varieties, with the exception of Wisconsin Late, were all essentially equal and that Madrid, although early in blooming, was equal to the late flowering types in pounds of nitrogen per acre.

Spanish, a medium early white blossomed variety, was low in yield of nitrogen. In tons of dry matter per acre, Madrid and Iowa Late White were significantly superior to Wisconsin Late, Spanish, Evergreen and Sangemon. In general, the late flowering varieties of biennial white and the yellow blossomed variety, Madrid, were superior to the earlier flowering white blossomed varieties in pounds of nitrogen per acre and in yield of organic matter at the end of the first year of growth.

Unfortunately, seed production of the late flowering biennial white varieties has been very poor—in many years a complete failure. This factor has been responsible

Sweetclover provides a large acre yield of nutritious pasture. Intensive grazing in May and June prevents too rank and woody growth. It preferably should be used in a mixture along with other legumes and grasses.
for the slow utilization of these varieties in the Corn Belt. In contrast, Madrid has produced abundant yields of seed. For this reason, and because of its very good performance as a green manure crop, this variety is being increased as rapidly as possible for distribution. Seed will not be available in quantity, however, for a few years.

At the present time our recommendation for using sweetclover in soil improvement is to plant with oats the standard biennial varieties for which seed is available, leave the sweetclover until the following spring and plow under the crop in preparation for corn following in the rotation. In fact, we’d recommend that every acre of oats that isn’t being seeded to alfalfa or red clover mixtures should be seeded to sweetclover, provided only that the land is naturally high in lime or has been limed.

**High Value for Pasture**

Sweetclover gives a large acre yield of nutritious herbage for pasture, either when used alone as a rotation pasture crop on the level land in the heavy corn-producing counties or when grown in mixtures with grasses in the rolling or hilly permanent pasture areas of the state.

When sweetclover is used alone as a rotation pasture crop it may be expected to provide excellent grazing from late August until mid-October of the seeding year, although care should be used to avoid overgrazing. From 4 to 6 inches of top growth should be maintained to permit the accumulation of sufficient root reserves to safely carry the plants over the winter.

In the second year of growth, sweetclover usually is ready for pasture by the first week of May. A growth of 10-12 inches should be made before livestock are turned on, and the crop should be heavily grazed during May to keep the plants from becoming coarse and woody in the following months. Under ordinary farm conditions the amount of growth is only half as much in June as in May, is further reduced in July, and by the middle of August the second year growth is practically gone. By this date, however, the first year growth from new seedings should be ready for moderate grazing. The major objections to sweetclover for pasture when seeded alone are its lack of palatability when cattle are first turned into pastures and the danger of bloat. Cattle soon become accustomed to its somewhat bitter taste, and many farmers have found this feature not to be a limiting factor in its use. There seems to be less danger of bloat when it is grown with a grass crop.

Sweetclover varieties vary widely in their value for pasture. The late flowering kinds have a longer period of productive growth than the early flowering varieties such as biennial yellow and Grundy County. When seed of the late flowering varieties, such as Iowa Late White and Evergreen, becomes available the value of sweetclover as a rotation pasture will be even greater than now.

Sweetclover also fits in well as a supplement to other pasture crops. During May, when the carrying capacity of sweetclover is at its height, the grazing of bluegrass pastures can be deferred for use during June and July when early grazed bluegrass pastures have passed their peak production. In areas where lespedeza is used for summer grazing the inclusion of a sweetclover pasture provides a source of needed legumes for the early part of the season.

Studies at the pasture research farms in Iowa also have demonstrated the value of sweetclover in pasture renovation. In these trials sufficient seed of the sweetclover plants has matured in the grass-legume mixture to maintain good volunteer stands for several years. But keep in mind that liming is necessary to maintain satisfactory stands in those areas where the soils are naturally acid. The inclusion of an aggressive legume crop—and no other is equal to sweetclover—increases the total production of pastures by providing additional nitrogen for the grasses in the mixture. The grasses in the pasture mixture also are essential to prevent soil loss from erosion on the hilly soils of the state.

Sweetclover will thus undoubtedly continue to be important among our crop plants. Its value in soil improvement when used as a green manure crop and its usefulness in pastures—alone or in combinations with grasses—make it a key crop for the food front on many Iowa farms.