SWEET CLOVER

By T. S. Parsons

Bulletins will be sent free upon request. Address: Director
Experiment Station, Laramie, Wyoming.
UNIVERSITY OF WYOMING
Agricultural Experiment Station
LARAMIE
BOARD OF TRUSTEES
Officers
TIMOTHY F. BURKE, LL. B..........................President
MARY B. DAVID......................................Vice President
C. D. SPALDING......................................Treasurer
FRANK SUMNER BURRAGE, B. A......................Secretary

Executive Committee
A. B. HAMILTON T. F. BURKE W. S. INGHAM
Members

Appointed

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>HON. ALEXANDER B. HAMILTON, M. D</td>
<td>1917</td>
</tr>
<tr>
<td>1911</td>
<td>HON. LYMAN H. BROOKS</td>
<td>1917</td>
</tr>
<tr>
<td>1913</td>
<td>HON. CHARLES S. BEACH, B. S</td>
<td>1917</td>
</tr>
<tr>
<td>1895</td>
<td>HON. TIMOTHY F. BURKE, LL. B</td>
<td>1919</td>
</tr>
<tr>
<td>1913</td>
<td>HON. MARY B. DAVID</td>
<td>1919</td>
</tr>
<tr>
<td>1914</td>
<td>HON. MARY N. BROOKS</td>
<td>1919</td>
</tr>
<tr>
<td>1911</td>
<td>HON. W. S. INGHAM, B. A</td>
<td>1921</td>
</tr>
<tr>
<td>1913</td>
<td>HON C. D. SPALDING</td>
<td>1921</td>
</tr>
<tr>
<td>1915</td>
<td>HON. J. M. CAREY, LL. B</td>
<td>1921</td>
</tr>
</tbody>
</table>

EDITH K. O. CLARK State Superintendent of Public Instruction Ex Officio
PRESIDENT C. A. DUNIWAY, Ph. D., L. L. D. Ex Officio

STATION COUNCIL
C. A. DUNIWAY, Ph. D..........................President
HENRY G. KNIGHT, A. M........................Director and Agricultural Chemist
F. S. BURRAGE, B. A............................Secretary
C. D. MOIR......................................Clerk
A. NELSON, Ph. D...............................Botanist and Horticultrist
F. E. HEPNER, M. S.............................Research Chemist
J. A. HILL, B. S...............................Wool Specialist
J. C. FITTERER, M. S., C. E....................Irrigation Engineer
A. D. FAVILLE, M. S............................Animal Husbandman
T. S. PARSONS, M. S............................Agronomist
KARL STEIK, M. A...............................Engineering Chemist
J. W. SCOTT, Ph. D............................Parasitologist
O. A. BEATH, M. A..............................Research Chemist
P. T. MEYERS, B. S. A..........................Assistant Agronomist
E. H. LEHNERT, D. V. S........................Veterinarian
Sweet Clover
By T. S. Parsons.

INTRODUCTION.

Sweet clover is becoming an important crop in Wyoming. It has until recently been considered a weed and a pest to be kept off the farm. As farmers come to understand the nature of the plant better, however, it is becoming more and more popular. It is a good soil builder, can be used as a pasture crop, and can be utilized to good advantage on lands too dry or too alkaline for alfalfa to grow.

Sweet clover will do very well on practically all of the soils of the state, provided they are not saturated or water-logged. The plant will not thrive on soil that is saturated but will do well on soils where the water table is within two feet of the surface. It also does not do so well on loose sandy soils but will usually make as good a crop on poor soils as any other crop that can be grown. It responds to good treatment and fertile soil as well as any other plant and if grown for hay it should be sown on good soil so that a better growth may be obtained. Lime is very essential for the successful growing of sweet clover. Wyoming soils are generally well supplied with this element, therefore sweet clover does well.

It is as a soil improver that the sweet clover has its greatest value. It brings quick results when used as green manure or when grown before another crop. It thrives well on soils lacking in humus, therefore it is valuable for building up these soils. The large fleshy roots of the plant penetrate the soil, breaking up the lower layers, and adding humus to it when they decay, thus improving its texture to a considerable depth below the depth of plowing. Sandy soils as well as heavy clay and hardpan soils can be reclaimed with sweet clover and put in condition for growing other crops. Another factor in favor of sweet clover is that the bacteria on its roots will inoculate the soil for alfalfa.* It is therefore a

valuable crop to grow on the land immediately preceding alfalfa. The bacteria not only inoculate the soil but the roots penetrate the soil, breaking it up and aerating it, making a condition more favorable to the growth of the last named plant.

There are two varieties of sweet clover quite generally grown: The white, botanically known as *Melilotus alba*, and the yellow, botanically known as *Medicago officinalis*. The white is the most common and the variety generally preferred for either hay or pasture. It grows larger and coarser than the yellow variety. The latter is preferred by some as a hay plant on account of its finer habit of growth. It is now being grown quite extensively over the state. Fig. 2 shows a row of yellow clover between two rows of white.

Sweet clover is also much esteemed as a honey producing plant. It is the only flowering plant that can be grown in waste places and utilized for this purpose. The tendency of sweet clover to occupy vacant land is noteworthy. It is seen on vacant lots, along roadsides, railroad embankments and irrigation ditches.† It does not, †It is passing out into the open range at least one point in the state.
however, usually occupy cultivated fields or meadows. Therefore, it need not be considered a pest. Cattle and other stock eat it readily when accustomed to it and apparently thrive as well on it as on alfalfa.

Fig. 2—Yellow sweet clover in the middle with white sweet clover on either side. Notice the finer and more compact growth of the yellow variety.

I. CULTURAL EXPERIMENTS WITH SWEET CLOVER.

Results on Water-Logged and Alkaline Land.

For the past five years some sweet clover has been grown on the Agronomy farm of the Experiment Station. No regular experimental work was attempted until the past two years. Certain portions of the farm not suitable for other crops on account of seepage and alkali were sown. A fair crop, usually about one ton per acre has been obtained from the poorest of these lands. Where sweet clover has been sowed on good soil, uniformly good stands and good yields have been obtained, showing that this crop as well as any other responds to good treatment.

At the east side of the agronomy farm is an area of land consisting of about four acres, which receives consid-
erable seepage from the land above and consequently is too alkaline for the growing of grain crops. According to the farm records this area was sowed to sweet clover in 1908. A fair crop was harvested in 1909 and in 1910, after the writer assumed charge of the work, one and one-half tons of cured hay was procured from this area from one cutting. A good second growth was made but a heavy frost on August 24 prevented a second cutting and no seed was produced. In the spring of 1911 no sweet clover appeared. Sweet clover is a biennial and if not permitted to go to seed the second year no plants will appear the year following. This area has been kept in sweet clover by reseeding every two years. By this method a crop has been cut each year until 1915.

The plots on this land were broken up in the fall of 1914 and in the spring of 1915 were seeded to sweet clover with a light nurse crop. A good growth started in the spring but more than the normal rainfall caused excessive seepage so that the soil became saturated and the seed was entirely killed out. It is very certain that sweet clover will not grow on soil that is saturated. A large body of water standing below these plots prevented drainage. In previous years there was sufficient drainage so that the water table was at least two feet below the surface. This area received no irrigation, the seepage from the irrigated land above providing sufficient moisture.

Immediately adjoining this area, but a little higher, is a piece of land of about two acres. This land is too alkaline for the growing of grain crops. This land was sowed to sweet clover on May 10, 1914, at the rate of 10 lbs. of seed per acre. The ground was not plowed, the seed being drilled shallowly with a Superior grass drill. An excellent stand was obtained and a good growth made the first year. It was decided, however, not to cut the crop. The area was clipped early in the season to keep down the weeds. In 1915 growth started early and the first cutting was made about July 15, a small strip being left for seed. A second cutting was not made. The second crop was about two feet in height when killed by frost. The first cutting yielded at the rate of 3 tons of cured hay to the acre. On account of the excessive rainfall and cool
Sept. 1916. Sweet Clover.

weather the plants in the strip left for seed continued to
grow. They became very coarse and woody but did not
mature seed. At the altitude of the station the first crop
if allowed to stand usually produces seed. At lower alti-
tudes of the state a first cutting can be made and the sec-
ond cutting kept for seed.

Results on a Dry Farm.

On May 4, 1911, an area of two acres was sowed to
sweet clover on the Holliday farm near Laramie, where
the station dry-farm experiments were then being carried
on. This crop was sowed at the rate of 10 pounds per
acre. The plants made considerable growth that year but
not sufficient for cutting. One acre was badly covered
by blowing sand; the other acre produced 3700 pounds of
hay the following year. Much of the seed on the sand-
covered acre came up through the sand the second year,
but did not make enough growth to warrant cutting. The
experiment was discontinued the end of the second sea-
son, the owner taking charge of the land.

Observations in various parts of the state would indi-
cate that sweet clover is a good dry-farm crop. In most
sections at least one crop per year can be cut and in many
sections two. It is evident that it will make a paying crop
on land far too dry for alfalfa.

Effect of Compactness of the Soil.

In the spring of 1914 some experiments with sweet
clover along definite lines were begun. The purpose of
the experiment was to determine, (1) the value of sweet
clover as a fertilizer for crops immediately succeeding it,
and (2) its value in a complete crop rotation. Results of
these experiments cannot yet be given. Only the methods
of soil preparation, seeding and yields can be discussed
at this time. Both the white and the yellow varieties were
used in these experiments and, so far as the work has
progressed, it would seem that the two varieties require
the same treatment.

For the fertility experiment one of the acre experi-
ment plots and a triangular plot of one-half acre adjoin-
ing it were selected. One-half of the acre plot was devoted
to the growing of field peas and alfalfa, one-quarter to white and one-quarter to yellow sweet clover. The triangular half-acre plot was given entirely to the white sweet clover.

These plots were uniform as to kind of soil and amount of barnyard manure received, and were all spring plowed. The seed beds were prepared and seeding was done on the dates as follows, the plots being designated as Nos. 1, 2 and 3:

April 18. Plots 1 and 2 were plowed 8 inches deep, and Plot 3 was plowed 6 inches deep.
April 19. Plots were harrowed with spiketooth.
April 21. Plots were harrowed with Acme.
April 21. Plots were harrowed with spiketooth.
May 8. Seeded Plot 1 with white sweet clover at the rate of 10 lbs. per acre, with 1 bu. oats as nurse crop. Sweet clover seed mixed with the oats.
May 8. Seeded Plot 2 with yellow sweet clover without nurse crop. Seed drilled in with alfalfa seeder.
May 8. Seeded Plot 3 at rate of 8 lbs. white sweet clover per acre with 1 bu. oats. Seeds mixed before sowing.
June 22. Plots given first irrigation.
July 26. Plots given second irrigation.
Oats on Plot 1 cut for hay. Practically no stand of sweet clover on Plot 2.
Aug. 10. Harvested oats on Plot 3. A yield of 785 pounds of threshed grain on the half-acre. There was also an excellent stand of sweet clover on this plot.
Plots 1 and 2 were plowed in the fall to be reseeded to sweet clover in the spring of 1915.
The Plots 1 and 2 were worked down and seeded in the spring of 1915 at the same rate as the preceding year but no stand was obtained.
The results obtained from these experiments would seem to indicate that sweet clover will not do as well on well prepared soil as on that less well prepared. Packing seems to be the most essential thing.
Plots 1 and 2 were looser and were plowed deeper as they had been in grains for two years preceding the sweet clover sowing. Plot 3 had been in alfalfa and the soil was much more compact so that such deep plowing was impossible and the seed bed was more easily compacted. Even fall plowing on Plots 1 and 2 did not compact the soil sufficiently to get a good stand.

In 1915 Plot 3 gave a yield of 2930 pounds of cured hay from a measured one-half acre. Only one cutting was made. This cutting was made on July 20. It should have been made two weeks earlier as the clover when cut was rather coarse for hay. Had the first cutting been made at the earlier date two cuttings could easily have been obtained. As it was, a good second growth was made. A strip left after cutting the measured area in July was allowed to stand for seed. It grew very tall, but on account of cool weather and rain did not mature seed before frost. The first and second growths are shown in Figure 3.

II. HOW TO GROW SWEET CLOVER.

In order to be successful in growing this crop one must have some understanding of the habits and requirements of the plant. With this knowledge one need not
fail in growing the crop nor fear that it will become a trouble: me weed. The main essentials to be observed in order to obtain a successful stand of sweet clover are the preparation of the seed bed and the selection of the seed.

**Preparation of the Seed Bed.**

To have the seed bed well packed is the essential thing. Experiments have shown and reports from farmers in various parts of the state indicate that success is rarely attained when the seed is sowed on new plowing and on well worked soil. A seed bed that is hard below with just enough loose soil on top to cover the seed is best. If there is sufficient moisture seed may be sowed broadcast on the sod and lightly disked in enough to cover it. Sweet clover seed has strong viability and will often lie in the ground a year or two before germinating. It takes considerable time for moisture to penetrate the hard seed coats. Alternate freezing and thawing is often sufficient to give the seed the needed covering of soil. This is evidenced by the fact that sweet clover grows well on the hard roadways, embankments, etc. There is more danger of having the seed bed too loose than too hard when trying to grow sweet clover on cultivated land. In preparing land for sweet clover seeding, such tools should be used as will only work the surface very lightly.

**Methods of Seeding.**

Sweet clover seeds itself by shattering from the plants and lying on the ground through the winter. Thus it would seem that the seed could as well be sown in the fall. This has been done successfully in parts of the state. The sweet clover was broadcasted after winter wheat was sowed. The time of sowing does not matter so much if the seed gets moisture. Seeding may be done from January until June. Much of the seed will not germinate until the next year anyway. Farmers in the eastern part of the state report sowing the seed during the winter on the snow and letting it sink into the ground. This can be done if winds are not too severe.
Selection of seed is important. Sweet clover seed is often gathered in waste places and therefore contains certain weed seeds. Care should be taken that only good clean seed is used. Hulled and unhulled seed may be obtained upon the market. It does not make much difference which is used. The unhulled is more apt to contain impurities. On the other hand the hulls on the seed may help to gather moisture and thus help germination. Ten pounds of good clean seed is sufficient for sowing one acre under irrigated conditions. One-half this amount is sufficient for the dry farm. More of the unhulled seed should be used. The seed may be drilled or broadcasted. If drilled care should be taken not to cover it too deep. Sweet clover should never be covered to a depth of more than half an inch. Inoculation of either the soil or the seed is not necessary in Wyoming. See Figure 4.

*Treatment of Hard Seeds.*

Many of the seeds in sweet clover have hard seed coats which are difficult for moisture to penetrate. Therefore some of the seeds are very slow in germinating, many in fact not germinating until the following year after sowing. Various methods of treating the seeds to soften the seed coats have been devised with more or less success. It is doubtful however, if any of the methods will be widely adopted by the farmers, as most of the seeds will germinate the second year anyway.

The sulphuric acid treatment probably gives the best and quickest results. This method consists in pouring concentrated sulphuric acid over the seed and stirring for twenty minutes. The seed is then placed under running water and washed until the acid is thoroughly washed out. The seed is then dried and planted. Porcelain or enameled ware should be used as the acid corrodes any
other substance. Care should also be taken that the acid does not come in contact with the hands or clothing. Seed given this treatment in field experiments of the Station made a much thicker stand the first year after seeding than the untreated seed, but no difference could be observed in the field the second year.

The Iowa State College has a scarifying machine which makes the seed coats thinner by rubbing them over sand paper. A pound of seed was sent there for treatment and used in comparison with the sulphuric acid treated and untreated seed. This showed a marked increase in germination over the untreated seed but not so good as the seed treated with sulphuric acid. The scarifying machine will probably not be practicable for the average farmer, but would be practicable for the seed house or dealer. Scarified seed could be put on the market at a slightly advanced price.
Sept. 1916. Sweet Clover.

The results of germination tests are shown in the following table:

Germination Tests of Sweet Clover.

<table>
<thead>
<tr>
<th>No.</th>
<th>100 Seeds Each</th>
<th>Number of Seeds Germinated</th>
<th>Total Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In 1 day</td>
<td>In 2 days</td>
</tr>
<tr>
<td>1.</td>
<td>Untreated Seed</td>
<td>13</td>
<td>45</td>
</tr>
<tr>
<td>2.</td>
<td>Scarified Seed</td>
<td>42</td>
<td>74</td>
</tr>
<tr>
<td>3.</td>
<td>Acid Treatment</td>
<td>82</td>
<td>87</td>
</tr>
</tbody>
</table>

No. 1. Untreated seed. Just as it came from the dealer.
No. 2. Scarified seed. Treated in scarifying machine at Iowa State College.
No. 3. Treated with concentrated sulphuric acid.

In the pot tests shown in Figure 4 there was apparently no increase in the germination of the scarified seed over the untreated seed. A marked difference is shown, however, in the acid treated seed. The even and dense growth shows the early germination. Apparently, however, the only advantage gained in the treatment of sweet clover seed is the hastening of germination.

III. THE PRODUCTS OF SWEET CLOVER.

Sweet Clover for Hay.

Sweet clover when cut at the right time and cured properly makes good hay. All of the sweet clover raised at the agronomy farm the past five years has been used for this purpose. It has usually been stacked near the corral and fed to the horses when they were running out. The 1915 crop was taken to the stock farm and used in a feeding experiment.

Sweet clover for hay should be cut before the stems begin to get woody. Just before blossoming begins is about the right time. It cures slowly. At the station the plan has been to rake into windrows about a half a day after cutting, and put up in shocks. It is allowed to cure in the shock. The curing takes about four or five days of good weather, about the same as alfalfa cured in this way. By this method few of the leaves are lost. If salt is sprinkled on when put in the stack the quality is improved and stock eat it better.
Sweet Clover for Pasture.

A number of farmers have reported good results from using sweet clover for pasture. It has proven better than alfalfa for this purpose in dry farm sections and very little trouble from bloat has been reported. It should not be pastured too close and some new seed should be scattered over the ground every year so that the pasture will be permanent. So far, the Wyoming station has conducted no experiment to test the pasture value of sweet clover.

Sweet Clover for Seed.

In many parts of the state sweet clover produces an abundant seed crop, and saving the seed is profitable, as the market demand for it is good. If seed is harvested from waste places where a mower or binder cannot be used, the plants can be cut by hand or with a scythe and tied up in bundles. These when cured can be threshed. Sweet clover should be cut for seed when most of the heads have turned dark. A binder may be used in larger fields and the bundles shocked like small grain. The seed shatters badly when dry; therefore the bundles must be handled carefully. It is better, if possible, to harvest it when slightly damp. It must be thoroughly dry, however, when threshed.
CONCLUSIONS.

There is no doubt but that sweet clover is a good crop for Wyoming conditions. The following points may be stated in its favor:

It prepares heavy, hard and poor soils for the growing of alfalfa.

It is a good fertilizer, adding both nitrogen and humus to the soil, when plowed under as green manure.

It has a high feeding value. Analyses show that it has nearly as much protein and more fat than alfalfa.

It will grow on land too wet or too dry for alfalfa.

It is more alkali-resistant than alfalfa.

It can be grown successfully under irrigation or on the dry farm.

It seeds freely under both of the above conditions.

It makes an excellent pasture and a first class green manure.

It does best on soils that contain plenty of lime.

It is a weed in waste places only. It never damages cultivated crops.

Those desiring a more extended discussion of the varieties and history of sweet clover are referred to Farmers' Bulletin 485 by the Department of Agriculture, Washington, D. C.