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ALFALFA IN WYOMING

By T. S. Parsons
UNIVERSITY OF WYOMING
Agricultural Experiment Station
LARAMIE

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Alfalfa in Wyoming

BY T. S. PARSONS.

INTRODUCTION.

Alfalfa is pre-eminently the great forage crop of the semi-arid regions. The crop is now so well known in all parts of the country that any discussion of its history is unnecessary here. It is grown in all parts of the United States, and the acreage is rapidly increasing. In 1899 the United States had a total of 2,094,011 acres in alfalfa. In 1912 this had increased to 4,707,136 acres, or an increase of over 100 per cent in 15 years.

The increase in acreage in Wyoming has probably been proportionately as great, as the crop does exceptionally well under Wyoming conditions where water is available for irrigation, and with the development of hardier and more drought-resistant varieties, it is becoming increasingly important on the dry farm.

Permanent and prosperous farming demands the growing and feeding of some legume. No other legume is as valuable or as well adapted to the climatic conditions of the state as alfalfa. No other legume, with the possible exception of field peas and sweet clover, possesses like qualities of resistance to drought and cold, and yield. Being a hardy perennial, maintaining itself for several years when once established, and producing a heavy growth of forage high in protein makes alfalfa the greatest of all forage crops for Wyoming conditions. It not only furnishes an abundance of forage, but is a soil builder of the highest order. Two cuttings per year may be obtained in all parts of the state under irrigation and in the more favored sections three crops are obtained, with a considerable growth
of pasture. By the growing of alfalfa the lands of Wyoming can be made to produce double. Conditions here are much the same as they were years ago in Colorado and Utah. Not until the fields of these states were made fertile by alfalfa could potatoes, melons, and apples be profitably produced.

Alfalfa is a good crop for improving and maintaining the fertility of the soil, provided the crop is fed on the farm and the manure properly conserved and returned to the soil with such other materials as may be required. Since alfalfa is classed as a nitrogen gatherer and a soil builder, many erroneous ideas concerning the plant have arisen. It is not a crop adapted to poor land. Under proper conditions it gets a part of its nitrogen from the air and by means of the bacteria on its roots stores some of it up in the soil. If, however, the soil is not well supplied with humus, so that conditions are favorable to the development of bacteria, the alfalfa will use up the nitrogen as well as the other plant foods in the soil.

Examinations of the roots of alfalfa plants growing in soils on the Experiment Station farm, low in humus, have shown the nitrogen nodules to be absent, while those plants growing on soils well supplied with humus had a plentiful supply of nodules on the roots.

I. CHOOSING THE SEED.

Alfalfa Varieties.

The botanical name of alfalfa is *Medicago sativa* L. All the different varieties, or strains, have originated from this, and are only distinct from this and from each other so far as habits of growth, hardiness, and productivity are concerned. Nine varieties have been grown at the Wyoming Station during the past six years, in order to study these variations. Some of these varieties show contrasts of decidedly practical value, such as hardiness, habits of stooling, resistance to frost, drought and diseases, and leafy hay qualities, *i.e.*, the proportion of leaves to stems in the hay. The names of these varieties and the yields for five years are given in Table I.
<table>
<thead>
<tr>
<th>VARIETY</th>
<th>Yield 1/2 A. 1911</th>
<th>Yield 1/2 A. 1912</th>
<th>Yield 1/2 A. 1913</th>
<th>Yield 1/2 A. 1914</th>
<th>Yield 1/2 A. 1915</th>
<th>Av. yield per acre, 4 yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First crop</td>
<td>Second crop</td>
<td>Yield per acre</td>
<td>First crop</td>
<td>Second crop</td>
<td>Yield per acre</td>
</tr>
<tr>
<td>Turkestan</td>
<td>1090</td>
<td>1050</td>
<td>10700</td>
<td>1135</td>
<td>1100</td>
<td>11750</td>
</tr>
<tr>
<td>Sand Lucern</td>
<td>1150</td>
<td>1100</td>
<td>11250</td>
<td>1135</td>
<td>1100</td>
<td>11175</td>
</tr>
<tr>
<td>Grimm</td>
<td>800</td>
<td>750</td>
<td>7750</td>
<td>900</td>
<td>800</td>
<td>8500</td>
</tr>
<tr>
<td>Provence France</td>
<td>650</td>
<td>525</td>
<td>5750</td>
<td>640</td>
<td>510</td>
<td>5750</td>
</tr>
<tr>
<td>Utah Seed</td>
<td>1045</td>
<td>950</td>
<td>9975</td>
<td>1040</td>
<td>975</td>
<td>10075</td>
</tr>
<tr>
<td>German Seed</td>
<td>620</td>
<td>525</td>
<td>5725</td>
<td>640</td>
<td>500</td>
<td>5700</td>
</tr>
<tr>
<td>Dry Grown Seed</td>
<td>1275</td>
<td>1120</td>
<td>11975</td>
<td>1250</td>
<td>1050</td>
<td>11500</td>
</tr>
<tr>
<td>Montana Seed</td>
<td>1260</td>
<td>1150</td>
<td>9640</td>
<td>1190</td>
<td>1240</td>
<td>9720</td>
</tr>
<tr>
<td>Native Seed (one-fourth acre)</td>
<td>1260</td>
<td>1150</td>
<td>9640</td>
<td>1190</td>
<td>1240</td>
<td>9720</td>
</tr>
</tbody>
</table>
A study of the table shows the Grimm to be considerably in the lead. There are reasons for this. It will be noticed that the Turkestan, Sand Lucern, Grimm, and Montana varieties stood nearly the same for the first two years. The winter of 1912-13 was very severe on alfalfa, and all of the varieties except the Grimm were winterkilled in varying degrees. This hardy variety showed no winterkilling at all and has proved perfectly hardy ever since. The yield of 1915 was lowered by late spring frosts, affecting the first cutting. The dry-grown seed had its conditions changed by irrigation, therefore the comparison in this test is hardly fair. The above yields are reckoned on the basis of one-fifth acre plots. Twenty-six other varieties from the United States Department of Agriculture were grown in rows, while native seed has been sowed each year in comparatively large fields and under varying conditions to determine the best time of seeding, the best amount of seed to sow, and the best kind of preparation of the seed bed, and also to study the methods of caring for and harvesting the crop and methods for the successful production of seed.

Alfalfa Types.

Questions often asked are: "Why does one variety of alfalfa stand through the winter better than another?" "Why does one variety yield more per acre?" and "Why is the Grimm better than the other varieties?" The preceding table shows the Grimm to have averaged 0.69 tons per acre more than the best of the other varieties, and it has showed no winterkilling. Therefore, the question arises, Has the type of the plant anything to do with its hardiness? Probably it has. Another question also is often asked: "Is the Grimm of sufficiently higher value to pay the advanced price asked for its seed?" Probably not, provided the farmer can get good northern-grown alfalfa seed at a reasonable price.

The study of types, however, is an important one. The farmer is interested in the one that will make the most hay. Will the Grimm do this? Results show that it does, on ac-
count of its resistance to winterkilling. If there were the same
number of plants per acre it would not yield better than some of
the other varieties, but usually more of the plants of the Grimm
stand from year to year. It has not, however, a great advan-
tage if the cost of seed and the yield per acre are compared.
At the Colorado Station the Baltic variety outyielded the
Grimm, while the Liscorn is recommended by Montana grow-
ners. These two varieties are much like the Grimm in character
and habits of growth. They are undoubtedly of the same
origin as the Grimm, both having come from Minnesota, where
the Grimm variety originated.
The habits of the Grimm, however, commend it to favor. Its heavy stooling habit produces finer stems and a more leafy hay. The underground shoots and feeding roots make it very hardy and resistant to winterkilling and late spring frosts. A study of the cuts (Figs. 1 and 2) of the one-year-old plants of the Grimm and the common variety shows this habit of growth in the Grimm plant, and its heavy root system as compared with the other. The Grimm is undoubtedly the best for dry-farm conditions. Less seed of this variety is required per acre and it is a heavy seed producer. Even at the high price of the Grimm seed at the present time, it would undoubtedly pay the farmer to sow a small amount and produce seed for the planting of larger areas.

Choice of Variety.

There are so many varieties and strains advertised at the present time that the farmer is at a loss to know which one to plant. The fancy varieties are so high priced that they are almost out of the question for general use. There are certain factors that should be kept in mind when selecting alfalfa seed:

The native-grown seed will be better for local conditions than fancy, imported seeds.

The farmer need not concern himself seriously in the choice of seed further than to try to get that which is locally grown.

If he cannot do this, he should get good, viable, and pure northern-grown seed. The native Wyoming, Montana, or Dakota seed is well adapted to Wyoming conditions and will do as well or better than many of the highly advertised fancy strains. If one desires to try the Grimm or some of the other varieties, he can do so on a small scale and at not too great expense.

In buying one should be certain as to the source of the seed and under no circumstances buy southern-grown seed.

Seed should be purchased from guaranteed sample and the sample should be sent to the Seed Commissioner for test.
as to purity and germination. The Dairy, Food and Oil Department at Cheyenne maintains a seed-testing department, where the testing is done free of charge by the State Agronomist. Every farmer should avail himself of this service, especially where purchasing alfalfa seed. Alfalfa seed should be plump, of good, bright color, and entirely free from weed seeds.

Fig. 3—Grimm Alfalfa

The Wyoming Seed Law.

Since the adoption of the state pure seed law the quality of the alfalfa seed sold within the state has been greatly improved. Outside dealers no longer ship low-grade alfalfa seed into the state. The law of Wyoming requires that alfalfa seed shall pass a purity test of 96 per cent and a germination test of 85 per cent and must be entirely free from the seed of dodder and other noxious weeds. Alfalfa seed that is not up to this standard cannot be offered for sale in the state.
The large seed houses and dealers have complied readily with the law, but many farmers are still careless in purchasing and selling seed among themselves. From March 1 to May 1, 1915, one hundred and thirty samples of alfalfa seed were tested by the State Agronomist. Many of these were of low grade, but were comparatively free from weed seeds, so that most of them were passed. The season of 1915 was unfavorable to the production of alfalfa seed. Therefore, much inferior seed was offered for the spring sowing of 1916. All alfalfa seed should be thoroughly cleaned and graded before being offered for sale.

II. Alfalfa Experiments at the Wyoming Station, 1911-1915.

The writer took charge of the agronomy work at the Wyoming Experiment Station on March 1, 1910. At that time the varieties listed in Table I were growing in quarter-acre subdivisions of Plots 30 and 31, having been seeded under the supervision of Mr. L. B. McWethy, who was then the Station Agronomist. The varieties on Plot 30 were, Turkestan, Sand Lucern, Grimm, and Provence France; and those on Plot 31 were, Utah Seed, German Seed, Dry Grown Seed, Montana Seed, and Native Seed. The crowding of other work and unfavorable conditions, such as lack of irrigation water and a severe freeze in August, so hindered the work of 1910 that the results of that year are not included in this bulletin. The work was better in hand by 1911, and so the experiments here discussed begin with that year.

A field of 15 acres at the south end of the farm was also in alfalfa. Much of this field needs leveling and the lower parts are affected with alkali, so that the stand is somewhat thin. A part of this field has been broken up and reseeded, and new areas have been seeded each year.

Alfalfa Work in 1911.

The crop of 1911 was a great improvement over that of 1910. The first crop was injured to some extent by improper
irrigation, but the second crop came on well, so that the total yield for the year was good. There was no winterkilling in any of the varieties and but little difference in the yields of the several varieties. (See Table I.) This year the alfalfa renovator was used for the first time to the great improvement of the crop. The benefits of renovating were most apparent in the south field, where there was a good deal of foxtail and other weeds in the alfalfa. All of the alfalfa received two irrigations during the season—one after growth had started in the spring and one after the first cutting.

Work on Plots.
April 25. Plots renovated.
May 27. Crop growing well. Plants not noticeably affected by spring frosts. Height 6 inches at this date.
June 6-7. Plots given first irrigation.
July 5. Plants about one-half in bloom.
July 8. First cutting. Hay cured in shock 4 days.
July 17-25. Plots given second irrigation.
Aug. 1. First bloom on second crop.

At the time these plots were sowed in 1909, duplicate plots were sowed. These were not uniform nor good yielders on account of having been used for an experiment to determine the best time of sowing the seed after plowing. These plots were broken up in the fall of 1911 to be used for other purposes.

Alfalfa Work in 1912.

In the spring of 1912 some cooperative work in testing of varieties was taken up with the United States Department of Agriculture. Twelve samples of seed were received for this purpose and these were sowed on the part of the agronomy farm known as Field A, on Plot 18.

In some cases there was sufficient seed to plant one drill width across the plot and in other cases there was only sufficient seed to plant one row. Table II gives a list of the varieties sowed and their departmental numbers and time of seeding.
Fig. 4—Grimm Alfalfa on left; Ordinary on right. Note weeds on right, showing alfalfa winter-killed

**Table II—Showing Date of Seeding of Alfalfa Varieties Planted in Rows, 1912.**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>S. P. I. No.</th>
<th>Date planted</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sand Lucern</td>
<td>23481</td>
<td>May 20</td>
<td>Plowed up in 1913</td>
</tr>
<tr>
<td>2</td>
<td>Turkestan</td>
<td>24352</td>
<td>May 20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Turkestan</td>
<td>23203</td>
<td>May 20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Corn Alfalfa</td>
<td>29212</td>
<td>May 20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>North Grown</td>
<td>32279</td>
<td>May 25</td>
<td>Kept with other varieties for seed</td>
</tr>
<tr>
<td>6</td>
<td>Turkestan</td>
<td>21032</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Grimm</td>
<td>29987</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Turkestan</td>
<td>22788</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Turkestan</td>
<td>22790</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><em>Medicago falcata</em></td>
<td>30436</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><em>Medicago falcata</em></td>
<td>30009</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><em>Medicago falcata</em></td>
<td>28071</td>
<td>May 25</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><em>Medicago falcata</em></td>
<td>31703</td>
<td>May 25</td>
<td></td>
</tr>
</tbody>
</table>

The first four varieties in Table II did not make a good stand, the seed being of poor quality, therefore they were plowed up in 1913, in order that the land might be used for other variety tests.
The seed was slow in coming up, the season being rather dry, and it was not desirable to irrigate until late. The varieties planted in rows were cultivated and all the varieties were given one irrigation during the season.

The varieties showed a great deal of variation in height, stoothing habits, color of bloom, etc. All of the varieties bloomed quite freely, but only a few of them produced seed, the blossoms appearing to blight when about in full bloom. All of the new seeding, except the first four numbers, entered the winter in good condition.

Work in Variety Plots, 1912.

The quarter-acre variety plots came through the winter with apparently no winterkilling. The late spring frosts, however, retarded the growth of the first cutting somewhat. The following is the record of the work for the year:

**PLOT 30.**

- March 28. Renovated the plots.
- June 8. Alfalfa varieties growing slowly on account of cool weather.
- June 17. Season late and growth of all varieties except Grimm retarded by frosts. Plots given first irrigation.
- June 22. All varieties growing rapidly since irrigation.
- June 22. Alfalfa beginning to bloom. Height of Provence France, 2 ft. 4 in., about 4 in. taller than other varieties.
- July 16. Grimm and Sand Lucern one-third in bloom. Height, 2 ft. 2 in.
- All varieties were raked soon after cutting, with side delivery rake, and cured in the shock. (For yields, see Table I.)
- Aug. 13. Weather favorable and all the alfalfa varieties are growing rapidly.
- Aug. 17. Plots given second irrigation.
- Sept. 5. Cut second crop. Hay cured in shock. (For yields, see Table I.)

**PLOT 31.**

- March 28. Renovated the plots.
- June 5. Alfalfa varieties all growing slowly on account of cold weather.
- June 17. Varieties all affected by frost.
- Plots given first irrigation.
June 28. All varieties growing rapidly.
June 8. Montana and Dry Grown seed 5 in. higher than German and Utah seed. Height of former 24 in. Height of latter, 19 in.
July 12. Dry Grown and German seed beginning to bloom.
July 16. Montana seed beginning to bloom.
July 21. Varieties about one-half in bloom.
July 22. Cut Dry Grown, German and Utah seed.
All plots raked green with side delivery rake and cured in shock. (For yields, see Table 1.)

*Alfalfa Work, 1913.*

The winter of 1912-1913 was very severe on winter grains and alfalfa. Much winterkilling was reported from all parts of the state. At the Station most of the plot varieties showed various degrees of winterkilling; the Grimm being the only variety that appeared to be absolutely hardy and resistant to winterkilling.

In 1911 seeding of government varieties on Plot 18 came through the winter with some loss. The remaining plants, however, made good growth and produced a fair crop for new seeding. The varieties were mowed July 30. No record of yields was kept. The plots were irrigated immediately after the first cutting. The varieties were not cut the second time, being allowed to grow through the balance of the season. At the time of killing frosts, September 12, the varieties averaged about 12 inches in height and were just beginning to bloom.

**Plot 30.**

March 29. Renovated the plots.
May 3. Alfalfa just starting to grow.
May 23. Irrigated the plots.
June 4. All of the varieties growing very rapidly.
June 28. Grimm beginning to bloom.
June 29. Sand Lucern beginning to bloom.
July 1. Turkestan beginning to bloom.
July 2. Provence France beginning to bloom.
July 3. Plot given second irrigation.
July 8. Provence France 29 in. high, and one-third in bloom. Grimm 28 in. high, and one-half in bloom. Turkestan 27 in. high, and one-fourth in bloom.
July 10. Cut all varieties, raked with side delivery rake and cured it in shock. (For yields, see Table I.) Yields of all varieties except Grimm lighter this year on account of winter killing.
July 24. Heavy rain fell, causing rapid growth of alfalfa.
Aug. 5. Plots given third irrigation.
Second crop apparently coming on better than first crop.
Aug. 12. Turkestan beginning to bloom.
Aug. 15. Grimm beginning to bloom.
Aug. 29. Second cutting cured same as first crop. (For yields, see Table I.)

PLOT 31.
March 29. Renovated the plots.
May 3. Alfalfa varieties just starting to grow.
May 25. Plots given first irrigation.
June 4. All varieties growing rapidly. No injury from spring frosts this year.
July 9. Montana seed 28 in. high and one-fourth in bloom.
Dry Grown seed 31 in. high and one-half in bloom.
German seed 25 in. high and one-half in bloom.
Utah seed 28 in. high and one-half in bloom.
(For yields, see Table I.)
July 24. Heavy rain on this date, causing alfalfa to grow rapidly.
Aug. 6. Plots given third irrigation.
Aug. 9. All varieties appear better than before first cutting.
Aug. 15. Montanana seed beginning to bloom.
Aug. 18. Utah seed beginning to bloom.
Aug. 19. Dry Grown seed beginning to bloom.
Aug. 29. Cut all varieties and cured as Plot 30.
(For yield, see Table I.)

Alfalfa Work, 1914.

Varieties from the United States Department of Agriculture left from last year stood winter well. These and the row varieties were given no irrigation during the season. The plants were allowed to stand until seed was matured.

PLOT 30.
May 26. Alfalfa varieties all growing rapidly; no injury from spring frost.
June 6. Plot given first irrigation.
(For yield, see Table I.)
The winter killing was the result of the cold winter of 1912 and 1913. There was apparently no winter killing in the winter of 1913 and 1914.

July 20. Plots given second irrigation.
Aug. 15. Made second cutting. This was unusually early for the second cutting, but the season was very favorable and growth rapid.
(For yield, see Table I.)
Sept. 2. Third growth, 4 in. high.
Sept. 12. First killing frost. Alfalfa then 14 in. high. Usually there is but little growth after the second cutting.

PLOT 31.

May 20. Reseeded bare places in plots.
May 25. Alfalfas all growing very rapidly; no injury from spring frosts.
June 27. First blossoms appearing.
Weight of 10 green plants at second cutting: Utah seed, 26 oz.; one-third winterkilled. German seed, 32 oz.; one-fourth winterkilled. Dry Grown seed, 24 oz.; one-fifth winterkilled. Montana seed, 24 oz.; one-sixth winterkilled.
Aug. 3. Blossoms appearing for second crop.
Aug. 15. Second cutting.
(For yields, see Table I.)

New Alfalfa Seeding, 1914.

Some new areas were seeded to alfalfa in 1914 to test various methods of sowing, namely, sowing with and without a nurse crop and on fall and spring plowing.

On May 25, one-quarter of an acre on Plot 32 was sowed to alfalfa alone at the rate of 10 pounds of seed per acre. Another quarter acre on the same plot was sowed to alfalfa at the same rate with oats as a nurse crop. The land was spring plowed. The alfalfa sowed alone was broadcasted and harrowed in, while that with the nurse crop was drilled. An ex-

Excellent stand was obtained from the seed sowed alone, but no stand was obtained from that sowed with the nurse crop. There is danger in drilling alfalfa of getting it covered too deeply when sowed with a nurse crop. This is especially true when sowing in spring plowing.

On Field B an area of four acres was plowed in the fall of 1912, and summer-fallowed in the summer of 1913 to prepare it for alfalfa. These acre plots were worked with the spike-tooth and acme harrows from April 18 to May 7, to prepare a good seed bed. Plots 2 and 4 were seeded to oats at the rate of one bushel per acre, as a nurse crop for the alfalfa. The alfalfa was sowed on May 11 with an alfalfa drill at the rate of 10 pounds per acre; Plots 1 and 3 being seeded to alfalfa without a nurse crop.

**RECORD OF TREATMENT, NEW SEEDING.**

May 20. Alfalfa coming up on all the plots.

July 2-6. Plots given first irrigation.

July 10. Alfalfa growing rapidly.

July 16. Mowed weeds on Plots 1 and 3.

July 20. Alfalfa sowed without nurse crops appears to be a thicker stand, but that sowed with nurse crop grew taller, probably on account of the shading by the nurse crop.


July 30. Mowed nurse crop on Plots 2 and 4.

Aug. 18. Mowed all pots and allowed material to remain on the ground as a mulch.

At the close of the season there was apparently no difference in the stand of the alfalfa sowed with the nurse crop and that sowed without. It would appear that the preparation of the seed bed, the moisture supply, and the seed are more important factors in the growth of the crop than the nurse crop. The nurse crop, however, gives a considerable crop of hay which otherwise could not be obtained from the alfalfa ground the first season.

**Alfalfa Work, 1915.**

**PLOTS 30 AND 31.**

Plots received a top dressing of three tons of barnyard manure during the winter of 1914-1915.

May 18. Plots renovated with the alfalfa cultivator. This implement had not been used before. Apparently good results may be obtained from its use.
May 25. Plots given first irrigation.
(For yields, see Table I.)
Aug. 3. Plots given second irrigation.
Sept. 7. Second cutting. (For yields, see Table I.)

The season was cold and backward. The growth of the varieties was checked all through the season. The first cutting was very poor and the second cutting below the average.

**New Seeding.**

Plots on Field B seeded in 1914 came through the winter with no winterkilling. A good stand remained on all the plots, but yields were below the average on account of poor season. Yield of four acres, two cuttings, 2.22 tons per acre.

A larger area in Field C was sown to alfalfa with oats as the nurse crop in 1915. This land is rather low and a portion of it receives seepage water. A total of about 12 acres was sowed. The area was divided into three sections, one section being sowed to oats and alfalfa drilled in at the same time. One section was sowed to oats and the alfalfa broadcasted and harrowed in, and one section was sowed to oats and alfalfa, with the broadcast alfalfa seeder. The ground was so wet that it was impossible to cut the oats. There was apparently a good stand of alfalfa in the fall, but that on the low part of the field was killed. There was no apparent difference in the stands obtained by the different methods of seeding. In each case 10 pounds of alfalfa seed was sowed to the acre, with one bushel of oats per acre as a nurse crop.

The broadcast seeding of alfalfa alone in 1914, on Plot 32, gave a yield of 2.75 tons per acre in 1915. Results this year would seem to indicate that alfalfa can be grown just as well with a nurse crop if there is sufficient moisture, and that broadcasting is as good as drilling.

**Native Seed.**

In the spring of 1912 two small areas consisting of one-half acre each were seeded with Wyoming-grown alfalfa seed to compare the effect of previous crops. One plot had been
in grain the previous year and the other in field peas. The plots were given the same treatment and were seeded at the same time with the same variety of seed. An excellent stand was obtained in the plot that had been in peas, but only a poor stand was obtained in the plot that had been in grain.

While peas will not inoculate for alfalfa, they seem to put the soil in better physical condition. In plowing and harrowing, the pea ground was more friable than the grain ground, so that a better seed bed was formed. There is no doubt but that field peas will help to put land that is in poor condition in better condition for alfalfa. The poor stand on the grain ground was plowed up the following year, but that on the pea ground was allowed to stand. One noticeable fact in regard to the native seed is that it has not winterkilled to any extent. This is peculiar since its first winter was unusually severe. (For yields, see Table I.)

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>Beginning of Bloom</th>
<th>Second Cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1911</td>
<td>1912</td>
</tr>
<tr>
<td>Provence France</td>
<td>July 9</td>
<td>July 10</td>
</tr>
<tr>
<td>Utah Seed</td>
<td>July 5</td>
<td>July 12</td>
</tr>
<tr>
<td>Native Seed</td>
<td>July 16</td>
<td>July 3</td>
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TABLE III—(Continued).

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>Time of Cutting</th>
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<tbody>
<tr>
<td></td>
<td>1911</td>
</tr>
<tr>
<td>Turkestan</td>
<td>July 8</td>
</tr>
<tr>
<td>Sand Lucern</td>
<td>July 8</td>
</tr>
<tr>
<td>Grimm</td>
<td>July 8</td>
</tr>
<tr>
<td>Provence France</td>
<td>July 8</td>
</tr>
<tr>
<td>Utah Seed</td>
<td>July 8</td>
</tr>
<tr>
<td>German Seed</td>
<td>July 8</td>
</tr>
<tr>
<td>Dry-Grown Seed</td>
<td>July 8</td>
</tr>
<tr>
<td>Montana Seed</td>
<td>July 8</td>
</tr>
<tr>
<td>Native Seed</td>
<td>July 25</td>
</tr>
</tbody>
</table>

Varieties earliest to bloom (dates in bold face in table):
1912, first cutting: Sand Lucern, Grimm, German, Montana, July 4; second cutting: Native, Aug. 17.
1913, first cutting: Grimm, June 26; second cutting: Turkestan, Aug. 12.
1915, first cutting: Sand Lucern, Grimm, Montana, July 10; second cutting: German, Montana, Aug. 25.
Summary of Experiments at the Wyoming Station.

1. The Grimm leads all other varieties in hardiness, in earliness of maturity, and yield per acre. (See Tables II and III.)
2. Broadcasting gave as good results as drilling.
3. Equally good stands were obtained with and without the nurse crop.
4. Summer fallowing put the ground in the best condition for alfalfa.
5. When a nurse crop is used a crop of hay averaging one ton per acre was obtained the first year.
6. The experiments showed no advantage from inoculation.
7. Liming the soil of the agronomy farm is not necessary.
8. Ten pounds of seed to the acre gave a sufficiently heavy stand in all cases.
9. One irrigation for each cutting was usually sufficient.
10. A well-packed seed bed with a loose surface, good seed, and sufficient moisture in the ground to germinate the seed and start growth seem to be the essential factors for successful alfalfa growing under conditions similar to those at the agronomy farm.

III. Cultural Directions for Growing Alfalfa.

Inoculation.

Inoculation of either the seed or the soil for the growing of alfalfa has not been found necessary in Wyoming. There is little trouble in getting a good stand and a successful growth where good seed is planted at the proper time in a well-prepared seed bed. Some experiments in inoculation have been carried out at the Station, but in no case have there been any better results than where there was no inoculation. (See Fig. 5.) The field experiments gave no better results than the pot experiments.

Liming is also unnecessary in most Wyoming soils. Liming is often necessary in the soils of eastern or humid regions
on account of their tendency to become acid. Wyoming soils are not acid, but tend more toward alkalinity and are generally well supplied with lime; therefore, alfalfa does well. Experiments at this Station show that the addition of lime to the soil is of no benefit.

Fig. 5—Inoculation of Alfalfa.
2. Inoculated Seed.
4. Soil Limed and Seed Inoculated.

Heavy manuring and a crop of white sweet clover will put the soil in good shape for growing alfalfa. The barnyard manure promotes the growth of bacteria in the soil and the bacteria on the roots of the sweet clover are closely related to those found on the roots of the alfalfa. There is seldom any trouble in getting a stand of alfalfa in soils well supplied with humus.

Selecting the Land.

Because of the wide distribution of alfalfa, its hardiness and deep-feeding roots, it is often taken for granted that the plant will do well on almost any kind of soil. This is a mistake. The selection of the field is of prime importance.

Alfalfa grows well on loamy soils. This condition can be obtained in almost any soil by the abundant use of manure. The character of the subsoil is also very important; there must be good drainage. This is why fields with considerable slope are better for alfalfa than low, level fields, where the water is
likely to stand. The water table should be not closer than 6 to 8 feet below the surface. Where the water table is closer than four feet it is doubtful if alfalfa will do well. If the subsoil is hard, impervious, or water-logged the feeding roots of the alfalfa cannot work to the best advantage. The subsoil must be loose enough so that the roots can penetrate it readily and get down to the moisture below. Even in a well-drained soil there may be saturation in the fall, so that the ground becomes covered with ice. Such a condition is almost sure death to alfalfa. When the plants are dormant they will stand flooding, but they will not stand being covered with ice. Alfalfa always does well on a hills side when once established, because water does not stand on the surface. The moisture conditions probably have more to do with the successful growing of alfalfa than any other factors. At the agronomy farm there has been no trouble in getting a stand of alfalfa, but it has been frequently observed that the plants have all been killed in the low spots in the fields where the water stood for a period of time. This was especially noticeable in the 1915 planting.

Alfalfa should not be seeded on new breaking nor on soils that have not been brought to good tilth by cultivation. Many letters of inquiry are received asking if alfalfa can be safely sown on new breaking or on sod that has merely been disked. The answer is invariably, “Do not risk it”. At no time have such practices been successful at the Experiment Station. A few farmers have reported success from sowing alfalfa on breaking, but in practically all cases the breaking had been done the preceding summer or fall and the land thoroughly worked down in the spring before sowing, and there also chanced to be a good supply of moisture that season.

Alfalfa will not stand much alkali. Where the alkali spots are not too bad in an alfalfa field they can be neutralized by the use of barnyard manure. If this is not an effective remedy they can be sown to sweet clover. The clover is strongly resistant to alkali and makes good forage. The spots will look
better covered with a rich growth of sweet clover than when bare of vegetation.

Land as free of weeds as possible should be selected for alfalfa. For this reason land that has been summer-fallowed the previous season or that has been in a cultivated crop is best. Success will be practically certain wherever alfalfa is sowed on deeply plowed, fertile soil that has been summer-tilled for a season, or that has grown a cultivated crop. The soil should also have a good supply of moisture stored up in it at the time the seed is sowed.

*Preparation of the Seed Bed.*

Alfalfa when growing properly has a marvelous root development. To allow the proper development of this root system the land must be plowed to a good depth. The soil, however, must be well packed below the surface. Therefore, fall plowing is preferable to spring plowing, because the soil has time to become packed during the winter. The disking and harrowing in the spring puts the seed bed in excellent condition for the alfalfa seed.

Disking and harrowing of fall plowing should begin as soon as the ground can be worked in the spring, and should be kept up at frequent intervals until seeding time. The weed seed that is in the ground will germinate and the cultivation will kill it. Summer fallow of the previous year is the ideal seed bed for alfalfa. Such ground will be well packed and free from foreign seeds.

If land is plowed in the spring for alfalfa, much attention should be given to the packing of the same. The packer should be used, or if this implement is not available the disk harrow may be used, keeping the disks straight when running through the soil. If the field is rolled with a smooth roller to pack it, or if it is planked or floated, the spike-tooth harrow should be run over it at once to make a surface mulch and stop evaporation.
Where land is rather light and loose, merely disking the stubble is often sufficient to prepare it for the seeding of alfalfa. Such land, however, is likely to contain weed seeds; therefore, seeding alfalfa under these conditions is not advisable. Land that has been in some cultivated crop, like corn or potatoes the preceding year, need not be plowed. Disking and harrowing will put this ground into good condition for seeding to alfalfa, provided it is not weedy.

There should be a sufficient supply of moisture stored in the soil at planting time to germinate the seed and give the plants a good start. The seed should not be irrigated up if it can possibly be avoided. If very dry, it is better to irrigate the ground before seeding. Good drainage is also necessary.

Our uncultivated soils are generally lacking in humus. Humus is essential for the growth of bacteria and the bacteria are necessary for the successful growth of alfalfa. New lands are the only place where inoculation has been found at all beneficial in Wyoming soils. Where barnyard manure is used or crop residues plowed under to increase the humus supply there has been no trouble in getting a successful stand of alfalfa without inoculation.

*Time to Seed.*

The establishment of a stand is the important thing. If a good stand is obtained and there is the proper development the first year there need be no further fear except for winterkilling, and the future success of the field is certain.

The time of seeding is not so important if soil and moisture conditions are favorable, and there is time enough for the plants to establish themselves before the close of the growing season. Sowings made in the spring, early summer, late summer, and even in the fall have been successful under Wyoming conditions, but taking all factors into consideration, spring sowing has proved the best. At the Experiment Station the most successful seeding has been done in May. The most important consideration, however, is the previous preparation of the soil. Too much attention cannot be given to this point. Given clean,
fertile land, deeply plowed, and well tilled, so that the seed bed conditions are ideal, there need be no fear but that a successful stand of alfalfa will be obtained.

The Amount of Seed to Sow.

No set rule as to amount of seed to sow per acre can be given. From 10 to 20 pounds are used in various parts of the state. The error is generally on the side of too heavy rather than too light seeding. The practice at the Station has been to sow 10 pounds per acre. This has given good stands in every instance and is considered sufficient for irrigated conditions. Good, tested seed should be used, however, so that one may know just the amount he is sowing. Ten pounds of 50 per cent seed will not be sufficient. On non-irrigated lands 4 to 5 pounds of seed per acre will be sufficient for drilling, or 1 to 3 pounds if planted in rows to cultivate.

The Nurse Crop.

In the non-irrigated sections the growing of alfalfa with nurse crop is not advised. There is usually no more moisture than is needed by the alfalfa. Under irrigation a nurse crop of oats or barley may be used to good advantage if moisture and soil conditions are favorable. Fifty pounds of oats or barley is sufficient. If the nurse crop gets too thick and appears to shade the alfalfa too much, it can be cut for hay. If conditions are all favorable, the nurse crop can be allowed to mature grain. In either case some crop is obtained the first year, while if the alfalfa is seeded alone no crop is obtained until the second year. The nurse crop also helps to keep down the weeds if the soil is foul. This is especially true when sowed rather early in the spring. Alfalfa can safely be seeded earlier than is the general practice over the state. The young alfalfa plants grow well in cool weather and will stand considerable cold when well started. The better developed the alfalfa becomes before the hot, dry weather of summer, the more chance it has of withstanding the winter successfully.
Methods of Seeding.

Alfalfa may be planted with the drill or it may be broadcasted. Both methods have been equally successful at the Experiment Station. The ordinary grain drill with the grass seed attachment is all right if care is taken that the seed is not planted too deep. The drill disks often go in the ground deeper than they appear to and the alfalfa seed following them down is liable to be covered too deeply. Alfalfa should have a covering of not more than half an inch in fairly heavy soil, and not more than one inch in light soils.

There is less danger of getting the seed too deep when it is broadcasted. The broadcasting may be done with the hand seeder or a combined alfalfa cultivator and seeder. After being seeded in this way the field should be harrowed. This will cover the seed to just about the proper depth.

Irrigation.

After seeding, if the soil is in good condition as regards tilth and moisture, the alfalfa field will require no more care until it is time to irrigate. At this time the alfalfa plants should be at least three or four inches high. It is better to postpone the first irrigation as long as possible and then irrigate heavily. This will be better than several light irrigations.

The later irrigation does not check the growth of the crop as the earlier irrigation often does since the weather is warmer and the water is warmer. The irrigation water is cold early in the season and when applied to the crop often checks the growth for several days. The desirability of delaying irrigation also holds after the crop has become established. At the Station it has been found that the first irrigation given after the crop was several inches high caused a much more rapid growth than when the water was applied before the growth started in the spring.

At the Station one irrigation for each crop has usually been found sufficient. Only once in six years has it been found necessary to irrigate more frequently. On this occasion a second irrigation was given shortly before the first cutting.
The irrigation for the second crop is given as soon as the first crop is off the ground. On lighter soils in various parts of the state a greater number of irrigations will be found necessary. No definite rule as to the number of irrigations can be given. The need of irrigation must be determined by the condition of the soil and the crop. A good rule is to wait until the crop is in real need, then irrigate thoroughly. The flooding method is generally used in the irrigation of alfalfa. As large a head of water as can be handled should be used and should be run over the field as rapidly as possible. The water should not be allowed to stand on the surface of the ground. Water allowed to stand on the surface will cause the alfalfa plants to turn yellow. The kind of soil, however, determines to a large extent the methods of irrigation. In general, lighter and more frequent irrigations are necessary on sandy soils, while heavier and less frequent irrigations can be applied to clay soils. In other words slow irrigations for clay and rapid irrigations for sand are economical.

Fall irrigation of alfalfa is also beneficial if not done too late. A fall irrigation will usually postpone the spring irrigation. Too late irrigation in the fall by allowing the ground to freeze up while still soggy often causes winterkilling.

Cultivation or Renovation.

The alfalfa crop needs cultivation. The first spring after seeding the plants will not be firmly enough established to stand a severe cultivation. A harrowing with the spiketooth will be sufficient at this time. After this, however, the cultivation should be thoroughly done each year. An alfalfa cultivator of some kind should be used. If the disk harrow is used, it should be run with the disks straight. The alfalfa plants should not be severely cut up.

The use of the old-fashioned porcupine type of renovator is no longer advised. In fact, the implement is no longer manufactured. It was found to be injurious to the alfalfa plants, because its sharp spike-shaped teeth often strike down in the
center of an alfalfa crown without splitting it, but leaving a
hole to fill up with water, thus forming an excellent place for
the development of fungi and bacteria. The result is that the
plant soon dies.

The newer types of alfalfa cultivators, however, are very
beneficial to the crop. The spring-tooth alfalfa harrow is a
good implement, as is also the alfalfa cultivator with the seed-
ing attachment. In this implement the teeth have play enough
to jump over or around the crowns without cutting them, clean-
ing out the weeds and loosening up the soil very thoroughly.
By means of the seeding attachment, bare places in the field
can be reseeded at the time the cultivating is being done. The
cultivating should be done early in the spring before growth
starts and again after the first cutting.

Cutting and Curing the Crop.

Cut when the crop is about one-third in bloom, is a gen-
erally accepted rule for cutting alfalfa. This does not always
apply to the best advantage, however, as the time of bloom
varies in different years. A better rule to follow is to cut
when the new shoots start at the base of the stems. Some
years these will be developed too far by the time the crop is
one-third in bloom, and cutting at this time injures the sec-
ond crop quite severely.

At the Station the plan is to rake up the hay close behind
the mower. It should not lie in the swath more than half a
day after being cut. With a side delivery rake the hay can be
put into the windrow very green, where it can be put up into
shocks and allowed to cure. In this way all of the leaves are
saved and the hay has a brighter color when cured. Since
about 65 per cent of the nutriments of the plant is found in
the leaves, it is very important that the leaves be saved. If
the hay is allowed to cure in the swath before being raked up
many of the leaves are lost. It takes from four to six days
of good weather for the hay to cure in the shock. A little
salt added to each load of hay when it is put in the stack
Stack Burning.

Many inquiries have come to the Station in regard to stack-burning alfalfa hay. Many of the stockmen of the state want their hay stack-burned for feeding purposes, holding that it has a higher feeding value and that the stock eat it better. The following article by Mr. A. L. Campbell, formerly County Agent of Fremont County, Wyoming, is of interest. He says:

Tests comparing the feeding value of bright alfalfa hay and "stack-burned" indicate the stack-burned has the greater feeding and fattening value per ton. The Kansas Experiment Station has made tests of hay sent from the Lander Valley which prove that stack-burned alfalfa has a higher per cent of digestible nutrients than does other hay taken from the same field. At least three or four feeders in this county (Fremont) have made comparative tests, alternating from one kind to the other and have satisfied themselves that the stack-burned is eaten more readily and fattens more rapidly than does the bright, clear or "pea green" hay for either cattle or sheep.

In order to have stack-burned hay, it is necessary to put the alfalfa into the stack as soon as possible after cutting. A process of fermentation then takes place similar to that which takes place in a silo. The fermentation breaks down the woody or crude fiber in the stems of the plant and makes more of it digestible. All of the leaves are also saved when alfalfa is put up by this method.

There is no doubt that the feeding value of the alfalfa is increased by this method, but it costs more, as the hay is heavier to handle and is usually too dusty to feed to horses. If the hay is to be fed on the farm the stack-burning will probably pay, but if the hay is to be sold the hay should be allowed to cure in such a way that it will have the bright "pea green color".

Growing Alfalfa Seed.

In many sections of Wyoming conditions are ideal for the production of alfalfa seed. Wyoming seed finds a ready market at home and in surrounding states. Good seed is produced under dry-farm conditions and under irrigation. One important factor in successful alfalfa seed production is that the moisture supply be limited at the time the alfalfa is in bloom and the seed being formed.
The second crop is usually left for seed under irrigated conditions, but the water is kept away from this crop so that the seed may form. At the higher altitudes of the state it is necessary to leave the first crop for seed on account of the shortness of the season; and unless the season is very dry no irrigation will be needed.

One can usually foretell a good seed crop by the appearance of the plants. Vigorous branching, a growth not too rank, and a uniform blossoming period indicate good seed production.

The seed should be harvested while the pods are still somewhat green. If the pods are allowed to attain more than a yellowish color there will be much shattering. The crop may be cut with the mower and allowed to cure on the ground. A self-binder can be used to good advantage and the bundles set up in shocks. This facilitates handling at threshing time. The threshing may be done with the ordinary grain separator, but this is not as satisfactory as the clover huller. Yields of from 300 to 600 pounds per acre should be obtained under Wyoming conditions.

Winterkilling.

Occasionally reports of winterkilling of alfalfa come to the Station and many theories of the causes and prevention of the same are advanced. There are several causes of winterkilling. Among these are insufficient growth the first year, pasturing too closely late in the fall, watering too late in the fall, becoming too dry, and lack of winter protection. New seeding should be done early enough so that the plants will get a good start before freezing up. If the alfalfa has been sowed alone and the field is weedy, it should be mowed early in the fall and the material allowed to remain on the ground as a mulch. If the alfalfa was seeded with a nurse crop the stubble will afford winter protection.

Alfalfa should not be pastured too closely after the last cutting. The tramping of animals when the ground is soft
is injurious. Pasturing after the ground is frozen, however, will do no harm.

Late irrigation sometimes causes winterkilling by saturating the soil so late that it freezes up in this condition. Fall irrigation is beneficial, provided it is done early enough so that the water has time to go down before the ground freezes. It is safer to give the last irrigation as soon as possible after the last cutting is out of the way. This will generally give the plants a sufficient moisture supply to carry them through the winter and up to the time of the first spring irrigation. A top-dressing of barnyard manure will give the alfalfa plants some winter protection and will also add fertility to the soil. This top-dressing of manure is especially beneficial to the alfalfa field on the dry farm.

Combating Diseases and Insect Enemies.
Wyoming alfalfa is subject to but few diseases. The root-rot has appeared in old fields in some parts of the state. This disease usually does not make its appearance until the plants are five or six years old. Crop rotation will keep the alfalfa free from this disease. Breaking up the alfalfa land and growing a crop or two of grain and a cultivated crop, and then seeding back to alfalfa, keeps the disease completely in check.

Stem blight is a disease which occasionally is brought on by the plants being affected by early spring frosts. The freezing affects the tender stems, causing them to soften, and they are attacked by bacteria, causing blight, and growth stops. When alfalfa fields become seriously affected by the blight the crop should be cut at once, so that the second crop can come on without hindrance.

Insect pests are not numerous. Grasshoppers occasionally do some harm. Cultivating the field early in the spring is beneficial, since it exposes the young grasshoppers to the spring frosts and the attacks of birds. The use of the “hopper dozer”, an implement which when drawn across the fields knocks the insects into a pan of oil, is sometimes necessary when the pests become serious.
Wyoming has thus far been practically free from the alfalfa leaf weevil. Some reports of damage done by the weevil have been received, but upon investigation they have proved false alarms. On several occasions when such reports came to the Experiment Station specimens of the insect were sent in and in every case the pest was identified as the alfalfa looper. The looper occasionally does some damage to alfalfa and other plants. It is not common, however, and appears only occasionally. It was quite numerous in the Big Horn Basin and in the central part of the state in 1914, but was not reported at all in 1915.

During the summer of 1914, the Agronomist received a letter from the Montana Station stating that reports of the alfalfa weevil doing destructive work had come from the Big Horn Basin. This office gave them the information on hand, namely, that the reports had been investigated and the pest found to be the alfalfa looper. To verify this the Montana Station sent a man into the section to investigate. He found no alfalfa weevil, but the alfalfa looper was found in abundance, thus corroborating the investigations of this office.

The looper is a green worm something like but somewhat larger than the so-called "measuring worms" or "span worms", often seen on garden plants. It usually does not do much damage to alfalfa and generally disappears after the first cutting. If the loopers are abundant the alfalfa should be cut as soon as possible and the field given a thorough irrigation. There is then little danger of their injuring the second cutting.

Since the alfalfa looper appears occasionally in sufficient numbers to do considerable damage and to cause some uneasiness on the part of the alfalfa grower, the following rules for the control of the pest given by the Montana Station are given here:

The loopers become noticeably abundant shortly before time to cut the first crop. They are not easily seen until one looks closely, and careful examination of the fields which the owner has seen daily may reveal a surprising number of the worms.
As the season advances the larvae become larger by the time the first crop is cut. They will not eat the hay and when the green alfalfa is removed, they are forced to search for food. They go to adjoining fields in great numbers and an effort should be made to prevent injury to the other crops, such as sugar beets and corn. To accomplish this a trial of the following methods is suggested:

1. Where practicable, run a ditch of water around the alfalfa field or between it and the other field to be protected, to prevent the crawling worms from crossing.

2. Spray heavily with Paris Green or Arsenate of Lead around the edges of the field, wherever the worms may be found feeding. In some instances it may be well to leave a strip of alfalfa around the edge of the field, and in large fields some in the middle, as bait, which should be poisoned. This should be later cut down and, when dry, burned, to prevent poisoning domestic animals. Paris Green may be used at the rate of three to four pounds to the hundred gallons of water. The addition of soap at the rate of four pounds to one hundred gallons of water aids in making the poison spread and stick.

**Alfalfa in the Crop Rotation.**

Experience has shown that alfalfa fields produce better crops when plowed up every four or five years and reseeded. In other words, a crop rotation system increases the yields of alfalfa and also the yields of other crops. A. L. Campbell, formerly County Agent in Fremont County, reports yields of alfalfa and grain crops more than doubled in that county by a crop rotation system in which alfalfa fields were plowed up every four years and grain crops and potatoes grown for two or three years, the land then being seeded back to alfalfa.

The usual plan of rotation is to allow the alfalfa to stand four years. It is then broken up and planted to a cultivated crop or grain crops for two or more years and then seeded back to alfalfa. It is usually better to grow grain the first year after the alfalfa breaking. If a root or other cultivated crop is grown the first year the many alfalfa plants that have not been killed will hinder the cultivation, but where grain is grown the alfalfa plants will not hinder its growth and a second plowing will kill out the remaining plants.

In the sugar-beet sections alfalfa works well in the crop rotation. Alfalfa land is excellent for beets. If plowed thoroughly, the beets can be grown the first year, but a grain crop
will follow the alfalfa better the first year after breaking. Plant beets the second year and the following year the land may be seeded back to alfalfa with grain as a nurse crop. In this rotation the alfalfa stands four years, being followed by two crops of grain and one cultivated crop. This permits the barnyard manure to be used on the alfalfa where it will be of the greatest value to that and the other crops.

Breaking Up Alfalfa Land.

There is often a good deal of trouble in getting rid of alfalfa unless the breaking is properly done. The alfalfa or breaker bottom should be used on the plow and the share kept very sharp so that it will cut through the crowns and not slide around them. The best time to break is in the fall after the last cutting. The breaking should be only deep enough to cut the crowns. A second plowing should be made in the spring; this should be deeper. The crown having been cut off, this plowing will be easier and will kill out practically all of the plants, so that a cultivated crop may be grown the first year, if so desired. Grain may be grown with one plowing if the saving of time is important. The second plowing, however, will be found to pay.

Pasturing Alfalfa.

While alfalfa is primarily a hay plant, it also affords excellent pasture for all farm animals. It is especially good for young, growing animals. When pastured by cattle and sheep, however, caution in regard to bloat must be observed.

Alfalfa should not be pastured too closely by any kind of stock, unless it is desired to destroy the stand. If the field is to be broken up in the crop rotation the animals may be allowed to eat the plants down to the ground. Animals should not be permitted to run on alfalfa when the ground is wet. The trampling of large animals injures the crowns of the plants. The heavy pasturing of alfalfa is hazardous under any conditions. Therefore, other pasture should be provided, so that intensive pasturing of the alfalfa fields will not be
necessary. Alfalfa seed may be used to good advantage in pasture mixtures.

*Alfalfa and Timothy.*

In some parts of the state it is a common practice to sow timothy with the alfalfa; the alfalfa-and-timothy hay being quite popular with many stockmen.

A mixture of five pounds of timothy and five pounds of alfalfa per acre was sowed at the Experiment Station some years ago. The timothy did not seem to do well under local conditions and was soon replaced by the alfalfa. In many parts of the state, however, conditions seem to be favorable for the growing of these two plants together. The alfalfa comes into bloom a little ahead of the timothy, so the alfalfa will be more mature when cut than when grown alone. This is not detrimental to the feeding value of the hay, but, on the other hand, makes it more valuable for feeding horses. The second crop comes on without the timothy and consists of clear alfalfa.

On lands that are suitably drained and where the water table is not too near the surface, the alfalfa and timothy mixture will probably be found valuable for permanent meadows.

*Alfalfa on the Dry Farm.*

But little experimental work along the line of growing alfalfa without irrigation has been done at the Experiment Station owing to the fact that the dry-farm work of the state is being conducted by the State Farm Board and it has been deemed wise to avoid duplication of work as far as possible. Numerous inquiries regarding the growing of alfalfa on the non-irrigated farm have been received at the Station, so it seems well to include a brief discussion of the subject in this bulletin.

Improvements in methods of dry-land farming and improvement in varieties by selection and otherwise, have made it possible to grow alfalfa in sections heretofore considered too dry for its utilization.
Much alfalfa is still broadcasted on the dry land, but the cultivated-row method is becoming more and more popular. The crop, whether grown for hay or seed, is improved by the row method. By this method there is more certainty of retaining it if moisture is scarce.

For growing alfalfa on the dry farm the hardy varieties of seed, such as the Grimm, Baltic or "Dry Grown", should be selected.

The land should be as carefully prepared for seeding as under irrigation, whether the seed is to be sowed broadcast or in rows. A deep-plowed, well-packed seed bed is necessary in either case. A thin uniform stand in rows 36 to 42 inches apart will give better results than seeding closer together. Only about two pounds of seed per acre will be required by this method of seeding.

The seeding can be done with an ordinary garden drill or with a grain or grass drill stopping up enough of the spouts so that the rows will be the required distance apart. A corn or beet cultivator can be used for cultivating as soon as the plants are large enough for the rows to be seen.

For the production of seed the row method is not only more certain of producing a crop, but will produce a larger yield, since it affords a better moisture condition and more light to the individual plant.

If it is desired to sow the seed broadcast or to drill in close rows, care should be taken to scatter the seed thin. Four or five pounds to the acre will be sufficient. Thin seeding is more certain to give a good stand than thick seeding. Rather early sowing is also advised. Probably from the first to the middle of May will suit most dry-farm conditions in Wyoming.
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MATERIAL FOR FURTHER READING.

Those who desire more information in general in regard to alfalfa are referred to the following books and bulletins on the subject:

Books:

*Alfalfa in America,* by Joseph Wing.

*Forage Plants,* by Chas. V. Piper.

Bulletins by the U. S. Department of Agriculture, Washington, D. C.:


Farmers' Bulletin No. 373, Irrigation of Alfalfa.

Farmers' Bulletin No. 495, Alfalfa Seed Production.

Bureau of Plant Industry Bulletin No. 209, Grimm

Alfalfa in the Northwest.

Booklets of the International Harvester Co., Chicago, Ill.