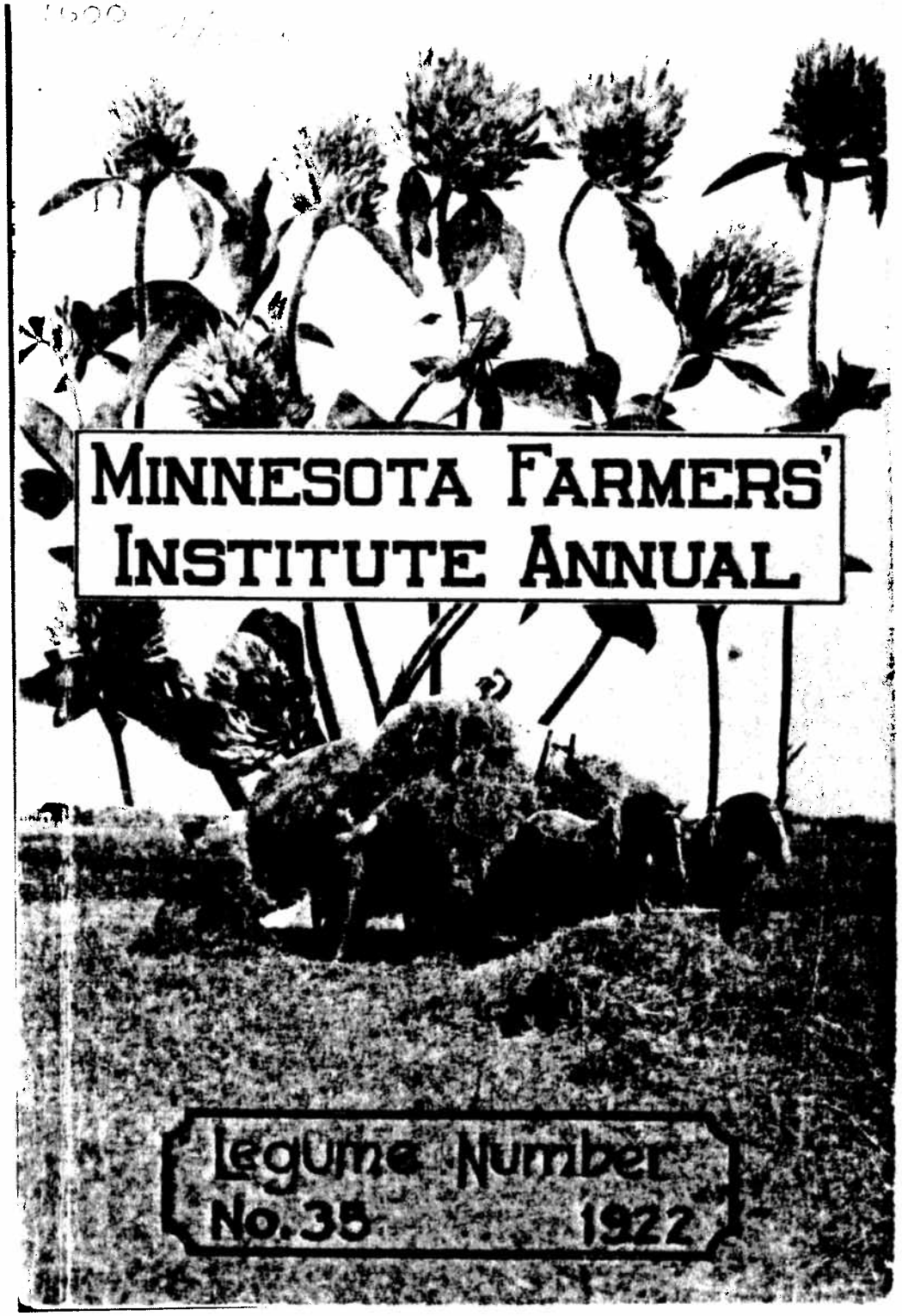
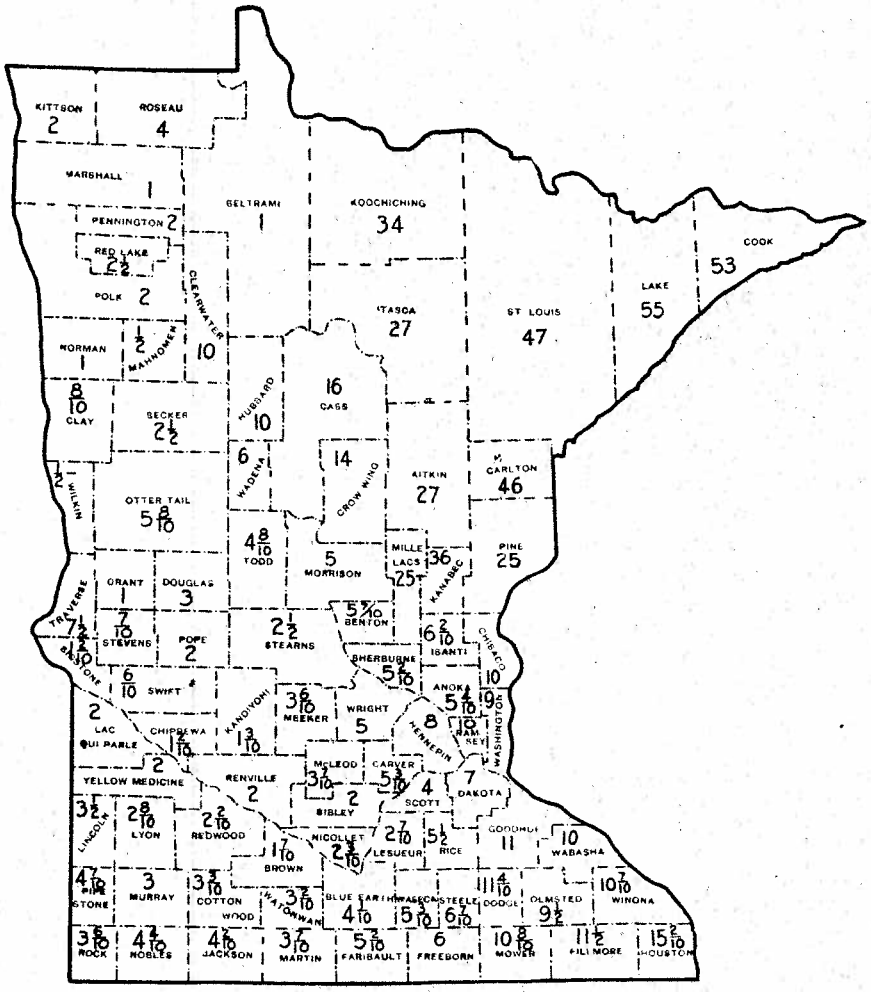

MINNESOTA FARMERS'
INSTITUTE ANNUAL
Legume Number
No. 35
1922



The figures on the map indicate the number of acres of legume crops for every one hundred acres of cultivated land in each county. These figures are based on the crop of 1919 as given in the census report.

Minnesota Farmers' Institute Annual

NUMBER 35, 1922

EDITED BY

F. W. PECK

Director of Minnesota Farmers' Institutes and Agricultural Extension Division
University Farm, St. Paul, Minnesota

AND

J. M. DREW

Agricultural Extension Division University of Minnesota
University Farm, St. Paul, Minnesota

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1922

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LETTER OF TRANSMITTAL

To the President of the Board of Administration of the
Farmers' Institutes of Minnesota:

I transmit to you the following report of the work of the Farmers' Institutes for the year ending June 30th, 1922:

Farmers' Institutes were held as follows:

Place	Date	Sessions	Attendance	Place	Date	Sessions	Attendance
Edgerton	Jan. 10	2	160	Grygla	Jan. 31	2	90
Taylors Falls	Jan. 10	2	105	Haverhill	Jan. 31	2	110
Ruthton	Jan. 11	2	290	Eden Prairie	Jan. 31	2	175
Nashua	Jan. 11	2	170	Middle River	Feb. 1	1	75
Elysian	Jan. 11	2	170	Pleasant Grove	Feb. 1	1	65
Dovray	Jan. 12	2	265	Silver Lake	Feb. 1	1	45
Rothsay	Jan. 12	2	210	Strandquist	Feb. 2	2	110
Cleveland	Jan. 12	1	75	Wykoff	Feb. 2	1	80
Dundee	Jan. 13	2	375	Argyle	Feb. 3	1	85
Fergus Falls	Jan. 13	2	225	Rushford	Feb. 3	2	150
Waldorf	Jan. 13	2	110	Richmond	Feb. 7	2	385
Luverne	Jan. 14	1	85	Clear Lake	Feb. 7	2	140
Underwood	Jan. 14	2	160	Hanley Falls	Feb. 7	2	240
Waseca	Jan. 14	2	155	Melrose	Feb. 8	2	565
Adrian	Jan. 16	2	285	Milaca	Feb. 8	2	165
New York Mills	Jan. 16	2	175	Clarkfield	Feb. 8	2	240
Lansing	Jan. 16	2	110	Sauk Center	Feb. 9	2	100
Okabena	Jan. 17	2	110	Wahkon	Feb. 9	2	145
Perham	Jan. 17	2	185	Drammen Twp.	Feb. 9	2	200
Adams	Jan. 17	2	250	Grey Eagle	Feb. 10	2	110
Petersburg	Jan. 18	2	225	Rock Creek	Feb. 10	2	90
Oakland	Jan. 18	2	115	Ivanhoe	Feb. 10	1	75
Nashville Center	Jan. 19	2	260	Hewitt	Feb. 11	2	135
Lake Park	Jan. 19	1	85	Sandstone	Feb. 11	2	130
Monterey	Jan. 20	2	625	Cottonwood	Feb. 11	2	225
Ellendale	Jan. 20	2	165	Zimmerman	Feb. 13	2	90
Comfrey	Jan. 24	1	75	Minneota	Feb. 12	1	100
Sebeka	Jan. 24	2	165	Motley	Feb. 14	2	105
Delavan	Jan. 25	2	310	Belvidere Mills	Feb. 14	2	175
Menahga	Jan. 25	2	140	Walnut Grove	Feb. 14	2	240
Nowthen	Jan. 25	2	75	Brainerd	Feb. 15	1	70
Frost	Jan. 26	2	375	Zumbrota	Feb. 15	2	325
Litchfield	Jan. 26-27	4	370	Belview	Feb. 15	2	165
Ponsford	Jan. 26	2	110	Pequot	Feb. 16	2	120
Pamberton	Jan. 27	1	125	Zumbro Falls	Feb. 16	1	90
Nary	Jan. 27	2	145	Lafayette	Feb. 16	2	140
Saum	Jan. 28	2	110	Baker	Feb. 17	1	80
Beaver	Jan. 28	2	160	Kellogg	Feb. 17	2	150
Lake Crystal	Jan. 28	1	110	Fairfax	Feb. 17	2	220
Puposky	Jan. 30	2	95	Gary	Feb. 20	1	80
St. Charles	Jan. 30	2	285	Twin Valley	Feb. 21	2	200
Utica	Jan. 30	2	425	Moose Lake	Feb. 21	2	90

Place	Date	Sessions	Attendance
Maynard	Feb. 21-22	2	110
St. Vincent	Feb. 23	1	70
Greenbush	Feb. 24	1	175
Dawson	Feb. 24	1	125
Salol	Feb. 25	2	90
Littlefork	Feb. 25	2	130
Clinton	Feb. 25	2	190
Goodridge	Feb. 27	1	75
Mizpah	Feb. 27	2	185
Beardsley	Feb. 27	1	30
Thief River Falls	Feb. 28	2	90
Remer	Feb. 28	1	100
Wheaton	Feb. 28	1	70
Oklee	Mar. 1	2	120
Boy River	Mar. 1	2	350
Browns Valley	Mar. 1	1	60
Federal Dam	Mar. 2	1	150
Hancock	Mar. 2	1	50
McGregor	Mar. 3	2	125
Chokio	Mar. 3	1	100
Aitkin	Mar. 4	2	200

Number of Institutes held	105
Number of Sessions	184
Total attendance	17,185
Average per Institute	163
Average per session	93

The fact that the last Legislature decreased the appropriation for Farmers' Institute work, making it $10,000 per year in place of $20,000, has made it necessary to greatly reduce the number of Institutes held. The Institute season was shortened to cover a period of only eight weeks, and three corps of instructors were used for that period. The lecturers sent out this last winter were Mr. John Bower of Lakeland and Mr. C. E. Brown of Elk River, who covered the southeastern and eastern part of the State; Mr. J. F. Conner of Redwood Falls and Mr. Frank F. Marshall of Grove City, who covered the southwestern and western part of the State; and Mr. J. E. Eastgate of Larimore, N. D., and Mr. O. M. Olson of Moorhead, who took care of Institutes in the Red River Valley and northern Minnesota.

FINANCIAL STATEMENT

For the year ending June 30th, 1922.

EXPENDITURES

1921:

July 15	C. H. Welch, salary	$37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Aug. 15	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Aug. 31	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
	J. J. Sprenger, services	50.00
Sept. 15	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
Sept. 30	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
Oct. 15	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Oct. 31	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
	Minneapolis Paper Co.,	24.00
Nov. 15	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Nov. 30	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Dec. 20	C. H. Welch, salary	75.00
	O. C. Gregg, salary	100.00
	Leona Palmer, salary	100.00
	Minnesota Engraving & Colorplate Co.,	541.77

1922:

Jan. 15	O. C. Gregg, salary	50.00
	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	Photo Laboratory, photos for Annual	14.18
	John Bower, expense	87.31
Jan. 31	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
	J. E. Eastgate, services	166.66
	C. E. Brown, services	166.66
	John Bower, services	166.66
	F. F. Marshall, services	166.66
	J. F. Conner, services	166.66
	O. M. Olson, services	100.00
	E. W. Smith, services	50.00
	C. R. Brown Printery,	33.60
	Minnesota Engraving & Colorplate Co., engravings for Annual	31.58
	John Bower, expense	58.41
	C. E. Brown, expense	55.41
	J. E. Eastgate, expense	77.99
	O. M. Olson, expense	22.61
	E. W. Smith, expense	34.10
Feb. 15	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
	Russells Railway Guide	2.50
	John Bower, expense	58.77
	J. F. Conner, expense	71.87
	J. E. Eastgate, expense	51.92
	F. F. Marshall, expense	69.59
	O. M. Olson, expense	67.78
Feb. 28	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
	C. E. Brown, services	150.00
	O. M. Olson, services	200.00
	John Bower, services	200.00
	J. E. Eastgate, services	200.00
	J. F. Conner, services	200.00
	F. F. Marshall, services	200.00
	J. M. Christgau, serv.	33.33
	C. O. Carlson, services	17.50
	Brown Printery, posters	46.60
	Jensen Ptg. Co., prepaid freight	36.40
	Jensen Ptg. Co., Annual No. 34	2406.25
	Remington Typewriter Co., paper	2.55
	John Bower, expense	57.77
	J. E. Eastgate, expense	85.30
	F. F. Marshall, expense	100.90
	O. M. Olson, expense	66.11
Mar. 15	C. E. Brown, expense	86.29
	J. F. Conner, expense	73.38
	C. H. Welch, expense	9.31
	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
Apr. 1	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
	Jensen Ptg. Co., prepaid freight	24.77
	J. F. Conner, expense	27.60
	J. E. Eastgate, expense	56.42
	F. F. Marshall, expense	77.52
	O. M. Olson, expense	30.77
Apr. 15	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
	C. H. Welch, salary	37.50
Apr. 30	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00
May 15	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
May 31	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
June 15	C. H. Welch, salary	37.50
	Leona Palmer, salary	50.00
	O. C. Gregg, salary	50.00
June 30	C. H. Welch, salary	37.50
	O. C. Gregg, salary	50.00
	Leona Palmer, salary	50.00

Total expenditures..$10,025.46

Resources:

Balance June 30, 1921	39.03	
Appropriation	10,000.00	
		10,039.03

Balance June 30, 1922..... $13.57

Respectfully submitted,

F. W. PECK.
Superintendent.

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Minnesota Farmers' Institute Annual

VOL. NOVEMBER 1922 XXXV

MORE LEGUMES IN MINNESOTA

F. W. Peck, University Farm

Minnesota possesses many natural advantages that contribute to the making of a most successful livestock producing state. In order to make the best use of such natural advantages as a favorable climate, desirable types of soil, reasonably adequate transportation, experienced livestock farmers, and a constantly increasing market demand it is essential that the best possible farm practice be instituted and maintained on a large majority of the farms of the state.

One of the significant features of profitable livestock practice in many parts of the state is the successful growing and feeding of leguminous roughages. It is believed that there is a great need for a reasonable expansion of such practice on many farms that are at present deficient in the kind and amount of legumes that are being grown. This is readily apparent in the figures of the last census which indicate that only about one acre in fourteen acres of crop land was in legumes in 1919. It is worth noting that in Wisconsin the ratio was about one to three and one-half acres; Michigan one to three; Iowa, one to nine, and also other states indicating even less legume acreage than our own state. That there is a great interest in the development of a greater legume acreage in many localities is evidenced by the increased acreage of alfalfa, soybeans, sweet clover, and other clovers during the past five years.

The Agricultural Extension Division is making the growing of legumes a very definite project,—one of its principal lines of work for the coming year,—not with a desire to unduly hasten the increase of leguminous crops, but to permanently and more generally promote the advantages of better cropping systems and the development of a more permanently profitable type of crop production in the state.

This Annual contains many testimonials of practical farmers who have experienced good returns from growing and feeding legumes, not only in the form of larger net profits from their livestock, but in the better maintenance of the necessary soil fertility that is so basic to permanent agriculture.

Crop production means fertility depletion under many systems of farming that do not take into consideration the rebuilding of the soil and replacing of those elements of fertility essential to the production of reasonably good crops. Therefore, as a soil builder these nitrogen-giving crops deserve special attention. As a fundamentally important feed for the economic production of livestock legumes have no equal. This is particularly true from a cost of production standpoint compared with the replacement cost in the form of relatively high priced commercial protein concentrates. Investigators report one ton of alfalfa as being practically equivalent to one ton of bran in feeding trials with clover running very close to it in feeding efficiency. From this standpoint it is well to con-

sider the relative cost to the producer of various forms of protein feed. The roughages on the farm are always produced at less cost than the corn and small grains and most certainly comparisons made with purchased feeds show a very decided advantage to the farmer in favor of growing all the protein roughages possible to replace the higher priced feeds. Finally as an up-builder and feeder of the farmer's bank account through a saving in the lower costs of valuable roughages expressed in better yields of crops and more economic production of milk, meat, poultry products, and wool, the legumes have played a most important part.

This Annaul therefore, is presented with the sincere desire to be of what assistance it can to aid in the more general growing and proper utilization of legume roughages in Minnesota. It is printed with a knowledge of the difficulties which confront the producer of legume crops in the obtaining of a profitable stand, in the curing of the hay in unfavorable seasons, of the difficulties of producing seed crops, and of the many adverse conditions under which the crops are grown and fed to livestock. It is our firm conviction, however, that the more general trial and use of legumes will develop, as time goes on, better varieties, better farm practice, and more general economic livestock production in the state.

CONSERVATION AND LEGUMES

W. C. Coffey, University Farm

Conservation must necessarily be a large feature in any constructive, agricultural program for a state or nation. As a rule, the term suggests simply preservation, and it is undoubtedly true that no program has yet been put over which succeeds in preserving all of the producing power of our virgin soil, in countries of great expanse such as the United States. This being the case the definition of conservation should go farther than the mere idea of preservation. It should include a consideration of methods whereby the natural inheritance of the human race, such as the soil, may be improved.

The ambitious, efficient farmer desires to leave to his children, a better inheritance than he received; that is, the feeling of turning over to his children acres that will produce more wheat, more corn, more hay, than these same acres would produce when they came into his hands. It is easy to predict what would become of our agriculture if we did not have a considerable percentage of farmers who possess the ambition and the efficiencies necessary to make the land more productive as the years go by. In any great industry, such as agriculture, there is sure to be a percentage who are not efficient; they can not keep even with the game, they live by taking away more from something than they give back to it. In agriculture, they almost invariably take away more from the soil than they return to it.

In soil robbing or depletion, one of the elements, which is lost very rapidly, and which is vital to plant life, is nitrogen. It is only within comparatively recent times that a cheap method of restoring this element to the soil was discovered. The great agriculturist, Sir John Lawes, of the Rothamsted Experiment Station, England, once wrote to Prof. Manley Miles of the Michigan Agricultural College "that, within his lifetime, England had well nigh exhausted the guano beds of the South Sea Islands." He also pointed out how these beds had been thousands of years in forming, and that there must be some natural process of nitrogen fixation by wholesale discovered soon or the civilized world would decline from lack of food. A short time after this letter was written, four years, I think, Helriegel made the wonderful discovery that the bacteria which attach themselves to the roots of leguminous plants are able to fix atmospheric nitrogen so that it becomes available to the plant, and thereby adds to the store of nitrogen in the soil. This discovery pointed the way to our salvation in soil fertility so far as the element of nitrogen is concerned.

Now that the way of salvation is pointed out, will we avail ourselves of it? Will we treat our soils so that leguminous plants can thrive in them, and will we so organize our farming that we can utilize the products of these plants in such a way as to maintain, and add to the total nitrogen content of our soil? In some cases it may not be necessary to add to the total nitrogen content, but there are few cases, indeed, where Minnesota can afford to subtract from the total nitrogen content of her land.

While we are addressing ourselves chiefly to the bearing of the growing of leguminous plants on the fertility of the soil, we must not forget that it is almost impossible to conduct a prosperous animal husbandry, or dairy husbandry without making use of the products of these plants. Years ago, before anything was known about leguminous plants from a scientific standpoint, England had a large sheep husbandry which she conducted with great difficulty. Had it not been for the exceedingly high price for wool, and the protection which the English government gave the industry, it would have been impossible to maintain it. Huguenot refugees from France introduced to England the root and clover crops. Almost immediately there was a great step up in the prosperity of the sheep industry, and because these crops kept the sheep properly nourished through the winter months.

In sum, the more widespread use of leguminous plants in Minnesota means a better dairy and livestock industry, and if the manurial products from these plants are properly conserved and applied to the land, the maintenance and increase of the nitrogen content of our soils. If this is done, we shall be led to observe the other considerations necessary in keeping our soils in proper balance with respect to elements of fertility. Therefore, we shall have made a great step-up in conservation, the infallible sign of progress.

SECURING AND MAINTAINING STANDS OF ALFALFA IN MINNESOTA

A. C. Arny, University Farm

Wherever alfalfa can be grown successfully and economically, it produces more valuable crops of hay in both quantity and quality than any other plant available for this purpose. In addition to this it puts the land in better shape for the crops which follow. The census for 1919 reports for Minnesota 45,410 acres of alfalfa. This acreage is materially less than that reported for Wisconsin, Michigan or Iowa. In Minnesota the conditions for growing alfalfa are as favorable or more so than they are in the neighboring states mentioned.

The comparatively limited acreage

devoted to the alfalfa crop in Minnesota indicates that the great majority of farmers do not fully appreciate the value of this crop.

Only as a large number of individual farmers take advantage of the opportunities offered by the alfalfa crop will the benefits be reflected in higher yields of both hay and other crops which follow and in increased and more economical livestock production.

Alfalfa growing on the majority of farms in Minnesota is not difficult. However, the conditions which it requires should be fully understood. On farms where these conditions do not exist and cannot economically be brought about, other suitable forage crops should be grown. Where only moderate expense is necessary to bring about the proper conditions, the increased value of alfalfa over other leguminous crops which may be grown warrants this outlay.

Favorable Soil Conditions

Alfalfa, to produce well, requires soils that are not acid. Therefore it is necessary to know before alfalfa is sown whether the soil is acid or not. The Division of Soils has made, and is continuing to make, numerous determinations of the acidity of soils in various parts of the state. These determinations are made free. Directions for taking the samples and shipping should be secured. From the results so far they have determined in a general way that the western and central parts of the state, including approximately Roseau, Clearwater, Becker, the western half of Ottertail, Douglas, Pope, Kandiyohi, Meeker, Wright, western Hennepin, Scott, Rice, Steele, and Freeborn counties and counties west of these the soils are usually not acid but occasional farms may have fields where acid conditions prevail particularly in the southeastern part of the area.

In southeastern Minnesota, including the counties of Dakota, Goodhue, Dodge, Mower, and the counties east of these, the highlands are usually acid and the lowlands neutral or, if lying high, may be acid also.

The counties to the north and east of the two groups indicated have acid soils generally.

Lime Corrects Acidity

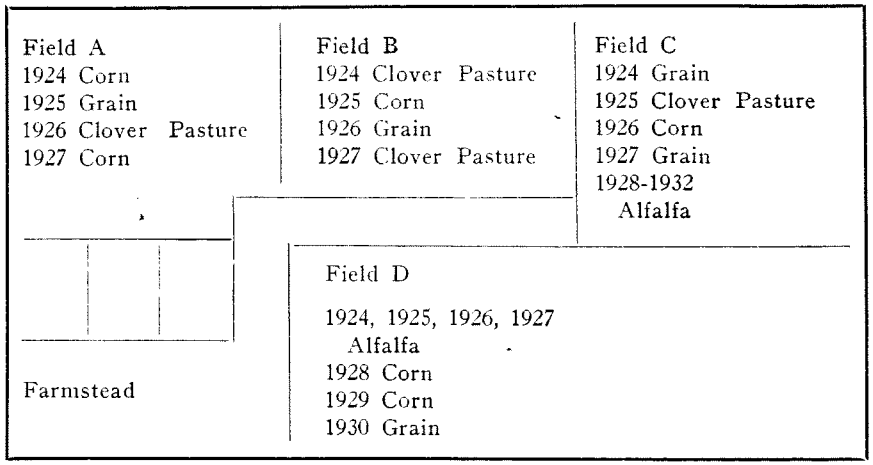
When the soil on a particular farm or field is found to be acid, some form of lime may be applied to correct this condition. An application of from two to four tons of ground limestone is usually sufficient to correct the acidity for a number of years. Marl, secured locally, is a desirable form of lime to use. It is well to apply the lime in the fall previous to the year the alfalfa is to be sown and work it in thoroughly with a disk or spring tooth harrow. The Soils Division is ready to advise in detail as to the available sources of lime and amounts to apply in its various forms.

When lime is necessary, it may be secured and applied each year according to the ability of the individual farmer. On this acreage alfalfa may be grown and the advantages of this valuable crop secured. On the remainder of the legume acreage necessary to provide the needed forage, crops that are not so sensitive to acid conditions in the soil may be grown. Red and alsike clover do well on acid soils.

Soy beans are a very practical crop in Minnesota and are not sensitive to acid conditions. Hence they produce good yields of hay and seed on acid soils.

The Soil for Alfalfa

Well drained lands are essential for alfalfa. No attempt should be made to grow alfalfa on fields that are not well drained to a depth of four to five



feet. Where alfalfa is sown on fields where, in small spots, water stands for any length of time after heavy rains or in spring, these spots may be sown to alsike clover and red top.

Stands of alfalfa are most easily secured and maintained on fields that are well supplied with organic matter and produce good yields of corn or potatoes. Applications of manure aid in securing and maintaining stands. Alfalfa cannot be recommended for peat soils. On all sandy soils, including those so light that some drifting may take place and periodic drouths are severe, alfalfa is the best legume that can be grown for hay and soil improvement. Profitable yields of alfalfa seed may also be secured on sandy lands in the counties in the central part of the state and in other parts of the state where the rainfall is somewhat lighter than in the eastern part. On small fields near the farmstead set aside for hog pasture, alfalfa should occupy a considerable portion of the area since it is so valuable for this purpose. After good stands have been secured alfalfa gives the best results when permitted to stand from three to five years or longer in parts of the state where securing a stand is very difficult. In southeastern and northeastern parts of the state where applications of lime are generally needed, only a few acres per farm will usually be put in condition for alfalfa annually. These areas may well be odd fields in many instances located some distance from he buildings. These fields may be left undisturbed for several years. In western and central Minnesota where lime is not necessary the larger fields may be cropped to alfalfa, working this crop into the regular rotation carried out on the farm. The accompanying plan provides for one-fourth of the farm in alfalfa each year for hay. After a successful stand has been secured on another field, the old alfalfa field, which has stood for four or five years or more, is plowed up. This plan is only suggestive and requires modification to suit conditions on each farm.

Hardy Variety Essential

Alfalfa growing can be generally recommended in Minnesota because seed of a hardy variety is available in quantity at prices that make it practical to purchase and sow it. The Grimm variety, developed in Carver

Fig. 1. Common Alfalfa on the Left. Grimm Alfalfa on the Right. Note the difference in winterkilling.

County of this state, has proven its ability to live through fall, winter and spring conditions in Minnesota and also in other north central and in the northeastern states and produce excellent yields of hay. This variety is recommended above all others for use in the state. The fact that Grimm alfalfa maintains a stand for a number of years and yields well makes it a good investment to purchase seed of this variety at a price higher than that for which common seed can be secured.

Purchase Seed Early

Larger amounts of alfalfa seed are being used in Minnesota each year. The best is often purchased early in the winter by discriminating buyers. This leaves much of the poorer grade and that not adapted to Minnesota conditions still on the market in the spring. Much of this inferior seed finds its way into the hands of growers who put off buying until just before they are ready to sow. By securing seed for a community in comparatively large quantities through an organization such as a farmers' club, Grimm seed of good grade may be secured at a somewhat lower price than if purchased in small quantities.

Amount of Seed to Purchase

Where conditions are at all favorable for growing, 12 to 14 pounds of alfalfa seed per acre is sufficient. On light sand it is frequently necessary to reseed during the same season once or even twice, if sufficient moisture is not available to enable the seedlings to become established. The use of large amounts of seed per acre at each seeding makes the seed cost prohibitive.

Inoculation

Alfalfa needs bacteria to make its best development. Grain and root crops draw on the soil for all the nitrogen they use in their growth. Even if these crops are fed to live stock and the manure returned to the soil, there is a loss of nitrogen. The leguminous crops, clovers, alfalfa, beans, and peas, are rich in nitrogen. They use the nitrogen in the soil as the other crops do, but this is not their only source of supply. They have the power, through the bacteria

which live in the nodules on their roots, of obtaining from the air the larger part of the nitrogen needed in their growth. If the right bacteria are not present the legumes are soil robbers, as grains, grasses, and root crops are. With the right bacteria present, the leguminous crops may leave in the soil as much nitrogen as was there before the crop was grown, or more. If the leguminous crop is removed from the field and sold, or fed and the manure not returned to the same field, then the nitrogen in the roots and stubble usually maintains but does not increase to any amount the supply of nitrogen in the soil. On the other hand, if the leguminous crop is fed and the manure returned to the same field, or if the crop is pastured off or plowed under as a green manure, the nitrogen supply in the soil is increased considerably.

In most cases leguminous crops are not able to secure from the soil all the nitrogen needed in their growth, and as a consequence, the hay is not as rich in nitrogen as it would be if the bacteria were present. In order that these crops may maintain or increase the supply of nitrogen in the soil and that the hay made from them may be as rich in nitrogen as possible, it is highly important that they be inoculated. The difference between the development of the inoculated and uninoculated plants is well indicated in Figure 2.

Data secured from 1914 to 1918 emphasize the necessity of inoculating alfalfa. The average data for 1915 and 1917 are given.

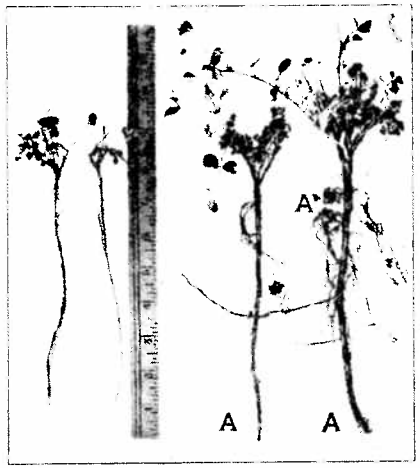


Fig. 2. Inoculation Makes a Difference.
The two groups of two plants each represent two plots lying side by side. Seed of the same variety was planted at the same rate on the same day. Soil from a well-inoculated field was spread on the plot represented by the plants showing the nodules (A). Note the size of the plants as compared with those where no bacteria were supplied.

Due to inoculation the weight of tops was increased over five times and the roots over four times. The differences in pounds of nitrogen per acre due to inoculation are still greater.

Methods of Inoculation

Carefully carried out experiments on black loam, light sand and on peat show the following results. The plants were dug and examined approximately a month from planting time.

Table 1. Effect of Inoculation on Yield and Composition of Alfalfa. One Cutting.

Treatment	Part of plants	Dry matter in pounds per acre	per cent nitrogen	Pounds of nitrogen per acre
Inoculated	Tops	3818	2.54	96.7
	Roots	1555	1.99	30.9
	Total	5373		127.6
Not inoculated	Tops	667	1.76	11.3
	Roots	439	0.87	3.6
	Total	1106		14.9

Table 2. Per Cent of Plants Bearing Nodules on Roots from Various Methods of Inoculation.

Methods of inoculation	Percentage of plants inoculated Black loam soil	Peat soil	Sandy soil
None	0.	0.	0
Glue solution and soil	31.3	15.5	0
Sugar solution and soil	28.0	46.7	0
Same weight dry soil as seed	80.5	81.7	50

Inoculation by the glue or sugar method was not found satisfactory. Careful determinations showed that by these methods only 8.2 pounds of soil adhered to each bushel of seed. This evidently is not sufficient to bring about efficient inoculation. From the results secured it is recommended that at least as many pounds of dry inoculated soil as seed be used for each acre. Soil taken from the upper three or four inches of a vigorous sweet clover patch will usually be found more efficient for this purpose than that taken from a well inoculated alfalfa field. The soil is taken under cover, sifted to make it very fine and then dried gradually. This may be done several weeks before seeding if more convenient. When ready to sow, the seed is moistened and as many pounds of the dry soil mixed in as there are pounds of seed. If the soil is sifted and dried as directed there will be no difficulty in the mixture of soil and seed going through the seeding machinery.

Scattering broadcast 200 pounds per acre or more of soil from an inoculated sweet clover or alfalfa field and harrowing in has been found to be an effective method. This method may be followed any time before or after the seed is sown.

Preparation of the Seedbed and Seeding

On the heavy, moisture-retentive soils of Minnesota, alfalfa may be sown early in spring with grain in the same manner as clover. When sown in this way, a firm, well prepared seedbed gives best results. Fall plowed, well harrowed fields provide these conditions. One-half to three-quarters of a bushel of barley, early oats, or wheat for each acre is sufficient. The seeding of grain should be thin in order that the alfalfa plants may not be shaded or crowded unduly. Careful regulation of the drill to seed these amounts is necessary before the seeding is done. The alfalfa seed may be sown from the grass seeder attachment with the tubes in the drills or hanging out so the seed is broadcasted. When drilled the seed should be sown not deeper than from 1 to 1½ inches deep. Deeper seeding is not to be recommended. The wheelbarrow seeder may also be used.

If at any time during June, or July, the grain lodges or a drouth occurs which causes the alfalfa plants to wilt, the grain should be cut for hay immediately. A fair hay crop may be secured in this way. Under such conditions, leaving the grain to mature will usually result in a very poor stand of alfalfa.

Where the drill is not equipped with a grass seed attachment, half a bushel of the seed grain may be put in the drill box and leveled off. On this the 12 to 14 pounds of alfalfa seed mixed with the same amount of soil may be spread evenly. The man running the drill should then insert his hand through the alfalfa seed and grain to the bottom of each drill cup so that some alfalfa seed may be sown as soon as the drill is started. Then other layers of the same amounts of grain and alfalfa seed may be added but no further mixing should be done. The seed may be distributed fairly well in this way but the grass seeder

attachment or the wheelbarrow seeder give better results.

When seedings are made without the grain, it is necessary to cultivate the land carefully before hand to free it from weeds. The length of time it takes to do this depends on the amount of weed seed in the soil. If no work has been done the previous fall, it usually requires careful attention until the middle of June to accomplish this result. Therefore, work should be done during September and October the previous fall or the seeding should be delayed until about the middle of June or later while the land is being prepared.

For beginners, careful preparation of the seedbed and seeding without a nurse crop is often the best practice.

On sandy land particularly, there are usually several periods during the spring and summer when there is not enough moisture present to supply the needs of grain plants and alfalfa plants at the same time and the alfalfa plants die. Therefore on sandy lands, alfalfa should not be sown with a grain crop. With the field limed, free from weeds and compact, the alfalfa may be sown whenever there appears to be sufficient moisture in the soil to permit the alfalfa plants to establish themselves. One of these times may occur early in spring. Therefore, it is well to have the field ready. This may be done by keeping all weeds out of early potato or corn fields the previous season. As soon as the crops are removed these fields may be cultivated well throughout the fall. Fields from which rye has been removed may be handled in the same way.

As early in spring as the land can be harrowed and rolled thoroughly with a corrugated roller, the seed previously inoculated may be sown preferably with a drill at a depth of 1 to 1½ inches. The corrugated roller should be used after the seeding is completed to make the seedbed firm.

If a good stand is not secured the first time, the field should be kept free from weeds and firm. Then after a good rain, seed should be put in again and the corrugated roller used. Conditions may occur which make a third seeding the same season necessary in order to secure a good stand.

Seedings may be made on weed-free soil without a nurse crop up to the last of July or the first week in Au-

Fig. 3. No Weeds in Late Summer Seedings of Alfalfa

Each of the plots, A, C, and D, was disked at intervals of a week or ten days from early spring to the time the seed was sown. The plot marked A was sown June 15 and contains more weeds than any of the others. Plot B was sown August 15, and was disked often enough to keep the weeds down. Plot C, sown July 17, contains only a few weeds, and plot D was sown July 1 and is very weedy. In localities where droughts frequently occur during July and August more intensive cultivation of the soil up to June 1-15, and seeding at about that time will allow the alfalfa to make sufficient growth before the dry weather comes.

Fig. 4. A Good Winter Covering.
Alfalfa should not be cut nor pastured later than October 1st in order that it may make a good growth for winter protection.

gust. Later seedings than this cannot be recommended for the reason that dry weather may delay germination or further growth after germination has taken place, and the plants may not become well established before winter sets in. Poorly established plants are apt to be heaved out on heavy soils and killed out under other conditions.

Care During the First Season

Under favorable conditions where alfalfa can be sown with a light seeding of grain, two points should receive attention the first year: (1) the grain should be cut for hay if it lodges or the weather becomes so dry that the alfalfa suffers; (2) the alfalfa should not be pastured in the fall as the stubble and alfalfa growth is needed to hold the snow which affords protection.

When the alfalfa is sown without a nurse crop, on ground that has been cultivated long enough to be practically free from weeds, the occasional weed that appears will do no harm and may be left until the alfalfa is ready to cut. However, if weeds make their appearance very thick in spots, the alfalfa is certain to be killed chiefly by shading and crowding and on sandy soils by using moisture. In such cases the weeds must be cut close to the ground soon enough and often enough to permit the sunlight to get to the small alfalfa plants. Cutting the weeds when they are partly grown will not kill them. Therefore the cutting must be repeated as necessary to keep them down.

Pasturing

Alfalfa should not be pastured the same season as it is sown. The second year alfalfa makes an excellent pasture crop for hogs. When it is used for this purpose, it is the best practice to sow a sufficiently large field so that the hogs may have access to it and the regular hay crops be removed just as if no hogs were on the field. With so large a pasture, the hogs root up very little except near the feeding and watering places, and mowing at the proper times keeps the plants growing and allows them to produce vigorous young stems which are relished by the hogs. Clover pasture lasts but one year, and the field is then plowed and planted to some other crop, so rooting and close pasturing are not so objectionable. When as many hogs per acre are put on an alfalfa field as are usually put on a clover field, permanent injury to the stand is likely to result. In many of the states where alfalfa is commonly grown, both cattle and sheep are pas-

Fig. 5. Alfalfa Pasture.
Alfalfa makes the best hog pasture known. It supplies a large amount of feed rich in blood-, muscle-, and bone-building material.

tured on it. There is no reason why it should not be used with success for cattle and sheep in this state, if the necessary precautions are taken to prevent bloat, by turning stock on it the first few times only after they are well filled with other feed to which they are accustomed. Alfalfa should not be pastured down close at any time. A growth of three or four inches should be left on the field for winter protection.

Keeping the Alfalfa Field Productive

Alfalfa fields that look like failures can very often be made to appear thrifty and yield well by proper treatment. To the inexperienced observer fields may not look very promising the same year as sown. If the stand is moderately good, there should be no haste in plowing it up. If Grimm seed has been used the field will usually look much better the following spring. A light top dressing of manure applied late in the fall will be beneficial. If on examination, the soil is found to be acid, lime should be applied and worked in immediately. The ordinary harrow should be used for this purpose when the plants are small and not yet well established. Where the plants are well established, a spring tooth harrow is the best implement to use. When the plants have a yellow appearance and do not look thrifty inoculation is probably lacking. Two hundred pounds or more of well inoculated soil broadcasted and harrowed in will usually bring about satisfactory inoculation and a vigorous appearance of the plants. Light top dressings of manure may be applied in the spring or immediately after any cutting. If made in the fall, it is best to make the applications during September or after the ground is frozen. Any stimulation which maintains growth of alfalfa plants late in the fall or stimulates them to new growth after they have become dormant is undesirable.

Kentucky bluegrass usually makes its appearance in alfalfa the second year from seeding. Vigorous working both ways to a depth of three to five inches with a spring tooth harrow before growth starts in the spring or immediately following any cutting so that the field looks as though there were no alfalfa on it, usually takes care of the Kentucky bluegrass for the year. Even if there is no Kentucky bluegrass present, the thorough use of the spring tooth harrow once or twice annually is very beneficial.

ALFALFA

as good as

GREENBACKS

In the Pocket

Martin County man says it was his most

Profitable Crop

Fed to

HOLSTEIN COWS

Rules for growing it:

Plant on well drained soil with fairly open subsoil.
Give it rich soil.
Prepare seedbed well, keeping out weeds.
Inoculrte seed.
Plant Grimm, hardy South Dakota, or Montana seed.
Time of seeding depends on state of soil as to moisture and preparation of seebbed.
Oats and barley good nurse crops.

Pocket gophers are fond of alfalfa roots. They become increasingly numerous with each year the fields stand to alfalfa. They do considerable damage as well as making the fields difficult to mow. They may be caught with Number 0 steel traps set at the level of the cross runs found by digging down from the freshest mounds of dirt. After the traps are set in the cross runs it is necessary to cover the openings well so that the traps are in the dark.

THE BEST PAYING CROP

PAUL JOHNSON, Martin Co.

"Alfalfa makes my soil worth $1,000 per acre," said R. E. McLaughlin of Fairmont at a Farmers' Club meeting. "Erwin" meant when the alfalfa was made into hay and fed to his Holstein cows. Every township in Martin County now grows alfalfa. C. F. Crissinger of Manyaska cut 25 big loads of hay off eight acres in his first cutting this year. McLaughlin's alfalfa averages between five and six tons per acre.

Success with alfalfa in our county has been good when certain rules are observed.

It grows well only on drained soil that has a fairly open subsoil.

It needs fairly rich ground or ground enriched with manure.

It needs a well prepared seed bed, one free from weeds, compact and worked down well.

The seed must be inoculated. Sweet clover soil or government inoculation is most commonly used.

About 12 lbs. of Grimm or 15 lbs. of hardy South Dakota or Montana seed is sown per acre.

The best time to seed varies. Crissinger seeded his in the spring with oats as nurse crop. McLaughlin got a good stand two years in succession seeding after September 1st.

Barley has proven a good nurse crop. Some good fields were seeded in July and August. It all depends on the moisture and how well the seed bed is prepared.

The seeding of alfalfa in Martin county has doubled each year since 1918. Alfalfa is finding its place as a hay and hog pasture crop.

ALFALFA IS THE ONE GREAT HOG PASTURE

ALFALFA

J. F. CONNER, Redwood Falls

Alfalfa uses all the season and it uses all the soil. It begins to grow as early in the spring as any farm plant, and it takes no midsummer rest. If harvested at the proper times it grows continuously until late in the fall.

Most farm plants draw their nourishment from near the surface of the soil. Alfalfa forms a network of roots to a depth of several feet. For these reasons it makes a greater yield than any other forage crop grown in our state; and because of its immense root growth it withstands drought better than any other crop. Not only does it produce the largest yield, but it is exceedingly rich in that most important and expensive food element, protein.

A ton of good alfalfa hay contains as much protein as a ton of bran. It has fully as high feeding value, and is much cheaper when grown on the farm.

Our cheapest and most abundant feed, especially in southern Minnesota, is corn and corn silage. This contains an excess of carbohydrates; and because alfalfa is rich in protein it makes, with corn and silage, a balanced ration, especially adapted to the feeding of milch cows and young, growing stock. The combination of alfalfa and corn silage is by far the cheapest balanced ration we can either raise or buy.

Hog Pasture

Alfalfa is exceedingly valuable for hog pasture. I know of nothing equal to it. Some other pasture crops are good for a part of the season, but alfalfa is good all summer. When grown for hog pasture more acreage is needed than the hogs will keep eaten down. It should, in fact, be used for both pasture and meadow. If pastured too closely it will die out. Properly handled it will last many years.

Alfalfa a Soil Builder

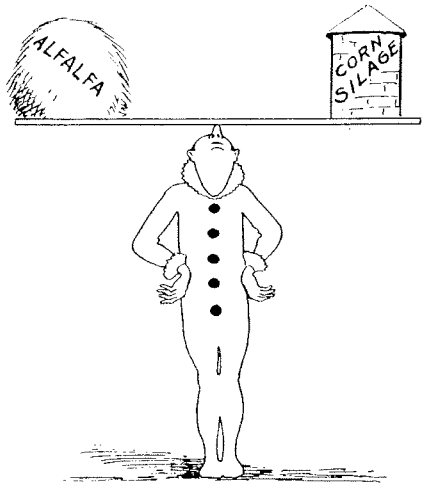
Alfalfa is valuable as a soil builder. Most farm crops constantly take nitrogen from the soil, leaving it deficient in this most important element. Alfalfa, like the other legumes —clovers, beans, peas, through the action of bacteria in the nodules on their roots draw nitrogen from the air; thus increasing soil fertility. Because of its immense root growth, alfalfa adds to the soil more nitrogen and more humus than any other leguminous crop.

How Seeded

Alfalfa should be sown on well drained land; preferably on land that has natural drainage rather than on tiled land. It will not stand wet feet. It will not thrive on acid soil unless the acidity is corrected by the use of lime. It requires a good seed bed well plowed, thoroughly pulverized, and well firmed so as to make a close connection between the furrow slice and the earth below. A surface earth mulch should be secured and maintained until the time of seeding so as to conserve moisture and prevent the formation of a crust. It should be given thorough tillage to produce this condition, and this should be continued until the weed seeds in the upper part of the soil have all had a chance to germinate and the resulting weeds killed, so that the young alfalfa plants will not have to compete with

Alfalfa
and
Corn Silage

Make a Balanced Ration



The alfalfa gives the **protein**
Corn Silage the **carbohydrates**

growing weeds. These conditions can rarely be secured before about the first of July, or possibly a little earlier on fall plowing or very early spring plowing. But it pays well to take the time to secure the right conditions; for when this is done it is as easy to secure a good catch of alfalfa as of any other crop. I have made at least a dozen seedings of alfalfa, and in no case have I failed to secure a first class stand.

Alfalfa is sometimes sown in the spring with a grain nurse crop. In a favorable season it is apt to do well; if, however, the season is dry, especially for two or three weeks just before harvest, it is likely to die when the grain is harvested. There are too many chances of failure to make this a safe plan.

When sown alone in the early spring, alfalfa nearly always starts well and generally makes a good stand. It will however, have an all summer battle with the weeds, and the weeds must be frequently cut down, so that rarely can any hay be harvested the first year.

Ten to fifteen pounds of seed per acre should be sufficient if the seed bed is properly prepared. If all seeds grew and lived, five pounds would be ample.

Inoculation

For the best results, where neither alfalfa nor sweet clover has been previously grown, bacteria should be supplied, either applied to the seed or to the soil. This is done either by the use of cultures or by using soil from a field where alfalfa or sweet clover has grown.

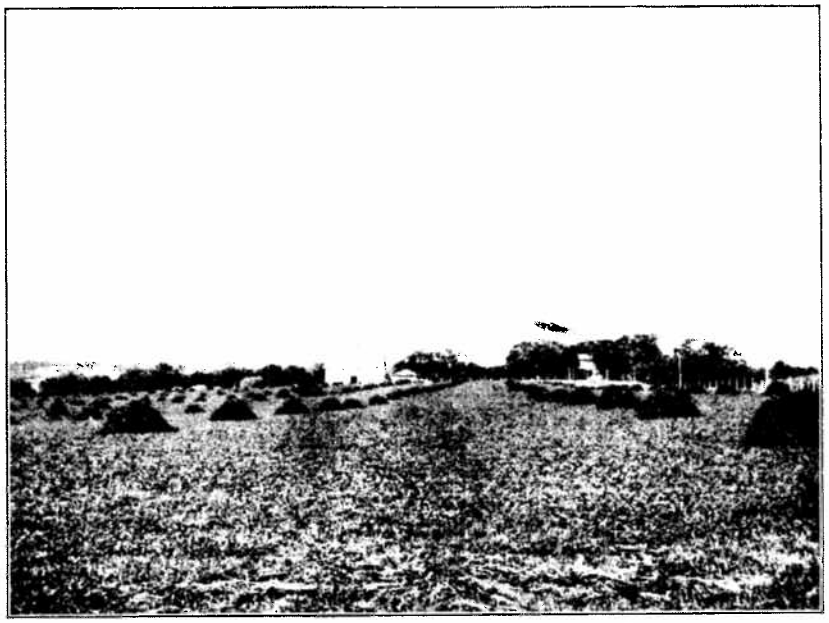
In most parts of Minnesota a stand of alfalfa can readily be secured. It makes an exceedingly large yield of very valuable feed which is greatly relished by all classes of stock—horses, cattle, hogs, sheep and chickens. It makes the best pasture I know of for hogs and horses. It is a valuable soil builder. At least ten acres of alfalfa should be raised on every farm in Minnesota, where it is at all possible to grow it successfully.

ALFALFA FOR HAY AND FOR HOG PASTURE

By H. C. Lau, Lyon County

We use the genuine Grimm alfalfa, sowing about 10 to 12 pounds per acre. We have had satisfactory results when sowing with a nurse crop, but prefer to sow alone on extra well prepared seedbed some time in June. The land is heavily manured before plowing. We do not inoculate the seed as this does not seem to be necessary in this locality when plenty of barnyard manure is used. We have used alfalfa quite extensively for hog pasture and find it the best of anything we have tried. As a hay crop it has been very satisfactory. We harvest three crops each year, the total yield varying from three to five tons per acre.

Our method of making hay has been to start mowing as soon as the dew is off, and if it is a drying, sunny day to follow the mower in about four hours with a side delivery rake, thus getting it into windrows when it is somewhat wilted, but not dry enough to lose any leaves. We try to cock it up the same day or the next day at



Alfalfa curing in the cock. Such cocks will not be injured by a light rain, but unless protected, continued heavy rains will cause the hay to heat, and it will be necessary to spread out the hay and recock it. It is a waste of labor to attempt to cure hay in unprotected cocks during bad weather.

If the weather is clear and the hay is in proper condition when put into the cock, there will be no necessity for hay-caps or for further labor until the hay is thoroughly cured and ready to be hauled. It may be handled as in the upper illustration. But hay-caps will pay for themselves in one year when the weather is bad. Hay-caps are more especially needed with clover and alfalfa hay, which cures slowly.

latest, depending upon the weather. Alfalfa piled up in good shape at this stage will not take water easily and will stand a good shower or two without any harm. We leave it in the cock from four to seven days, so that it may cure, then we haul it to the barn. If the ground is damp, as it often is when cutting the first crop, we upset the cocks a few hours before hauling in so that the bottoms may dry out.

I believe every farmer in Minnesota that possibly can should grow some alfalfa. It makes a wonderful hog pasture, and there is no better hay producing crop.

HE BELIEVES IT

WHAT?

That Every Farmer In Minnesota Should Grow

A L F A L F A

ALFALFA

By Nils Skinnemoen, Grant County

I have a field of Grimm alfalfa which was seeded ten years ago and which has never been reseeded. Two crops have been taken from it every year, one of hay and one of seed. I paid 60 cents a pound for the seed and sowed 5½ pounds to the acre. The stand is still good. I would advise the sowing of more seed to the acre. I prefer about ten pounds.

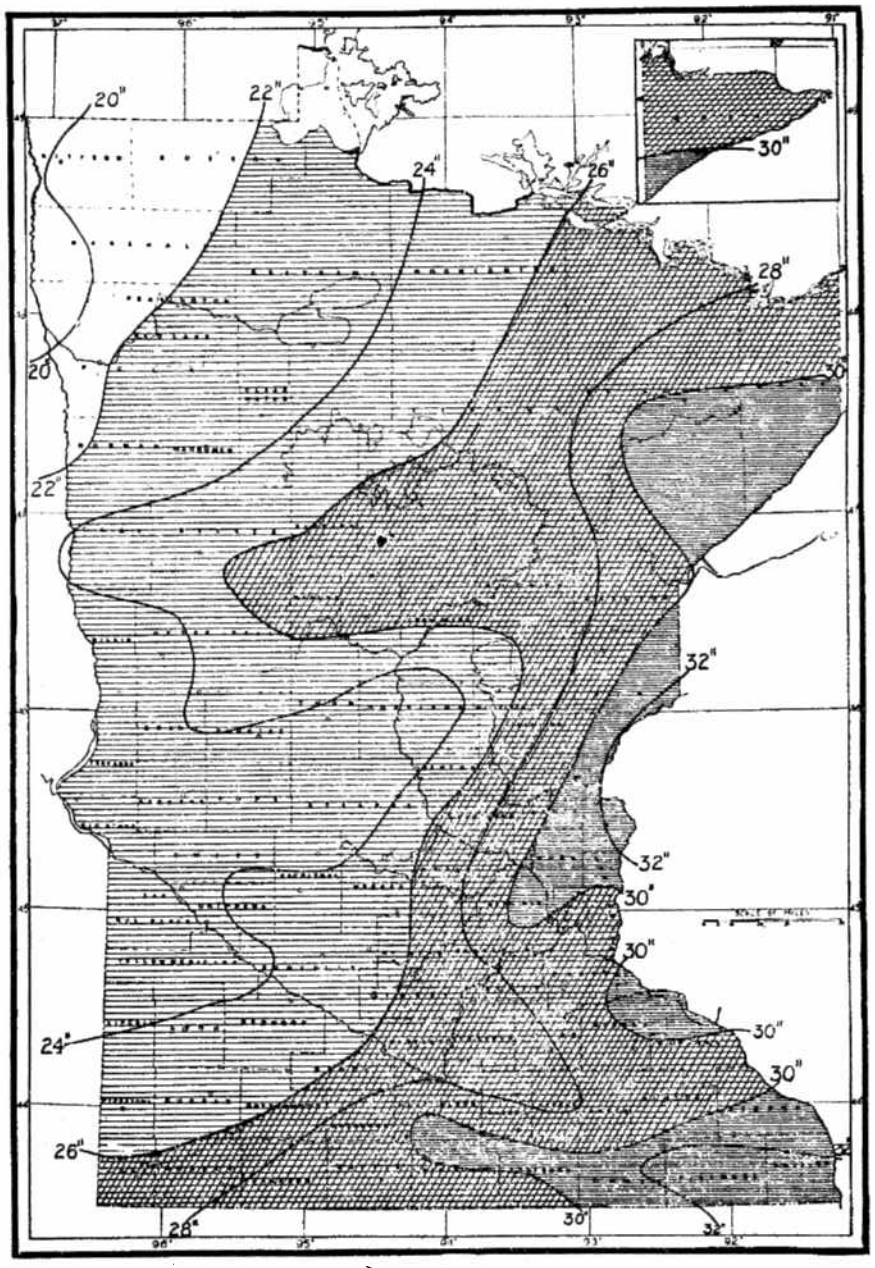
The main point in getting a stand of alfalfa is to get good seed. It should be sown early in the spring when the ground is moist and not put in too deep. I prefer barley or flax as a nurse crop and work the soil very thoroughly before seeding. I raise only the Grimm alfalfa. I tried the common kind first, but it froze out whereas the Grimm did not.

No other kind of hay can equal alfalfa for stock of all kinds, even the hogs like it. I have never sold any alfalfa hay, but always fed it to the stock on the farm.

The seed crop is cut with a binder and shocked. We thresh it with a clover huller. It takes just about three months to produce a seed crop after the hay crop is cut.

If after sowing a crop of alfalfa you happen to have a dry season and get a rather poor stand, do not be in a hurry to plow it up; for the seed that did not grow the first year will start the second and sometimes the third year and in a few years you will have a good stand. We consider it just as easy to get a good stand of alfalfa as any other crop.

A large hayrack on a low-wheeled wagon is the best type to use when it is necessary to haul with a wagon.



Map showing average annual precipitation for Minnesota

MINNESOTA GRIMM ALFALFA SEED

By A. C. Arny, University Farm

The Grimm variety of alfalfa is distinctly a Minnesota product. It was developed by a Minnesota farmer in Carver County and has made successful alfalfa growing possible, not only in this state, but in other states and countries where similar conditions prevail.

From the time it was known that Grimm alfalfa was superior to other kinds for Minnesota conditions, only small amounts of seed were available due to the uncertainty of seed production in Carver County. This resulted in a very high price for seed and a consequent limited acreage both in Minnesota and in other locations where the Grimm variety is necessary for successful alfalfa culture.

It apparently was not known at that time that some sections of Minnesota are better adapted to alfalfa seed production than others. Therefore, in 1906, Grimm seed was taken to Montana and a year later additional amounts were taken to the same state. Subsequently seed was taken to the Dakotas and Idaho. A considerable acreage has been developed in these states and seed is now available in greater quantities and consequently at a lower price.

In the meanwhile, Grimm alfalfa has been grown in practically every section in the state. Particularly in West Central and Northwestern Minnesota has the acreage increased largely. This is due to the favorable conditions for alfalfa which make it easy to secure and maintain stands.

Alfalfa seed crop cut with binder and shocked. Farm of A. B. Lyman, Excelsior

Alfalfa seed crop ready to cut in foreground. Stack of first cutting hay in background. Farm of Nils Skinnemoen, Wendelly.

Examination of the accompanying annual precipitation map brings out the fact that the rainfall in West Central and Northwestern Minnesota is about four inches, more or less, lower than in Eastern and Southern portions of the state. The soils vary from clay to sandy and are not usually acid. Much of this land is of prairie formation. In this region is located by far the largest part of the 700 acres of Grimm seed certified by the Minnesota Crop Improvement Association in 1922. The largest center of seed production is at present in Grant county. The success of the comparatively small acreage now devoted to this purpose in that county indicates the possibilities of the industry in West Central Minnesota. Other seed acreages are located in Kittson, eastern Roseau, central Marshall, eastern Polk, Norman, Ottertail, Wilkin, Becker, Crow Wing, Chippewa, Lac qui Parle, Todd and Stevens. Some seed has been produced in eastern Cottonwood County, but in Southwestern Minnesota, and on the heavy lands of the Red River Valley alfalfa is an excellent hay crop, but produces seed only when the seasons are exceptionally dry.

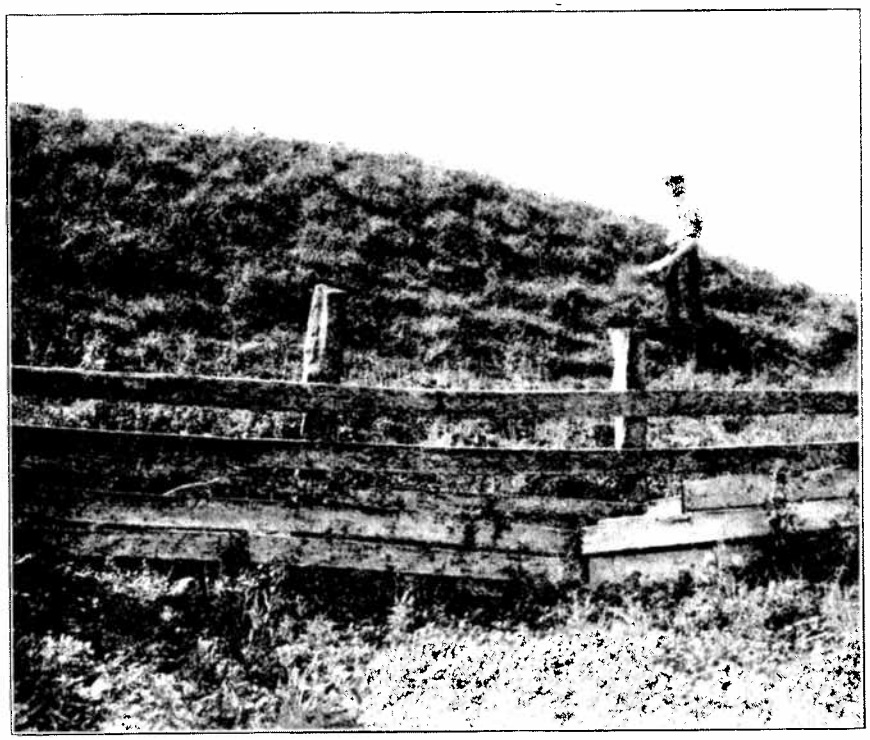
On the more or less sandy lands in East Central and Northeastern Minnesota there are exceptional opportunities for alfalfa seed production. Here the rainfall is heavier than in Western Minnesota, but the moisture is taken up readily by the open soil and dry weather very often occurs in July and August. This makes for more limited plant growth and the

Alfalfa seed crop cut with binder and stacked ready for threshing. Farm of A. B. Lyman, Excelsior

conditions are favorable for seed production. On these sandy lands, receipts from sales of alfalfa seed may aid materially in making the operation of farms financial successes.

Good yields of alfalfa seed have been produced in Wadena, Sherburne and Stearns Counties. On the heavy lands of eastern Minnesota, seed is secured only when light rainfall occurs in July and August.

Grimm alfalfa and Minnesota are two names very closely associated. Purchasers of Grimm alfalfa seed, both in and outside the state, naturally look to Minnesota for their seed stocks. Farmers in the sections of the state where conditions for seed production are favorable can profitably establish acreages of alfalfa tracing direct to the original in Carver county to supply this constantly increasing demand.



The original patch of Grimm Alfalfa planted in 1857. —Copyright A. B. Lyman

HISTORY OF ALFALFA

By A. B. Lyman

Alfalfa was taken by the early Spaniards to South America over four hundred years ago. As early as 1855 it was introduced into California and soon spread throughout the western states and was a success in all sections of a semi-arid climate This South American alfalfa met great favor in states like Kansas and Nebraska, but was not a success in states like Minnesota, Wisconsin, Iowa, etc., because of its tendency to winter-kill, especially following a wet fall as it failed to become dormant and get ready for our severe climate.

In 1857, two years later, another introduction of alfalfa to the United States was made by one of Carver County's early settlers. Wendelin Grimm brought with him from Baden, Germany, fifteen pounds of seed which he planted in Laketown township, Carver County, Minnesota. His alfalfa differed somewhat from the western alfalfa introduced into California. The western importation is known as (medicago Sativa). The flowers of this species are normally violet. The alfalfa from Germany is an intermediate cross between the common alfalfa and the wild yellow flowered alfalfa (Medicago falcata). For this reason the bloom shows a great variety of colors; especially is this true when in full bloom during a dry time. There are wet seasons here in June when the great variety of bloom color is not noticeable.

The writer's attention was first called to this alfalfa in 1880 at the home of Tobias Ottinger at Victoria, Carver County, Minnesota. He told of its superiority over Red Clover and my father bought a few pounds of seed in Minneapolis. This was planted

Mr. and Mrs. Wendelin Grimm

and made a perfect stand only to winter-kill entirely the following winter.

Ten years later I taught school in Dahlgreen Township, Carver County, and found many farmers growing alfalfa. It was called "Ewiger klee" or "Everlasting Clover" as the children called it. I took a sample of the hay home and my father again bought thirty pounds in Minneapolis. This was planted in the Spring of 1890 and it made a perfect stand. The following winter was one of good snow protection and the following summer our new alfalfa cut three heavy crops but the following winter it killed out 100 per cent.

We then began to investigate and

found that the Germans still had a perfect stand. A more careful investigation revealed the fact that the successful growers were using neighborhood seed that traced to Grimm while those that used outside seed were not successful.

While attending a Farmer's Institute at Shakopee in 1895, one Mr. A. W. Trow, of Glenville, Minn., gave a very interesting talk showing the feeding value of Red Clover, Timothy, etc., but did not give the feeding value of alfalfa. One of the Carver County farmers asked him why he did not give the feeding value of alfalfa. He replied by saying that he did not give the feeding value of alfalfa as it could not be grown in Minnesota.

It happened that in 1900 I met Prof. W. M. Hays, agriculturist of the University Farm. I told him of our hardy alfalfa and he accompanied by Prof. Andrew Boss drove out thirty miles with the station team to investigate. They took three days and made a most careful investigation. Prof. Hays remarked on this trip that he was satisfied that we now had an alfalfa for the east. Later he became Assistant Secretary of Agriculture at Washington and largely through his influence the Department of Agriculture became interested. In 1903 he wrote Press Bulletin No. 20 in which this new alfalfa was named "Grimm."

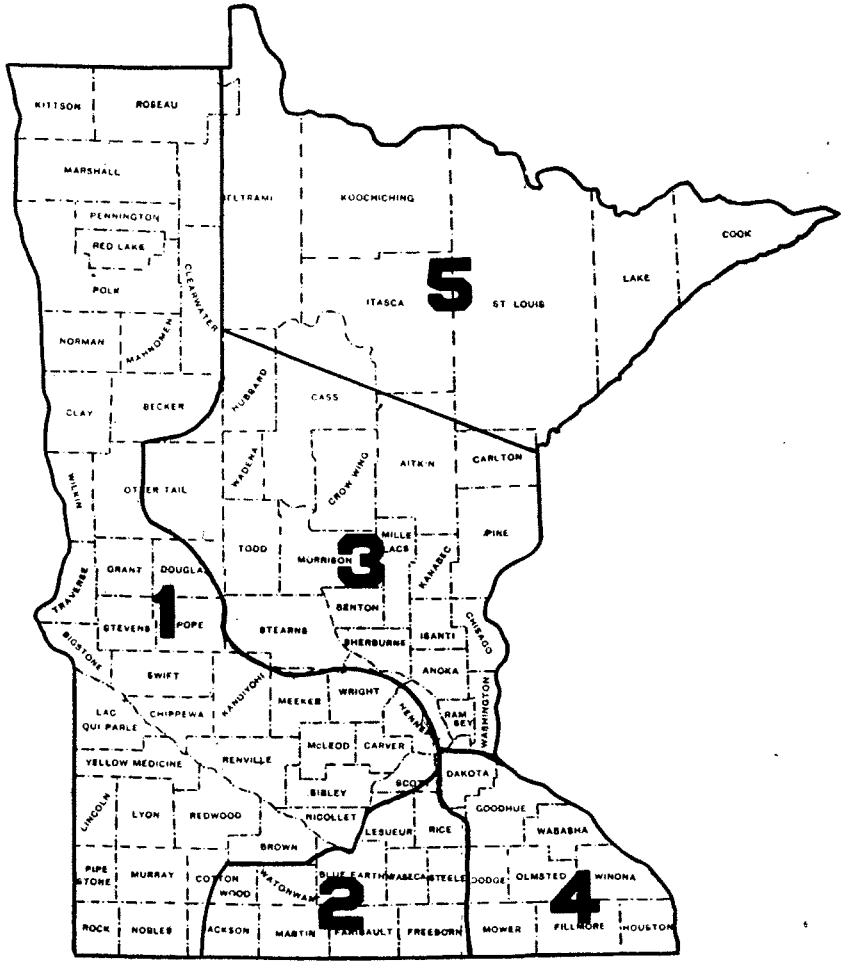
This variety is now widely known in all parts of the world. It is eagerly sought after in eastern Asia, also in southern Africa and southern South America and wherever a hardy variety is needed. In sections of high altitude it is of great value because of its hardiness. On the other hand it is not the best variety to grow in places like southern California where there is need of a variety that will grow in the winter. There the Peruvian variety gives better results, as it grows all winter

The Grimm alfalfa will not make as much growth the first summer as the common alfalfa and for that reason many think their stand is a failure when it would be all right if allowed to stand another summer. It starts to grow earlier in the Spring, but becomes dormant sooner in the fall. All Grimm alfalfa will show the variegated blossoms yet all variegated alfalfa is not Grimm. In western South Dakota they have a large acreage of alfalfa that one cannot tell from Grimm in appearance yet it is not hardy when planted under eastern conditions.

The only safe guide in getting Grimm seed is a record tracing the stock back to Carver County, Minnesota.

On the heavy soils of Minnesota alfalfa does not produce good crops of seed, except when the late summer and fall weather is very dry. Therefore this hardy variety is now being grown in the Dakotas and Montana, where a good seed crop is produced annually, and is proving very profitable to those who have true stock. The lighter soils of Minnesota can build up a great Grimm seed industry. There is no guess work about this. I know of farmers on these light soils who have had fair crops seven years out of ten. On heavy soils it will not produce a seed crop except during the very dry season.

Thousands of acres of this Minnesota variety are now to be found in the eastern states and the demand for this seed will be greater each year as more farmers learn of its value. The real value of alfalfa in Minnesota is the hay crop. It can be depended upon to produce three crops and many cut a fourth crop or pasture. Perhaps this ought to be discouraged as three good crops of alfalfa hay should be satisfactory.



The five alfalfa districts described on the following page.

STARTING A FIELD OF ALFALFA IN MINNESOTA

By B. Forbell, University Farm

Reprinted from Institute Annual No. 31

Since the spring of 1915, the Extension Division and Division of Soils have carried on in co-operation, in different parts of the state, a large number of liming demonstrations on alfalfa, and, incidentally, have examined the soil of many fields on which farmers wished to try alfalfa and of districts in which the question had been raised as to the suitability of the soil for this crop. The present article is based upon this work, full details of which will be published later.

The conditions for alfalfa growing in the different parts of the state are so varied that it seems best to consider the state as divided into the five districts shown on page 36. It should be understood, however, that the boundaries indicated on the map are only approximate, as similar conditions may prevail for some distance on either side of the line. Individual farmers in any of the districts may have experiences different from those described here, but the results of the work mentioned above doubtless represent those to be expected in the greater part of each district.

District 1. Alfalfa is admirably adapted to the well-drained parts of this district. Surveys made in representative counties show that acid soils are practically absent, and that where proper methods have been employed very little difficulty has been experienced in establishing permanent stands of alfalfa. A number of failures were encountered but these could be explained in almost every instance by a lack of the observance of one or more simple rules of alfalfa growing. Weather conditions are generally favorable for both starting and handling the crop.

While all crops furnish a labor problem during the growing season alfalfa is of such value as a feed or for the market that the farmer can well afford to provide the extra labor necessary for its proper care. If he finds difficulty in caring for the first crop, he can meet it by pasturing the field with hogs and cutting only the later crops.

District 2. This area is similar to District 1, except that some acid soils are to be found, especially in the hilly portions. Demonstrations conducted on medium to strongly acid soils in this area show that the use of lime is necessary to the establishment of a successful stand of alfalfa, but suitable fields with a neutral soil can be found on almost every farm.

District 3. Acid soils are quite common in this district, especially in the eastern part. Many trials on both the light and the heavy soils show that the use of lime is necessary where the soil is from slightly to strongly acid.

In this district where the first crop does not come on as early as in Southern Minnesota, the farmers growing it are generally agreed that it is no more difficult to cure than any other hay crop. As the farms are generally small, and livestock, especially dairying, is becoming increasingly important, it would seem that in case a neutral field could not be found it would pay to go to the expense of liming the soil.

District 4. In this the soils of the uplands in general are acid, but those of the lowlands usually neutral. The

latter condition is to be attributed to the lowlands receiving the washings from the limestone formations which crop out along the valleys. Where the valley soils are not subject to over-flow, receive no wash from the hills, and are much above the water-table, they are often found to be acid.

In this district permanent stands have been secured on neutral soils but in the case of the strongly acid soils with strongly acid sub-soils the results have been so discouraging, even where lime has been used, that it is doubtful whether permanent stands can be secured. Because of this fact and because both Red and Alsike clovers thrive on the acid as well as the neutral soils of this district and also work so admirably in their established rotations, most of the farmers now take little interest in the possibilities of alfalfa. Extra labor is required to start a field of this and where liming is necessary, also extra expense. Further, where it is sown without a nurse crop, there is usually no return from the land for the year in which it is seeded.

District 5. No alfalfa demonstrations were conducted in this district, and hence it will not be considered in the present article.

Starting a Field

The first step in starting alfalfa is that of selecting a suitable field. In districts Nos. 1 and 2 farmers are meeting with some success in growing alfalfa in a rotation. In most cases, however, alfalfa is grown on minor fields which usually do not work into rotations. Because the crop makes such a good hog pasture and three crops of hay may be cut annually, there is an advantage in having the field near the farmstead. Another reason for selecting such a field is that it is usually more productive, an important consideration in starting alfalfa.

Drainage

A field where the first 4 to 5 feet are well drained is necessary. Where the soil is poorly drained after the first season, the alfalfa deteriorates and vegetation adapted to wet conditions develops and crowds it out. In the case of tiled fields alfalfa does well, providing the tile are at least 4 feet deep and enough have been used to thoroughly drain the field. Several

Alfalfa is suitable for small or odd-shaped fields which do not work well into a rotation. This field is properly tile-drained and the alfalfa has been growing successfully on it for five years.

stands of alfalfa which have now been growing 5 and 6 years on tiled land are under observation. These fields are all doing well and no ill effects from roots clogging the tile have been noticed.

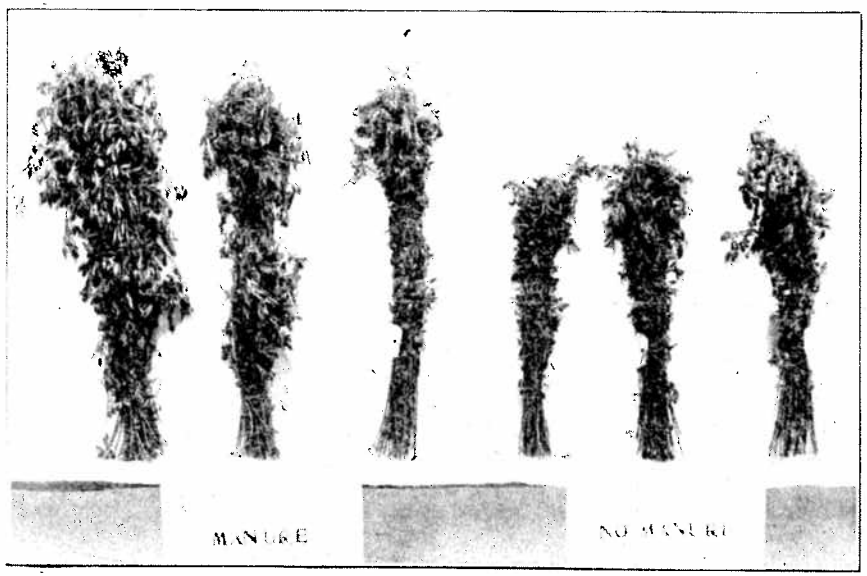
A Productive Soil Essential

A productive soil will not only insure a better stand, but a better growth of the plants as well. Where enough available plant food is present to supply the needs of all, and the moisture supply is sufficient, the alfalfa may continue to grow until the crop of weeds or grain, as it happens to be, is ready to cut. Many of the demonstration fields illustrated this point. Where the soil was productive excellent stands of alfalfa were obtained on extremely weedy ground. As soon as the weeds were headed out they were cut and removed and the alfalfa came on well, while where the soil was in an unproductive condition many of the alfalfa plants died out and those remaining did not develop into vigorous plants like those found on the productive fields.

It is desirable to apply the manure in the fall before planting so that the weed seeds usually found in the manure will germinate. Top dressing alfalfa early in the fall increases the growth, which adds to the winter protection. Fields are at present under observation on which the manured parts have a full stand while the unmanured parts alongside have only 40% to 50% of a stand, due to winter-killing.

Acid Soils

The liming demonstrations conducted throughout the State showed that in nearly all cases sandy soils



A productive soil will insure a better stand and growth of plants. Average results on three fields where owners thought the soil sufficiently productive without the use of manure.

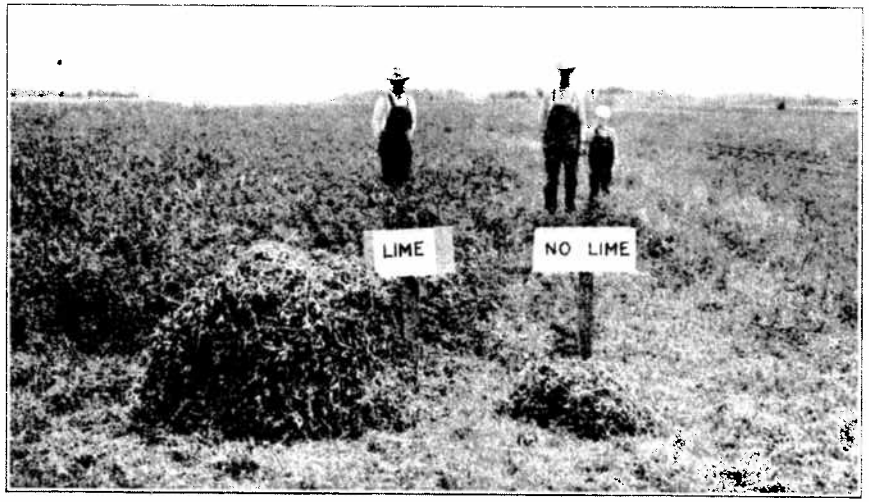


Fig. 4. A liming demonstration in Hennepin County on sandy soil of medium acidity. Green weight per acre from first crop. On limed area, 8,312 lbs. On unlimed area, 220 lbs.

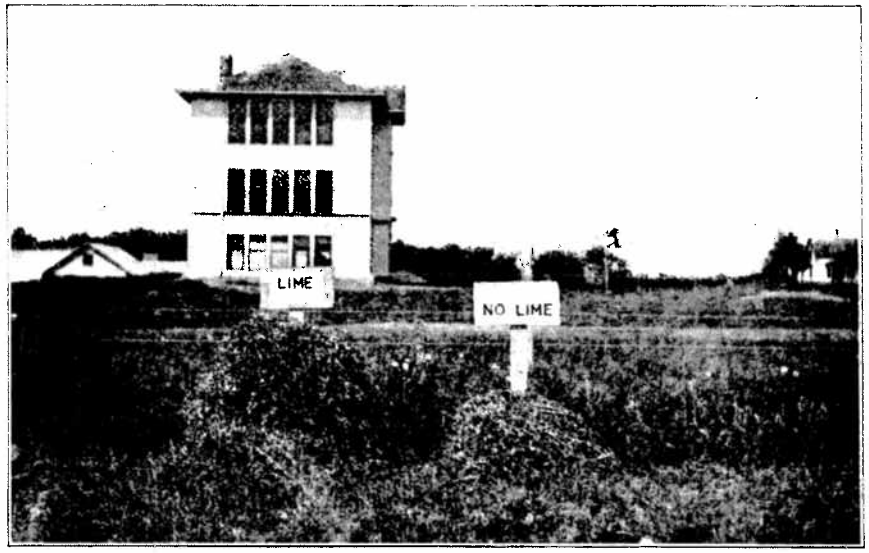


Fig. 5. Liming demonstration in Pine County on heavy soil of medium acidity. First Crop. Green weight per acre: On limed area, 5,368 lbs. On unlimed area, 1,944 lbs.

which were from slightly to strongly acid, and heavy soils which were medium to strongly acid, required an application of lime in order to secure a satisfactory stand of alfalfa. Here and there an exceptional acid soil is found on which this crop is not benefited by liming, it doing well on the untreated soil.

How to Take Samples for Acidity Tests

In order to decide whether the use of lime is likely to be necessary, samples of soil from the field should be tested. The Division of Soils, University Farm, St. Paul, Minn., will make without charge tests for acidity on all samples of Minnesota soils properly taken. Directions for taking the samples will be sent on request.

Form of Lime and Amount to Use

In Minnesota the only forms available are ground limestone, limestone screenings, and lime-cake from the sugar factory at Chaska. The first is to be recommended. The screenings are usually so coarse that a much heavier application of these is required. The Chaska lime-cake is exposed to the rain and so usually carries a large proportion of water, causing a freight charge on the contained water. Otherwise it is satisfactory. The form which any particular person should use will depend upon the cost per ton of the product laid down at his farm, its content of lime and its fineness.

From two to four tons per acre of ground limestone, or waste lime is desirable.

In the case of lime-cake the more moist it is the heavier the application should be; when dry, from two to four tons is sufficient. With limestone screenings from four to eight tons should be employed, according to the fineness.

A liming demonstration in Mower County on heavy soil of medium acidity. First crop. Green weight per acre: Limed area, 6,718 lbs. Unlimed area, 273 lbs.

How to Apply

Finely ground limestone should always be applied dry. A special lime spreader or a manure spreader can be used. When the latter is used the bottom should be covered with coarse manure before adding the lime. The lime should not be plowed under, but should be spread after plowing and then disked in. It may be applied at any time of the year which is most convenient, but to prevent loss by blowing and in order to incorporate it with the soil so that the acidity will be corrected, it should be disked in at once. The use of a harrow for this purpose, in place of a disk, is unsatisfactory.

Preparation of Seed-Bed

A firm, clean, moist, fertile seed-bed is required. Any manner of preparation that will provide such a seed-bed will do. Fields that have produced cultivated crops the preceding year are easily prepared by thorough disking. Next to these, fall plowed land is to be preferred. Early spring plowing followed by frequent disking and harrowing to compact the soil will do when necessary. No matter how the soil has been handled the preceding year or whether it is fall plowed or spring plowed, it must be thoroughly and persistently disked through the early part of the summer before sowing the alfalfa. The disking causes the weed seeds to germinate and later kills the weeds. It also conserves moisture and liberates plant food so that when the alfalfa is seeded it will make a quick, strong growth thus aiding it in getting ahead of weeds.

Kind of Alfalfa to Seed

There is little doubt but that under Minnesota conditions alfalfa is more valuable if it can be kept growing on the same field for from 5 to 7 years than for only a shorter period. Since considerable effort and expense are required to establish a stand, it will naturally cost less per year where the alfalfa remains a longer period. Furthermore, a permanent crop is more desirable for isolated fields and is more dependable for hay than one that is changed often.

In securing a permanent stand of alfalfa much depends upon obtaining hardy seed. Where winter conditions are mild and favorable to alfalfa, practically all of the common varieties have proved to be durable; but when severe winter conditions prevail, many of the plants will winter-kill. If this continues for two or three years, the stand will become thinned out and grasses and clovers will enter. One of the greatest objections to growing alfalfa in this state has been the tendency of grasses to enter the fields and apparently crowd out the alfalfa. Where the alfalfa plants are hardy and do not thin out, it is an easy matter to prevent the entrance of grasses by annually renovating the fields with a spring tooth harrow, or disk but where the stand of alfalfa becomes thinner each year, the removal of other vegetation is not so easy or practical.

During the summer of 1915, 168 alfalfa fields were established in Southeastern Minnesota. On 47 of these fields Grimm was sown alongside of Liscomb alfalfa, a variety which has been developed in Montana and was advertised to be quite as hardy as the Grimm. On many of the other fields common alfalfa was sown. During the winter of 1915-16, an ice sheet from 2 to 3 inches deep covered these fields for a month or more. All of the clover, rye and many of the meadows and pastures were winter-killed, but this newly sown Grimm alfalfa came through the winter in excellent condition, excepting in sags and dead furrows where the ice and water stood until quite late.

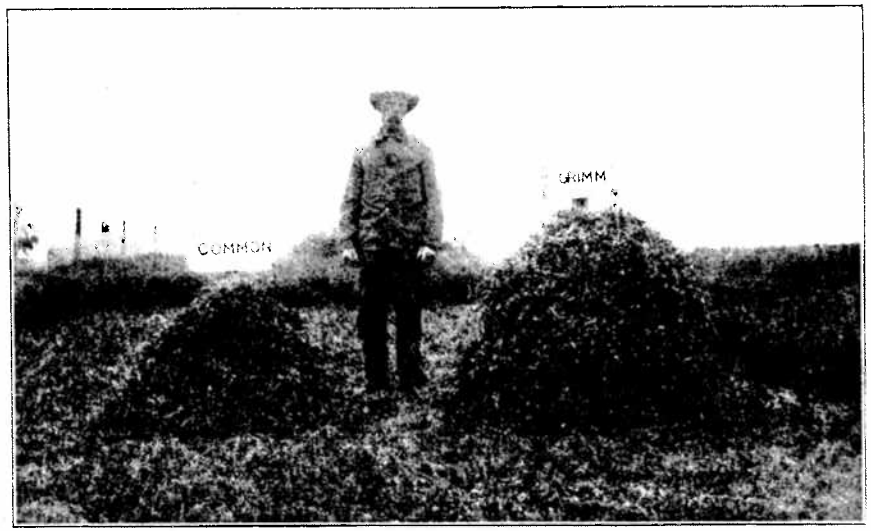
Below are given the data on 9 different fields which were checked up at the time the first crop was ready to cut. Two square rods were harvested on representative parts of both the Grimm and the Liscomb areas. These tests are considered to be representative of the 47 started.

	Average Green Weight per acre	Stand	Height of Plants
Grimm...	11702	92.7	26.3
Liscomb..	3216	36.1	16.6

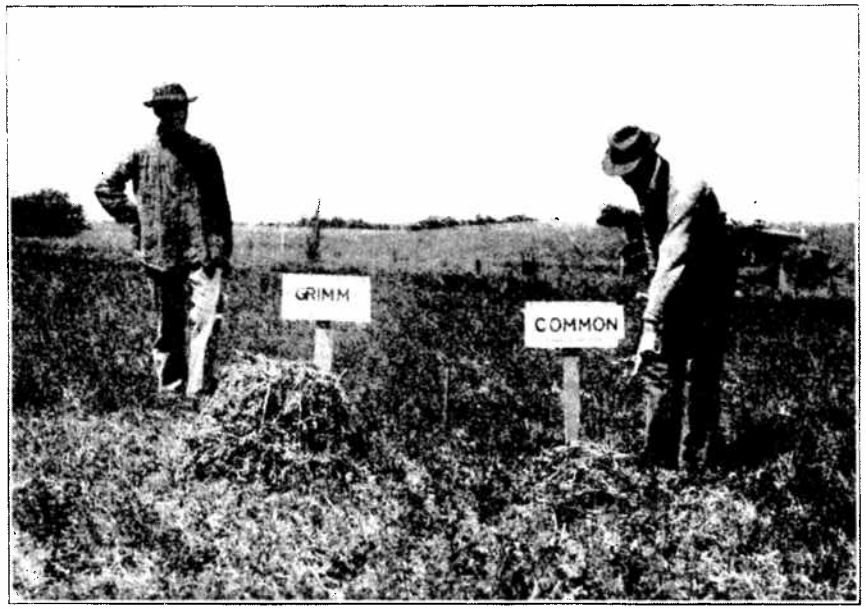
In order to prevent the loss of lime by blowing before it is incorporated with the soil, it should be worked in at once. A disk is the best implement for this purpose.

GRIMM COMMON

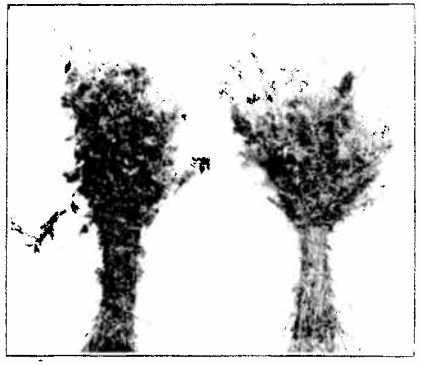
Grimm alfalfa has the greatest possible resistance the first year. After that time it has far more resistance than the Common varieties and can be relied upon, except during the severest of winters. A variety test in Mower County.



A variety test in Ottertail County. First crop. Green weight per acre: Grimm, 11,552 lbs. Common, 3,232 lbs.



A variety test in Ottertail County. First crop. Green weight per acre: Grimm, 1,237 lbs. Common, 80 lbs. The light yield on the Grimm area was caused by a severe drought.



GRIMM. COMMON.

The alfalfa plants from an average square yard of Grimm and Common alfalfa in Hubbard County. Where the alfalfa dies out, grass and weeds are certain to enter.

The Grimm alfalfa proved to be very vigorous throughout the whole season, while the Liscomb plants were so severely injured by the ice that with the exception of a few instances they did not become thrifty during the season.

Variety Tests in Northern Minnesota

During the season of 1916-17, Grimm and common variety tests were started. In October, 1916, counts were made on two representative square yards, each of the Grimm and Common areas. These areas were again counted during May, 1917. Below are given the results.

Average Results of Counts on the 40 Square Yards of the 20 Fields of Grimm, and the 42 Square Yards of the 21 Fields of Common:

	Average No. of Plants per sq. yd. in Oct., 1916	Average No. of Plants per sq. yd. in May, 1917	Dead Plants No.	Dead Plants %
Grimm...	91.8	91.6	8	0
Common.	111.6	69	1772	37.5

The Grimm plants were found to be much growthier than the common. The roots on a large number of the common plants were found to be frozen off from 2 to 3 inches below the surface. Later in the season most of the fields of common alfalfa failed completely.

In Northern Minnesota, during the winter of 1917-18, all of our remaining demonstration fields of common and some of those of Grimm winter-killed. Clover and rye also winter-killed. In the case of the Grimm fields only those more than one year old were injured. The fields sown in 1917 came through in perfect condition. In two cases in 1917 Grimm alfalfa was sown alongside of Grimm alfalfa fields sown in 1916. The seed in both cases came from the same place. Those sown in 1917 wintered perfectly, while those sown in 1916 winter-killed. The same experiences were observed in Southeastern Minnesota after the severe winter of 1915-16. Eleven fields of Grimm more than one year old winter-killed, while 47 sown in 1915 did not. From this it would seem that Grimm has the greatest possible resistance the first year. After that time it has far more resistance than the common varieties and can be relied upon except during the severest of winters.

At one time Grimm alfalfa seed was scarce, high in price, and much uncertainty prevailed as to whether the seed purchased was true to name. On account of the extensive development of the Grimm seed industry, it is now possible in most years to secure dependable seed at reasonable prices. Prospective buyers can get in touch with supplies by writing to their county agent, or to the Secretary, Crop Improvement Association, University Farm, St. Paul, Minn.

Inoculation

From experiences with alfalfa since 1914, it is apparent that more fields fail through lack of inoculation than from all other causes together except

from winter-killing where common alfalfa seed is sown. In districts Nos. 1 and 2 less unsatsifactory results have been obtained when inoculation has been omitted than elsewhere in the State, but even there the fields when inoculated averaged so much better than those not treated that there remains no doubt but that it pays to inoculate.

Below are given some results from alfalfa surveys in 7 counties in districts 1 and 2.

	No. of Fields	Average Stand	Per cent of Plants Inoculated
Fields inoculated when seeded	64	90.6	99
Fields not inoculated when seeded	88	80	66.6

The difference in yield was greater than the difference in stand because plants not inoculated do not yield as much hay as those which are. (See Fig. 13.)

At Osseo in district 3, Mr. K. A. Kirkpatrick in co-operation with the Experiment Station, put on 11 inoculation demonstrations. Through lack of time but three were checked up when the first crops were cut. These three, however, are representative of the 11 demonstrations. Below are given the results.

Inoculated Area		
Stand	Inoculation	Green Weight per Acre
95	100%	10018.6
Uninoculated Area		
Stand	Inoculation	Green Weight per Acre
66.6	39.3%	2426.6

Methods of Inoculation

The following methods were used in connection with the alfalfa demonstrations:

A. Spreading, during cloudy weather, 200-300 pounds of soil per acre from an alfalfa or sweet clover field and disking it in immediately.

B. For each acre sown, 1 bushel of soil was gathered, as above, dried in a shady place, mixed with the seed, and sown through the body of a seeder.

Soil from wild sweet clover patches is more dependable for inoculating alfalfa than soil from alfalfa fields. Wild sweet clover plants are always inoculatd; they develop more nodules than does alfalfa, and grow so long in one place that the soil is loaded with bacteria.

Inoculation demonstration in Hennepin County. The uninoculated alfalfa in the foreground was crowded out by weeds in the early part of the first season of growth. On the inoculated area in the background the alfalfa was not injured by weeds.

LIME AND INOCULATION. LIME AND NO INOCULATION. INOCULATION AND NO LIME. NO INOCULATION AND NO LIME.

Inoculation dmonstration on first crop in Hennepin County. Green weight per acre: Lime and inoculation, 12,200 lbs. Lime and no inoculation, 2,960 lbs. Ioculation and no lime, 1,408 lbs. No lime and no inoculation, 1,200 lbs.

C. Government cultures applied to the seed as per directions.

D. Glue method: i. e., glueing a pound of alfalfa soil on to a bushel of seed.

The government cultures and the glue method cannot be relied upon. Spreading 200-300 pounds of soil broadcast and working in has given good results. The easiest and most dependable method is to mix the seed for each acre with a bushel of soil and sow. This was tried on 42 fields with entirely satisfactory results. Practically all of the plants were found to be inoculated a month after sowing. In using this method care should be taken to keep the seed mixed with the soil.

LIME AND INOCULATION. LIME AND NO INOCULATION. INOCULATION AND NO LIME. NO INOCULATION AND NO LIME.

Bundles of alfalfa plants showing the average difference in top and root development on 11 dmonstration fields in Hennepin County.

Soil from Wild Sweet Clover Patches More Dependable than Soil from Alfalfa Fields

Wild sweet clover plants are always inoculated; they develop more nodules than does alfalfa and grow so long in one place that the soil is loaded with the bacteria. For the reason that all alfalfa plants are not fully inoculated and the fields have not always been established long enough to thoroughly inoculate the ground, the soil from alfalfa fields is not always reliable. This is illustrated by data given below, these being from 24 fields which were inoculated with soil from a three-year-old field of alfalfa in which most of the plants had been found to be inoculated.

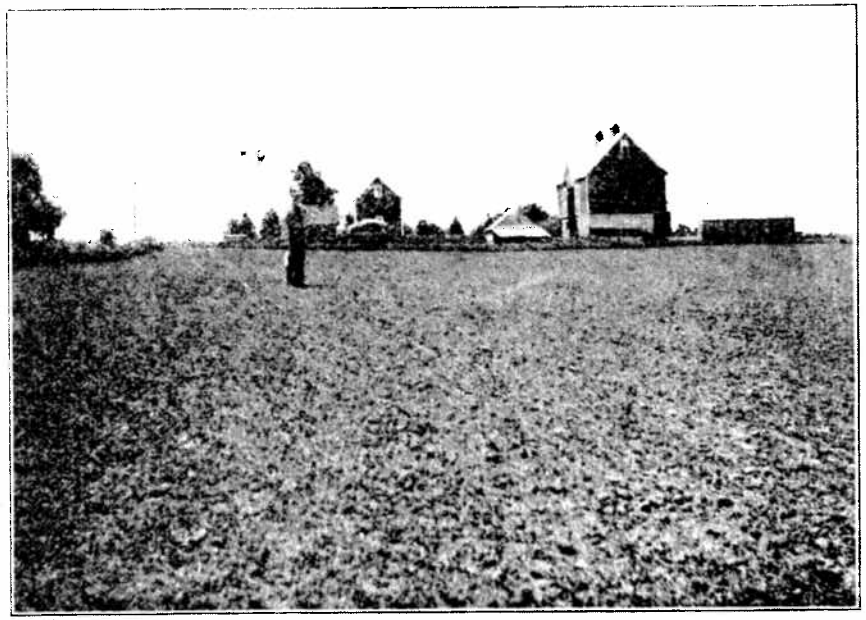
For comparison results are also given on 138 fields, sown the same summer where effective inoculating soil was applied in the same manner.

Stand	Inoculation Per cent	Weeds per cent	Failures	
			No.	Per cent
75	3	63	6	25

Stand	Inoculation Per cent	Weeds per cent	Failures	
			No.	Per cent
99	100	9	0	0

The above data were gathered during the first year of growth. At the same time, the 24 fields first mentioned, were treated again, using 600 pounds of sweet clover soil per acre. This took immediate effect.

To make sure that the inoculation is effective the field should be watched the first year. If the plants turn yellow examine the roots for nodules. If none are found, treat again. Soil can



Where the seed-bed is well prepared, less seed is required, the weeds are not so troublesome, moisture is conserved, and plant food is liberated, so that when the alfalfa is seeded it will make a quick, strong growth.

Alfalfa should be cut when the shoots for next crop appear. In Southern Minnesota the last crop should not be cut later than Sept. 5 to 10, and in Northern Minnesota, from Aug. 25 to Sept. 1.

Renovating an alfalfa field with a spring tooth harrow. After alfalfa roots are 10 to 12 inches long, there is little danger of injuring the plant.

be spread broadcast and worked in, or even a more satisfactory way is to drill in 2 to 3 bushels per acre of inoculating soil.

Sowing the Seed

Use from 10 to 12 pounds of clean alfalfa seed per acre. When a good seed bed is prepared and the seed is put in shallow, a lesser amount will give as good results.

Data on Well Prepared vs. Poorly Prepared Seed Beds.

Light Soil

	No. of Fields	Stand Per cent	Inoculation Per cent	Failures No.	Failures %
Well prepared seed beds....	48	98	96	0	0
Poorly prepared seed beds....	16	60	88	7	44

Time of Seeding

When alfalfa is sown alone the best results have been obtained on heavy soil by sowing in July, when moisture conditions are favorable. On light soil, sowing before June 6 has given the best results.

Data on Fields Sown in 1916.

Heavy Soil.

No. of Fields	Sown from	Stand Per cent	Inoculation Per cent	Failures No.	Failures %
30	June 6-July 1	73	80	10	33.3
20	July 3-Aug. 1	93	57	0	0
	Light Soil				
64	M'y 15-Jun 6	92	97	6	1
20	Jul 6-Jul 15	60	15	7	35

On the light soil not only were the stands better on the earlier seedings but the inoculation was more effective. The weeds were more numerous, but did no serious damage. On productive fields, where the alfalfa plants were fully inoculated, the best results were obtained by letting the weeds head out and then cutting them short. At that time the alfalfa was also ready to cut. The next crop then came on so rapidly that the weeds did not get another start.

Pruning the weeds by cutting them high before they are headed out does not check their growth sufficiently to appreciably lessen their injury to the alfalfa.

Alfalfa sown on light soil is often injured by sand storms. Where the field is not affected by drifting sand from adjoining fields this can be prevented by top-dressing the alfalfa with six to eight loads of manure per acre, directly after seeding.

Use of a Nurse Crop

Where all conditions are extremely favorable, good results may be obtained by sowing alfalfa early in the spring with a nurse crop. However, there is less chance of securing a full stand with a nurse crop than where sown alone. For this reason beginners are strongly advised to sow alfalfa without a nurse crop.

Good results have been secured by sowing alfalfa with barley, oats, wheat or flax. Barley probably makes the best nurse crop, and when used should be sown at the rate of three pecks to one bushel per acre. When wheat and oats are used they should be sown at a correspondingly light rate. If the nurse crop endangers the alfalfa by lodging or in unduly drying out the soil, it may be necessary to cut it for hay before it is ripe.

Clipping and Fall Care of Alfalfa

It is desirable to clip alfalfa fields when the weeds become troublesome. The most satisfactory way is to clip just after the weeds have headed out. In case there is danger of the clippings smothering the alfalfa, it is best to rake them off. Where the alfalfa plants develop new shoots by August 25, clipping will create a more vigorous root and top development. Al-

lowing a good growth to develop in the fall will increase the resistance of alfalfa during the winter. Top dressing with fine manure early in the fall is beneficial because it increases the growth. In the case of the severe winter of 1915-1916 in district No. 4 and that of 1916-1917 in district No. 3, top dressing after the ground froze did not seem to help.

Renovating Alfalfa Fields

Under Minnesota conditions it is very desirable to renovate alfalfa fields once, or more, annually as soon as they are established. Doing so will prevent grass from entering and crowding out the alfalfa. Undoubtedly the increased yields which are almost certain to be secured, will pay for the extra work required. Renovating early in the fall, after the first crop is cut, will increase the growth for winter protection. Renovating after the first crop is cut, the first year, and continuing annually will prevent grasses from entering, as well as keeping the surface in good condition.

Either of the following methods for renovating a field are found to be satisfactory:

A. Double disking one way with disks set to cut and cross dragging with spiked tooth harrow with the teeth set straight.

B. Cultivating the field both ways with a spring tooth harrow; after the plant roots are 10 to 12 inches long there is but little danger of injury.

Pasturing Alfalfa

Alfalfa should not be pastured during the first year of growth. Caution should be used in pasturing small fields at any time, as there is great danger of injurying the stand. When a field is well established limiting the pasturing each season so that two crops of hay may be cut, gives good results and insures a permanent stand.

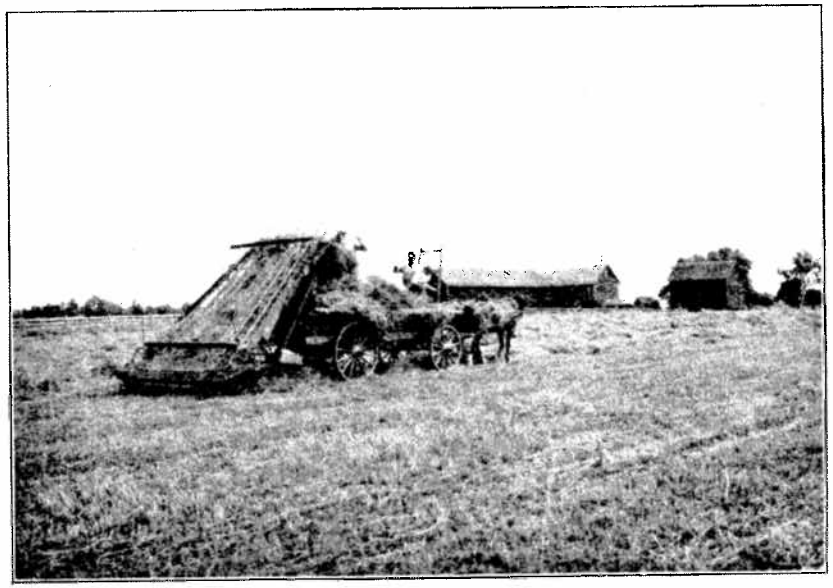
Reclaiming Unthrifty Fields

When alfalfa fields up to a year after seeding are not doing well, the following procedure is recommended:

Have the soil tested for acidity, and if acid, apply from 3 to 5 tons of ground limestone and 500 to 1000 lbs. of sweet clover or alfalfa soil per acre, and work the surface of the field according to the development of the plants. Where the alfalfa plants are small, a harrow can be successfully used by setting the teeth straight cross harrowing two or three times. Where the plants are well developed, use a spring tooth harrow or disk. If the soil is not acid, apply only the inoculating soil and work as above.

The above methods are most effective during the early spring.

Loading hay in the hardest and most expensive manner. The men are working hard but the horses are resting while the load is being put on. It is much better to work together as shown below.



Loading with a hay loader. The hard part of the work is done by the horses. A crew using a loader can handle about 30 per cent more hay than when it is pitched on by hand. When a small boy is used to drive the team two men can handle the hay without difficulty.

METHODS AND TIME OF SEEDING ALFALFA

R. E. Hodgson, Southeast Experiment Farm, Waseca

During the past season an experiment has been conducted to determine the best method and time of seeding alfalfa. One piece of alfalfa was sown at the rate of twelve pounds per acre the last of May. The alfalfa was mixed with twice its weight of inoculated soil. The seed and soil were then mixed with again as much sifted dirt taken from the field to be planted. The idea in doing this was to secure bulk enough so that the seed might be sown evenly over the whole piece. The seeding was done by hand going lengthwise of the piece and then crosswise, and because of the large bulk of the seed and dirt it could be sown liberally each time. After the alfalfa was seeded, oats were drilled in at the rate of two bushels to the acre. The oats were cut for hay while in the milk and the alfalfa gave a beautiful stand very even and uniform throughout the whole piece.

A similar plot of land was worked carefully throughout the early spring and kept black through April, May and June. On June 30th alfalfa was planted in the same way and at the same rate as on the other field, except that no nurse crop was used. The alfalfa came up nicely and so did the weeds. When the weeds got up taller than the alfalfa some boys were hired to pull them. A short time later another crop of weeds got up above the alfalfa and again these weeds were pulled. A third time the weeds got up above the alfalfa and this time they were cut with the mower producing five loads of green trash from two acres. Of the two stands of alfalfa, that planted with a nurse crop is if anything the more uniform and thicker on the ground. In addition, there was a good crop of hay of fair quality and throughout the summer that planted with a nurse crop has been a pleasure to look at, while that planted without a nurse crop has been unsightly in the extreme. It is possible that if the land had been kept clean another month the weeds would not have developed so rapidly, neither would the alfalfa have been as well rooted to withstand the winter as where it had had a whole summer to get a foothold.

On another piece of ground about eight pounds per acre of alfalfa seed were mixed right in with barley sown at the rate of two bushels per acre. The barley yielded fifty bushels and the new alfalfa plants are now a foot high and should go through the winter in good shape.

The time to seed alfalfa depends somewhat on the locality where it is to be grown and to a much greater extent on the soil. On the heavy clay lands of southern Minnesota we are convinced that alfalfa might as well be sown with a nurse crop thus getting the use of the land the first year. On heavy land barley would perhaps be a better nurse crop than oats as it is less apt to smother the new seeding. One bushel per acre of barley would be enough seed if previous experience had indicated that it was hard to get a catch of alfalfa. While alfalfa must have a sweet soil for the best results, experiments indicate that it is not as sensitive to lime as is sweet clover. Alfalfa has been grown at this Station for seven years on both limed and unlimed soil. It has never shown any response to the lime, but sweet clover this year on an adjoining piece of land shows a marked response to lime applied seven years previous. The dairyman on the ordinary Minnesota farm who does not have at least some alfalfa is not getting the highest possible returns from his land. In this locality there are numerous fields seven or more years old which are giving back returns year after year with practically no labor except for harvesting.

NURSE CROP

gives best results in seeding alfalfa at the Waseca sub-station of the Department of Agriculture, University of Minnesota.

LIME

at same place produces no appreciable effect, though it does bring good results with sweet clover.

Ten Commandments of Alfalfa Growing

1. Select well drained land, a well cultivated plot, free from noxious weeds.
2. Fall plow land (disk if corn or potato land), cultivate up to time of planting in spring.
3. Test soil for acidity, and if sour treat with lime or marl.
4. Use Grimm or Cossack tested seed.
5. Sow from 12 to 14 pounds to the acre.
6. Inoculate seed before planting.
7. Do your seeding in June without a nurse crop (after a rain, if possible).
8. Clip weeds if necessary, but harvest no crop the first year.
9. Cultivate with spring-tooth harrow the first year and thereafter, after each cutting.
10. Always leave a good growth for winter protection.

The foregoing is the "law" as worked out for—

Wadena County Farmers

MORE ALFALFA FOR WADENA COUNTY

By S. B. Cleland, University Farm

Farmers of Wadena County are engaged in a great movement to increase the acreage of alfalfa in that county. They consider that it has proven itself a crop well adapted to their conditions and is needed as feed in the growing dairy business of that section. So much money is being paid for bran and other protein concentrates that the farmers feel that they should raise their protein feed at home. Comparing the fact that 1000 pounds of bran contains 119 pounds of available protein, while 1000 pounds of alfalfa hay contains 117 pounds, 1000 pounds of alsike clover contains 84 pounds and 1000 pounds of medium red clover contains 71 pounds of available protein, the farmers feel satisfied that they can avoid a very large share of their bran purchases if they have plenty of clover and alfalfa on hand. Clover is already produced in large quantities, but more alfalfa is needed.

The campaign to increase the acreage of alfalfa in Wadena County was started in July 1922, by the county farm bureau under the leadership of County Agent W. A. Peters. It was felt that it would be necessary to demonstrate to every man in the county the correct methods of planting alfalfa and taking care of it in order to avoid failures in getting it started. The plan adopted was to get 500 farmers in the county to put in an acre apiece in the spring of 1923 under the standard requirements laid down for Wadena County conditions. Considering the fact that there are from 1200 to 1500 farmers in the county this will mean that about one farm out of three will have a field of alfalfa started in 1923. This should enable everyone who is interested to see just what is necessary to get a stand and keep it. The standard requirements as worked out by County Agent Peters in co-operation with specialists at University Farm are as follows:

(1) Select a well drained, well cultivated plot, free from noxious weeds.

(2) Soil to be fall plowed (disked in case of corn or potato ground), cultivated during spring up to time of planting.

(3) Soil to be tested for acidity and if sour, lime or marl to be applied.

(4) Grimm or Cossack tested seed to be used.

(5) Twelve to 14 pounds of seed per acre to be sown.

(6) Seed to be inoculated before planting.

(7) Seed to be sown in June without a nurse crop (after a rain if possible).

(8) Weeds to be clipped if necessary but no crop harvested first year.

(9) During the second year and thereafter, cultivate with a spring tooth harrow after each cutting to keep out June grass and preserve a dust mulch.

(10) Always leave a good growth for winter protection.

An aggressive campaign to introduce this project to all the people of the county was worked out as a part of the alfalfa campaign. In August, 1922, a series of meetings was held, one in every township in the county. Extension specialists were called on to assist with these meetings. At each meeting the value of alfalfa as a crop and a feed was discussed and also the best methods of getting it started. At the close of the meeting each one who cared to co-operate in the campaign

An old "back-breaking" method in use for more than 100 years. It consists of nearly all hand-work. This is the slowest and most costly of all methods of making hay. Note the small, poorly built stack at right. A large amount of hay is entirely spoiled in stacks of this type. A larger, higher, and better stack is possible by the method shown below.

Stacking hay with a push rake and an overshot stacker, mounted on wheels, eliminates nearly all of the heavy work. The trouble with this crew is that not enough push rakes are used. With a yield of from one to one and a half tons per acre, two men on the stack can easily handle all of the hay brought in by three push rakes. A vast saving in labor and hay is possible over the method shown in the upper picture.

was asked to sign a card giving his name and location and the acreage which he would plant in 1923. Usually this was one acre each. He was also given a small cloth sack and shipping tag with which he was to send a sample of soil to the Soils Division of University Farm to have it tested for acidity. The next day after the meeting the Extension Specialists in company with a local man visited those in the county who were not at the meeting the evening before, and enrolled additional co-operators. All parts of the county were thus covered in this campaign which lasted for one week. Many who were not seen during this week sent in their names later until by October 1st over two hundred men had enrolled with a total of 411 acres. At this rate it looked reasonable to expect 500 co-operators by the spring of 1923.

During the fall and winter the campaign for more co-operators is being actively pushed. An example of the way this is kept before the people of the county was shown in the alfalfa haystack erected as a farm bureau booth at the county fair. This haystack, made by spreading alfalfa hay over a frame work inside of which the county agent maintained his headquarters, was such a striking object that it attracted widespread attention and set many people to thinking seriously about alfalfa as a crop.

One very commendable feature about the plan as followed in Wadena County is that very few men are trying more than a small acreage. They are not investing very much because the initial acreage is small and consequently no one is kept from trying the crop because of the expense. Also the small acreage makes it possible to give this first tract special care that might not be given to a larger field. It is felt that as soon as the men have convinced themselves that alfalfa can be grown and have learned the safe methods of getting it established, it will be only a short time until a very extensive acreage is devoted to the crop.

Alfalfa haystack booth on fair grounds at Wadena

One Failure in Fifteen Years

That's the story of a Norman County farmer *in growing alfalfa.*

The hay taken off that farmer's 15-year-old field has been "something wonderful," and the soil has been greatly improved.

Success lies in—

getting good seed
planting on well drained land
preparing good seedbed
right cutting and curing.

ALFALFA AND SWEET CLOVER IN NORMAN COUNTY

By Frederickson Bros.

At a cattle sale last year a farmer asked Professor Shepperd, of the North Dakota Agricultural College, how to get a stand of alfalfa; the terse reply was, "Sow alfalfa seed," and that is just about all there is to it. Of course, there will be occasional failures, but we will have them with wheat or whatever we sow. We have now had partial failures of wheat for four years in succession here in the Red River Valley, while if a farmer has one failure with alfalfa he gets disgusted, and two failures will make most of them say, "It can't be done."

We have raised alfalfa here on our farm for fifteen years and have had only one failure to get a good stand. We now have 40 acres of as pretty alfalfa as ever grew anywhere. Last year we broke up our original patch, seeded 15 years ago, and it still was a pretty good patch, and all these 15 years we have been getting our two crops of hay every year. The hay that will come off a patch of alfalfa in 15 years is something wonderful, and on top of that when the land is plowed up again it seems to be as rich as virgin sod.

Our method of planting is simply to seed it in as early as we can get on the land in the spring. We prefer to seed it with wheat as a nurse crop. The reason for most failures here in the Red River Valley is that the plant will start well in the spring, but when the July and August drouth comes the plant is not rooted deeply enough to stand and it dries up; while if it is seeded early the plants will be rooted deeply enough to stand it.

Now comes what I consider the most important part; that is, the seed. Use no other seed than Northern grown of a hardy strain, as Grimm, Cossack or Vale No. 22. We personally have used the Vale. One year we did not have enough seed of our own raising so we bought some common alfalfa, secured a good stand of both and had several crops of hay from both, then came the bare winter of, I think, 1915; the common lafalfa froze out completely while we still had a fair stand from the hardy seed. These pieces were adjoining so one had no advantage over the other. Now, if we had had but the common variety of alfalfa we would have had no hay that season and would have had difficulty in getting hay to winter the stock. Such experiences will disgust one with alfalfa, so I suggest that if anybody has alfalfa that is not of hardy seed, he sow another patch using the hardy seed, as some time sooner or later we will have another winter like that one.

The next important step is to seed it on well drained land. The last few years a lot of alfalfa has been seeded on very low and poorly drained land and the results are that they have secured more hay than those on higher land, but the weather will not forever stay dry, and when the wet years return these farmers with their alfalfa on poorly drained land will not have any at all, as alfalfa will not stand it for any length of time with "wet feet." As to size of patch, be sure to seed a large enough patch. The proper way is to not only have enough in the good years but to have plenty even in the dry years. There will, of course, be more than needed in some seasons, but it is better to have too much than too little. We usually aim to have enough hay from the first crop to

A COMMON RAKE, A BETTER RAKE, THE BEST RAKE

The small one-horse rake operated by a man makes raking very costly. Many farmers purchased one-horse rakes years ago and are still using them because they are not worn out. The 8-foot one-horse rake should be used only when a small acreage is grown. For large areas, the one shown below is a great saver of time and labor.

Raking alfalfa and Johnson grass hay yielding 2 tons per acre. The 12- or 14-foot rake and a good strong team should be used on farms growing 40 acres or more of hay. A boy who understands the work can do as much per day as the ordinary man. This rake will cover 50 per cent more ground and do it more easily than the one shown above.

When the curing is done in the swath, the crew, if using a hay loader, can start taking the hay from the windrow as soon as the side-delivery has made one double windrow across the field, whereas when the sulky rake is used they will have to wait until the rake has gone several times across the field. The side-delivery rake should be used before the leaves become dry enough to shatter. It is better on large farms than those shown above.

supply our needs, and cut the second crop for seed, but if we do not get enough hay from the first crop we cut as much more as we need from the second crop.

As to cutting and curing. We handle it much as we would any other hay. We always try to get the mowers started in the forenoon of one day and the next afternoon the alfalfa should be ready to rake into windrows (very small ones), using, preferably, a side delivery rake; then let it lie until the next afternoon, when, if it is reasonably dry, it should be bunched; if not, turn it with the rake. It should, under all ordinary conditions be dry by the next afternoon. We put it up so green that the neighbors thought we were crazy, and some of them did not hesitate to tell us so. Usually it comes out just as green and nice as grass. Sometimes, of course, it gets dusty, but I always have enough of it free from dust for the horses, and some dust will not hurt the cows.

I know there are better ways of curing alfalfa, but here in the valley where we try to cover a pretty large acreage I think this is just about the best way to handle it. In cutting, it is a good idea to cut it rather high, say about 3 inches from the ground. This will give the air a chance to circulate under it. After several cuttings there will be a stubble that will hold the hay up from the ground completely.

For two years we pastured a 30-acre patch of alfalfa and were fairly well satisfied with results, but the constant anxiety that your cattle may bloat takes all the pleasure out of life, especially if one has blooded stock. The first season we did not lose any, but the second season we had heavy rains and the weather turned hot and muggy, then for two weeks it was not an uncommon sight to see a cow come in with her stomach sticking up over her back like a balloon. We lost only two, but the continual trouble we had with them surely cured me of my enthusiasm about alfalfa for pasture, and as at about that time we began to realize the value of sweet clover for pasture we quit alfalfa for pasture entirely, and have found sweet clover a better pasture than anybody ever thought we could have here in the valley.

We seed our sweet clover exactly the same as alfalfa, putting it in as early as possible in the spring and using a nurse crop. We have two 40-acre fields fenced. We seed one to sweet clover. The next year we pasture it and reseed the other field. In that way we have 40 acres of pasture and 40 acres of wheat alternately, and as it is already fenced it does not cost us anything but the seed.

The cattle will feed on the pasture until about the 15th of September. We then turn them on the other pasture where the young, sweet clover is in the stubble. We always seed about 2 lbs. of rape per acre with our sweet clover. The rape and sweet clover will furnish excellent pasture until the most severe frost comes.

We have tried very little sweet clover for hay, and what we have tried has been so inferior to alfalfa that we have quit it entirely and do not think anyone that can raise alfalfa should plant sweet clover for hay.

In summing up we advise the planting of alfalfa and plenty of it for hay, then sweet clover and plenty of that and then some for pasture. Build a silo and be sure to have it filled with fairly well matured corn. When we all do this we will make this Red River Valley more famous as a dairy and beef country and it will pay us better than growing wheat.

ALFALFA AS A HOG FEED

By E. F. Ferrin, University Farm

Alfalfa is one of the best hog feeds whether used as pasture or as hay. It contains considerable protein and is also high in mineral compounds. Both of these feed substances are badly needed by swine since their principal feed is corn, which is very low both in protein and minerals. The feeding of alfalfa pasture and hay to hogs will save purchasing much of the high priced commercial feeds which should be used in a swine ration to get best results.

Alfalfa is not a crop which will stand heavy pasturing. It is best not to graze it at all the first season. After the first year a limited number of hogs can be carried for several seasons without seriously damaging the crop. It is not possible to pasture closely enough to keep down the plants without running a great deal of risk of the crowns being eaten off, which will kill the plants. Hay should be cut as well, usually two crops each season. Brood sows need to be rung to prevent their rooting up the field. Eight to ten sows per acre can usually be pastured without too much damage to the crop, but the number will vary with the season.

For growing pigs, alfalfa pasture is a great feed. Most permanent pasture grasses get brown and dry during the summer and furnish little feed, but alfalfa stays green and keeps the pigs growing. Experiments at stations throughout the corn belt with different kinds of forage crops have usually shown a greater return from alfalfa than from any other pasture. Medium red clover ranks very close to alfalfa as a hog forage. There is very little difference in the gains made by pigs on the two kinds of pasture or in the grain fed per pound of pork made, but alfalfa gives a more regular supply of feed during the summer and more hay is cut than from red clover. Clover and alfalfa will carry about the same number of growing pigs—from fifteen to twenty per acre—and neither crop has much advantage over the other in ability to withstand abuse by grazing.

A good plan for handling alfalfa that is to be pastured with hogs, is to have the field divided into two parts. The hogs should graze these lots alternately. It will not be necessary to pasture one half of the field until after the first crop of hay is cut from it. Allowing ten days or two weeks for the plants to make growth after the first cutting, the hogs can be taken out of the piece first pastured and hay cut from it. This plan makes it possible to save a stand of alfalfa for several years, where continuous grazing of one piece would soon spoil it.

While mature sows can make their living from alfalfa alone, that is, without any grains, growing pigs need about a one-half grain ration in order to keep thrifty and hardy. If kept on pasture without grain, some of the pigs will grow reasonably well, but the average of them will be unthrifty. For every hundred pounds of live weight of pigs, two pounds of grain is necessary every day. Bigger gains will be made if more grain is fed, but the maximum use of the pasture is obtained when only enough concentrates are given to keep the pigs in thrifty growing shape. The amount of pork which can justly be credited to an acre of alfalfa varies a great deal, but several experiment station averages show that about five hundred pounds is a reasonable amount. The return per acre of good alfalfa when pastured by hogs is high enough to make it pay to reseed the crop every two or three years if necessary.

Growing pigs when given all the grain they want, whether by hand feeding or in a self-feeder, do not make as efficient use of pasture as when on light rations of grain. Thirty or even thirty-five pigs per acre can be kept on alfalfa if all the grain they want is fed.

Alfalfa pasture reduces the protein feed needed by growing pigs. Smaller quantities of wheat, shorts, milk, tankage, or other supplemental feeds are needed. This reduces the cost of the feed bill and cheapens the process of pork making.

Alfalfa hay yields good returns when fed to hogs in winter. The later cuttings of leafy hay are the best because a hog can not handle coarse feed. The stems of the hay will not be eaten, but this item of waste is far overbalanced by the good the leafy part of the plant does the hog. Hogs fattening for market are sometimes fed alfalfa hay along with corn. This is better than fattening them on corn alone, but considering the time necessary to get them ready for market, a corn and tankage ration beats corn and alfalfa hay.

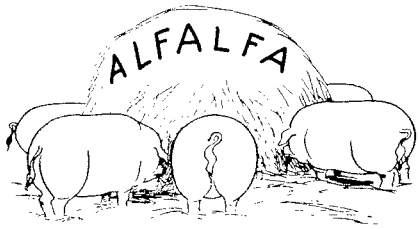
Brood sows should have alfalfa hay during the winter. It provides bulk, protein and minerals, all of which are lacking in corn. It is a good plan to give sows all the hay, or even a little more, than they will clean up. The cost of feeding during the winter will be reduced and the sows will farrow stronger, healthier pigs than if no alfalfa is fed.

Sometimes racks are made to feed the alfalfa to hogs. This is not necessary. A concrete floor is satisfactory or the hay can be fed with good results upon the ground when it is dry or frozen. Usually not more than one-tenth as much alfalfa hay as grain is fed. Old sows can use a higher proportion than this, but young sows and gilts have body growth to make and must have chiefly grain if they are to make their own growth and produce a strong litter.

Wherever alfalfa grows to good advantage, the hog raiser is missing a good opportunity if he fails to grow the crop for pasture during the sum-

Feeding Alfalfa Hay to Hogs

Hogs Need Protein and Mineral Compounds



They have to have it in order to grow

They can get both in

ALFALFA

The Reason Is---

that their ration is usually chiefly of corn, which is lacking both in protein and minerals

Give Hogs **ALFALFA---** Either as **Pasture** or **Hay**

mer. From the same acreage he will cut hay, if the field is well managed, to be stored away and saved for the brood sows as winter feed. Or if, after trial, the farm does not seem to be suited to growing the plant, it will pay to buy a little hay to give the brood sows in winter.

THE VALUE OF LEGUMINOUS CROPS IN THE FEEDING OF SHEEP

By P. A. Anderson, University Farm

The feed value of legumes has long been known by progressive sheep men. Legumes can now be grown on most farms in the state. This statement may be truthfully said to include alfalfa, which in the past has been considered rather difficult to grow in some sections. Experiments and various demonstrations have shown that it is a sure crop when properly handled and should be included in the farm program of crops.

In the feeding of sheep the leguminous crops are used as roughage, pasture, and for green feeds. Their value depends greatly upon the manner in which they are handled. When used as hay the manner in which they are cured and stored determines their feeding value. Overcuring causes considerable loss of the leaves, leaving a stem which is rather coarse and woody. Under curing is often the cause of moldy hay, which is not a desirable sheep feed. When used as a pasture crop their value depends upon management. For example the time when the sheep are turned into the pasture, the season, the number of head and the condition of the feed. In the case of the use of legumes for pasture or green feeds, the sheep should not be subjected to violent change from dry feed, but should be gradually accustomed to the new feed to avoid digestive disturbances.

Alfalfa as a sheep feed leads all the legumes in feed value, tonnage per acre, and the number of years that it can be used for hay, pasture and green feed. Its main value lies in the high protein content, the slightly laxative quality and the way sheep relish it as feed. As a roughage it stands at the head of the list, when properly cured. It is relished by lambs at an early age; even those only a few days old learning to eat the green leaves. For growing breeding stock it is a first class feed; and for ewes in lamb, and after lambing it is excellent for the roughage part of the ration. For fattening purposes its value has long been known, and is being appreciated more every day as shown by results produced by experiment stations and feeders in general.

The lamb feeding centers were formerly located close to market and where waste grains could be procured; but in recent years many sheep men in the west feed their stock at home where, as a general rule, alfalfa of good quality may be had. In this way they can reap the full benefit of their labor by marketing the finished product.

Alfalfa is being used more and more as a pasture crop. The only drawback to it as a pasture for sheep is the fact that there is danger from bloat if care is not used. The same objection holds true in the case of clover. Sheep must be gradually accustomed to either alfalfa or clover pasture; and should never be turned into such a

As a Sheep Feed

ALFALFA

Leads All of the Legumes

The reason is that—

It is rich in proteins

Is slightly laxative

Is relished by the sheep

But

the clovers

alsike

and sweet clover

are all valuable for sheep
though sheep have to
become accustomed
to the sweet clover

pasture when very hungry. It is a good plan to turn them in for only a short time, say half an hour, at first and then only after they have had a fill of some other feed. The danger of bloat is especially great if the pasture is wet from dew or rain.

As a green feed, alfalfa is highly recommended. When cut just before bloom and fed to growing lambs, it is unexcelled, as the young shoots are tender and very little waste is noticed after the lambs are older. This practice of feeding is done before turning on pasture after weaning, or to form a part of feed fed in the fitting of sheep for show.

Alfalfa as a silage crop for sheep has only been partially tried out. In some sections of the West, where some provisions are made for winter feed, alfalfa has been used for silage. Silage of good quality has resulted when it has been placed in the silo immediately after cutting before the leaves have had a chance to wilt. It has a less agreeable flavor than corn silage, but sheep soon accustom themselves to it. In some sections, where the alfalfa field is infested with weeds, the first cutting is often used as a silage crop.

The other legumes as the clovers, consisting of red, mammoth, alsike crimson and sweet clover are all more or less valuable as feed for sheep. Red clover and alsike are important as hay and pasture crops. Red clover usually dies out in about three years, while alsike may last for several years. Red clover ranks second to alfalfa as a roughage and is used by many in fattening and wintering sheep of all ages. As a silage crop it may be recommended if siloed soon after cutting, placed in an air tight silo, preferably one that is tall in proportion to its width or diameter.

Its value as a pasture crop has long been known, though the same precautions must be taken as with alfalfa.

Mammoth clover is less valuable as a sheep feed on account of its coarseness, and it has been looked upon with less favor by most farmers because of its being only a one year crop.

Crimson clover is less favored by most sheep men, than those listed above on account of the minute barbed hairs on the blossoms which harden as the head ripens; making over-ripe crimson clover a very unsatisfactory feed.

Sweet clover as a sheep feed has, as yet, not had a chance to really prove itself. If cut for hay previous to blooming, much of the coarse stems can be avoided and greater use of the plant can be made. Sheep, as well as other stock, must be accustomed to it slowly, as it has a bitter taste, but they soon relish it. As a pasture crop it is worthy of a trial.

CAN LEGUME CROPS BE USED SUCCESSFULLY IN FEEDING HORSES?

By W. H. Peters

In all the experimental work that has been done to determine the feeding value of the legume crops for farm animals, the horse has been almost entirely neglected. In fact, the value of the legume crops as feed for cattle and sheep has been so thoroughly established that no one at all familiar with the feeding of farm animals would expect the best results without the use of some hay made from a legume crop. What is the reason then that the legumes have not been more extensively used in the feeding of horses? Several reasons may be offered. Among them should be mentioned first that timothy hay and oats have long been the recognized standard feeds especially for work horses. The user of horses in the city seldom deviates far from these two feeds, and when the farmer has substituted something for them, he has usually substituted prairie hay or oat hay and corn. Oats and timothy hay owe their popularity as horse feeds to the fact that they are both clean, sound feeds, usually free from dust or moulds, they keep well in storage and when fed in combination supply a well balanced ration suitable to the horse at work. Another reason that accounts for the lack of popularity of the legumes as horse feed is that they have not been produced extensively, and because of the experimental work that has been done with them with other classes of stock, they are used with the other stock rather than with the horses. Still another reason may be found in the fact that the use of dusty or mouldy feeds often effects the respiration of the horse adversely, sometimes bringing on "heaves" and other lung troubles. The legume crops are more inclined to mould and become dusty in storage than are less leafy, thinner stemmed crops, such as timothy or prairie grasses.

The above arguments are all sound, especially from the standpoint of feeding the horse at hard work. Let us, however, consider some of the other purposes for which horses must be fed such as the feeding of the growing colt which is really the most important type of horse feeding the farmer has to do, also the feeding of the brood mare and the idle horse in winter.

The criticism of the American farmer as a horse breeder in the past has been the fact that he does not seem to be able to grow his colts up as big and sound as the imported animals from which they have descended.

The reason for this is principally because he feeds all his horses just the same as he feeds his work horses. In summer, of course, the colts are on pasture and usually do very well during the pasture season, but in winter when the colts should be receiving a good growing ration, they are running with the idle work horses eating straw, fodder and possibly some prairie or timothy hay with very little grain. The one thing that the farmer can do to improve upon the growth of his colts, and cheapen the cost of feeding all his horses in winter is to introduce the legume hay crops into his list of horse feeds for winter.

Red clover, alsike clover, sweet clover, and alfalfa all make suitable hay, especially for any type of an idle horse at any age. Any acre of land in Minnesota that will grow any crop

Handling hay in a very primitive manner. Scenes like this are often witnessed in the South, where the boll-weevil has made it impossible to grow cotton and the former cotton-grower is just beginning to grow hay for the market. This hay was bunched by women, a few minutes before it was loaded on the wagon. About 500 pounds make a load on the wood rack. This method is both costly and wasteful. A big saving over this method is shown below.

The most economical method of hauling hay to the stack, barn, or hay press when the distance is not much more than one-fourth of a mile. One man or boy with a good push rake and team used to the work will handle more than three times as much hay as the crew shown in the upper picture.

successfully will grow one or the other of these four crops successfully.

For the growing colt or the idle horse the legume hay has an advantage over any other type of roughage that can be used because it contains more protein, the compound that is needed especially by the growing colt for building up bone and muscular tissue. Legumes have an advantage over any other type of roughage also because they have a slightly laxative effect upon the digestive system and help materially in keeping the horse in good bloom through the winter months. They have an advantage from the standpoint of economy because they yield more feed per acre than any other type of hay crop, and will help materially to reduce the cost of the winter feed. Their use because of their high protein content reduces the amount of grain required and thus still further reduces the cost of wintering the growing colts and idle horses. The one precaution that should be taken in the feeding of legume hay to horses is to avoid the long continued use of hay that has become mouldy or dusty. While hay from the legumes can be used also as the roughage for horses at hard work it is just as well to use timothy or prairie hay for that purpose.

If you wish your colts to grow large

feed 'em

A LEGUME HAY

in winter

The reason many colts don't develop to good size is because after they come off of pasture in summer they are fed like work horses in winter.

The growing colt needs protein, and he gets it in the legume crops.

LEGUMES ON CUT-OVER CLAY SOILS

M. J. Thompson, Northeast Experiment Station, Duluth

In the western part of the Great Lakes Basin, the region frequently known as "Cloverland" the place where "Cows and Clover Meet," two types of soil are found, a sandy and a clay loam. In this paper we will deal entirely with the second type. The principal leguminous crops grown in this area are alsike, medium red, mammoth and small quantities of white clover; yellow and white biennial sweet clover; white annual sweet clover; alfalfa and very limited acreages of field peas and soy beans. Wild peas and wild vetches abound in some localities.

The clovers are doubtless of first importance. For this crop establishes itself with great speed and ease. It will invade a cultivated garden so quickly that it is frequently known as a weed. Five pounds per acre scattered between the stumps and lightly worked in in April will frequently produce a crop which will blossom in August, and afford light pasturage the same fall and abundant pasturage and forage the next season. Sown alone in meadows, 8-9 pounds of alsike, 10 pounds of medium red are sufficient; used in mixtures, they will usually constitute 35-40 per cent of a 12-14 pound mixture. With recurring dry seasons, we find that seeding should be done before May 15 if possible.

White clover is a pasture crop and of minor importance. It is rarely sown in the mixture, purposely, but usually comes in as a volunteer crop. While extremely good feed, the volume is small. Of the three remaining clovers, alsike is probably of first importance on clay soils. For much of the land is slightly rolling or level, under which conditions this clover thrives best. It stands the severe winters as well as the dry summers and will persist for a number of years. Red clover, on the other hand, is a two year crop. Altho red clover will produce two crops, alsike produces a later first crop usually heavier in tonnage and of better quality. Frequently in this latitude, the one crop of alsike will equal the two crops of medium red. In 1921, we took approximately four tons per acre off a field somewhat under two acres. Moreover, it ripens with the timothy and at a time after the first of July when the weather is more settled and there is less danger of unsettled weather. Its finer growth makes it superior to red clover for a pasture crop.

But on a hilly farm, red or mammoth clover is to be preferred. Red clover, altho it produces less than mammoth, is usually of somewhat better quality both as to hay and pasturage. It would seem then, that medium red would come midway between alsike and mammoth. The question as to which clover has the highest fertilizing value is a debatable one. For altho the mammoth and, in less degree, the medium red produce a larger root system than the alsike, careful examination has disclosed the fact that the latter has a corresponding nodule formation. The following represent average annual yields over a two year period: Medium red, 3371 pounds per acre; mammoth red 3575 pounds per acre; alsike, 4770 pounds per acre.

Sweet clover is being grown in ex-

Clovers for "Cut-Over" Clay Soils

M. J. Thompson of the Northeast Experiment Station, Duluth, says they are to be preferred to

Sweet Clover
and ***Alfalfa***

by the farmer who is making a start on a *clay loam* farm in the cut-over country, because they are—

CHEAP AND SAFE

tensive tests. Dates of seeding alone and with various nurse crops and the comparative virtues of yellow and white biennial and white annual are being determined. The annual crop, harvested in the fall of 1921 yielded little more than one ton per acre. The biennial yellow, first crop, 1922, produced 1.987 tons per acre and the white biennial 2.7 tons per acre. The yellow sweet clover is somewhat earlier than the white. Indeed, in the colder sections, it is very questionable whether the white biennial may not be too late for seed production some seasons, while the yellow crop would usually be safe. Altho lighter in yield, the hay is of far better quality, and the pasture crop is more greedily eaten as well. The annual white sweet clover does not offer much promise in this district. In its effort to set seed, it produces such a high per cent of branching that its feeding value is reduced. In the dates of seeding test, no material difference in yield was secured during a two year period, with crops sown May 18, June 1, and June 15, although the first year the early sown crop looked much the stronger.

The writer would not strongly recommend the extensive growing of sweet clover at this time on the clay soils of northeast Minnesota. With abundant crops of alsike and red clover for hay and pasture, grown without lime and with little trouble, the cutover land farmer had best go slow. For, unless cut at the right time, and unless the weather is very favorable, the feeding of sweet clover may prove disappointing. The cutting season comes in June when the weather is frequently unsettled and the curing process in our humid atmosphere is sometimes a problem. We find cutting with a binder for hay as well as for seed gives the greatest satisfaction. As a bacterial preparation for alfalfa, sweet clover has a decided place. While it need not be inoculated, nevertheless using culture or dirt from an old field is good practice. It is even more exacting in its lime requirements on our soils than alfalfa. We usually allow one ton per acre of hydrated lime in sowing the crop. Better stands are secured without a nurse crop. If a nurse crop is used, do not sow above one bushel per acre preferably.

Alfalfa, the wonder crop, has its devotees in the northern timber belt as elsewhere. But again we would utter a word of caution. Until a man has a considerable clearing, we would recommend that he plan to secure the bulk of his feed from clover. For alfalfa demands a first class seed bed. To get this on new land and in a short time is expensive practice. But if several crops are taken off, in the course of a few years the land is worked into shape and automatically prepared for this crop of exacting demands. The same labor that prepares the seed bed for alfalfa also produces the intervening crops. Until a comfortable number of acres are being farmed, the farmer will do well to grow the cheap, safe forage crops that he understands and put his surplus time into clearing more land. Then, when ready, he can start alfalfa culture on a small scale on his best land.

Both inoculation and liming are needed on our soils. One hundred pounds of dirt, from an old field of alfalfa or sweet clover, distributed in the absence of bright sunshine covers the first need and one ton of hydrated lime or two or more tons of raw lime satisfies the second requirement. A cultivated crop such as corn or potatoes grown the previous year is excellent preparation for the alfalfa crop. Its worst enemy is the April freeze following the melting of the snow. This is more destructive on

clay than on sandy land. For the alternate freezing and thawing breaks off the root system and the plants that almost invariably come thru the winter well and give early promise of a crop suddenly dry away. This condition happens less frequently on the open sandier soils. Sow from 10 to 15 pounds per acre, 12 pounds being a common quantity.

Experimental work has been under way for some years. In 1920, southern grown alfalfa produced 7,722 pounds of alfalfa for the season as compared with 6,461 for northern grown common, but the destructive spring of 1921 was far more severe on it. Grimm alfalfa sown June 9, 17, and 30 produced respectively 6,627 pounds, 7,722 pounds and 7,098 pounds for the season of 1920, but the following spring it was noticed that the early planting came thru twice as well as the later seeding. Grimm and Cossack alfalfa have been grown side by side in 1922. The first crop averaged 2,275 pounds and 2,450 pounds respectively, while the second crop of these respective crops produced 1,475 pounds and 2,150 pounds.

Soy beans do not grow profusely on the northern clay soils except in the southern portions of the territory. Minsoy beans matured at Duluth in 1921. Field peas are a natural crop for this region but for some reason they are not widely grown. This may be partially due to the difficulty of harvesting. Yields up to 30 bushels per acre have been harvested. The Alaska continues to be the most widespread variety. This crop makes excellent silage in so far as quality is concerned but it does not yield up with the cultivated crops. Silage made from peas and oats tested out as follows: (Dry basis) Ash, 7.27%; Protein, 9.57%; Ether Extract, .39%; Crude Fibre, 2.98%; Nitrogen Free Extract, 79.79%. Note the high content of protein and small amount of fat. To summarize, alsike clover, with red in lesser degree, will continue to be the major legume on the northern clay soils for many years, owing to the cheapness and safety of growing the crop. With larger holdings we may expect to see considerable acreages of the hardier alfalfas, and somewhat smaller acreages of sweet clover, biennial white and yellow. It is probable that the annual white sweet clover and the soy bean will occupy minor places in our cropping system, but the field pea should and doubtless will occupy a more prominent place in our agriculture of the future.

CLOVER AND ALFALFA

By J. J. Quiring

"Clover and alfalfa on every farm." That is my slogan. Not very long ago southern Minnesota was quite a wheat country. Things have changed and wheat is no longer a paying crop; and you hear it often said we cannot raise it here. Now why is this true and what is wrong? We are robbing our soil, taking everything and giving nothing, and the longer we do this, the harder the comeback will be. The remedy is clover, alfalfa and stock. Clover should stand first as it fits nicely into crop rotation. Medium red clover will grow where small grain will grow and we have no trouble whatever getting a stand unless there is a drouth, as there was in some places this summer. We always aim to have a good seed bed either for clover or alfalfa. Ground must be well worked and well packed and it should be sown shallow, not over an inch deep. If sown too deep, it will be a sickly plant when it comes up and will be easily killed by weeds or a dry spell. We sow the clover with barley or early oats.

Curing clover and alfalfa for hay is quite a problem at times when the season is rainy. We watch the sky very closely at that time. We have had the best success letting it dry for one day in the swath as the mower leaves it, raking it up with a side delivery rake in the morning when it is damp so as to save all the leaves. Let it lie till in the afternoon, then haul it in. We have been able to secure (with some exceptions) very good hay in that way, both as to color and quality. Medium red clover will also make a very good pasture for one summer. If pastured close, it will most always die the next winter.

As to alfalfa—I have been saying at times it was almost too good to be true, for it surely cannot be beaten for hay and hog pasture. We always had good luck in getting a good stand; even this summer as dry as it was. We sowed 3 pecks of early oats

First cut of Alfalfa on the J. J. Quiring farm

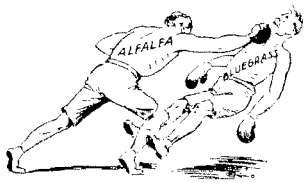
to the acre as a nurse crop. We never inoculated our ground, but we think that where there is no sweet clover at the roadsides, it would be a wise thing to do.

In regard to seed, we like to have it grown as near home as possible. We prefer the Grimm, although I have seen some very good fields of the common variety. Land for alfalfa must be well drained. The second cutting of alfalfa comes sometimes in August, right in or after harvest. We haul 3 or 4 loads of it into the hog lot, build a round stack of it and top it with oats bundles. In other words, build it as you would an oats stack. We use about a load of oats bundles to top it with, which will shed water nicely and keep the alfalfa from spoiling with the rain. This makes the nicest kind of alfalfa self feeder we know of and but very little is wasted. The oats bundles we throw to the chickens or brood sows in the winter. Either do a good job of threshing.

Feed is going to be scarce this coming winter and we have a vision of cattle in corn fields eating dead stalks, or trying to make a living at the straw pile. Here is where clover and alfalfa work both ways, enrich your soil and give you the right kind of feed for your stock. Now let us all strive to so manage that when we turn that farm of ours over to our boy, it will be more productive than when we got it.

Better Farms—Better Live Stock—Better Homes—Last but not least, Better Boys and Girls. Yours for more clover and alfalfa in 1923.—

Alfalfa Sometimes Needs Assistance Against Bluegrass



If it does, the thing to do is ***to go after the bluegrass hard***—even if you do seem to be uprooting the alfalfa.

RENEWING ALFALFA FIELDS

R. E. Hodgson, Southeast Experiment Farm, Waseca

Alfalfa fields in the state of Minnesota are often ruined after four or five years by blue grass and other native plants which seem to be able to stand the crowded conditions better than do the more productive alfalfa plants. The Waseca Substation of the University of Minnesota, Department of Agriculture, had such a field and in 1920 the hay from a two acre piece of alfalfa was about half blue grass and half alfalfa. It was necessary to either plow up the field or in some way get out the blue grass.

Early in the spring when the ground was moist the piece was worked lengthwise with a sharp disk, lapping half each time so as to give the ground a very thorough double disking. In addition to this, one third of the field was single disked crosswise and one third double disked cross-wise. On the last third the blue grass was almost the only thing to be found. That year the crop of alfalfa was much better than the year before. In the spring of 1921 when the alfalfa was about four inches high, a spring tooth harrow was used and the performance repeated, going over one-third of it twice, one-third of it three times and one-third of it twice each way. The two acre field produced three very satisfactory cuttings, yielding in 1921 about three and one-half tons to the acre. In the spring of 1922 an alfalfa cultivator was used which was even more severe than the spring tooth harrow. It was set down until four big horses had all they could pull and again one-third of the field was gone over twice, one-third of it three times and the last third four times. This year the field yielded five tons per acre in three cuttings and the piece which had received the most severe treatment each year was by far the best part of the field. Each winter the field was manured and it certainly paid well.

In carrying out a job of this kind it is usually best for the owner to give the hired man careful instructions as to what to do and then leave the farm until the job is done. It was hard to believe last spring that it could be profitable to tear up a nice thick stand of alfalfa four inches high until the ground was all black and apparently ready to plant. It seemed as though blue grass, alfalfa and everything else had been destroyed, and yet the yield this year and the quality of the hay were both astonishingly good. It would undoubtedly do just as well to disk or spring tooth the field just after the first or second crop had been cut, but as that is such a busy season of the year the work is apt to be neglected. Early in the spring the alfalfa field can be worked when the plow land is too wet to handle and our results here would indicate that the spring working is just as desirable.

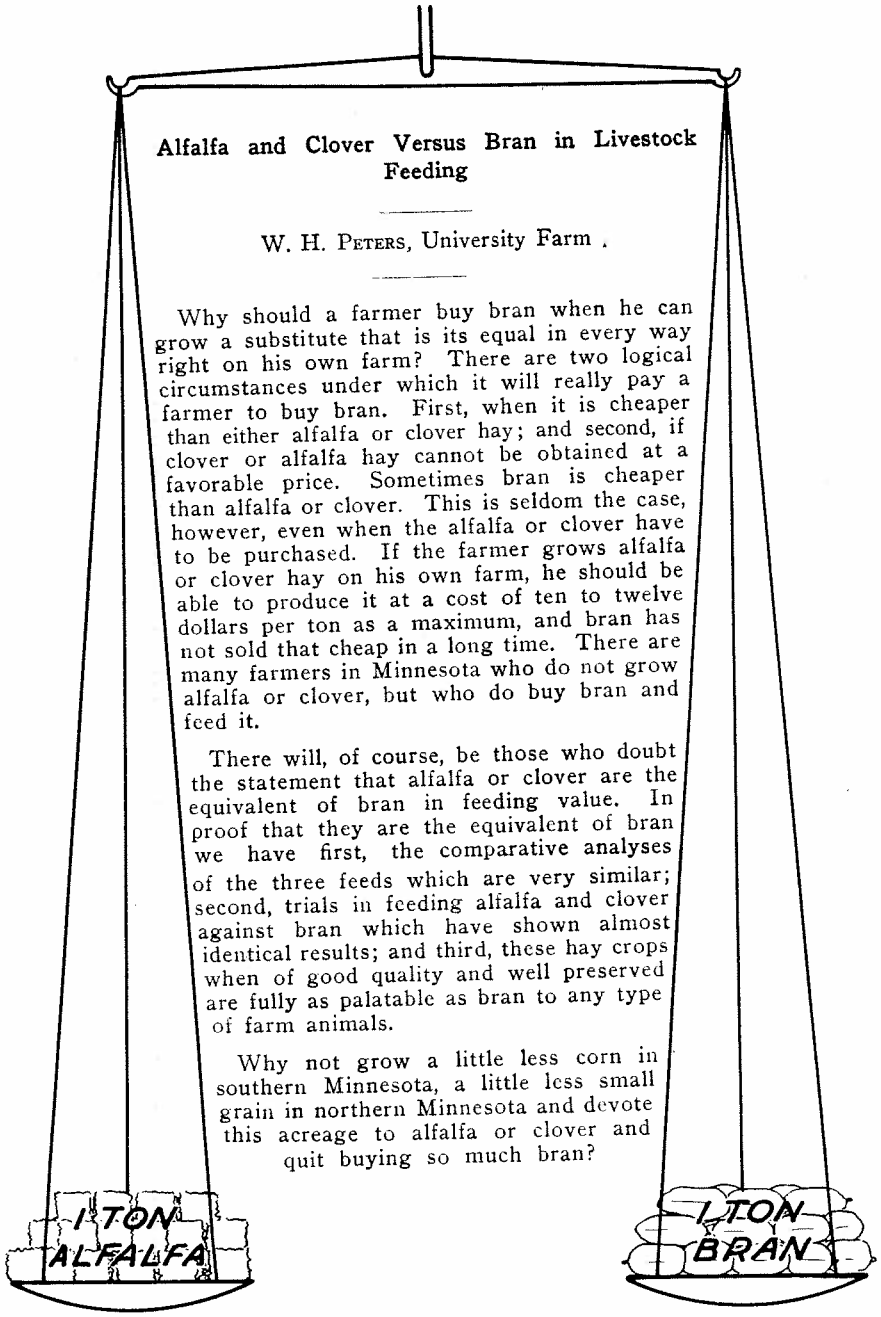
Alfalfa and Clover Versus Bran in Livestock Feeding

W. H. Peters, University Farm.

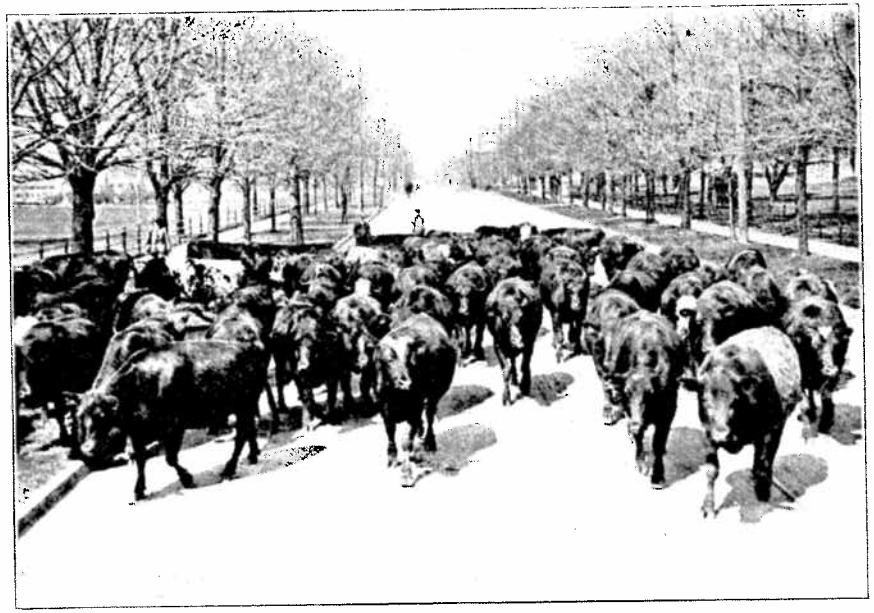
Why should a farmer buy bran when he can grow a substitute that is its equal in every way right on his own farm? There are two logical circumstances under which it will really pay a farmer to buy bran. First, when it is cheaper than either alfalfa or clover hay; and second, if clover or alfalfa hay cannot be obtained at a favorable price. Sometimes bran is cheaper than alfalfa or clover. This is seldom the case, however, even when the alfalfa or clover have to be purchased. If the farmer grows alfalfa or clover hay on his own farm, he should be able to produce it at a cost of ten to twelve dollars per ton as a maximum, and bran has not sold that cheap in a long time. There are many farmers in Minnesota who do not grow alfalfa or clover, but who do buy bran and feed it.

There will, of course, be those who doubt the statement that alfalfa or clover are the equivalent of bran in feeding value. In proof that they are the equivalent of bran we have first, the comparative analyses of the three feeds which are very similar; second, trials in feeding alfalfa and clover against bran which have shown almost identical results; and third, these hay crops when of good quality and well preserved are fully as palatable as bran to any type of farm animals.

Why not grow a little less corn in southern Minnesota, a little less small grain in northern Minnesota and devote this acreage to alfalfa or clover and quit buying so much bran?



In the marketing of hay and roughage there is a large bulk to handle and haul to the point of delivery. Here there is much extra labor for the men and teams on grain and crop farms, and much fertility is taken off which might otherwise be returned to the fields.



One of the chief advantages in keeping cattle is that they assimilate large quantities of roughage and waste feeds and carry it to market themselves in a more concentrated form. The farmer is thus saved the labor of marketing bulky feed products, as in the upper picture, and the fertility remains on the farm.

COST OF PRODUCING ALFALFA IN STEELE, COUNTY MINNESOTA

By C. E. Wise, Jr., University Farm

Alfalfa is an excellent feed, saves high priced protein, can be produced cheaply and as a result, cost accounting figures show it to be a money maker. From the farm management view, alfalfa has one limitation in that the first cutting competes with corn cultivation, while the second cutting occurs during small grain harvest. The weather also limits the scale of production to farm consumption. An average farm of 160 acres should have from 5 to 10 acres of alfalfa.

Cost accounting data show that alfalfa usually pays. Some farmers make more than others. The factors that vary the profit are clearly indicated in the accompanying table.

Cost of Producing Alfalfa in 1921

	Av. 1¼ Tons 3 farms	Av. 2½ Tons 6 farms	Av. 4¼ Tons 6 farms
Man hours @ 30c..	$2.70	$5.40	$7.05
Horse hours @ 15c.	1.88	3.56	4.88
Seed	6.40	6.40	6.40
Machinery	1.60	1.60	1.60
Land Rent	6.50	6.50	6.50
Total	$19.08	$23.46	$26.43
Yield tons per acre.	1¼	2½	4¼
Price per ton	$17.00	$17.00	$17.00
Value per acre....	$21.25	$42.50	$72.25
Profit	2.17	19.04	45.82

The above figures are based on cost accounts kept by the Division of Agronomy and Farm Management of the Minnesota College of Agriculture in co-operation with farmers in Steele County. The man hours are figured at 30c per hour and the horse hours at 15c per hour. The alfalfa was cut, raked and bunched for curing. Two cuttings were made as a rule. The charge of $6.40 for seed and seeding seems high, but it covers labor of seeding 12 to 15 pounds of seed per acre, a light application of lime, inoculation and land rent for one year, as no nurse crop is used in Steele County. The total cost of labor, seed, lime and rent ($25.60) is distributed equally over four years upon the assumption that the stand will last for four years. The machinery charge $1.60 per acre is taken from the average cost of machinery used on alfalfa for the year. Depreciation, interest on investment and repairs are all accounted for. Land rent at $6.50 is the average cash rent paid in Steele County. The sale price of $17.00 per ton is the December 1st price at the local market.

Alfalfa requires less labor than corn and more than small grain.

Two factors that affect profit on any crop and are subject to change are labor and yield. When the yield is light, the only decrease in cost is a small saving on labor; the other costs being fixed. An increase in yield increases the labor, but not in proportion to the yield. It takes nine man hours and twelve horse hours to harvest a yield of 1¼ tons. An increase of three tons in the yield increases the labor to 23½ man hours and 32½ horse hours. The yield was increased 3½ with only 2½ times the amount of labor. Roughly, in dollars, five dollars spent on harvesting large yields accomplishes as much as seven dollars on small yields of alfalfa. Profits are in direct proportion to yield. At $17.00 per ton, 1 ton pays the fixed charges and the harvesting. The man labor alone for harvesting ranges from $1.50 to $3.50 per ton, with an average of $2.50. With the first ton to pay

expenses every additional ton yields a profit of $17.00 minus $2.50 or $14.50. With this method, a yield of 2½ tons gives a profit of $21.75, while a yield of 4¼ tons gives a profit of approximately $47.13. With a yield of 2½ tons one could get $6.50 per acre land rent and wages for man and horse labor, if the hay were worth $9.38 per ton.

The figures in the table show the value of high yields and the possibilities offered. On the average farm a small tract of alfalfa given the proper attention in preparation and handling will be far more profitable than a larger acreage managed carelessly. Five acres yielding 4 tons per acre better than 10 acres, producing 2 tons each. The gross results are the same, while the net results give the high yield an advantage of $71.50. Alfalfa, when compared with other legumes and hays on this basis, shows clearly the reason for its increasing popularity.

Alfalfa is all the agronomist and feeder claim for it and more than pays its way in a time when most crops give little return for land rent after charging labor and other expenses of production. The question is no longer whether or not to grow alfalfa, but how to get a good stand and how much to grow.

Growing a Crop of Alfalfa Requires Less Labor than Corn and More than Wheat

Notice the figures on the opposite page. They are from actual accounts kept by the Division of Farm Management, and they show that

PROFITS ARE IN DIRECT PROPORTION TO YIELD

AND MAY VARY FROM TWO DOLLARS TO FORTY-FIVE DOLLARS PER ACRE.