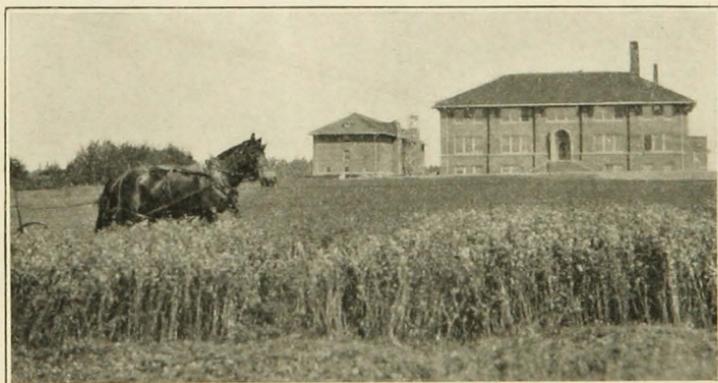


UNIVERSITY OF MINNESOTA  
AGRICULTURAL EXPERIMENT STATION

ALFALFA TRIALS AT THE NORTH  
CENTRAL EXPERIMENT STATION

OTTO I. BERGH  
NORTH CENTRAL EXPERIMENT STATION  
GRAND RAPIDS, MINNESOTA



UNIVERSITY FARM, ST. PAUL

## CONTENTS

	Page
Introduction .....	3
Liming .....	3
Sowing alfalfa with and without grain crop.....	7
Rate of planting.....	8
Inoculation .....	10
Varieties .....	11
Summary .....	14
Recommendations on growing alfalfa in the timbered district of northern Minnesota .....	15
Appendix .....	18

## ILLUSTRATIONS

Fig. 1. Alfalfa mixed with clover makes good hay.....	5
2. Alfalfa, three feet deep, on the farm of Frank Pohl and Sons, Remer, Minnesota .....	6
3. Alfalfa fields like this make dairying profitable.....	6
4. Comparing yields from rates of planting.....	8
5. Cut alfalfa when one-half to full bloom.....	10
6. Windrowing alfalfa with the side delivery rake.....	11
7. Curing alfalfa in windrows.....	11
8. Per cent of stand of alfalfa varieties five years after planting.....	12
9. Loading from the swath.....	13
10. Alfalfa cures better in the windrow and loading is quicker.....	13
11. Discussing alfalfa varieties .....	14
12. Second growth Grimm 18 days after first cutting.....	16
13. Close grazing of alfalfa in late fall may result in winter-killing.....	16
14. Corn crop following alfalfa at the North Central Experiment Station	17

# ALFALFA TRIALS AT THE NORTH CENTRAL EXPERIMENT STATION

OTTO I. BERGH

## INTRODUCTION

Hay is a major crop among the farm crops at Grand Rapids and is grown chiefly as roughage for dairy cattle. The farmer realizes that it is important that his hay should contain ash and protein in goodly quantities, both for the most economical feeding and to maintain the cows in strong, thrifty condition under the constant drain of milk production. He realizes that legumes best meet the requirements and therefore gives them prominence in his meadows. Alsike and red clovers grow readily on new land and are used almost exclusively, except when an annual hay crop is desired. Under these conditions the legume used is usually field peas. However, alfalfa has been grown by an occasional farmer, mostly in a small way and with varying success. Those who have grown it successfully have increased the acreage while those who have met with failures have, for the most part, placed their sole reliance on the alsike and red clovers.

Many inquiries relating to the growing of alfalfa have been and still are being received from farmers. The questions relate to the need for liming, the amount of seed to plant, when and how to inoculate, what varieties are winter hardy, and others.

To be able to answer the questions, projects have been laid down on several fields. The investigations date back to 1915. However, a number of projects have been carried on since to determine the various factors essential for successful alfalfa growing in this district on soils such as are being cropped on the experimental farm.

## LIMING

The first project to determine the effects of liming was laid down on the hill field in 1915. The soil is a fine, sandy loam developed on a sandy moraine. The subsoil is variable, ranging from sand to sandy clay with a considerable number of boulders and cobblestones. Two plots in this project received quick lime at the rate of 2,000 pounds per acre, while two other plots were left untreated. The average yield from the limed plots for a period of three years, 1916-18, was 3,525 pounds of air-dried alfalfa hay; from the two untreated plots, 3,534 pounds.

TABLE I  
YIELDS PER ACRE OF ALFALFA, FIELD CURED, 1916-18

Plot	Variety	1916			1917			1918			Three-year average		
		First cutting	Second cutting	Average	First cutting	Second cutting	Average	First cutting	Second cutting	Average	First cutting	Second cutting	Yearly average
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	Minn. Grimm .....	5,028	1,029	6,057	416	232	648	3,060	1,600	4,660	2,835	954	3,789
2	Disco No. 52 .....	2,514	800	3,314	171	95	266	3,460	700	4,160	2,048	532	2,580
3	Turkestan .....	2,971	1,829	4,800	306	170	476	3,080	1,200	4,280	2,119	1,066	3,185
4	Imp. N. K. & Co. ....	2,971	2,171	5,142	172	95	267	2,440	1,020	3,460	1,861	1,095	2,956
5	N. W. Experiment Station.....	4,114	2,400	6,514	409	227	636	2,640	1,200	3,840	2,388	1,275	3,663
6	Dakota .....	2,286	2,743	5,029	166	92	258	2,000	1,000	3,000	1,484	1,278	2,762
7	Disco No. 28—South Dakota.....	3,200	1,829	5,029	108	60	168	2,200	1,000	3,200	1,836	963	2,799
8	Kansas .....	3,200	2,514	5,714	205	114	319	2,520	800	3,320	1,975	1,143	3,118
9	Montana .....	3,200	1,829	5,029	209	116	325	2,160	1,000	3,160	1,856	982	2,838
10	Turkestan .....	3,200	2,743	5,943	155	86	241	2,600	1,000	3,600	1,985	1,276	3,261
11	Grimm .....	3,771	2,400	6,171	522	290	812	2,440	1,200	3,640	2,244	1,296	3,540
12	Disco No. 52 .....	2,514	2,629	5,143	187	104	291	2,040	600	2,640	1,580	1,111	2,691
	Average, all varieties.....	3,247	2,076	5,323	252	141	393	2,553	1,027	3,580	2,018	1,081	3,099
13	Turkestan, no treatment.....	5,291	1,920	5,211	384	213	597	3,264	1,656	4,920	2,313	1,263	3,576
14	Turkestan, limed 2,000 lbs. per acre	2,834	1,645	4,479	296	164	460	3,280	1,520	4,800	2,133	1,110	3,243
15	Turkestan, limed 2,000 lbs. per acre, seed treated with Govt. bacteria culture .....	3,749	1,920	5,669	475	264	739	3,760	1,256	5,016	2,661	1,147	3,808
16	Turkestan, seed treated with bac- teria culture.....	3,200	2,012	5,212	300	167	467	3,440	1,360	4,800	2,313	1,180	3,493
	Average, all plots.....	3,269	1,874	5,143	364	202	566	3,436	1,448	4,884	2,355	1,175	3,530

The second project was on the south field. Half the plots received two tons of ground limestone per acre and half was left untreated. The average yield from the plots treated with limestone for 1926, 1927, and 1928 was 5,842.1 pounds; from the untreated plots, 6,122.5 pounds.



Fig. 1. Alfalfa Mixed with Clover Makes Good Hay

The results indicate no benefit from the lime treatment and confirm the previous results. Alfalfa has also been planted on the west fields, in a mixture of timothy and clover, on land limed and unlimed. Here, again, there was no apparent benefit from liming.

TABLE II

LIME VS. NO LIME\*—THREE-YEAR AVERAGE YIELD OF ALFALFA PER ACRE, 1926-28

Plot No.	Rate of seeding per acre	Lime			No lime		
		With grain crop	Without grain crop	Average	With grain crop	Without grain crop	Average
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	8	6,406	5,940	6,173	5,340	6,192	5,766
2.....	12	6,192	5,946	6,069	6,026	6,232	6,129
3.....	16	6,272	5,792	6,032	6,400	6,712	6,556
4.....	20	5,952	6,032	5,992	6,280	6,512	6,396
5.....	8	6,032	6,272	6,152	6,080	6,592	6,336
6.....	12	5,660	5,940	5,800	5,872	6,480	6,176
7.....	16	5,346	5,952	5,649	5,606	6,232	5,919
8.....	20	5,332	5,426	5,379	5,912	6,192	6,052
9.....	8	5,666	6,192	5,929	6,240	6,112	6,176
10.....	12	5,766	5,872	5,819	5,812	6,760	6,286
11.....	16	5,546	5,900	5,723	5,580	6,552	6,066
12.....	20	5,766	5,012	5,389	5,466	5,760	5,613
Averages of three plots							
1-5-9.....	8	6,034.6	6,134.6	6,084.6	5,886.6	6,298.6	6,092.6
2-6-10.....	12	5,872.6	5,919.3	5,895.9	5,903.3	6,490.6	6,196.9
3-7-11.....	16	5,721.3	5,881.3	5,801.3	5,862.0	6,498.6	6,180.3
4-8-12.....	20	5,683.3	5,490.0	5,586.6	5,886.0	6,154.6	6,020.3
Average yield per acre with 2 tons of lime, lbs. ....							5,842.1
Average yield per acre without lime, lbs. ....							6,122.5

\* For detailed data, refer to tables in the Appendix.

All of these fields had previously received applications of stable manure and the soil was fairly fertile, affording favorable conditions for the young alfalfa plants. The subsoil, a glacial drift, is well supplied with lime, as indicated by the limestone boulders that are uncovered during road construction work and other excavating. It is concluded, therefore, that in this district, on soils like those here dealt



Fig. 2. Alfalfa, Three Feet Deep, on Farm of Frank Pohl and Sons, Remer, Minnesota

with, alfalfa can be grown successfully without liming, if the soil is in a fertile condition. On some soils in this district liming may be necessary for the growth of alfalfa.

If satisfactory alfalfa crops can be obtained without liming, it permits the use of the field in the regular rotation with less danger of growing scabby potatoes.

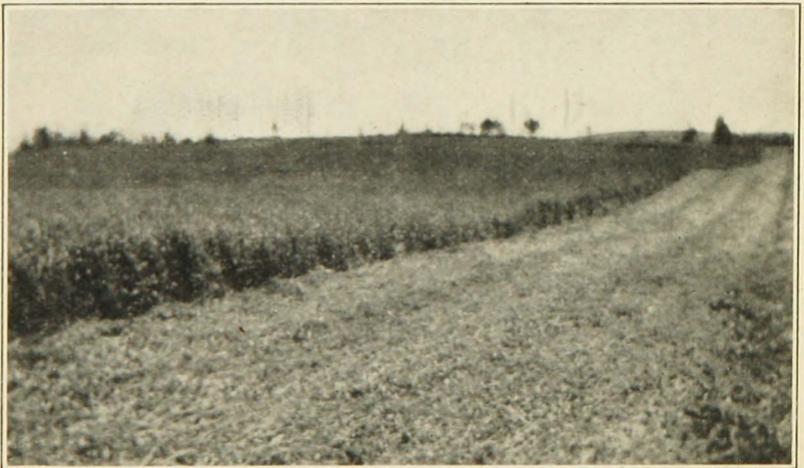


Fig. 3. Alfalfa Fields Like This Make Dairying Profitable

## SOWING ALFALFA WITH AND WITHOUT GRAIN CROP

Projects comparing the yields from alfalfa planted with and without grain crop indicate a slight advantage in favor of the plots with no grain crop. This is true if the new seeding is left uncut and unpastured to catch and hold the snow, permitting the stalks to protrude through the ice during the spring break-up and allow adequate ventilation. If a grain crop is used and is not cut too closely, the remaining stubble provides the required conditions.

The average yields over a period of three years, 1926-28, from all plots planted without a grain crop was 6,108.4 pounds; with a grain crop, 5,856.07 pounds per acre. In this district, where the acreage of land under cultivation is still limited and an ample winter supply of feed for the livestock is of primary importance, it seems advisable to plant alfalfa with a grain crop. However, the following precautions should be taken: (1) Select an early maturing grain crop. (2) Do not plant grain crop too thickly, especially if the soil is very fertile.

TABLE III

GRAIN CROP VS. NO GRAIN CROP—THREE-YEAR AVERAGE YIELD OF ALFALFA PER ACRE, 1926-28

Plot No.	Rate of seeding per acre	With grain crop			Without grain crop		
		Lime	No lime	Average	Lime	No lime	Average
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	8	6,406	5,340	5,873	5,940	6,192	6,066
2.....	12	6,192	6,025	6,109	5,946	6,232	6,089
3.....	16	6,272	6,400	6,336	5,792	6,712	6,252
4.....	20	5,952	6,280	6,116	6,032	6,512	6,272
5.....	8	6,032	6,080	6,056	6,272	6,592	6,432
6.....	12	5,660	5,872	5,766	5,940	6,480	6,210
7.....	16	5,346	5,606	5,476	5,952	6,232	6,092
8.....	20	5,332	5,912	5,622	5,426	6,192	5,809
9.....	8	5,666	6,240	5,953	6,192	6,112	6,152
10.....	12	5,766	5,812	5,789	5,872	6,760	6,316
11.....	16	5,546	5,580	5,563	5,900	6,552	6,226
12.....	20	5,766	5,466	5,616	5,012	5,760	5,386
Averages of three plots							
1-5-9.....	8	6,034.6	5,886.6	5,960.2	6,134.6	6,298.6	6,216.6
2-6-10.....	12	5,872.6	5,903.3	5,887.9	5,919.3	6,490.6	6,204.9
3-7-11.....	16	5,721.3	5,862.0	5,791.6	5,881.3	6,498.6	6,189.9
4-8-12.....	20	5,683.3	5,886.0	5,784.6	5,490.0	6,154.6	5,822.3
Average yield per acre with grain crop, lbs. ....							5,856.07
Average yield per acre without grain crop, lbs. ....							6,108.42

\* For detailed data refer to tables in Appendix.

It is not advisable to use more than two bushels of oats or one and one-half bushels of barley per acre. (3) Plant as early in the spring as possible to assure ample soil moisture while the alfalfa plants are small. There is usually ample moisture during the time the frost is going out of the ground. Packing the seedbed with a roller or culti-

packer after planting will aid in bringing moisture to the surface to assure germination of the seed.<sup>1</sup> (4) In case of excessive drought, do not allow the grain crop to mature but cut for hay, thereby conserving the soil moisture for the alfalfa plants.

### RATE OF PLANTING

Results from rate of planting indicate that from eight to twelve pounds per acre is sufficient if the following precautions are taken: (1) The land should be properly fertilized by applications of manure

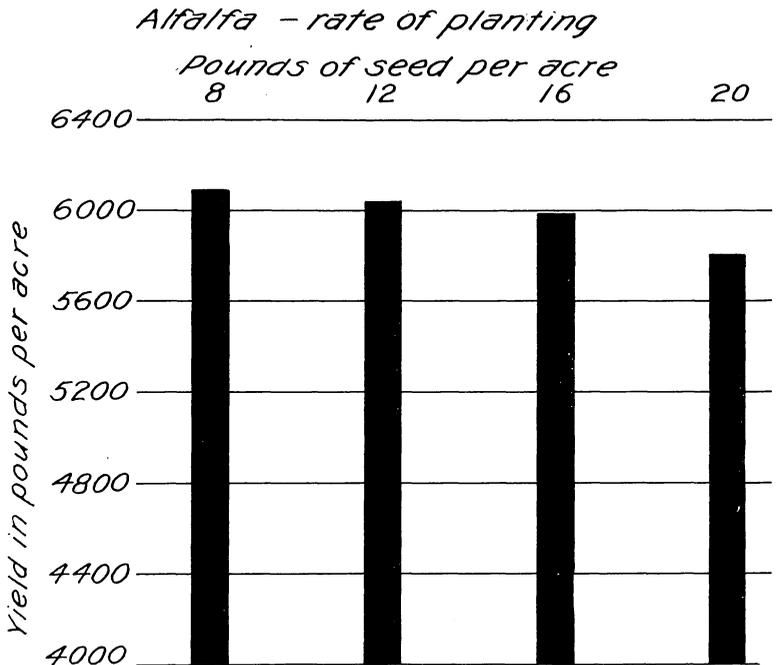


Fig. 4. Comparing Yields from Rates of Planting  
Yields are indicated in pounds per acre, two cuttings.

or commercial fertilizers. (2) The seedbed should be well pulverized, packed, and moist. (3) The seed should show a high germination test. (4) Seed should be planted not to exceed one-half inch on light soils, and less on heavy soils.

<sup>1</sup> "Sometimes a farmer wishing to seed alfalfa with a small grain will find that the surface is too dry for alfalfa, altho everything is favorable for the grain. Under such conditions, if both are seeded, the grain, being put down much deeper, will germinate and may make considerable growth before rain comes to start the alfalfa. Then, even if the alfalfa at first makes a full stand, it will be at a disadvantage in competition with the grain, should dry weather set in before harvest. It would be better to delay the seeding of the grain with which the expensive alfalfa seed is to be sown, until a rain gives the desired moist surface to the soil." Agr. Ext. Special Bull. No. 107, page 24.

TABLE IV  
RATE OF SEEDING ALFALFA AND THREE-YEAR AVERAGE YIELD PER ACRE\*

Plots	Rate of seed per acre												
	Eight pounds per acre			Twelve pounds per acre			Sixteen pounds per acre			Twenty pounds per acre			
	1	5	9	2	6	10	3	7	11	4	8	12	
Without grain crop	Lime .....	Lbs. 5,940	Lbs. 6,272	Lbs. 6,192	Lbs. 5,946	Lbs. 5,940	Lbs. 5,872	Lbs. 5,792	Lbs. 5,952	Lbs. 5,900	Lbs. 6,032	Lbs. 5,426	Lbs. 5,012
	No lime .....	6,192	6,592	6,112	6,232	6,480	6,760	6,712	6,232	6,552	6,512	6,192	5,760
With grain crop	Lime .....	6,406	6,032	5,666	6,192	5,660	5,766	6,272	5,346	5,546	5,952	5,332	5,766
	No lime .....	5,340	6,080	6,240	6,026	5,872	5,812	6,400	5,606	5,580	6,280	5,912	5,466
No lime	With grain crop.....	6,406	6,032	5,666	6,192	5,660	5,766	6,272	5,346	5,546	5,952	5,332	5,766
	Without grain crop....	5,940	6,272	6,192	5,946	5,940	5,872	5,792	5,952	5,900	6,032	5,426	5,012
Lime, 2 tons	With grain crop.....	5,340	6,080	6,240	6,026	5,872	5,812	6,400	5,606	5,580	6,280	5,912	5,466
	Without grain crop....	6,192	6,592	6,112	6,232	6,480	6,760	6,712	6,232	6,552	6,512	6,192	5,760
Average yield per plot.....		5,969.5	6,244.0	6,052.5	6,099.0	5,988.0	6,052.5	6,294.0	5,784.0	5,894.5	6,194.0	5,715.5	5,501.0
Average yield of different rates.....		6,088.6			6,046.5			5,990.8			5,803.5		

\* For detailed data refer to tables in Appendix.

Table IV shows the average yields from the different rates of seed used for a period of three years. The yields are slightly in favor of the thinner plantings. However, the quality of hay from the thicker planting was superior, in that it was finer stemmed than the hay from the plots where less seed was used.

### INOCULATION

Of all factors, except possibly that of varietal hardiness, inoculation is the most important, especially on farms where alfalfa has not previously been grown. If the soil shows marked acidity, it may be necessary to inoculate before each new planting even tho alfalfa has been grown there previously. On the first project laid down at the station, the benefits from inoculation were quite apparent and especially so when the inoculation was made by using soil from well-established



Fig. 5. Cut Alfalfa When One-half to Full Bloom

alfalfa fields. Plants appeared much more thrifty, of uniform size, and the color was a uniform dark green when inoculation was made with inoculated soil. The plants from seed not inoculated were less uniform in size and many showed a light green or yellow color. The yield from the two plots planted with seed inoculated with bacteria culture gave an average yield for the three-year period, 1916-18, of 3,650 pounds per acre as against 3,409 pounds from the adjacent plots where the seed was not treated. One plot of each pair had received 2,000 pounds of quick lime before being seeded in 1915.

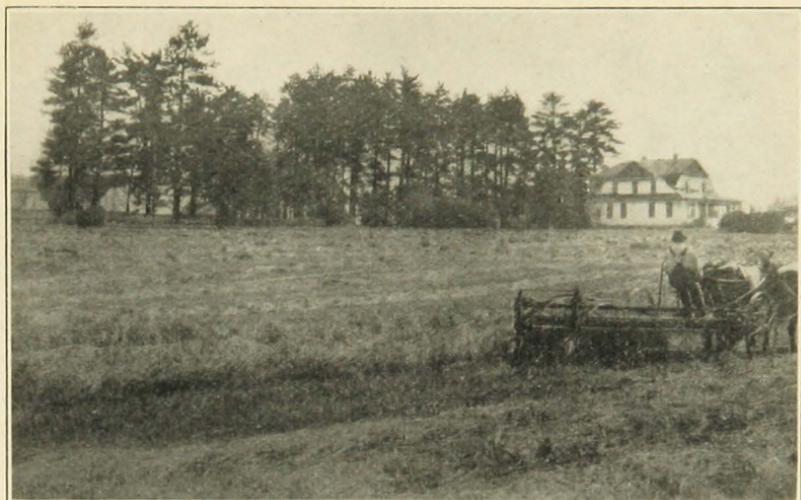


Fig. 6. Windrowing Alfalfa with the Side Delivery Rake



Fig. 7. Curing Alfalfa in Windrows

### VARIETIES

The Grimm variety has uniformly proved to be one of the most hardy. However, the Baltic appears to be almost, if not fully, as hardy as Grimm. The Ladak, a new variety included only in the last project which is still being continued, also appears to be hardy. Other varieties that are fairly hardy, tho not comparable with Grimm or Baltic, are Cossack and Turkestan.

*Alfalfa Varieties*

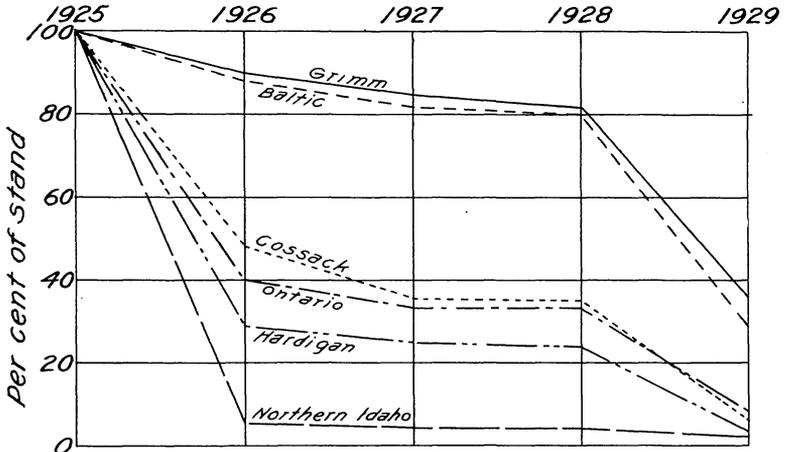


Fig. 8. Per Cent of Stand of Alfalfa Varieties Five Years After Planting

TABLE V  
YIELD PER ACRE OF ALFALFA, FIELD CURED, 1916-18

Plot No.	Variety	1915 seeding, south field			Three-year average
		1916	1917*	1918	
		Lbs.	Lbs.	Lbs.	Lbs.
1	Minnesota Grimm	6,057	648	4,660	3,789
5	N. W. Experiment Station	6,514	636	3,840	3,663
11	Grimm	6,171	812	3,640	3,540
10	Turkestan	5,943	241	3,600	3,261
3	Turkestan	4,800	476	4,280	3,185
8	Kansas	5,714	319	3,320	3,118
4	Imp. N. K. & Co.	5,142	267	3,460	2,956
9	Montana	5,029	325	3,160	2,838
7	Disco No. 28 So. Dak.	5,029	168	3,200	2,799
6	Dakota, Common	5,029	258	3,000	2,762
12	Disco No. 52	5,143	291	2,640	2,691
2	Disco No. 52 So. Dak.	3,314	266	4,160	2,580

\* The rainfall for 1917 was the lowest on record over a period of 43 years. The precipitation for twelve months was only 14.7 inches, as against the annual normal precipitation of more than 25 inches.

TABLE VI  
YIELD PER ACRE OF ALFALFA, FIELD CURED, 1927-28

Plot Nos.	Variety	1924 seeding, west field		Two-year average
		1927	1928	
		Lbs.	Lbs.	Lbs.
1-8-15	Grimm, Minnesota	5,680	6,040	5,860
5-12-19	Baltic	5,760	5,620	5,690
7-14-21	Grimm	5,840	5,140	5,490
4-11-18	Ontario	5,020	4,500	4,760
2-9-16	Cossack	4,840	4,460	4,650
3-10-17	Hardigan	4,700	4,540	4,620
6-13-20	Northern Idaho	3,500	3,060	3,280

TABLE VII  
YIELD PER ACRE OF ALFALFA, FIELD CURED, 1928-29

Plot Nos.	Variety	1927 seeding, west field		Two-year average
		1928	1929	
		Lbs.	Lbs.	Lbs.
6a-14a-22a	Baltic .....	8,260	2,660	5,460
4-12-20	Ladak .....	8,160	2,700	5,430
5-13-21	Cossack .....	8,020	2,540	5,280
3-11-19	Grimm Sel. No. 666.....	7,320	3,040	5,180
6-14-22	M. A. C. Sel. ....	7,680	2,220	4,950
2-10-18	Grimm Sel. No. 451.....	6,920	2,940	4,930
1-9-17	Grimm .....	7,260	2,500	4,880
7-15-23	So. Dak. No. 12.....	7,240	1,220	4,230
8-16-24	Idaho Common .....	7,320	1,000	4,160

It should be noted that the weights in the above tables represent not only the weights of the alfalfa but also weed and grass mixtures. Table VIII on per cent of stand indicates more clearly the comparative hardiness of the different varieties.

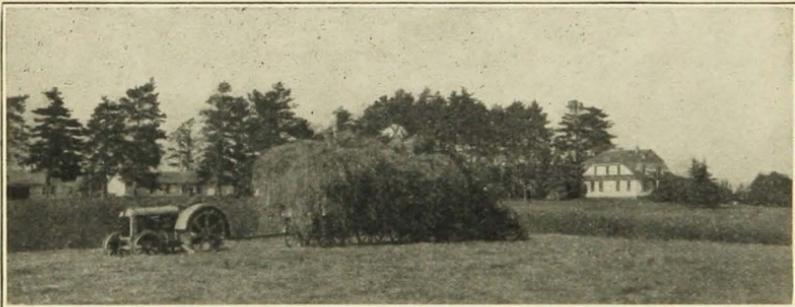


Fig. 9. Loading from the Swath



Fig. 10. Alfalfa Cures Better in the Windrow and Loading Is Quicker

TABLE VIII  
VARIETIES, PER CENT OF STAND, 1927-29

Plot Nos.	Variety	1924 seeding, west field		
		1927, third crop, per cent of stand	1928, fourth crop, per cent of stand	1929, fifth crop, per cent of stand
7-14-21	Grimm, Certified .....	82.5	83.0	42.0
1-8-15	Grimm, Minnesota .....	83.3	80.0	30.0
5-12-19	Baltic .....	81.7	80.0	29.0
2-9-16	Cossack .....	35.8	35.0	6.0
4-11-18	Ontario Variegated .....	33.3	33.5	8.0
3-10-17	Hardigan .....	25.0	24.0	3.0
6-13-20	Idaho Common .....	4.2	4.0	T to 2

The data in Table VIII, showing the per cent of stand or extent of winter-killing of the different varieties of alfalfa for the third, fourth, and fifth year after planting, is striking evidence of the superior hardiness of Grimm and Baltic as compared with other varieties.



Fig. 11. Discussing Alfalfa Varieties

## SUMMARY

1. Liming for alfalfa planted on land previously well fertilized with stable manure did not result in larger yields.
2. Gopher oats planted at the rate of two bushels per acre, or barley at the rate of one and one-half bushels did not appreciably affect the stand of alfalfa unfavorably, or greatly reduce the yield of hay.
3. Inoculation with soil from a well-established alfalfa field gave better results than inoculation with the bacteria culture available at that time, 1916-18.
4. The Grimm variety was consistently the most winter hardy variety in all trials. Grimm has been grown in Minnesota for nearly three fourths of a century, and registered seed of this variety is easily obtainable.

TABLE IX

SUMMARY ON RATE OF SEEDING ALFALFA; THREE-YEAR AVERAGE YIELD PER ACRE, 1926-28

Plot Nos.	Rate of seeding per acre	Treatment			Average yield	
		Two tons of lime	No lime	With grain crop		Without grain crop
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1-5-9.....	8	6,084.6	6,092.6	5,960.2	6,216.6	6,088.6
2-6-10.....	12	5,895.9	6,196.9	5,887.9	6,204.9	6,046.5
3-7-11.....	16	5,801.3	6,180.3	5,791.6	6,189.9	5,990.8
4-8-12.....	20	5,586.6	6,020.3	5,784.6	5,822.3	5,803.5
Average from all rates of seeding .....		5,842.1	6,122.5	5,856.07	6,108.42	

## RECOMMENDATIONS ON GROWING ALFALFA IN THE TIMBERED DISTRICT OF NORTHERN MINNESOTA

1. Grow the Grimm variety. It is hardy, having been acclimated to Minnesota conditions for a period of 73 years. Certified Grimm seed is easily obtainable.

2. Use only seed showing a high germination test. If such seed is used the planting of 8 to 12 pounds per acre is sufficient. If seed with a low per cent of germination is used, a proportionately larger amount must be planted to obtain a satisfactory stand.

3. The field should be well drained. Water standing and freezing on an alfalfa meadow will kill the crowns by smothering.

4. Inoculate with soil from a well-established alfalfa field. One bushel of such soil well distributed through each spreader load of stable manure, where eight to ten tons is used per acre, will satisfactorily inoculate the field. If inoculated soil is not available, bacteria culture may be purchased and applied to the seed just before planting.

5. The land should be well packed and pulverized, and should be free from perennial grasses, particularly quack grass and blue grass. Annual weeds are seldom troublesome after the first year, and may help to protect the alfalfa through the first winter.

6. Plant alfalfa seed shallow—not more than one-half inch deep in light soil and even less in heavy soil.

7. If a grain crop is used, plant as early in the spring as possible to get the seedbed into proper condition for the grain crop. Early planting usually assures an ample supply of moisture for the germination of the seed. The slower growth of the grain crop during cool weather will also give the young alfalfa plants an opportunity to become established.

8. In case of drought, cut the grain crop for hay before maturing to save the soil moisture for the alfalfa plants. When possible, follow with a top dressing of stable manure. This serves as a mulch and further conserves soil moisture. It also stimulates the growth and gives added winter protection.

9. Cut the alfalfa for hay when from half to full bloom. This will be about the first of July and again the last of August in this district. Alfalfa should not be cut too late in the fall or pastured too closely. When the second crop is taken in August, it will produce a good growth during the fall for better winter protection.



Fig. 12. Second Growth Grimm 18 Days After First Cutting

10. When alfalfa or alsike and red clover are used as the main hay crops, the farm should be divided into six or more fields and a modified three-course rotation planned, including (1) cultivated crops, (2) grain crops, and (3) hay or seed crops.

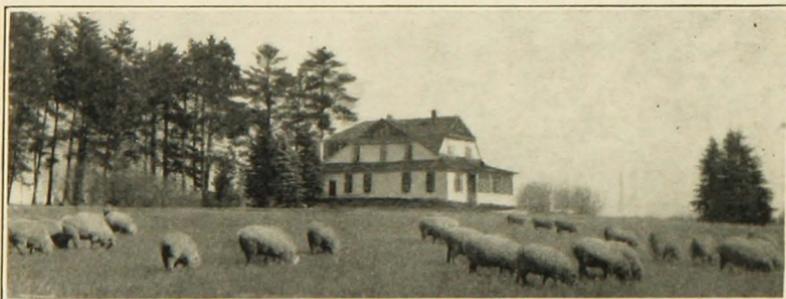


Fig. 13. Close Grazing of Alfalfa in the Late Fall May Result in Winter-Killing

Following the above rotation permits a crop program having one or two fields for cultivated crops, such as potatoes, roots, corn, or sunflowers; a field for grain in which the new seeding of alfalfa or clover may be made; and three or more fields of alfalfa or clover either

for hay or seed. This provides a regular place for alfalfa in the rotation and will allow leaving a field in alfalfa for three or more years if the stand should continue satisfactory. Alsike or red clover may be used alone as a catch crop when a new planting of alfalfa is not necessary or where one or more of the fields are too wet for growing alfalfa.

Alfalfa used in a cropping system in this manner will result in having at least half the tilled area of the farm in alfalfa or clover either for hay or seed. There will be an ample winter supply of roughage that will enable the farmer to maintain a maximum number of livestock in relation to the area in crops. It will also reduce the amount of plowing each year to one third of the tilled area. The growing of two cultivated crops in succession will offer an opportunity for weed eradication without disrupting the cropping scheme and throwing the



Fig. 14. Corn Crop Following Alfalfa at the North Central Experiment Station

farm system out of balance. This arrangement offers a wide choice of crops to meet farm needs and market conditions.

It provides a maximum amount of roughage of the right kind for the dairy herd and other livestock, and, finally, it will help maintain the land in a high condition of fertility for larger yields and more economical production of all the crops in rotation.

Alfalfa deserves more favorable recognition on dairy and livestock farms. No crop is more important. It has no peer among forage crops either in the quality, quantity, or net value produced per acre, year after year.

## APPENDIX

TABLE X  
LIME VS. NO LIME; YIELDS OF ALFALFA PER ACRE, 1926-28

Plot No.	Rate of seeding per acre	1926		1927		1928	
		Lime	No lime	Lime	No lime	Lime	No lime
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	8	4,160	3,760	6,740	5,800	7,620	7,740
2.....	12	4,120	3,920	7,200	6,260	6,890	8,210
3.....	16	4,360	4,120	6,360	6,480	7,380	9,070
4.....	20	4,000	3,760	6,240	6,120	7,740	9,310
5.....	8	4,000	4,600	6,120	6,190	8,340	8,220
6.....	12	3,920	4,660	5,620	5,770	7,860	8,100
7.....	16	4,000	4,340	5,580	5,200	7,370	8,220
8.....	20	3,800	4,600	6,300	5,940	6,040	7,620
9.....	8	4,660	4,120	7,200	5,950	5,930	8,460
10.....	12	4,040	4,040	7,010	6,480	6,410	8,340
11.....	16	4,040	4,060	6,720	6,890	6,410	7,250
12.....	20	3,570	3,520	6,670	6,430	5,930	6,890
Yearly average, each treatment.....		4,055.8	4,125.0	6,480	6,125.8	6,993.3	8,119.16

TABLE XI  
GRAIN CROP VS. NO GRAIN CROP; YIELDS OF ALFALFA PER ACRE, 1926-28

Plot No.	Rate of seeding per acre	1926		1927		1928	
		Grain crop	No grain crop	Grain crop	No grain crop	Grain crop	No grain crop
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	8	4,000	3,920	6,120	6,420	7,500	7,860
2.....	12	4,040	4,000	6,550	6,910	7,740	7,360
3.....	16	4,480	4,000	6,670	6,170	7,860	8,590
4.....	20	4,120	3,640	5,640	6,720	8,590	8,460
5.....	8	4,600	4,000	5,590	6,720	7,980	8,580
6.....	12	4,540	4,040	4,900	6,490	7,860	8,100
7.....	16	4,520	3,820	4,660	6,120	7,250	8,340
8.....	20	4,280	4,120	5,820	6,420	6,770	6,890
9.....	8	4,540	4,240	6,670	6,480	6,650	7,740
10.....	12	4,080	4,000	7,010	6,480	6,280	8,470
11.....	16	4,240	3,860	6,530	7,080	5,920	7,740
12.....	20	3,530	3,560	6,910	6,190	6,410	6,410
Yearly average, each treatment.....		4,247.5	3,933.33	6,089.1	6,516.66	7,234.1	7,878.33

TABLE XII  
RATE OF SEEDING ALFALFA AND YIELD PER ACRE, 1926-28

Plot No.	8 pounds of seed per acre			Plot No.	12 pounds of seed per acre		
	1926	1927	1928		1926	1927	1928
	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
1.....	3,960	6,270	7,680	2.....	4,020	6,730	7,550
5.....	4,300	6,154	8,240	6.....	4,280	5,694	7,980
9.....	4,380	6,574	7,194	10.....	4,040	6,744	7,374
Yearly average...	4,213.3	6,332.6	7,718		4,113.3	6,389.3	7,634.6
Three-year average		6,088				6,046	
Plot No.	16 pounds of seed per acre			Plot No.	20 pounds of seed per acre		
	1926	1927	1928		1926	1927	1928
	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
3.....	4,240	6,420	8,224	4.....	3,880	6,180	8,524
7.....	4,160	5,390	7,794	8.....	4,200	6,120	6,830
11.....	4,040	6,804	6,830	12.....	3,540	6,550	6,410
Yearly average...	4,146.6	6,204.6	7,616		3,873.3	6,283.3	7,254.6
Three-year average		5,990				5,803	