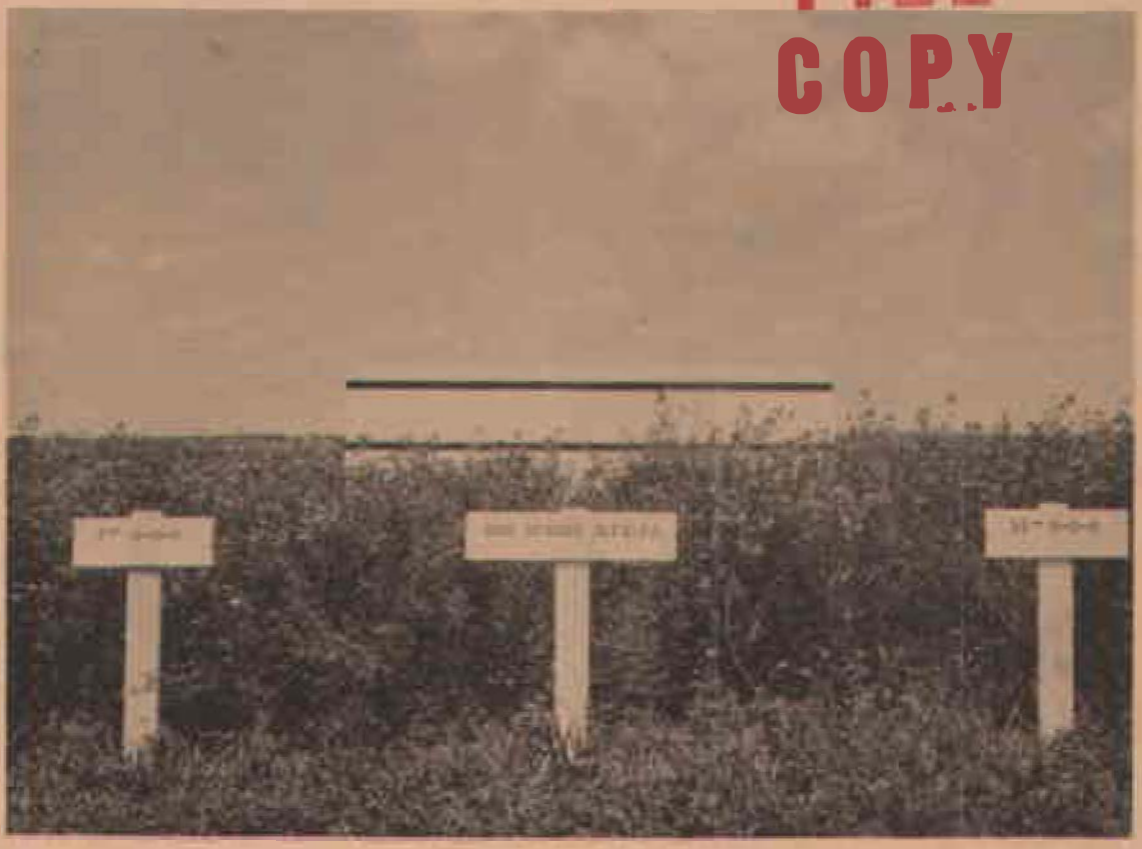
Agronomy Pamphlet #49 DECEMBER 1958

ANNUAL PROGRESS REPORT

NORTHEAST RESEARCH FARM



The picture illustrates Row Spaced Alfalfa in about three quarter bloom. This experiment also incorporates the use of phosphorous on the three row spacings 7", 21" and 35". Further discussion and results of this experiment may be found under the heading "Row Spacing and Seed Crops of Bromegrass and Alfalfa", in the Cultural Practice Section.

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Origin and History of Mobile Unit Farms

During the past several years there has been an increasing need for research work on crops and soils in the northeast and southeast areas of the state. After several meetings of the people interested in research for areas not already represented by experiment stations, plans were made to ask the State Legislature for additional appropriations for this work. Adequate funds were granted and two new Research Farms or "Mobile Units" were started in 1956. The term "Mobile Unit" was used for two reasons: (a) some of the equipment could be moved from one unit to another to prevent purchasing a full line of machinery for each location, (b) after 5 to 8 years (depending on the nature of the experiments selected) the experimental units would be moved to a new location within the area with an entirely new set of problems such as slope, drainage, fertility, soil type, etc.

In each of the two areas, meetings of interested farmers and county agents were held to set up area committees to assist the Agricultural Experiment Station in selection of the research farms and to plan the experiments. The Area Committees are composed of the county agents and one farmer from each county in the area.

After looking at several possible locations, a joint committee of farmers and college representatives selected the present farms. The amounts of land devoted to each form of agronomic research, and also the specific experiments on fertility and soil management, were selected by the respective area committees.

Each farm or unit represents a particular soil and problem area that is characteristic to that geographical region. The experimental work is performed precisely where the problems occur. Therefore, the results of these investigations are directly applicable to the regions studied, and in addition it is considerably easier for the people in these areas to observe experiments when the research is conducted near their homes.

Field days every other year, starting in 1958, will be held to observe first hand the results and progress of all experiments in the field. In addition, it is planned to have a winter meeting in each area to permit the presentation and discussion of results for all people who are interested.

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ANNUAL PROGRESS REPORT FOR

NORTHEASTERN RESEARCH FARM

1958

NOTE: This is a progress report and therefore results presented are not necessarily complete nor conclusive. Any interpretation given is strictly tentative because additional data resulting from continuation of these experiments may result in conclusions different than those of any one year.

INTRODUCTION

In the spring of 1955, money was appropriated by the State Legislature to begin new research on crops, soils and crop diseases in the northeastern part of the state. A site involving 20 acres was originally selected. It is located on the Otto Korth farm, 15 miles north of Watertown at the junction of Highways 81 and 20.

The purpose of this farm is to provide research facilities to obtain solutions of local problems in crop production and soil management. Experiments involving fertilizers, plant disease control, crop management, soil fertility, and crop variety testing have been underway for three crop seasons.

A winter meeting was held March 21, 1958 with the Northeast Research Farm Advisory Committee and county agents. They adopted the following policies: Field Days will be held on even years from 1958 on; the winter meeting will be held in Clark this year, and will be held in other counties in alphabetical order thereafter.

The third annual field day was held July 10, 1958 with approximately 225 people attending. The program included tours and lectures on moisture data, small grain diseases, spring grains, alfalfa insects, alfalfa diseases, grass and legume yields, and cultural practice work. Also included in the tour were opportunities for inspection of other areas of research such as, corn, sorghum, soybeans and potatoes. The next field day will be in July 1960.

This report was prepared by the staff members of the South Dakota State College as indicated in each section and assembled by Q. S. Kingsley, Agronomy Department.

1958 CROP SEASON

Table 1. Total Rainfall and Average Temperature by Months, with their Departure from Long-Time Average at N. E. Research Farm*, 1958

	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Rainfall in Inches	1.41	1.49	2.65	2.68	0.57	0.81	0.18	9.79
Departure from Long-Time Ave.	-0.65	-1.31	-1.16	-2.08	-1.12	-0.98	-.746	
Ave. Monthly Temperature in Degrees F.	41.9	56.3	64.5	69.2	57.8	46.9		
Departure from Long-Time Ave.	-3.5	-1.8	-12.7	-10.0	-2.4	-4.7	-0.7	
Frost Free Days		May 23 - Sept. 16				116 days		

* The above rainfall and temperature were taken and recorded at the N. E. Research Farm. The departure from long-time average was obtained by comparing the data taken at the farm to the long-time average at the Watertown weather Station, Courtesy U. S. Weather Bureau, Huron, S. Dak.

The temperatures and rainfall for the 1958 season were below normal for every month. The yields of corn were reduced, but small grain yields increased over the 1957 crop year. The low temperatures and low rainfall helped curb disease infections, which are associated with higher moisture and temperature conditions.

Sub soil moisture reserves were high at the beginning of the season, but were quite low in the fall. The rainfall for the recorded months was 7.46 inches less than normal.

FERTILITY AND CULTURAL PRACTICE EXPERIMENTS

By F. E. Shubeck and Q. S. Kingsley

Fertility Experiment #1

Objectives of Experiment

1. When there is no legume in the rotation is it better to apply a small amount of fertilizer every year, or a large amount in one application but only once in 4 or 5 years? What is the effect on per cent of protein in grain?
2. Which method will give the most effecient recovery of fertilizer nutrients?

Table 2. Residual Effect of Commercial Fertilizer on Yield of Corn and Per cent Protein in Grain.

1956 Fertilizer Treatment			Fertilizer applied both in 1957 and 1958			1958 Yield of Corn bu/acre	1958 % Protein in corn grain*
N	P_2O_5	K_2O	N	P_2O_5	K_2O		
0	0	0	0	0	0	43.3	10.29
40	20	0	40	20	0	46.2	10.88
80	40	0	0	0	0	46.5	10.57
120	60	0	0	0	0	44.2	10.56
160	80	0	0	0	0	48.0	10.78
200	100	0	0	0	0	46.4	10.63
L.S.D. at 5% level						3.3	

*Analyzed by Experiment Station Biochemistry Department.

This is the third crop taken from these plots (corn in 1956, oats in 1957 and corn in 1958.) Residual or carry over effect on yield of the third crop (corn) after fertilizing amounted to an increase of about 3 or 4 bushels per acre.

The annual application of 40-20-0 increased the yield of corn about the same as the residual effect of twice as much fertilizer appliedin 1956. This is somewhat different than the results obtained with oats the preceding year (1957). For oats in 1957, the annual application of 40-20-0 was decidedly more favorable from a yield standpoint than the residual effect of twice as much fertilizer applied in 1956. (Agronomy Pamphlet #43).

There was very little residual effect of fertilizer on per cent protein in corn grain in this experiment.

Fertility Experiment #2

Objectives of Experiment

1. Compare efficiency of alfalfa, red clover and biennial sweet clover for increasing grain yields.
2. Compare commercial nitrogen to legume nitrogen as a means of increasing crop yields.
3. Will a sweet clover fallow treatment increase grain yields sufficiently or reduce risks enough to justify its adoption?

Table 3. Comparison of Legumes, Commercial Nitrogen and Fallow for Increasing Yields of Spring Wheat and % Protein in Grain.

Preceding crop or treatment	Pound per acre of fertilizer applied to wheat N	P_2O_5	K_2O	Spring wheat bu/acre	% Protein in grain*
1 oats (check plot)	0	20	0	28.7	11.20
2 oats	30	20	0	33.2	12.37
3 alfalfa for hay	0	20	0	33.3	15.57
4 Red clover for hay	0	20	0	36.2	14.03
5 sweet clover for seed	0	20	0	42.5	14.48
6 sweet clover fallow	0	20	0	37.9	15.28
L.S.D. at 5% confidence level				3.92	---

* Analyzed by Experiment Station Biochemistry Department.

Treatment number one may be considered as the check plot, because no commercial nitrogen or legumes were used.

The yield of spring wheat was significantly increased by commercial nitrogen, and by the inclusion of a legume in the rotation.

For the past 2 years, the rotation with sweet clover for seed has increased the yield of wheat more than rotations including alfalfa or red clover cut for hay. It should be noted that in this experiment each of the legumes were grown 2 years--the seeding year and one full year for hay or seed.

The fallow treatment was moderately effective for increasing yields this year.

There was a striking increase, over the check plot, of per cent protein in spring wheat - especially from the legume rotations.

Table 4. Influence of Crop Sequence on Per cent of Water in Soil Under Spring Wheat, 1958.

1957 crop	1958 crop	Depth in feet	% water May 15	% water June 15	% water July 15	% water Aug.15	% water Sept.15
Oats	Wheat (check plot)	0-1	16.4	21.3	14.5	11.3	12.2
"	"	1-2	12.4	13.3	11.7	9.7	12.4
"	"	2-3	7.7	13.3	6.9	7.1	8.6
"	"	3-4	10.1	9.3	10.5	9.1	10.7
"	"	4-5	9.1	10.8	11.0	11.2	14.7
Alfalfa hay	wheat	0-1	15.4	15.9	14.3	9.5	16.3
"	"	1-2	13.9	10.3	10.1	7.3	9.7
"	"	2-3	7.3	10.8	7.9	6.6	5.1
"	"	3-4	5.9	7.4	7.7	7.2	7.6
"	"	4-5	5.7	6.4	8.3	7.4	7.0
S. clover for seed	wheat	0-1	17.2	18.8	12.9	10.3	10.4
"	"	1-2	12.4	13.0	8.6	8.6	10.2
"	"	2-3	9.9	11.3	7.2	7.0	7.5
"	"	3-4	11.3	11.7	7.9	9.6	6.9
"	"	4-5	9.6	11.6	8.6	12.5	10.4
S. clover summer fallow	wheat	0-1	16.2	19.5	13.8	10.3	9.4
"	"	1-2	12.7	14.4	10.7	7.9	10.9
"	"	2-3	9.6	11.6	7.6	6.5	7.8
"	"	3-4	10.1	12.0	9.1	9.0	9.7
"	"	4-5	11.5	11.5	8.8	9.2	12.2

Where wheat followed alfalfa hay, the subsurface moisture under the wheat on May 15th was down to 5.7%. Where wheat followed sweet clover cut for seed, the subsoil moisture on the same date under wheat was about 10to11%. This difference in soil moisture was apparent through June 15, but not on the July 15 sampling date.

The yields of wheat in the 2 rotations were consietent with the supplies of subsoil moisture (table 4). For two consecutive years, the yields of wheat following sweet clover for seed has been greater than wheat following alfalfa or red clover cut for hay. Perhaps the relative quantities of subsoil moisture is responsible, in part at least, for the difference in wheat yields.

The question now arises, why should there be more moisture for wheat in the rotation using sweet clover for seed, than in the rotation using alfalfa for hay? One possible explanation is, that the sweet

clover matures in mid-summer and the water requirements are then reduced, but alfalfa is using all the water available in making the second or third crop of hay.

At the beginning of the season there was a relatively small difference in soil moisture under wheat which followed sweet clover fallow compared to the soil moisture under wheat which followed sweet clover for seed. The legume year in the rotation (1957) was a year of above average rainfall which would have a tendency to minimize the differences in possible soil moisture build-up between fallow and sweet clover for seed.

Table 5. Influence of Commercial Nitrogen and Residual Effect of Legumes in Rotation on Yield of Corn.

Rotation number	1956 crop	1957 crop	Lbs. per acre of Fertilizer applied in 1956, 1957 and 1958			Yield of corn in 1958 bu/acre
			N	P_2O_5	K_2O	
1	oats	spring wheat	0	20	0	47.9
2	oats	spring wheat	30	20	0	46.4
3	alfalfa for hay	spring wheat	0	20	0	46.9
4	Red clover for hay	spring wheat	0	20	0	45.9
5	S. clover for seed	spring wheat	0	20	0	44.6
6	Fallow	spring wheat	0	20	0	46.3
L.S.D. at 5% confidence level						3.9

In this experiment, neither the commercial nitrogen nor rotations, including legumes, were very effective in raising corn yields this year. Note that the test crop, corn, was the second grain crop harvested after the legumes were plowed under. This is a measure of the residual effect of the legumes.

Fertilizer Experiment #3

Objectives of Experiment

1. From the standpoint of weed control and maximum yields what is the best way to fertilize flax? Should it be broadcasted and disced in, drilled with the seed, or plowed under?
2. Can method of fertilizer application reduce the seriousness of the weed problem?
3. Is drilling the fertilizer with the seed a more efficient method of application? Is it safe to drill 30 lbs. of nitrogen per acre with the seed?
4. Will the residual effect on the following crop, corn, be different for the various fertilizer application methods?

Table 6. Effect of Fertilizer and Methods of Application on Yield of Flax.

Lbs. per acre N	P_2O_5	K_2O	Method of application	Weed Control*	Yield in bu/acre
0	0	0		None	10.1
0	0	0		weed control	16.6
40	30	0	drilled with seed	none	5.7
40	30	0	drilled with seed	weed control	19.1
40	30	0	disced in	none	9.0
40	30	0	disced in	weed control	21.8
40	30	0	plowed under	none	12.8
40	30	0	plowed under	weed control	19.3
20	15	0	drilled with seed	none	10.0
20	15	0	drilled with seed	weed control	21.3

*Weed control consisted of 5 lbs. per acre of TCA to control grassy weeds, and 1/4 lb. per acre of MCPA for boradleaved weeds, applied when the flax was about 2 inches high.

The combination of fertilization and weed control was fairly successful this year for increasing the yields of flax.

Without weed control, shallow or surface applications of fertilizer greatly stimulated the growth of weeds and reduced flax yields considerably.

When the fertilizer was plowed under and no weed control sprays applied, the weed problem was still very serious, but there was no depression in yield compared to the check plot that received no weed control treatment.

When drilled with the seed, the lower rate of application used in this experiment (20-15-0) gave excellent yield increases when weed control measures were used.

Fertilizer Experiment #4

Objectives of Experiment

1. Will the seed yield of bromegrass and alfalfa be greater if the plantings are made in wide spaced rows and cultivated?
2. Is the application of supplemented nitrogen necessary to obtain maximum bromegrass yields when the brome is planted in rows and cultivated.

Table 7. Effect of Row Spacing, Cultivation Between Rows and Fertilizer on Yield of Bromegrass Seed.

Row spacing**	Lbs. of seed per acre (fertilized)*	Lbs. of seed per acre (unfertilized)
7 inches	680.7	325.2
21 inches	666.0	446.9
35 inches	627.4	422.5

* Fertilized with 40 lbs. of nitrogen per acre.

** Only the 21 inch and 35 inch row spacings were cultivated between the rows.

The fertilized bromegrass yielded considerably more seed than the unfertilized brome, especially in the plots with 7 inch row spacing.

The unfertilized brome benefited from the practice of wide row spacing and intertillage.

Table 8. Effect of Row Spacing, Cultivation Between Rows, and Fertilizer on Yield of Bromegrass Hay.

Row spacing **	Tons of Hay per acre (fertilized)*	Tons of hay per acre (unfertilized)
7 inches	1.83	0.62
21 inches	1.28	0.72
35 inches	1.09	0.77

* Fertilized with 40 lbs. of nitrogen per acre.
** Only the 21 inch and 35 inch row spacings were cultivated between the rows.

The yield of bromegrass hay was much greater on plots that received nitrogen fertilizer.

In the unfertilized plots, hay yields were not increased much by the practice of wide row spacing and intertillage.

Table 9. Influence of Row Spacing and Cultivation Between Rows on Yield of Alfalfa Seed.

Row spacing **	Lbs. of seed per acre (fertilized)*	Lbs. of seed per acre (unfertilized)
7 inches	79.3	47.8
21 inches	75.4	53.4
35 inches	54.7	37.1

*Fertilized with 40 lbs. of available phosphate per acre.
**Only the 21 inch and 35 inch row spacings were cultivated between the rows.

There was a substantial increase of alfalfa seed produced per acre when phosphorus was applied. This was especially true in the plots with narrow row spacing and greater plant populations.

INSECT CONTROL
Prepared by the Department of Entomology & Zoology

Grasshoppers were a problem in many areas of the north-east and may continue to be a problem in 1959. The best time to apply chemical controls is while the grasshoppers are still young as they become harder to kill as they reach the adult stage. This season dieldrin was the insecticide of choice, and farmers received excellent control applying this materila at the rate of one ounce of actual material per acre. Aldrin was second choice applied at the rate of four ounces of actual material per acre. Chlordane, 1/2 to 1 pound per acre; heptachlor, 2 to 4 ounces per acre and toxaphene, one to one and onehalf pounds per acre were also used with good results. The lower dosages are used for the young ateges of 'hoppers and the higher dosagee for the adults.

Armyworms were a problem in certain localities of the north-east primarily on barley and rye. Some spraying was necessary in areas where they were heaviest. Aldrin and heptachlor at the rate of 1/2 to 3/4 pounds of actual material per acre gave satisfactory control of armyworms. Dieldrin, 4 to 8 ounces per acre and toxaphene, 2 pounds per acre also control these pests.

European corn borer numbers were lower in 1958 than in 1957. As a result, very little spraying for this pest was noted. However, the corn borer is a potentially serious pest to all areas where corn is grown. DDT, either at the rate of one and one-half pounds per acre or 15 to 20 pounds per acre of the 5% granular form, is the most often used insecticide. Any corn to be used for silage should be treated with 0.20 to 0.25 pounds of endrin, either as a spray or granular. The use of endrin will avoid any residues in the silage as when DDT is used which might contaminate milk or beef which is nearing slaughter.

Potato insects, including the potato aphid, the potato leafhopper and the potato flea beetle, are perennial pests of potatoes. DDT at the rate of one and one-half to two pounds of actual material per acre will control all three pests. In some potato areas, insects have shown a resistance to DDT but this is not known to be true in South Dakota as yet. Should resistance develop, the use of other insecticides will have to be developed.

Control of harmful insects in legumes is important and especially so in the production of alfalfa seed. To produce good yields of alfalfa seed, it is essential to control such pests as lygus bugs, plant bugs, blister beetles, grasshoppers, leafhoppers, field crickets, and flea beetles. A mixture of one pound of DDT combined with either four ounces of aldrin, or one and one-half pounds of toxaphene or a pound of chlordane per acre will properly control these pests. The proper time to apply the spray is during the bud stage before bloom. If the spray is applied during the blooming stage, many beneficial bees are likely to be poisoned. If spraying is necessary during the bloom stage, only toxaphene at the rate of one and one-half pounds per acre should be used and this material applied in the evening or early morning (between 7 p.m. and 7 a.m.) when bees are not working.

Sweet clover weevils constitute a threat to newly-seeded stands of sweet clover. It is good insurance to apply an insecticide where sweet clover has been sown for a stand. Although sprays may be used, granular forms of insecticides are more convenient to use in most cases. The granular forms of insecticide may be mixed right with the seed and sown together. The seed and insecticide need to be thoroughly mixed. Deep placements of this mixture should be avoided as the chemical works best near the soil surface. Spraying should be done early in the spring as soon as damage has been noted to new seedlings. Materials to be used, either as spray or granular, along with the rates to use, are as follows:

DDT, 2 pounds per acre; aldrin, one half pound per acre; dieldrin, one half pound per acre; heptachlor, one half pound per acre or toxaphene; 2 pounds per acre.

Preliminary experimentation shows that the use of granular materials may be beneficial in controlling insects on alfalfa acreage reservee.

Wireworms and cutworms can be damaging to small grains in the North-east area. For wireworms it is good insurance to treat the seed before planting. Aldrin, dieldrin, heptachlor or lindane at the rate of one ounce per bushel can be used for seed treatment. With use of lindane, treated seed should be planted following treatment as storage of lindane treated seed for a period of time will lower germination. Cutworms occasionally have to be controlled where populations start getting heavy. Using the same materials as outlined for armyworms will give satisfactory control of these pests.

CORN BREEDING AND YIELD TESTING

By D. E. Kratochvil and B. B. Shank.

This growing season was characterized by considerably below normal temperature and moisture. Each month from May through September, resulted in below average yields. These conditions also caused wide differences in per cent moisture at harvest time, between hybrids. This clearly emphasizes the need to select early maturing hybrids for this area. Many of the entries would have resulted in a soft corn crop. Fertilizers containing 60 pounds of available nitrogen and 40 pounds of available phosphorous were applied previously to plowing. Planting was done May 22 and harvested October 17.

In table 10 each hybrid has been ranked on the basis of a performance rating which evaluates the entries on their relative yields and maturity. This rating was obtained by first convering yields for each hybrid to a percentage of the average yield of all the entries. Similar calculations were made for moisture at harvest time after first subtracting each moisture percentage from 100, so as to rank the hybrids on their ability to produce sound, rather than soft, corn. The performance rating then equaled:

$$\frac{6 \text{ (yield percentage } + 4 \text{ (moisture percentage)}}{10}$$

The hybrid with the highest performance rating is listed as number 1, the second highest as number 2, and so on.

Table 10 Area 5 (Codington County) 1958 Corn Performance Test

Hybrid or Variety	Acre Yield Bu.	Moisture per cent	1958 Yield bu. *	1958 Moisture per cent	Performance Rating
5 year average					
Pioneer 388	44	27	37	36	10
Sobota S.D. 220	43	25	40	25	4
S.D. 250	42	30	39	32	8
Average of 3 entries tested 5 years	43	27			
4 year average					
S.D. 210	49	21	43	22	2
S.D. Exptl. #18	46	22	42	24	3
Farmers 205	43	30	31	35	17
S.D. Exptl. #17	41	23	39	27	7
Average of 7 entries tested 4 years	45	24			
3 year average					
Pfister P.A.G. 32	47	30			9
Average of 8 entries tested 3 years	45	28			
2 year average					
DeKalb 62	46	41	34	38	13
Pfister P.A.G. 44	45	42	34	41	16
Kingscrost K35	44	43	36	40	12
Funk G-21A	43	43	40	39	15
Funk G-26	41	46	31	45	20
Kingscrost K34	41	48	27	48	21
Average of 13 entries tested 2 years	44	38			
DeKalb 46			45	24	1
Gurney 95			39	24	5
Agsco 62			37	20	6
Disco 90W			34	29	11
Cargill 105W			35	41	14
Trojan T-99			31	44	18
Tomahawk 161			32	47	19
Pioneer 383			29	53	22
Hampala H-130A			23	52	23
United Hagie UH30-B			25	60	24
Average			35	37	

*Differences in yield of less than 5 bushels per acre are not statistically significant.

SORGHUM AND SOYBEAN VARIETY TESTING

By C. J. Franzke

Table 11. Height, Maturity and Yield of Sorghum Varieties, 1958.

Variety	Height	Maturity	Bu./A.
Eureka	47	2	26.6
Prairie Rose	53	3	31.5
Brown Marval	51	3	23.1
Reliance	45	2	27.9
Norghum	43	2	38.0
Redbine 60	45	4	26.5
Martin Milo	34	7	1.5
RS501	53	3	47.9
RS610	38	6	18.6
Frontier 400	37	6	31.2
Combine Grain Sorghum	39	4	44.7
Dekalb C44A	36	6	35.0
Dual	52	2	32.1
Pfister 305-S	45	4	54.0
Pfister 405-S	36	6	12.8
Stickleys R103	36	6	13.4

Maturity Range

1. Very Ripe
2. Ripe
3. Hard Dough
4. Late Dough
5. Soft Dough
6. Early or Milk
7. Fertilized and Seed
8. Heading
9. Not Headed

The temperatures were not ideal for sorghum production this year. Every month was below normal, and sorghum will develop much better with warmer temperatures. There were four varieties which ripened and would be safe from frost. The remainder varied from hard dough stage to fertilized and starting seed formation. Any of the varieties in the later group would suffer frost damage.

Table 12. 1958 Soybean Variety Test.

Variety	Height	Bu./A.
Capital	29	10.9
Chippewa	31	12.2
Grant	28	11.6
Mandarin Ottawa	27	10.5
Norchief	27	12.5
Blackhawk	31	9.4
Mandarin	29	11.7
Flambeau	29	13.6

GRASSES AND LEGUME TESTING

By R. A. Moore

Objectives

To determine the adaptability of various legume and grass forages to growing conditions (soil and climate) in the area served by the experimental farm. Adaptability would be measured by:

a) Ease of getting a stand
b) Stand survival
   Winter resistance
   Drought resistance
c) Yield of forage, or green manure value
d) Varietal reaction to insects and diseases
e) Consistency of performance

Grass performance tests were established at the Northeast Research farm in 1957. Good stands were obtained of the following grasses to determine yield and adaptability:

Smooth bromegrass	10 varieties
Crested wheatgrass	10 varieties
Intermediate wheatgrass	7 varieties
Pubescent wheatgrass	4 varieties
Tall wheatgrass	5 varieties

These tests appeared to provide quite reliable information on the performance of the included varieties.

The 4 varieties of Switch grass planted failed to establish good stands. Observation plots of orchard grass yielded very well in 1958. This was probably due to an ample supply of moisture in the fall of 1957. This grass is generally not productive under dryland farming in South Dakota.

Tables 13-17 compare varieties of 5 different grasses in regard to % stand, plant height at time of harvest (June 23, 1958), and dry matter produced in tons per acre.

Table 13. Bromegrass

Variety	Height inches	Per cent stand	Tons per* acre
Saratoga	40	95	1.84
Southland	42	80	1.50
Lancaster	40	70	1.80
Wisc. 55	40	82	1.88
Cand. Comm.	42	92	.97
Achenbach	36	90	1.64
Lincoln	39	92	1.77
Manchar	38	82	1.46
Wisc. 63	38	50	1.26
Homesteader	34	85	1.68

L.S.D. = .48

*Differences in yield of less than .48 tons per acre are not significant differences.

Table 14. Crested Wheatgrass

Variety	Height inches	Per cent stand	Tons per* acre
Commercial	23	45	.70
Neb. 3576 Fairway	24	58	1.47
Nordan	26	74	1.20
Summit	22	72	1.19
Mandan 2359	23	67	.87
Comm. Fairway	23	67	1.18
Utah 42-1	26	70	.92
Neb. 10	26	55	.97
S. Dak. II	17	42	.45
P-27	21	32	.35

*Difference in yield of less than .37 tons/acre are not significant differences.

Table 15. Intermediate Wheatgrass

Variety	Height inches	Per cent stand	Tons per * acre
Idaho #4	32	77	1.54
Ree	28	77	1.52
Amur	31	77	1.32
Greenar	26	82	1.17
A 12496	30	77	1.40
Neb. 50	29	90	1.61
Idaho #3	27	82	1.65

*Difference in yields are not significant.

Table 16. Pubescent Wheatgrass

Variety	Height inches	Per cent stand	Tons per * acre
A1488	32	62	.71
Utah 109	33	57	.72
Mandan 759	31	92	1.63
Topar	35	37	.57

*Differences in yield of less than .28 tons per acre are not significant differences.

The pubescent wheatgrasses have no advantage over the intermediate wheatgrasses in this area. They do tend to be more productive on low fertility sites, in very dry years, and on soils that tend to "dake" or become hard when moisture is limited.

Table 17. Tall Wheatgrass

Variety	Height inches	Per cent stand	Tons per* acre
Nebraska	17	72	.70
S-64	21	80	1.02
A13044	22	70	.54
Utah	18	70	.65
Mandan 1482	18	72	.92

*Differences in yield are not significant.

Tall wheatgrass is especially adapted to high alkaline areas.

Table 18. Tons of Dry Matter Produced Per acre by 6 Varieties of Sweet Clover at Northeast Research Farm, 1957.

	Tons DM/acre
Intermediate coumarin	1.73
Madrid	1.54
Goldtop	1.83
Evergreen	1.96
Spanish	1.79
Common yellow	2.06
Hubam (annual)	1.10
Vercil (annual)	1.21

There are no significant differences in yield between the varieties tested. Goldtop does possess qualities not measured by yield. It is low in coumarin (bitter tasting substance), possesses resistance to many foliage diseases and is vigorous. The first three listed in the table are early maturing and good seed producers. The last 3 listed are late-maturing varieties, more valuable as a plow-down crop.

Table 19. Tons of Dry Matter Produced at 1st cutting by 6 varieties of Red Clover at N. E. Research Farm, 1958.

	Tons/acre*
Wisconsin Synthetic	1.50
Dollard	1.74
La Salle	1.60
Pennscott	1.11
Kenland	1.14
Stevens	1.06

*Differences of less than .42 tons per acre are not significant differences.

Dollard not only has a yield advantage, but is able to live over and produce well in the second harvest year.

Table 20. Yields of Birdsfoot Trefoil Strains in Tons Per Acre at N. E. Research Farm, 1958.

	Tons per acre*
Tana	.64
Cascade	.61
Granger	.45
Mansfield	.74
Douglas	.59
Viking	.72
Iowa Empire 2297	.70
Iowa Empire 2306	.99
Empire F.C. 32080	1.04
Imported	.46

*Differences in yield of less than .34 tons per acre are not significant differences.

The Empire strain has a decided yield advantage and is also the most winter hardy at thislocation.

Table 21. A Comparison of 11 Different Alfalfa Varieties in Regard to % Stand, Height at 1st cutting, % Flowering at 1st cutting and Tons of Dry Matter Produced, Northeast Research Farm, 1958.

	% Stand	In. ht. at 1st. cutting	% Flowering at 1st. cutting	Tons/acre* 1st. cut	2nd. cut	Total
Ranger	94	20	15	1.50	1.07	2.57
Ladak	94	20	30	1.69	1.10	2.79
Cossack	95	19	35	1.62	1.06	2.68
Grimm	89	20	45	1.43	1.20	2.63
Vernal	94	20	25	1.89	1.24	3.13
Narreganaett	94	20	35	1.74	1.14	2.88
Teton	91	15	15	1.55	.91	2.46
Rhizoma	91	18	25	1.48	.87	2.35
Du Puits	94	21	50	1.44	1.26	2.70
Nomad	86	16	30	1.40	.82	2.22
Labonton	90	18	10	.99	.70	1.69

*Differences of less than .22 tons per acre are not significant differences.

SMALL GRAIN VARIETY TESTING

By V. A. Dirks, D. B. Harpstead and P. B. Price

Extremely favorable growing conditions in 1958 produced oat yields which, in most cases, exceeded the one hundred bushel level. While yields from experimental nurseries usually exceed those from commercial fields, the real value of such tests is found in the yield differences aparent among the various varieties. Yields such as were harvested in

1958 rarely provide much indication of what a variety will produce under more adverse conditions. In 1958, late oat varieties had the greatest yield advantage.

Notes on stem rust and crown rust clearly indicate the potential danger of these diseases if they were prevalent early in the growing season. Oat data is presented in table 23.

Flax yields were excellent over most of the primary flax growing region. Weeds constituted the greatest yield reducing factors in 1958. Data from flax yields is presented in table 22.

The Watertown station is located in the area of the state in which most of the acceptable malting barley is produced. A number of the standard varieties are analyzed each year to determine their malting quality. Also, any selection which performs well for several years in the yield trials is submitted to the USDA Barley and Malt Laboratory at Madison, Wisconsin for analysis. Adequate soil moisture, cool temperatures and the relative absence of disease promoted the production of rather good yields. Approximately 85 varieties and selections were grown at the station this year. Barley yield data is presented in table 24.

The importance of wheat as a cash report in Northeastern South Dakota makes work on spring wheat very necessary in this area, especially since frequent visitations by disastrous disease epidemics indicate the value of local tests for disease resistance. 1958 was no exception, and excellent information on leaf rust and black chaff resistance of some 50 varieties and 210 selections of hard red spring and durum wheat were obtained at the Northeast farm, along with yield, test weight and general performance ratings. Data like these are very necessary in realizing the full potential of the wheat breeding program at the experiment station.

The performance of spring wheat varieties now available to farmers is reported in table 25.

Table 22 Yields from Flax Variety tests at the Northeast Research Farm, Watertown, 1958.

	Yield in Bu./A.			Av.	Test weight
	1956	1957	1958	1956-58	1958
Marine	17.0	14.2	17.7	16.3	52
Redwood	14.8	14.3	19.9	16.3	52
B-5128	15.2	13.4	19.5	16.0	51
Arny		14.8	19.1		52
Bolley	14.3	13.3	19.0	15.5	52
Dakota	15.9	14.2	18.0	16.0	50
Norland	15.5	15.2	19.7	16.8	52
Linda		14.6	18.3		48
Raja		15.0	14.9		48
Royal		14.6	23.7		51
Cheyenne	17.8	14.1	16.5	16.1	52

Table 23. Oat Yield and Disease Summaries from the Northeast Research Farm.

Variety	Yield in bushels 1958	Yield in bushels 1956-58 Av.	Date Headed	1958 Test Weight	1958 Stem Rust	1958 Crown Rust
Minhafer	111.5	78.8	6-23	38	-	-
Ransom	104.9	69.1	6-20	40	-	30
Cherokee	102.1	70.5	6-22	40	10	50
Marion	107.7	78.4	6-26	42	1	30
Mo-0-205	107.7	69.9	6-24	40	10	50
Newton	103.0	--	6-27	38	20	60
Waubay	101.1	73.9	6-27	39	20	50
Clinton	94.5	64.7	6-25	40	50	50
Garry	123.8	82.6	6-29	40	-	30
Ajax	111.5	79.4	7-1	39	20	20
Simcoe	123.8	84.2	6-30	40	10	20
Rodney	128.5	83.9	7-1	34	1	10
Branch	114.3	77.4	7-1	36	1	20
Sauk	118.1	87.0	6-30	36	5	30
Burnett	115.5	79.3	6-23	39	5	50
L.S.D.	11.3					

Table 24. Barley Yield and Disease Summaries from the Northeast Research Farm.

Variety	Test wt.	Bushels/A	Rank	Disease data Septoria*
1. Custer	48.0	69.9	1	5
2. Feebar	47.0	69.9	2	2
3. Forrest	52.0	58.6	6	5
4. Husky	50.5	58.6	7	5
5. Kindred	46.0	46.0	14	5
6. Liberty	46.5	52.3	12	5
7. Manchuria	48.5	56.7	9	5
8. Parkland	49.5	58.6	8	5
9. Plains	46.0	55.4	11	5
10. SD 1483	44.0	56.7	10	5
11. Traill	49.0	68.0	3	5
12. Trebi	46.0	62.4	4	5
13. Tregal	47.5	47.9	13	5
14. Velvon 11	45.0	60.5	5	5
15. Wisc 38	49.0	46.0	15	5
L.S.D. at 5%		10.04		

*Septoria 1 - lightly infected or resistant
5 - heavily infected

Table 25. Spring Wheat Variety Test at the North East Research Farm, 1956-1958.

Variety	Yield in bu./acre 1958	Yield in bu./acre 1956-58	Test wt. 1958	1958 Performance Date headed	Stem rust%	Leaf rust%	Black-chaff*
Bread wheat							
Rushmore	26.9	20.7	58	6-28	6	60	2
Lee	33.1	23.9	60	-28	6	45	3
Selkirk	31.6	25.1	57	-30	0	60	3
Conley	22.9	18.4	58	7-3	0	65	9
Mida	28.5	22.5	59	6-28	10	50	4
Spinkota	33.3	25.3	61	7-2	4	80	1
Thatcher	24.1	18.7	58	-2	8	80	3
Lee 6 x K. Farmer	36.7	--	60	6-28	3	45	2
That 6 x K. Farmer	25.0	--	58	-28	3	80	2
Overby Sel.	30.5	--	62	-29	3	45	3
Durum Wheat							
Vernum	45.9	27.4	61	7-2	9	5	3
Sentry	43.6	31.1	62	6-28	10	3	2
Langdon	43.5	28.7	62	-30	2	8	2
Yuma	37.7	26.6	62	7-6	0	18	3
Ramsey	39.3	26.2	60	-1	18	8	2
Nugget	39.5	26.1	58	6-28	40	5	2
Ld 392	51.2	--	60	-28	2	5	2
Ld 393	45.3	--	62	-27	T	15	2
L.S.D.	6.4	2.9					

*where 1 is best

CROP DISEASES AND THEIR CONTROL

Corn Root Rot

C. M. Nagel and D. B. Shank
Plant Pathology and Agronomy Departments

Objective:

The control of root rot diseases in hybrid corn.

Results:

Root rot diseases which cause reductions in yield and increases in lodging are present in most farmer's corn fields. This problem is worse in certain areas than others in the state. The experimental evidence indicates that the loss in yield may be about 15 per cent.

One method of controlling root rot diseases is to develop inbred strains of corn which are less susceptible to the root rot organisms which live in the soil and cause the rotting of the healthy roots. These are present to a more-or-less extent in all farm land.

As a result of a number of years' of research work on this problem a number of inbred lines of corn have been developed which, when combined into certain hybrid combinations, provide considerable protection in the form of root rot resistance. The yield performance of several of these hybrids is presented in table 26.

In 1958, 37 experimental hybrids were grown on the Research farm. Four commercial hybrids having the best performance in the South Dakota Hybrid Corn Performance Trials, as conducted in previous years on Northeast Research Farm, were included for purposes of comparison. The experimental hybrids consisted of new inbreds having various degrees of resistance to root rot, a soil-borne disease which occurs in most of the farm land now under cultivation.

The principle factor of the new experimental hybrids responsible for their yields in this experiment appears to be their root rot resistance which the better lines possess. In other words, the higher root rot resistance of particular hybrids is reflected in a higher percentage of healthier or functional roots. Only a healthy root system has the ability to absorb from the soil the kinds and amounts of nutrients and water required by the corn plant. Plants with badly diseased roots cannot do this satisfactorily. Such benefits should be present in the new disease resistant experimental hybrids, and may be responsible for their marked improvement in yields.

From table 26 it can be seen that the yields of many of the new experimental lines are superior to the four commercial hybrids. For example, experimental 1 yielded 25.8 per cent more than the average yield of the four commercial hybrids grown for comparison in this experiment. Experimental 1 also yielded 12.6 per cent more than the highest yielding commercial hybrid; namely, S.D 220. Only one commercial hybrid ranked within the first 35 entries in the experiment.

In a similar experiment in 1957 at the Northeast Research Farm, experimental 1 was likewise the top yielding hybrid in the test. In the 1958 trial experiment those experimental hybrids which produced a low performance score were dropped from the tests and a similar number of new lines were placed in the experimental because a large number are still to be tested.

The experimental design used in this experiment consisted of randomized blocks replicated three times.

Table 26. Peformance of 37 new experimental corn hybrids having varying degrees of resistance to root rot in comparison to 4 of the better performing commercial hybrids grown at the Northeast Research Farm, Watertown, S. Dak., 1958.

Expt'l. Hybrid or Com'l Hybrid No.	Yield * Bu./A	Moisture Per cent	Performance Score
Expt'l 1	49.53	34.3	1
" 2	48.96	33.2	2
" 3	46.66	33.2	7
" 4	45.61	25.5	3
" 5	44.18	24.6	5
" 6	44.10	31.7	11
" 7	44.07	22.3	4
" 8	43.76	24.4	6
" 9	43.58	27.6	10
" 10	43.33	30.0	12
SD 220	43.29	26.8	9
Expt'l 11	43.25	26.2	8
" 12	42.54	30.2	14
" 13	42.11	36.6	22
" 14	41.81	27.9	13
" 15	41.71	37.5	26
" 16	41.59	28.1	15
" 17	41.20	31.5	17
" 18	41.14	37.5	28
" 19	40.95	32.1	21
" 20	40.67	34.4	25
" 21	40.56	29.6	16
" 22	40.52	30.8	20
" 23	40.20	33.9	27
" 24	40.07	29.3	18
" 25	40.07	29.6	19
" 26	39.90	35.7	31
" 27	39.68	30.5	23
" 28	38.96	29.2	24
" 29	37.86	29.5	29
" 30	37.44	35.8	33
" 31	37.27	31.4	32
" 32	36.86	27.4	30
" 33	36.71	40.0	37
" 34	35.53	36.7	36
Pf 32	35.47	35.0	35
SD 250	34.58	37.6	38
Expt'l 35	34.09	31.2	34
" 36	33.81	40.1	39
P 388	33.75	41.6	40
Expt'l 37	31.73	47.4	41

*L.S.D. (Least Significant Difference) 4.44 Bu./ Acre. This means thatfor any two hybrids to be significantly different in yield from one another, a yield difference of 4.44 bushels per acre is required.

Potato Diseases

C. M. Nagel
Plant Pathology Department

Objectives:

1. To determine the effectiveness of Terraclor as a soil fungicide for scab control.
2. To develop an improved potato fungicide for the control of seed piece rot to improve field stands.

Results:

Scab Control

Terraclor, the chemical which was used for the control of scab at the Research Farm in 1957 and which appeared to be promising, was again used in 1958.

The fungicide was applied to the soil with a special mechanical applicator. Four treatments were used and replicated five times throughout the experiment. Records were taken on the experiment during the growing season; however, at time of harvest it was found that scab had been very inactive in the soil on the tubers in 1958. There was very little pit-type scab, and only slight russet-type scab. Because of average temperature and dry soil conditions, scab did not develop sufficiently to constitute the usual hazard common in most seasons. The unusually light amount of scab present on tubers harvested from treated and untreated plots was insufficient to obtain reliable readings between treatments. This was in contrast to 1957 and in most other years when scab is a serious disease problem and requires heavy culling to make U. S. No. 1 grade.

Seed Treatment

With regard to the performance of the seven different seed treatments under test the past season, it should be pointed out that seed piece rot was also not as serious as in previous years. However, similar to the results obtained at the station in 1957 phytomycin (an antibiotic) at 500 parts per million of water plus captan at two pounds per 100 pounds of seed appeared to give the best protection against seed rot and consequently better stands.

Flax Diseases

Merle E. Michaelson
Department of Plant Pathology
and U.S.D.A., Industrial Crops Section, cooperating

Objective:

The control of flax diseases.

Discussion of tests and results

A nursery of 24 varieties planted on 3 dates was observed to

determine differences in resistance of the varieties to aster yellows and to learn when most of the infection occurs. This nursery was established following the severe outbreak of aster yellows in flax in the summer of 1957. The most striking symptom of aster yellows observed in 1957 was the greenish flowers which did not produce bolls. In less sever cases the bolls frequently were deformed and the seed was not well filled. Aster yellows is a virus disease transmitted by the six-spotted leafhopper. In that aster yellows infection was so light, one could not select varieties with greater resistance nor determine when most of the infection occurred.

Individual plants of 47 varieties had been selected in 1957 as having superior resistance to pasmo. Seed of individual selections was sown as plant rows. All plant rows of 18 varieties and individual rows of other varieties were eliminated because of insufficent resistance to the diseases.

The standard rust nursery was grown to determine the races (strains) of rust which prevailed in South Dakota in 1958. Rust collections for identification of races were made from Bark, Marshall, B. Golden selection, Victory A, Williston Brown, Koto, and Dakota. As far as is known, no new races of rust were collected.

Small Grain Diseases

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Plant Pathology and Agronomy Departments

Objective:

The control of small grain diseases.

Results:

BARLEY

Septoria Blight

Septoria leaf blight of barley was the most important barley disease in 1958. The Regional Barley (Septoria blight) disease nursery consisting of a large number of strains of barley were grown at the Research Farm. Disease records taken showed that frequently 50 per cent of the leaf area of the plants were prematurely killed on susceptible strains in the experimental plots. This was also true at Brookings, Highmore and Eureka. Forty-nine barley strains were under a disease test at the station. Twelve of the 49 strains were from South Dakota. Six of the South Dakota strains appeared to have good resistance to septoria blight. These may provide a basis for developing disease (septoria) resistant varieties.

Loose Smut

There are no commercially available varieties of barley recommended for South Dakota that are resistant to (nuda) loose smut. Loose smut is very prevalent even in certified seed. Consequently, there is a real need for some practical method of control. One objective of the program

is to find sources of smut resistance which can be used to produce a loose smut resistance commercial varieties or to find a chemical seed treatment which will control this particular type of smut.

Other diseases

Spot blotch and bacterial leaf blight are diseases of barley which frequently cause serious reductions in yield. Both of these diseases were included in the experimental work at the station the past season.

WHEAT

Stem and Leaf Rust

Stem rust and leaf rust of wheat are very serious diseases which developed only in light amounts in 1958. However, these diseases are always major threats to wheat production in this area.

The following experiments on wheat diseases were conducted at the Research Farm in 1958:

1. Stem and leaf rust disease nursery.
2. Other wheat diseases.
3. Durum wheat disease nursery.

Soybean Cyst Nematode Disease Survey in South Dakota

M. Komanetsky
Plant Pathology Department, State College
and
Plant Pest Control Branch
United States Department of Agriculture

The soybean cyst nematode* is a serious new disease to the soybean industry in the United States. Although the disease is not now known to be in South Dakota, there is a chance this new disease could become established in the soybean growing areas of this state.

This new disease was previously known only in Japan. It was found for the first time in the United States in North Carolina in 1954. Since 1954 this disease has been found causing serious damage to the crop in the following additional states: Arkansa, Kentucky, Mississippi, Missouri and Tennessee. Soon after its discovery in North Carolina, that state decided to control the disease by placing a quarantine on the movement of soil, plant parts, equipment and other materials which might spread the organism responsible for the disease. This step was taken because the disease can live in the soil, it may be spread by machinery, plant parts, soil, wind and water. A Federal quarantine was put into effect in July 1957. Other states concerned issued similar restrictions designed to protect the uninfected soybean growing areas in this country. The nearest known infestation to South Dakota to date is in the extreme Southeast part of Missouri where it has been found in parts of three counties.

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* Heterodera glycines, Ichinohe

The soybean cyst nematode is a microscopic soil-borne organism which penetrates and feeds inside the plant rootlets. When the roots of soybeans become infected, the organism causes the infected plants to become yellow, stunted and yields are seriously reduced, usually causing a crop failure.

The Plant Pathology Department in cooperation with the Plant Pest Control Branch of the United States Department of Agriculture conducted a survey during November and December of 1958. Soil samples were collected in each of 15 counties which includes the principle soybean producing counties. Processing of the soil samples in the Plant Pathology laboratories is in progress and until these examinations are completed the results of the survey will not be known.

At the present time control of this nematode disease in the field is very difficult and its eradication is even more so should it become established in South Dakota. In those states which have the disease, crop rotations are being stressed as a control measure since this parasite must have certain kinds of plants present in the field on which to feed and reproduce. Other plants affected by this disease are lespedeza, common-vetch and snapbeans or garden beans.

NORTHEAST EXPERIMENTAL FARM COMMITTEE

Member	County	Address
W. H. Schwanke (Chairman)	Codington	Watertown-Route 4
F. Morris (Secretary)	Codington	Watertown
W. Peterson	Day	Lily
Donald Veddy	Marshall	Britton
Elmer Greeeth	Roberts	Sisseton
Otto Beyer	Grant	Revillo
Oliver Heitemeyer	Hamlin	Estelline
Alfred Skovly	Duel	Astoria
Bob Myers	Clark	Clark