Agronomy Pamphlet #53 December 1959

ANNUAL PROGRESS REPORT

NORTHEAST RESEARCH FARM

WATERTOWN, SOUTH DAKOTA

This picture shows how wheat is affected by sweet clover fallow (right) compared to sweet clover held over for seed (left). This research is discussed on page 7, "Fertility Experiment #2."

Agronomy & Plant Pathology Departments
Agricultural Experiment Station
South Dakota State College
Brookings, South Dakota

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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 these areas, 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. Area committees were set up to assist the Agricultural Experiment Station in selecting the research farms and planning 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 are held to observe first hand the results and progress of all experiments in the field. In addition, winter meetings in each area permit the presentation and discussion of results for all people who are interested.

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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 Vaddy	Marshall	Britton
Elmer Greseth	Roberts	Sisseton
Otto Beyer	Grant	Revillo
Oliver Heitsmeyer	Hamlin	Estelline
Alfred Skovly	Deuel	Astoria
Bob Myers	Clark	Clark

ANNUAL PROGRESS REPORT FOR

NORTHEAST RESEARCH FARM

1959

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 February 7, 1959 at Clark, South Dakota with the Northeast Research Farm Advisory Committee and County Agents. There was considerable discussion concerning the yearly publication of this pamphlet. The general consensus will be to continue its publication with unassembled sections sent ahead of time to the County Agents.

The next Field Day will be July 7, 1960 during the small grain season. The tours will concentrate on areas which merit the greatest amount of interest.

The 1960 crop season will be the completion time of an experiment on whether to "Fertilize Once Every 4 or 5 Years, or Once Each Year." When the crop is removed, another crop will be planted to try and equalize the land as quickly as possible. When the 1962 season comes, it is hoped this land will be ready to start with another experiment.

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.

1959 CROP SEASON

Table 1. Total Rainfall and Average Temperature by Months, with their Departure from Long-time Average at Northeast Research Farm*.

	April	May	June	July	Aug.	Sept.	Oct.	Total
Total Rainfall in Inches	0.58	3.47	1.91	1.66	4.69	1.10	1.95	15.36
Departure from Long-time Avg.	-1.48	+0.67	-1.90	-1.18	+2.04	-0.83	+0.79	-2.00
Avg. Monthly Temperature in Degrees F.	41.5	50.4	66.3	68.4	71.4	58.1	38.2	
Departure from Long-time Avg.	-1.7	-5.7	+0.5	-4.2	+1.3	-2.0	-9.5	
Frost Free Days	May 22 to September 10 = 110 days							

The temperatures and total rainfall for the season were below the long-time average. The months of May and August exceeded the average, but the conditions were so dry and windy that moisture loss was rapid. The surface soil at the station was moist enough for germination and emergence. Frost damage in May and continuously blowing winds retarded the small grain crops to the point that many didn't fully recover. The August rain helped the corn crop, but it had already pollinated and much of it was severely hurt by drought and wind damage.

The crop diseases were not too severe this year. Low temperatures and moisture helped curb infections.

Subsoil moisture reserves were low at the beginning of the season, and gradually decreased through July. The rains of August and October increased the percent moisture in the soil from 3% at the five-foot depth to about 10% at the one-foot depth. The rainfall of April through October was 2.0 inches less than normal for this period.

* The above rainfall and temperature were taken and recorded at the Northeast 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, South Dakota.

FERTILITY AND CULTURAL PRACTICE EXPERIMENTS

Q. S. Kingsley and F. E. Shubeck

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 percent protein in grain?
2. Which method will give the most efficient recovery of fertilizer nutrients?

Table 2. Residual Effect of Commerical Fertilizer on Yield of Corn and Per Cent Protein in Grain.

1956 Fertilizer Treatment			Fertilizer Applied in 1957, 1958 and in 1959			1959 Yield of Oats bu/Acre	1959 % Protein in oats grain*
N	P_2O_5	K_2O	N	P_2O_5	K_2O		
0	0	0	0	0	0	13.2	14.78
40	20	0	40	20	0	11.0	15.31
80	40	0	0	0	0	10.6	15.41
120	60	0	0	0	0	12.5	15.03
160	80	0	0	0	0	12.1	15.53
200	100	0	0	0	0	18.3	14.60
L.S.D. at 5% level						N.S.	------

* analyzed by Experiment Station Biochemistry Department

The oats yields were so low, that a true reflection of the residual fertility may not have been obtained. However, there seemed to be a residual effect from the heaviest rate of application, but this increase was not significant at the 5% confidence level.

No clear cut advantage in protein content of grain was obtained from the residual effects of fertilizer treatments. It should be remembered that this is the 4th grain crop harvested since the heavier fertilizer rates were applied in the spring of 1956.

Fertility Experiment #2

Objectives of Experiment

1. Compare the 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 Per Cent Protein in Grain.

Preceding Crop or Treatment	Pounds per Acre of Fertilizer Applied to Wheat			Spring Wheat Bu/Acre	% Protein in Wheat Grain*
	N	P_2O_5	K_2O		
1. Oats (check plot)	0	20	0	5.2	16.06
2. Oats	30	20	0	1.8	16.76
3. Alfalfa for hay	0	20	0	no grain	------
4. Red Clover for hay	0	20	0	no grain	------
5. Sweet Clover for seed	0	20	0	1.7	------
6. Sweet Clover fallow	0	20	0	19.5	15.34

L.S.D. at 5% confidence level (could not be analyzed because of no grain in treatments 3 and 4).

* analyzed by Experiment Station Biochemistry Department.

The sweet clover fallow treatment gave excellent yields of wheat, but when a legume hay crop preceded the wheat, there was a complete crop failure.

There was not enough grain in some of the plots to make a protein determination.

The 1959 crop season completed a full four year cycle of this experiment. Starting in 1960, the phosphorous rate will be increased to 40 pounds per acre instead of 20 pounds as in the past. There are indications of need for more of this element, and the increased rate should bring the level of availability more in line with the plant requirements.

Table 4. Influence of Commercial Nitrogen and Residual Effect of Rotation Legumes on Yield of Corn.

1957 Crop	1958 Crop	Lbs. per Acre of Fertilizer Applied Yearly			Yield of Corn in 1959 Bu/Acre
		N	P_2O_5	K_2O	
Oats	Spring Wheat	0	20	0	23.2
Oats	Spring Wheat	30	20	0	19.6
Alfalfa for hay	Spring Wheat	0	20	0	16.2
Red Clover for hay	Spring Wheat	0	20	0	17.6
S. Clover for seed	Spring Wheat	0	20	0	16.5
Fallow	Spring Wheat	0	20	0	22.8
L.S.D. at 5% confidence level					5.2

In these rotations, corn is the second grain crop after plowing the legumes. Legumes in the rotations appeared to exert a negative influence on yield, which extended into the second crop year after the legumes were plowed.

The application of thirty pounds of nitrogen per acre did not increase the yield of corn in this experiment under the 1959 growing conditions. Note the over all low yields.

Fertility 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 lb. 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?

The method of application in this experiment was a little different than indicated in the following table. The flax froze in early spring and was all replanted with a press drill. Therefore, in the second planting in treatments 3,4,9 and 10 no fertilizer was drilled with the seed. The fertilizers applied with the first seeding in these four plots are comparable to band applications. Comparisons of band applications to broadcasting are still valid.

In general, the yields of flax were fairly good considering the dry weather and spring frost. No definite yield advantage was obtained for weed control treatment or for method of fertilizer application under the conditions of this experiment. This is in direct contrast with the results obtained in 1958. (See Agronomy Pamphlet #49).

Table 5. Effect of Fertilizer and Methods of Application on Yield of Flax

Treat.	Lbs per Acre N	P_2O_5	K_2O	Method of Fertilizer Application	Weed Control*	Yield in Bu/Acre
1	0	0	0	None applied	None	8.2
2	0	0	0	None Applied	Weed Control	7.4
3	40	30	0	Drilled with seed	None	8.8
4	40	30	0	Drilled with seed	Weed Control	8.9
5	40	30	0	Disced in	None	10.4
6	40	30	0	Disced in	Weed Control	9.4
7	40	30	0	Plowed under	None	9.9
8	40	30	0	Plowed under	Weed Control	10.7
9	20	15	0	Drilled with seed	None	10.1
10	20	15	0	Drilled with seed	Weed Control	8.8

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

Fertility 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 supplemental nitrogen necessary to obtain maximum bromegrass yields when the brome is planted in rows and cultivated?

Table 6. Effect of Row Spacing, Cultivation Between Rows and Fertilizer on Yield of Bromegrass Seed.

Row Spacing	40-40-0 Applied/Acre	0-40-0 Applied/Acre
7 inch (not cultivated)	656.3 lbs	451.2 lbs
21 inch (cultivated)	642.2 lbs	485.8 lbs
35 inch (cultivated)	639.5 lbs	388.5 lbs

Yield of bromegrass seed was increased considerably by the application of 40 lbs. of nitrogen per acre. The differences in seed yields due to row spacings were small except for the 35 inch spacings in plots receiving 0-40-0.

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

Row Spacing	40-40-0 Applied/Acre	0-40-0 Applied/Acre
7 inch (not cultivated)	0.99 ton/acre	0.38 ton/acre
21 inch (cultivated)	0.70 ton/acre	0.42 ton/acre
35 inch (cultivated)	0.68 ton/acre	0.37 ton/acre

More bromegrass hay was harvested in the plots receiving 40 lbs nitrogen per acre, especially with the 7 inch row spacing. Where no nitrogen was applied, there were only minor effects on yield due to row spacings.

Table 8. Influence of Fertilizer, Row Spacing and Cultivation Between Rows on Yield of Alfalfa Hay.

Row Spacing	0-0-0 Not Fertilized	0-40-0 Applied per Acre
7 inch (not cultivated)	0.25 ton/acre	0.46 ton/acre
21 inch (cultivated)	0.44 ton/acre	0.63 ton/acre
35 inch (cultivated)	0.52 ton/acre	0.66 ton/acre

A small increase in alfalfa hay was obtained in favor of the fertilized plots.

FORAGE LEGUME VARIETY TESTS NORTHEAST FARM

M. D. Rumbaugh, R. A. Moore, and Q. S. Kingsley

The severe winter conditions prevailing last year caused extreme damage to the stands of all varieties in the red clover and birdsfoot trefoil trials. For this reason, these tests were not harvested and no additional data are available.

Table 9. Alfalfa variety test at the Northeast Research Farm, Watertown. Seeded in 1956 and harvested 1957 - 1959.

Variety	Total annual tons of dry forage per acre			
	1957**	1958**	1959*	Average
Cossack	3.76	2.68	.30	2.25
Du Puits	3.89	2.70	.00	2.20
Grimm	4.06	2.63	.75	2.48
Ladak	2.74	2.79	.47	2.67
Lahontan	2.76	1.69	.00	1.48
Narragansett	4.25	2.88	.38	2.50
Nomad	3.48	2.22	.08	1.93
Ranger	4.06	2.57	.41	2.35
Rhizoma	3.62	2.35	.14	2.04
Terra Verde[1/]	----	----	----	----
Teton	4.18	2.46	.54	2.39
Vernal	4.44	3.13	.42	2.66
Average	3.93	2.55	.32	2.30
L.S.D. (0.05)	0.44	0.24	0.27	0.44

1/ Winterkilled and omitted from averages.
* One cutting
** Two cuttings

Differential stand reduction among varieties was noted in the alfalfa forage yield test summarized above. This effect is clearly shown by the disproportionate yields of nonhardy varieties in 1959 when compared to previous years. Stands of Du Puits, Lahontan, Nomad, and Rhizoma were greatly depleted. The recommended varieties of Ladak, Ranger, Teton and Vernal yielded some forage in spite of slight stand reductions, and the severe drought which occurred during the growing season.

GRASS VARIETY TESTS

J. G. Ross and R. A. Moore

Grass experiments were established in 1957 and have been topdressed in the spring of 1959 with 60 lbs. of nitrogen and 40 lbs. of phosphorous per acre.

In general, differences in yielding ability between the species shown in the tables are not great. No outstanding variety of smooth bromegrass, crested wheatgrass or tall wheatgrass is shown. However, the pubescent wheatgrass Mandan 759 and the intermediate wheatgrass Nebraska 50 yield significantly higher than other grasses. Both the extreme southern type of bromegrass, Southland, and the extreme northern type, Canadian Commercial, are low in yield.

Table 10. Bromegrass Variety Trial. Harvested June 29, 1959.

Variety	Maturity	Stand %	Yield Tons/Acre
Saratoga	3	94	.61
Southland	3	92	.43
Lancaster	3	90	.59
Wis. 55	3	93	.52
Canadian Commercial	3	38	.43
Achenbach	3	95	.53
Lincoln	3	94	.65
Manchar	3	88	.64
Wis. 63	3	61	.59
Homesteader	3	92	.57

Key to Maturity
1. Before heading - immature
2. Headed out - blooming
3. Headed out - set seed
4. Mature seed

Table 11. Wheatgrass Variety Trial. Harvested June 29, 1959

Variety	Maturity	Stand %	Yield Tons/Acre
Crested Wheatgrass			
Standard Commercial	3	55	.60
Nordan	3	72	.66
Summit	3	75	.64
Mandan 2359	3	74	.68
Utah 42-1	3	68	.57
Neb. 10	3	65	.58
P. 27	3	48	.30
Fairway Commercial	2	79	.70
Neb. 3576 Fairway	3	68	.69
A 1770 Fairway	2	16	.23
Intermediate Wheatgrass			
Idaho #4	2	82	.73
Ree	2	85	.70
Amur	2	72	.66
Greenar	2	89	.70
A 12496	2	82	.72
Neb. 50	2	85	.88
Idaho #3	3	85	.66
Tall Wheatgrass			
Neb. 98526	1	72	.57
S-64	1	76	.60
A 13044	1	30	.20
Utah A-1876	1	66	.37
Mandan 1422	1	71	.54
Pubescent Wheatgrass			
A 1488	2	68	.48
Utah 109	2	60	.55
Mandan 759	2	90	.93
Topar	2	41	.26
Stream Bank Wheatgrass			
Sodar	4	94	.07

Key to Maturity
1. Before heading - immature
2. Headed out - blooming
3. Headed out - set seed
4. Mature seed

SORGHUM AND SOYBEAN TESTING

By C. J. Franzke

Table 12. Height, Maturity and Yield of Sorghum Varieties, 1959.

Variety	Height	Maturity	Bu/A
Northrup King NK 135	49	1	41.7
Northrup King NK 140	38	3	46.3
Northrup King NK X3000	37	2	37.1
Northrup King NK 210	32	3	16.2
Northrup King NK 230	33	3	8.6
Northrup King NK Exp 3026	27	2	18.9
Northrup King NK Exp 3005C	26	2	23.7
Northrup King NK Exp 3021	23	2	25.8
Northrup King NK Exp 3022	31	2	20.6
Northrup King NK Exp 3000B	30	2	17.9
Northrup King NK Exp 3000C	28	2	11.2
Notthrup King NK 145	46	1	11.0
Steckley R-99	38	2	17.1
Steckley R-103	31	2	7.7
Steckley R-104A	36	3	7.2
Steckley R-106	36	3	11.2
Steckley R-108	35	2	13.3
DeKalb C-44-a	31	3	9.8
DeKalb X-30	35	2	13.8
DeKalb X-49	36	2	5.8
Frontier 400B	34	2	17.3
Frontier 400C	28	2	9.1
Frontier 410B	28	5	8.4
Frontier 410C	37	5	7.3
Frontier S-210	55	7	0.0
Norghum	32	1	19.4
Reliance	32	1	18.6
Dual	33	1	24.7

Key to Maturity

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 dry-hot day time weather at flowering and pollination time caused much "blasting" or nonfertilization of flowers. It was not unusual to see many heads half fertilized, and in many cases the center portion of the head would not be fertilized. The adverse weather clearly defined the limits of many of the varieties. Any variety that was not in the "one" or "two" maturity range was much too late for grain production in this area.

Table 13. Soybean Variety Testing, 1959.

Variety	Group	Height inches	Maturity days	Bu/A
Flambeau	1	19	+3	9.0
Grant	1	16	+3	8.7
Mandarin or (Ottawa)	0	13	0	7.1
Norchief	1	16	+4	8.0
Blackhawk	0	12	-1	4.5
Chippewa	0	13	-2	8.2

The Mandarin or (Ottawa) is used as the guide crop, and all maturity ratings are expressed with reference to it. This soybean variety is quite well adapted to this area, and anything with minus days, matures that many days before Mandarin. Anything with plus days matures after Mandarin does.

The group designation is used because the Northeast Research Farm is in the transitional area between Group 0 and Group 1. These two groups have to be tested to find out which is more nearly adapted.

CORN BREEDING AND YIELD TESTING

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

The distinct advantage of earliness is quite evident in per cent moisture in the corn at harvest time. The soil moisture stress was very high till the rains during August came. This lessened the moisture demand somewhat, but the subsoil moisture was still low.

There are many advantages, from a corn breeder's standpoint, of the adverse conditions which existed during the 1959 crop season One being the ease of which nature helps eliminate the less desirable plants. It brings to light whether the plant will pollinate properly; produce a good sturdy stalk; have sufficient brace roots, also good roots below the surface. There are a multitude of things which help speed up selection under these conditions.

In table 14 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 converting 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 substracting 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 14. Codington County - Corn Performance Tests - 1959

Hybrid or Variety	1959 Perf. Score	Yield bu./A. *	Moisture %	2-yr. average Yield bu./A	2-yr. average Moisture %	3-yr. average Yield bu./A	3-yr. average Moisture %	4-yr. average Yield bu./A	4-yr. average Moisture %	5-yr. average Yield bu./A	5-yr. average Moisture %
Sokota SD210	110.2	37.7	29.6	40.4	25.6	43.4	28.9	44.5	25.4	46.5	22.6
SD Exptl. #30	108.8	36.9	29.5								
SD Exptl. #50	108.8	37.5	31.3								
Jacques 1005J	106.4	37.3	34.7								
Sokota SD220	106.3	34.7	27.2	37.4	26.3	42.4	29.5	42.2	26.3	43.3	24.0
DeKalb 46	105.7	34.4	27.3	39.7	25.8						
SD Exptl. #31	104.3	34.4	29.5								
Cargill 655	103.3	35.7	35.0								
Pfister PAG28	102.7	34.3	31.9								
Tomco 161	101.9	35.3	36.2								
Pride WM200	101.0	34.6	35.6								
Farmer 205	100.1	32.1	29.7	31.7	32.5	35.8	35.4	39.8	33.8	40.7	30.2
Kingscrost KS4	99.7	34.5	37.4	31.0	42.8	38.8	44.5				
Kingscrost KS3	99.0	34.5	38.6	35.4	39.4	41.0	41.2				
Pioneer 377A	98.5	34.0	38.0								
Funk G-18	98.4	33.5	36.6								
Pfister PAG32	96.5	30.3	30.3	34.2	30.9	40.2	34.0	43.0	30.2		
DeKalb 62	96.3	32.2	36.3	33.0	37.0	41.2	39.2				
SD Exptl. #32	95.8	30.6	32.4								
Pioneer 388	95.6	30.5	32.4	33.7	34.1	40.6	33.2	42.4	29.0	43.5	25.8
Gurney 90	93.4	29.6	33.4								
Funk G-11A	93.2	30.5	36.4								
Haapala H366	93.2	30.9	37.6								
Disco 108AA	92.3	30.7	38.5								
Master F-75	91.2	30.1	38.5								
United Hagie UH30B	82.1	26.6	43.1	25.8	51.6						
Average		(33.4)	(33.8)	(34.2)	(34.6)	(40.4)	(35.7)	(42.4)	(28.9)	(43.5)	(25.7)

* Least significant difference is 3.66 bu./acre.

SMALL GRAIN VARIETY TESTING

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

The very open winter of 1958-59 resulted in an almost complete kill of the winter grain nursery at the Northeast Research Farm. The few plants living in spring were considered chance survivors and the entire nursery was worked up and planted to flax. Since other locations in the state furnished excellent survival data, this loss did not affect the winter grain breeding program.

Soil moisture reserves in the spring of 1959 were low, and the presence of some snowbanks over part of the plots made yields very variable. Small grains were planted earlier than usual, on April 10. The low incidence of precipitation during the critical weeks of small grain development resulted in a rather stunted, variable crop. A brief period of high temperature stress in June reduced test weights and kernel weights.

Flax grown during the four year period 1956-59 has not been subjected to major yield reducing factors which would attack varieties differentially. In 1959, yields averaging nearly 6 bushels per acre are somewhat remarkable. Severe frost on May 14 destroyed above groundgrowth made to that date. Flax yields are presented in Table 15.

Table 15. Yields from the flax variety tests at the Northeast Research Farm, Watertown, 1959.

Variety	Yield in Bu/Acre		Test Weight
	1959	1956-59	1959
Marine	6.3	13.8	50
Redwood	5.8	13.7	49
B-5128	5.2	13.3	48
Bolley	6.0	13.2	48
Arny	6.2	13.7	47
Norland	5.3	13.9	47
Raja	4.1	11.3	48
Redwing	5.6	----	48
Bison	6.4	----	48
Linda	6.0	13.0	48

Spring wheat was rather stunted, and very ragged. Heads were very short, tillering very sparse. Later in the season, there was a substantial buildup in stem and leaf rust on the wheat. Yields were quite low, as seen in Table 16, where the yields of the spring wheats, both the hexaploid bread wheats and the durum or macaroni wheats, are shown, together with other data, and averages for the four years this station has been operative. The four year averages indicate the adaptation of durum wheat to this area.

Table 16. Spring Wheat Variety Test at the Northeast Research Farm, Watertown, 1956-59.

Variety	Average Yield Bushels per Acre 1959	1958-59	1956-59	Test Wt. 1959	Height inches 1959	Stem* Rust 1959	Leaf* Rust 1959
Hard Red Spring Wheat							
Selkirk	9.2	20.4	22.0	54	14	T	30
Lee	6.4	19.8	19.2	54	15	5	20
Rushmore	6.6	16.8	16.6	56	17	8	30
Conley	8.2	15.6	18.3	54	20	T	30
Spinkota	5.1	19.2	20.2	54	19	7	40
Overby's Sel.	3.4	17.0	----	52	20	27	40
Thatcher	4.1	14.1	15.5	54	17	8	60
Canthatch	8.3	16.6	----	54	18	8	50
Pembina	8.7	----	----	58	18	5	15
Mida	10.4	19.4	20.5	57	20	7	30
Lee[6] K. Farmer	4.9	20.8	----	54	15	18	30
Durum Wheat							
Sentry	5.4	24.5	25.6	56	23	7	2
Yuma	3.1	20.4	19.7	51	19	4	7
Ramsey	7.7	23.5	22.9	54	24	2	5
Langdon	2.2	22.8	23.4	54	22	5	3
Wells	6.3	26.6	----	56	21	2	12
Lakota	7.6	29.4	----	56	21	2	4
L.S.D.	Not. sig.	4.7	2.7				

* Stem and Leaf rust readings in percent.

Lack of adequate moisture and generally adverse growing conditions served to obliterate many differences among oat varieties. In this season late maturing varieties appeared to fare as well as any. It would appear that on the high ground, such as surrounds the Northeast Research Farm, a shift from late varieties to a high temperature tolerant type would not be profitable. Oat yields are presented in Table 17.

Table 17. Yields from the Oat Variety Tests from the Northeast Research Farm, Watertown, 1959.

Variety	Yield in Bu/Acre 1959	Yield in Bu/Acre 1956-59	Test Weight 1959
Andrew	16.4	60.0	32
Minhafer	23.9	65.1	31
Ransom	15.5	55.7	28
Mo-0-205	14.0	55.9	32
Burnett	19.4	64.3	30
Garry	19.3	66.8	24
Rodney	20.7	68.1	25
Sauk	24.1	71.3	31
Clintland 60	11.2	----	28
Minton	23.6	----	24
Goodfield	10.6	----	25
Ajax	19.3	64.4	25
Simcoe	20.3	68.2	27
CI. 7271	17.5	----	32
CI. 7272	19.4	----	27
L.S.D.	7.6		

Table 18. Barley Yield Tests from the Northeast Research Farm, 1959.

Variety	Bu/A	Test Wt.	Rank
Betzes	14.9	39	6
Custer	14.3	43	8
Feebar	4.5	35	13
Forrest	12.9	39	12
Husky	23.7	41	3
Kindred	16.1	42	5
Liberty	16.2	42	4
Manchuria	13.1	40	11
Parkland	24.3	40	2
Plains	13.8	40	10
Traill	13.9	41	9
Trebi	14.5	41	7
Wisc. 38	27.3	41	1

L.S.D. at 5% = 12.16

The barley was planted April 10, and started its growth in relatively dry soil. It was set back by a severe frost of May 15, and subjected to hot drying winds during the heading period. Due to dry conditions and low humidity, during small grain season, disease was of little consequence on barley. The crop was harvested July 28, 1959. Yields are presented in Table 18.

POTATOES

C. M. Nagel
Plant Pathology Department

Objective:

The selection of a superior potato variety possessing a high degree of resistance to our major disease problem.

Results:

Several hundred new potato seedling lines produced from the U.S.D.A. potato breeding program located at Presque Isle, Maine, have been obtained over the past several years as a result of a cooperative arrangement with the Vegetable Research Branch of the U.S.D.A., Beltsville, Maryland.

The following disease-resistant sources are involved: scab, ring rot, verticillum wilt, late blight, leaf roll, net necrosis (leaf roll), corky ring spot, viruses X, A, Y and S. Also, the main horticultural characteristics, such as tuber shape, skin color (red, white and russet), and percentage solids are considered in determining the overall performance of these lines ; when grown under South Dakota conditions at the Northeast Research Farm and at Brookings.

Because of the unusually dry seasons both in 1958 and 1959, accurate results on the disease reactions of these lines have been difficult to obtain. However, the results obtained are presented in table 19. Although yields were low and not trulyindicative of their performance under more favorable conditions, it is the purpose to select a few lines possessing high disease resistance to at least certain of our major disease problems and secondly, to have them possess desirable horticultural characteristics as well.

The lines appearing in table 19 have been grown in South Dakota for two years. Because only a few tubers of each line were obtained, yield data were not possible in 1959; however, adequate seed is now available for yield trials in 1960.

Table 19. Yield, disease and growth reactions of 20 U.S.D.A. potato lines grown at Watertown and Brookings, South Dakota, 1959.

Potato Line Pedigree	Yield Bu/A		Scab*		Rhizoc	Maturity	Vine Development
	Brookings	Watertown	Type	% Surface			
50B9	220.70	83.39	4	1	-	L	Good
			1	90			
B605-10	121.31	52.27	1	80	10	E	Poor
			2	20			
B2368-4	231.91	112.01	1	70	-	L	Good
			2	10			
B2368-13	182.54	92.93	2	70	T	L	Good
B3139-24	76.33	40.66	2	60	5	L	Good
			4	30			
B3309-8	170.09	104.96	2	60	-	E	Poor
B3352-8	199.96	72.19	1	70	20	L	Good
			2	15			
B3401-4	132.75	48.95	2	50	2	L	Fair
			4	10			
B3696-13	146.86	113.67	1	90	5	E	Good
B3726-6	102.88	74.67	2	60	-	M	Poor
			4	20			
B3837-4	143.54	92.51	2	70	-	L	Good
B3857-19	273.80	112.01	1	90	5	L	Good
			4	1			
B3900-3	194.57	55.18	1	40	5	L	Good
			2	20			
B3903-1	247.25	102.05	1	80	-	E	Poor
B3947-2	153.50	92.51	1	95	10	E	Poor
			2	30			
B4084-1	4.15	4.98	2	30	-	L	Fair
			4	80			
B4085-1	172.58	53.93	1	60	5	M	Fair
			3	2			
B4090-3	222.36	53.93	1	40	2	L	Good
			2	30			
B4134-14	154.33	102.88	2	80	2	M	Poor
B4158-1	96.25	70.53	1	90	3	M	Poor
			3	5			
Red LaSoda (Check)	268.83	121.14	1	40	3	M	Good
			2	30			

* Scab Type - 1 = mild, 4 = most severe or pit type acab
Maturity: L = late, M = medium, E = early

SMALL GRAIN DISEASES

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The "new" yellow dwarf disease problem of oats, wheat and barley was widespread and destructive on these crops during the 1959 season. This disease has also been referred to as the red leaf disease of oats. The yellow dwarf disease has also been the most destructive disease affecting oats throughout the United States during the past season. This disease is caused by a virus which is spread by certain known aphids. Although the same virus is responsible for the disease on oats, wheat and barley, the symptoms are different. On oats it causes the upper leaves to turn a reddish-buff to a bright red color. On wheat and barley it causes the leaves to turn a pale yellow color. Due to the drought conditions in 1959, which caused unfavorable growing conditions, it was difficult to distinguish between the disease symptoms of this disease on wheat and barley and the damage done by drought. However, there was less difficulty in distinguishing the red leaf symptom in the case of oats.

The disease also causes severe stunting, the tillers fail to produce heads, and yield may be reduced to a few bushels per acre. In fact, many fields were plowed under in 1959 because the plants in these fields were 100 percent severely diseased with virtually no prospects of any yield in sight. An estimate of the dollar loss to farmers would be upwards to a quarter million dollars; however, had the disease struck in a year in which weather conditions were favorable for high crop production, the loss would have been more like 10-50 millions of dollars.

The control of this disease is complicated by the fact that several strains of this virus disease are known to exist. Therefore the problem of the development of resistant grain varieties to a disease possessing more than a single strain makes its control much more difficult.

The map, Figure 1, will show the areas in the eastern part of the state where this disease was most damaging on oats, wheat and barley.

Infection in oat fields ranged from a trace to 90 percent; wheat, trace to 80 percent; and barley trace to 50 percent. Percentage losses in the areas having the disease were estimated as follows: oats 50, wheat 30, barley 20.

About the second or third week in May, winds from the south carried aphids into eastern South Dakota. These aphids through their feeding process on yellow dwarf diseased oat fields in the southern states carried the yellow dwarf disease virus north in their bodies. Therefore, as they started to feed on the crops in South Dakota, they automatically injected the virus into the grain plants as they sucked the juice from the plants.

FIGURE 1. Distribution of yellow dwarf virus in South Dakota in 1959.

= area where BYDV occurred on oats.

= area where BYDV occurred on wheat.

= area where BYDV occurred on barley, oats, and wheat.

By early June, aphids had largely disappeared because of unfavorable conditions. However, the oat crop, spring wheat and barley began to show signs of the yellow dwarf disease and decline of these crops continued until harvest time. The major damage to the crop occurred after the aphids disappeared. It is important to note that the explanation for the delay in the development of the yellow dwarf symptoms is due to the fact that it requires about ten days for the incubation period; that is, between the time the virus first enters the plant and the time that the first disease symptoms appear.

The crop most damaged by this disease in South Dakota was oats; it appears to be the most susceptible of the three crops. Fortunately, a few varieties and unnamed selections of oats possess some degree of resistance to the barley yellow dwarf virus. However, none are well adapted to South Dakota conditions. Nevertheless, these resistant sorts can be useful in a breeding program to develop new virus resistant varieties suitable to our conditions, but this will take time to accomplish.

SOYBEAN CYST NEMATODE DISEASE SURVEY IN SOUTH DAKOTA

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The soybean cyst nematode* is a serious new disease to the soybean industry in the United States. Although the disease is not known to be in South Dakota, there is a chance this new disease could become established in the soybean growing areas of this state. It currently is spreading in the eastern and south central states.

The Plant Pathology Department in cooperation with the Plant Pest Control Branch of the United States Department of Agriculture has 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 has been completed and the soybean cyst nematode was not found.

It is fortunate the survey was contemplated and carried out prior to the appearance in South Dakota of this dangerous plant disease. Periodic surveys will be made every other season to determine if the disease has entered the state and, if found, a coordinated program will be worked out for its control.

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* Heterodera glycines, Ichinohe