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ANNUAL PROGRESS REPORT

NORTHEAST RESEARCH FARMS
Garden City and Watertown, South Dakota

INTRODUCTION

The State Legislature appropriated money in 1955 for new research in crops, soils, and crop diseases in northeastern South Dakota. A 20-acre site was originally selected. It is located on the Otto Korth farm, 15 miles north of Watertown at the junction of Highways 81 and 20. A second site was added in 1965 at Garden City. It is located on the Everett Fletcher farm, 2 miles north and a half mile west of the Garden City junction on Highway 25. There are 45 acres in this farm for crop and soil management and 15 acres for weed control studies.

These farms provide research facilities to obtain solutions for local problems in crop production and soil management. Soil and crop management experiments include tillage methods and the use of fertilizers and the soil fertility. Crop oriented experiments are conducted on disease control, weed control, and the testing of potentially adaptable varieties.

Evaluation of plant materials by plant breeders in the Agronomy Department are carried on at these farms. Local weather conditions aid in the selection of plants adapted to the area.

There will not be a field day at the Garden City Unit in 1969, but tours may be scheduled by the County Extension Agents at either Research Unit.

NORTHEAST EXPERIMENTAL FARM COMMITTEE

Member	County	Address
W. H. Schwanke (Chairman)	Codington	Watertown-Rt. #3
Fred Morris (Secretary)	Codington	Watertown
Grant Kellogg	Codington	Watertown-Rt. #2
Harold Hurlbut	Clark	Raymond
William Peterson	Day	Lily
Alfred Skovly	Deuel	Astoria
Lyle Kriesel	Grant	Summit
Oliver Heitsmeyer	Hamlin	Estelline
Donald Naddy	Marshall	Britton
Elmer Greseth	Roberts	Sisseton

Farm Personnel		
Quentin Kingsley, Project Leader	SDSU Agronomy Dept.	Brookings
Donald W. Nelson	SDSU Employee	Garden City Unit
Edwin O. Noeldner	SDSU Employee	Watertown Unit

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

BRIEF HISTORY

All experiments or cultural practices, which were at Watertown are discontinued. New ones are now being studied at Garden City. During the coming 1969 season at Garden City, the following general work will be continued: winter wheat hardiness and yield trials; to determine and control the local diseases and insects of potatoes; influence of sorghum row spacing and population on yield; sunflower seed production, and plots to increase the seed supply of some experimental and plant introductions. All experiments are on the contour with roadways located in the grassed drainways for access to the experiments.

The Watertown Unit is utilized for adaptation studies with corn, small grain, winter grain, sorghum, soybeans, and for plant disease observations. These studies will be continued on this farm due to its environment and soil condition.

TABLE OF CONTENTS

1968 CROP SEASON

Table 1. Total Rainfall and Average Temperature by Months with Their Departure from Long-Time Average at Northeast Research Farms*

Watertown and Garden City Units

	April	May	June	July	Aug.	Sept.	Oct.	Total
RAINFALL**								
Total in Inches								
Watertown	3.04	2.15	3.18	2.39	1.53	2.56	2.00	16.85
Garden City	3.70	2.71	4.01	2.62	1.69	2.25	2.20	19.18
Departure from Long-time Avg.								
Watertown	+0.98	-0.72	-0.52	-0.28	-1.25	+0.71	+0.84	- 0.24
Garden City	+1.51	-0.14	+0.01	-0.25	-1.27	-0.02	+0.68	+ 0.51
TEMPERATURE								
Average Monthly in degrees F								
Watertown	41.7	50.4	63.8	67.2	68.7	56.2	44.3	----
Garden City	43.6	49.9	64.7	65.7	66.8	55.9	48.7	----
Departure from Long-Time Avg.								
Watertown	- 1.5	- 5.6	- 0.1	- 5.1	- 0.3	- 3.7	- 3.4	----
Garden City	- 0.7	- 6.9	- 1.3	- 7.1	- 4.2	- 4.8	+ 0.1	----
Froat free days								
Watertown	May 24 to October 3 = 132 days							
Garden City	May 18 to October 3 = 138 days							

** Longtime rainfall average for 12 months

Watertown Airport	20.85
Clark	22.46

The past crop season had below normal average temperatures for all months of the growing season, except October at Garden City. Rainfall was above average at Garden City for April, June and October, and at Watertown for April, September and October, but below normal for the rest of the season. Corn was mature by frost and was safe for satisfactory storage. Fall subsoil moisture reserves were 2.72 inches higher than in the spring.

* The above rainfalls and temperatures were taken and recorded at the Northeastern Research Farms. The departure from long-time average was obtained by comparing data taken at the farm to the long-time average at the Watertown and Clark Weather Stations, courtesy U. S. Weather Bureau, Huron, South Dakota.

Table 2. Periods of Frost-Free Days Recorded at the Northeast Research farm, Watertown Unit

Year	Last Frost	First Frost	Frost-Free Days
1956	May 4	Sept. 6	125
1957	May 20	Sept. 16	119
1958	May 23	Sept. 16	116
1959	May 22	Sept. 10	110
1960	May 11	Sept. 19	123
1961	May 10	Sept. 25	138
1962	April 30	Sept. 20	143
1963	May 23	Oct. 28	158
1964	June 11	Sept. 10	92
1965	May 28	Sept. 9	104
1966	May 20	Oct. 5	138
1967	May 21	Sept. 26	129
1968	May 24	Oct. 3	132
		Average Frost Free Days	125.1

FERTILITY AND CULTURAL PRACTICE EXPERIMENTS

Garden City and Watertown Units

Q. S. Kingsley

TITLE: The Long Term Effect of Row Versus Broadcast Method of Fertilizer Application on Soil Fertility and Crop Rotation.

OBJECTIVES OF EXPERIMENT:

1. To compare the effect on crop yields of fertilizer applied in a row with that broadcast and then plowed under or disked in.

2. To determine the relative management efficiency of the three methods in terms of economic returns for labor, equipment, and other inputs for the typical South Dakota farms.

3. To determine the effect of the three methods on soil tests and the effect of residual carryover on the succeeding crop yield.

NEED TO STUDY:

1. Should the farmer buy equipment for the row application of most of the phosphate required for small grain and row crops: Additional labor would be needed during busy planting time for this application in comparison to the other methods.

2. Should he eliminate the additional labor by having higher rates of phosphate broadcast with nitrogen and plowed under?

3. What is the long term effect on yield and soil fertility of (1) a small amount of fertilizer applied to a small part of the surface soil as compared to (2) a large amount of fertilizer mixed throughout the surface soil?

EXPERIMENTAL PLAN:

The plots receiving nitrogen are to receive the same amount, but the two crops will receive different amounts. Corn has received 50 pounds of nitrogen and wheat, 30 pounds of nitrogen per acre. The phosphate applications vary according to the following summary. In this summary the rates are expressed as elemental phosphorus and nitrogen in pounds per acre. Phosphorus may be converted to phosphorus pentoxide by multiplying the elemental P shown in formula by 2.3. To reverse this procedure multiply 0.44 times P_2O_5 to get the elemental quality.

Corn - 6 treatments	Wheat - 6 treatments
N-P-K	N-P-K
0-0-0	0-0-0
0-0-0	30-0-0
50-0-0	30-7-0
50-7-0	30-15-0
50-15-0	30-15-0
50-30-0	30-30-0

The three initial corrective treatments were included in each experimental block, as is shown below. These ratios are also in terms of the elements N,P, and K. A maintenance treatment will be applied to each of these plots starting with the first crop season. No K is added in the maintenance fertilizer. The fertilizer treatment for corn is to be:

Corrective	Maintenance*
100-0-0	50-0-0
100-60-0	50-7-0
100-60-100	50-7-0
for wheat	
100-0-0	30-0-0
100-60-0	30-7-0
100-60-100	30-7-0

* The fertilizer will be broadcast in the fall and spring plowed.

There are 8 replications of the plots for each crop-year block and treatment, except for the corrective treatments which was applied to 3 plots in each of the 16 blocks. These three plots are on one end of each block. A randomized block design was used and the plots will remain as whole plots until the last year of the experiment (1969) at which time all plots are to be divided. Half of each plot will receive fertilizer and the other half none. Residual effects are to be determined at this time. The residual fertility is the fertilizer which was not used by corn but is used the following year by wheat or vice versa.

N and P contents will be determined for the grain, the corn stover, wheat straw and for the soil at the beginning and the end of the experiment.

Fertilizer will be applied at three different times:

1. Fall application, with plowing the following spring.
2. Spring application after plowing, then disk in.
3. Drill-with-the-seed application or starter

Weed control will be maintained at the discretion of the farm manager.

RESULTS:

Table 3. Time, Rate and Placement of Fertilizer for Whaat

Treatment	Time of Method of Fertilizer Application Yield in Bushel per acre								
	Broadcast Fall		Av. protein	Broadcast Spring		Av. protein	Drill with Seed		Av. protein
	1968	65-68	65-67	1968	65-68	65-67	1968	65-68	65-67
0-0-0	26.6	22.5	13.1	28.4	24.1	12.6	25.6	21.8	12.4
30-0-0	35.7	27.3	13.8	37.3	33.5	13.4	37.1	27.7	14.1
30-7-0	45.6	30.3	14.5	43.0	29.8	14.1	45.0	32.1	14.1
30-15-0*	48.1	32.4	14.0	42.8	30.4	12.9	42.8	31.4	14.1
30-15-0**	44.5	31.2	14.0	38.2	28.8	13.1	42.9	31.1	14.0
30-30-0	49.2	32.2	13.7	45.3	31.1	12.8	46.2	33.0	13.3

*30-15-0 Preceded by corn 1967 with 50-15-0 treatment
**30-15-0 Preceded by corn 1967 with 0-0-0 treatment

DISCUSSION AND INTERPRETATION OF RESULTS:

For this year, the addition of phoaphorus with nitrogen increased yields more than nitrogen alone when compared to the untreated plots. The method and time of application of the different levels of fertilizer seemed to affect the yield. Fall broadcasting of fertilizer (Table 3) at 30-30-0 pounds per acre, produced 22.6 bushels more than

the untreated plot. Spring broadcasting of fertilizer at a rate of 30-30-0 pounds per acre, produced 16.9 bushels more than the untreated plot. At a rate of 30-30-0 pounds per acre, fertilizer drilled with the seed increased yields 14.9 bushels per acre more than the unfertilized plot. The time, rate and placement of fertilizer were important factors during the 1968 crop season.

RESULTS:

Table 4. Time, Rate and Placement of Fertilizer for Corn

Treatment	Time and Method of Fertilizer Application Yield in Bushels per Acre								
	Broadcast Fall		Av. protein	Broadcast Spring		Av. protein	Starter In Row		Av. protein
	1968	65-68	65-67	1968	65-68	65-67	1968	65-68	65-67
0-0-0*	60.2	44.7	8.7	50.6	43.5	7.8	61.3	46.9	8.1
0-0-0	61.3	45.3	7.9	57.5	45.3	8.1	56.5	44.4	8.3
50-0-0	70.8	58.5	9.5	72.1	59.7	9.2	67.5	55.9	9.2
50-7-0	69.8	62.5	9.1	67.9	58.4	8.6	68.8	58.5	8.7
50-15-0	72.2	61.2	9.2	65.3	61.9	8.8	65.5	57.9	8.7
50-30-0	58.8	57.9	9.2	56.6	56.6	8.5	68.1	57.5	8.4

* This treatment received 30-15-0 for wheat in 1967

DISCUSSION AND INTERPRETATION OF RESULTS:

The broadcasting of fertilizer in the fall seemed to be the better method for corn the 1968 crop season. Yield, Table 4, response from nitrogen alone was about as high in the 1968 as those having phosphorus in the ratios. A residual carryover for the 0-0-0 treatment, which was preceded by 30-15-0 in 1967, helped increase yields 4.8 bushels in the starter applied fertilizer treatment. The yields on an over all average are higher than for 1967 and the moisture content was lower.

Three plots of each replication received high applications of fertilizer for wheat and corn in 1965. Subsequent to this large application, a maintenance amount is to be applied each year as indicated in Tables 5 and 6.

RESULTS:

Table 5. Large Initial Application of Fertilizer plus Maintenance Fertilizer for Wheat

Rate 1965	Rate 1968	Yield Bu/A	Av. 65-68	Av. Protein 65-67
100-0-0	30-0-0	40.1	28.8	13.2
100-60-0	30-7-0	44.3	32.2	14.4
100-60-100*	30-7-0	47.3	32.9	14.2

*Potassium was applied in 1965 only.

As a brief resume, wheat was planted initially in the spring of 1965 after the plots received the initial heavy application of fertilizer reported in Table 5. Each fall starting with 1965, the maintenance amounts of fertilizer were applied and then plowed under the following spring.

The yield increase caused by the large initial application plus the maintenance application of fertilizer, Table 5, produced a slightly higher yield than the similar treatment which lacked the initial application, Table 3.

RESULTS:

Table 6. Large Initial Application of Fertilizer Plus Maintenance Fertilizer for Corn

Rate 1965	Rate 1968	Yield, Bu/A	Av. 65-68	Av. Protein 65-67
100-0-0	50-0-0	74.1	61.9	9.1
100-60-0	50-7-0	70.5	64.9	8.8
100-60-100*	50-7-0	66.1	64.6	9.2

*Potassium was applied in 1965 only.

Corn was planted following these heavy applications in 1965 and the management was the same as for fertilized wheat. By comparing Table 6 to the fall broadcast treatment in Table 4 the effect of residual fertilizer becomes apparent. Increases in yield vary from 3.3 bushels for the 50-0-0 treatment to 0.7 bushels for 50-7-0 treatment and no increase in yield may be due to the potassium in the initial application.

RESULTS:

Table 7. Time, Rate and Placement of Fertilizer for Wheat. Fall Broadcast Fertilizer, Moisture Use and Bushels Per Inch of Water Utilized

Treatment N+P Lbs/A	Yield Bu/A	Water Loss Inches*	Precip. During Season	Loss from Profile and Precip. **Inches Used	Bushels Per Inch of Water Used***
0-0-0	26.6	0.67	12.52	13.19	2.01
30-0-0	35.7	1.46		13.98	2.52
30-7-0	45.6	1.17		13.69	3.33
30-15-0(1)	48.1	1.26		13.18	3.60
30-15-0(2)	44.5	1.56		14.08	3.16
30-30-0	49.2	0.30		12.82	3.83
100-0-0(3)	40.1	0.20		12.72	3.15
100-60-0(4)	44.3	3.72		16.42	2.72

*Soil water loss in the 3-foot section of the soil from April 10 to Aug. 14 when the soil was near the wilting point.

**Loss includes water used by plant, evaporation, and runoff after receiving precipitation. Even though some is lost, all figure into the total used.

***Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used.

(1) Preceded by 50-15-0 in 1967
(2) Preceded by 0-0-0 in 1967
(3) 100-0-0 applied in 1965 with 30-0-0 applied every year after.
(4) 100-60-0 applied 1965 with 30-7-0 applied every year after.

Table 8. Time, Rate and Placement of Fertilizer for Corn, Fall Broadcast Fertilizer, Moisture Use, and Bushels of Grain Per Inch of Water Utilized

Treatment N+P Lbs/A	Yield Bu/A	Water Gain Inches*	Precip. During Season Inches	Loss from Profile and Precip. Inches** Used	Bushels per Inch of Water Used***
0-0-0	61.3	2.10	12.93	10.83	5.66
0-0-0(2)	60.2	2.27		10.66	5.64
50-0-0	70.8	2.51		10.42	6.78
50-7-0	69.8	3.96		8.97	7.78
50-15-0	72.2	1.05		11.88	6.08
50-30-0	58.8	2.76		10.17	5.78
100-0-0(3)	74.1	4.04		8.89	8.33
100-60-0(4)	70.5	3.12		9.81	7.19

*Soil water loss in the 3-foot section of the soil from May 20 to Nov. 1 when the soil was near the wilting point.

**Loss includes water used by plant, evaporation and runoff after receiving precipitation. Even though some is lost, all figure into the total used.

***Calcualted by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used.

(2) Preceded by 30-15-0 in 1967
(3) 100-0-0 applied in 1965 with 50-0-0 applied every year after.
(4) 100-60-0 applied in 1965 with 50-7-0 applied every year after.

DISCUSSION AND INTERPRETATION OF RESULTS

The use of stored soil moisture and precipitation during the growing season to produce wheat or corn was studied in the plots fertilized by the fall-broadcast method. The results are reported in Tables 7 and 8. Residual response for fertilizer applied in previous years increased wheat yields and the use of moisture in comparison to untreated plots. With the addition of fertilizer, plants made better use of the moisture and produced more bushels of grain per inch of water used this season.

TITLE: DEPTH PLACEMENT OF FERTILIZER FOR WHEAT AND SILAGE CORN

OBJECTIVES OF EXPERIMENT

1. Evaluate various methods of fertilizer application.
2. How much will placement increase yield or profits?
3. What effect will fertilizer placement have on moisture extraction?

EXPERIMENTAL PLAN:

1. Land was laid out by areas and each Block contained 8 plots which represented 1 replication. There are five replications in each phase.

2. A rotation of wheat and silage corn is being used.

3. Treatment No. 1 - The fertilizer is broadcast on the stubble and plowed in;
   Treatment No. 2 - Plow Sole fertilizer is banded at 21 inch intervals;
   Treatment No. 3 - Deep Application - fertilizer is banded at 21 inch intervals and from 14 to 16 inches deep.

4. All fertilizers are applied in the fall except in the first year. Plots not receiving deeply placed fertilizer are subjected to the same deep ripping treatment.

5. Plowing is on the coutour along the long axis of the block with beginning and finish of plowing in the alleyways between blocks.

6. Direction of plowing must be altered every year.

7. Planting is on the contour. Silage corn in 30 inch rows, small grain in 7 inch rows.

8. A plant mulch is maintained for winter cover.

9. Soil moisture is sampled with a Neutron measuring and recording device at depths of 8 inches, 12 inches, 24 inches, and 36 inches.

10. Soil analysis - Soil samples to be taken at 0-6", 6-12", and 12-18" for Organic matter, Soluble Nitrates, Available P, Available K, pH, and Soluble Salts.

ROTATION:

1. Wheat-Silage Corn

TREATMENTS

	Wheat	Corn
Broadcast on stubble	60-0-0 + 15# P*	0-0-0
	120-0-0 + 15# P*	0-0-0
Plow Sole	60-0-0 + 15# P*	0-0-0
	120-0-0 + 15# P*	0-0-0
Deep Placement	60-0-0 + 15# P*	0-0-0
	120-0-0 + 15# P*	0-0-0
Check plot (Ripped)	0-0-0	0-0-0
Check plot (Not ripped)	0-0-0	0-0-0

* The 15 pounds of phosphorus will be applied with the grain drill at planting time.

Ratios expressed in actual N and P.

PLANTING RATES

1. Wheat; 1 Bushel-1 1/4 Bushel per acre. Cris wheat.
   Corn, Silage 17-18 thousand plants per acre.

WEED CONTROL

Small grain; 2, 4-D
Corn - Ramrod and 2,4-D

RESULTS:

Table 9. Depth Placement of Fertilizer for Wheat. Fall Applied in 1967. Moisture Used and Bushels of Grain Per Inch of Water Used.**

Treatment N+P (4) Lbs/A		Yield Bu/A	Water Loss Inches*	Precip. During Season	Loss From Profile and Precip. Inches Used**	Bushels Per Inch of Water Used***
0-0-0	No Rip	52.2	2.92		15.44	3.37
0-0-0	Rip	51.8	2.36		14.88	3.48
60-0-0	Broadcast (1)	56.3	2.44		14.96	3.76
60-0-0	Plow Sole (2)	53.4	1.64		14.16	3.77
60-0-0	Deep (3)	51.6	2.36		14.88	3.47
120-0-0	Broadcast	53.2	1.36		13.88	3.77
120-0-0	Plow Sole	49.8	2.88		15.40	3.23
120-0-0	Deep	53.2	2.72		15.24	3.49

* Soil water loss in 3-foot section of the soil from April 9 to Aug. 14 when the soil was near the wilting point.

** Loss includes water used by plant, evaporation and runoff after receiving precipitation. Even though some is lost, all figure in the total used.

*** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used.

(1) Fertilizer broadcast on surface and plowed in.
(2) Fertilizer applied at 21 inch spacing 6-7 inches deep.
(3) Fertilizer applied at 21 inch spacing 14-16 inches deep.
(4) At planting time, 15# of P is applied with grain drill to the nitrogen treatments.

DISCUSSION AND INTERPRETATION

Deep tillage loosens and shatters the soil to increase water penetration. It is most effective when the soil is dry as was the case last fall when the plots were prepared for 1969.

There were no wheat yield, Table 8, increases due to ripping of unfertilized plots. Nitrogen fertilizers, either 60-0-0 or 120-0-0, increased yield 1.0 to 4.0 bushels, but the depth placement did not seem to have much effect. In addition, the number of bushels of wheat produced per inch of watar lost which was stored in the soil and added by precipitation was not increased by ripping but was increased by nitrogen application.

TITLE: WINTER WHEAT MANAGEMENT

OBJECTIVES OF EXPERIMENT

1. The effect of various fertilizer rates and ratios and methods of application to winter wheat yield.
2. Comparison of equipment used to plant in stubble mulch maintained by minimum tillage.
3. Relationship of protein content to yield at various fertilizer rates and tillage methods.

EXPERIMENTAL PLAN

1. Winter wheat follows either oats, barley or flax depending upon the plots available that year.

2. There are 4 replications in the experiment.

3. Fertilizer treatments
   All fertilizers are applied in the fall.
   Levels in different treatments.
   (1) Nitrogen - 30 and 50 pounds per acre.
   (2) Phosphorus - 7 and 15 pounds of actual P per acre.
   (3) One no treatment in each replication.
   (4) Nitrogen and phosphorus are used singly or combined in all ratios.

4. Mechanical treatments
   (1) The fertilizer s broadcast on the stubble and wheat is planted with a press drill, with 7 inch spacings.
   (2) The fertilizer is applied with the seed using a press drill with 7 inch spacings.
   (3) The fertilizer is applied with the seed using a deep furrow drill with 12 inch spacings.

5. Planting rate 1 to 11/4 bushels of Lancer winter wheat per acre.

6. Soil analysis - soil samples to be taken at 0-6" and 6-12" depths for organic matter, soluble nitrates, available P, available K, pH, and soluble salts.

7. Protein analysis (Kjeldahl Method) of the grain from all treatments.

RESULTS:

Table 10. Fertilizer Placement and Planting Methods for Winter Wheat, Garden City Unit, 1968

Actual N and P	Broadcast Press Drill	With Seed Press Drill	With Seed Deep Furrow
0-0-0	20.3	23.3	12.0
0-7-0	19.8	21.5	19.0
0-15-0	20.8	20.6	16.7
30-0-0	25.1	26.3	14.6
30-7-0	36.8	31.3	25.8
30-15-0	40.6	35.7	25.8
50-0-0	33.8	31.0	16.1
50-7-0	41.6	50.5	32.2
50-15-0	51.9	54.1	33.7

DISCUSSION AND INTERPRETATION:

The stubble mulching of barley for this experiment is performed about 11/2 weeks after combining. Tillage is 3 to 4 inches deep which is deep enough to cut all weed roots but not deep enough to bury the stubble. Tillage must be at sufficient speed to disturb the soil without turning the stubble under.

The winter wheat yield, Table 10, for the broadcast treatment 30-0-0 plots was 4.8 bushels more than the untreated plots. The addition of phosphorus at 7# and 15# to the 30-0-0 treatment increased yields 16.5 and 20.3 bushels. Where 50-0-0 was applied, yield for the broadcast treatment increased 13.5 bushels. The 50-7-0 and 50-15-0 treatments increased yields by 21.3 and 31.6 bushels per acre more than the 0-0-0 treatment.

The yields where the fertilizer is applied with the seed using a press drill, are similar to those where the fertilizer was broadcast. The addition of phosphorus to the 30# and 50# nitrogen treatments increased yields as much as 9.4 bushels for the 30-15-0 when compared to the 30-0-0 and 12.4 bushels more than 0-0-0. A 23.1 bushel increase over 50-0-0 resulted for the addition of 15# of phosphorus to the 50# rate of nitrogen and a 30.8 bushel increase over 0-0-0.

The yields for application of fertilizer with the aeed using a deep furrow drill or hoe drill are much lower at the Garden City Unit than for plantings using the press drill. Rainfall during the growing season was near normal to above normal. Adequate rainfall minimized the yield increase occasionally obtained from wider row spacings. Yield increases of 21.7 bushels were obtained at the 50-15-0 level of fertilization but this yield was 19.3 bushels below the average yield of the 50-15-0 level for the other 2 methods using a press drill.

The combining of 2 fertilizer elements in this fertility program resulted in higher yields for all methods of application. Winter wheat requires fertility for fall starting and again in the spring to continue the growth cycle. Being a two season user of fertility, its requirements are higher than for spring grains, which require fertilizer for one seaaon.

RESULTS:

Table 11. Fertilizer Placement and Planting Methods For Winter Wheat, Watertown Unit, 1968.

Actual N and P	Broadcast Press Drill	With Seed Press Drill	With Seed, Deep Furrow
0-0-0	16.6	19.2	18.5
0-7-0	16.5	19.6	21.8
0-15-0	17.7	21.4	20.4
30-0-0	20.2	18.2	17.7
30-7-0	18.0	22.5	20.8
30-15-0	15.5	22.8	23.0
50-0-0	16.5	18.1	20.0
50-7-0	21.7	22.1	22.7
50-15-0	18.2	19.9	25.0

DISCUSSION AND INTERPRETATION

The moisture conditions at the Watertown Unit, except for April, were below normal during the growing season and in the fall of 1967. The yield response pattern varied with the method of fertilizer application and the type of grain drill used.

In dry seasons, the method of fertilizer incorporation into the soil is important. The yields, Table 11, for broadcasting the fertilizer on the surface indicates the fertilizer was not available for plant uptake. The use of the deep furrow drill for fertilizer application and planting was the better method, at higher rates, in this year of low rainfall and low subsoil moisture reserves.

This is but one year's results and are not sufficient for definite conclusions. Winter wheat had been grown successfully at both farms for 4 years when planted in stubble mulch. The use of a deep furrow drill or press drill on plowing, summer fallow, or debris-free soil has not produced a good stand the following spring.

Volunteer barley plants from the previous crop is not a deterent to the winter wheat. The volunteer plants left standing after frost offers more protection to the young wheat plants, and serves as a blanket to control temperature variations and wind and water erosion.

GREEN CHOP FORAGE

OBJECTIVES:

1. Determine the forage yield of crops planted with a grain drill using oats and various companion crops.

2. Compare regrowth of these crop combinations.

RESULTS:

Table 12. Green Chop Forage Combination Test 1968, Tons Per Acre
Garden City Unit

Crop*	Wet Wt.	12% H_2O Wt.
Oats + Sorghum 0-0-0	7.5	2.7
Oats + Sorghum 30-15-0	9.8	2.7
Oats + Soybeans 0-0-0	7.9	3.1
Oats + Soybeans 30-15-0	10.7	3.4
Oats + Field Peas 0-0-0	8.9	3.0
Oats + Field Peas 30-15-0	10.4	3.4
Oats 0-0-0	6.7	2.5
Oats 30-15-0	10.1	3.6

* Planted May 16
Harvested July 22

DISCUSSION AND INTERPRETATION

A press drill was used for planting these crops. The planting rate for oats was 3 bushels per acre and 2 bushels per acre when planted with other crops. The sorghum, soybeans and field peas were planted at half their normal recommended rates per acre. The addition of fertilizer to this forage study helped increase the wet weights and the dry weights of all except dry weights for the oats-sorghum combination. Yield tests were taken when the oats was in the late dough stage.

The oats plus sorghum produced enough regrowth for pasturing but not cutting.

SOIL AND WATER LOSS DEMONSTRATION (RUNOFF)

E. J. Williamson

OBJECTIVES:

1. To demonstrate soil and water losses affected by up and down slope farming for two cropping sequences:

   a) 2 year: row crop - small grain
   b) 4 year: row crop - small grain - legume - legume

2. To demonstrate soil and water losses affected by contour farming for the two year cropping sequence.

3. To quantitatively show and compare the effects of up and down slope versus contour farming on crop yield, soil moisture, soil erosion and runoff.

HISTORY AND INSTALLATION:

The demonstration is a cooperative effort between the Soil and Water Conservation Districts of Area I and South Dakota State University. The eleven Districts (ten counties) of the Northeast Area provided the funds for the construction materials of the demonstration. Installation was done in the spring of 1968 by personnel of the Experiment Station and Cooperative Extension Service.

DEMONSTRATION DESIGN:

There are nine plots involved in the demonstration. Each plot is 72' long and 14' wide, approximately 1/50 acre. Runoff from each plot is collected in catch basins and measured for both soil and water runoff. All plots are on a 4 2/3% slope. The soil type is Poinsett silty clay loam.

OPERATIONAL PLAN:

1. Two cropping sequences are used:

   a) Corn and oats (2 year).
   b) Corn - oats - alfalfa & brome - alfalfa & brome

2. The two year cropping sequence is compared to both up and down slope and across slope planting directions, and the four year sequence to the up and down slope only.

3. Minimum tillage for maximum residue surface cover is maintained.

4. Varieties recommended for the area, fertilizer rates from soil tests and recommended rates of herbicides and insecticides are used. 1968: Brave oats, Sokota 220; Vernal alfalfa and Smooth Brome; Fertilizer treatments: Corn 60-35-0, Oats 35-35-0, Alfalfa 30-140-0, all broadcast prior to seeding; Aldrex for rootworm control.

5. Planting of small grain in 7 inch rows; row crop in 36" rows.

6. Soil moisture is sampled at 6, 12, 24 and 36 inch depths at beginning and end of growing season.

DISCUSSION AND INTERPRETATION:

It was necessary to earth shape some of the plots to obtain a uniform 4 2/3% slope. As a result considerable soil disturbance and compaction occurred. Consequently, data from this year's results were quite erratic. However, over winter climatic factors of freezing and thawing and wetting and drying should be effective in alleviating this situation for the next growing season.

WATER STORAGE CAPACITIES OF VARIOUS SURFACE CONDITIONS AND GEOMETRIC SHAPES*

C. A. Onstad and P. E. Stegenga

OBJECTIVES:

1. To determine the geometric shapes of bedding, conventional tillage, listing, and listing superimposed on bedding.
2. To determine the surface water storage capacities for these types of tillage operationa.
3. To determine the effects of these tillage operations on soil moisture, crop yield, and terrace spacing.

*This study was conducted by the Soil and Water Conservation Research Division, Agricultural Research Service. Project No. SWC 2-W7 for 1968.

1968 PRACTICES AND OBSERVATIONS

All plots were planted of May 28, 1968, with Pioneer 384 MF at the rate of 14,000 plants/acre and fertilized with 200 lbs/acre of 22-22-0.

The plots, in general, looked very good throughout the growing season. However, the conventionally tilled plots looked better than the listed, probably due to the relatively cool early summer. At harvest, the listed plots did not yield so well as the conventional plots.

No soil moisture or surface storage measurements were made during 1968. These characteristics as affected by different tillage practices are discussed in detail in a M.S. Thesis by Coy W. Doty.**

**Doty, Coy W. "Potential Surface Water Storage Capacity of Various Contoured Geometric Shapes." M.S. Thesis in Agricultural Engineering. South Dakota State University, 1968.

SUMMARY OF EXPERIMENT, 1966-1968

Table 13 summarizes the corn yield on the plots for 1966-1968 and includes the averages. There is some variation in the corn yield averages but the averages are not significantly different. The average yields year by year are also not significantly different.

To evaluate the effect of these six different tillage treatments on potential surface water storage throughout the year; Doty, in his thesis, introduced the potential surface water storage index. This index utilizes the amount of available storage on the different geometric shapes and the percent of mean annual precipitation between each cultural operation. Table 14 shows the index and

the storage increase over conventional contouring for each of the five other tillage practices on a 4% slope. Doty goes on to say that even though the 4-row bedding treatments increase potential storage most, 8-row bedding is nearly as good and is the most versatile of the shapes studied. Eight-row beds are easily constructed during normal plowing operations and the maintenance program is simple. furthermore, 8-row beds are more conductive to the large field equipment presently being used by farmers.

The increase in surface water storage by bedding reduces the potential amount of runoff and soil erosion so that no terraces are needed to maintain a tolerable soil loss on the soils of eastern South Dakota. So in addition to conserving moisture, they also reduce erosion.

Soil moisture data for the year 1966 and this and two other locations where this experiment was conducted indicates that there was no significant difference in soil moisture under average conditions. However, under very dry conditions there were apparent differences in soil moisture among the treatments. It was observed during periods of drought that the soil moisture beneath conventional tillage practices was least grading up to the highest in the more drastic tillage methods. This increase in soil moisture increased the yields but not significantly.

In conclusion, it can be said that different geometric shapes of tillage increased the surface water storage potential but did not necessarily increase soil moisture or corn yield over the years tested. On the other hand, it did not necessarily decrease soil moisture or corn yield either. In addition, the increase in surface storage potential through bedding practices eliminated the need for further erosion control measures on mildly sloping fields planted to corn in eastern South Dakota.

Table 13. Effect of Different Geometric Shapes on Corn Yield

Treatment	1966	1967	1968	Average
Conventional Contouring	84.6	55.1	73.8	71.2
Contour Listing	93.3	55.3	61.9	70.2
Contoured 4-row bedding				
Conventional planting	73.6	51.6	73.7	66.3
Lister planting	83.4	54.5	65.3	67.7
Contoured 8-row bedding				
Conventional planting	76.6	56.3	72.4	68.4
Lister planting	85.7	54.3	65.9	68.6

Table 14. Increase of Potential Surface Water Storage Capacity Index Over Conventional Contouring on a 4% Slope.

Treatment	Index	Percent Increase
Conventional Contouring	0.4	0
Contour Listing	1.2	200
Contoured 8-row bedding with		
Conventional planting	1.9	375
Lister planting	2.4	500
Contoured 4-row bedding with		
Conventional planting	2.5	525
Lister planting	2.8	600

PERFORMANCE TRIALS, NORTHEAST REASEARCH FARMS, 1968

Joseph J. Bonnemann

Topography, soil and climate generally define certain areas or boundries across the state, though these are not absolute. Testing only at Brookings would be an insufficient guide to varietal performance of the major crops grown across the state. Hence, testing is conducted at substations and with farmer-cooperators so those interested can be better informed on the relative performance of the varieties grown under similar environmental conditions.

STANDARD VARIETY SMALL GRAIN TRIALS

Winter wheat trials were seeded at both Garden City and Watertown but erratic stands caused abandonment of these trials. A rye trial was seeded at the Watertown site and survived the winter with reasonably decent stands for those varieties with sufficient winter hardiness. The trial was a collection from available varieitee in thia and foreign countries and served as a screening to see if some of the material was equal or superior to our presently grown varieties in both yield and winterhardineas. Though only one year's results are available some lines appear to have promise.

The spring grains were tested in rod-row plots only at Watertown. They were seeded on April 11 and harvested in early August. Germination and growth were retarded by cool temperatures. The cool temperatures throughout the season combined with adequate precipitation allowed the grains to produce satisfactory yields, generally of fair quality.

The semi-dwarf wheats in the trial produced quite well. Also the new release, Waldron, a hard-red spring, yielded satisfactorily in the 1968 trials. This material has only been in the trials for one year.

Larker and Primus both performed well as malting barley varieties. A feed barley, Liberty, continues to yield very well.

The oat trials were not as high in test weight as in past years but the same varieties have continued to perform very well; Burnett, Clintland 64 and Holden. The new South Dakota release, Kota, has done well also.

The flax trials suffered some stand losses from both freezing temperatures and disease. The new release, Nored, performed most satisfactorily in 1968. Redwood, Summit and Windom have the highest five-year averages. All the varieties mentioned are presently resistant to the known races of flax rust in North America.

Further information on the 1968 small grain trials will be found in Circular 1964, 1968 Small Grain Trials.

CORN PERFORMANCE TRIAL

Thirty-two entries were included in the 1968 trial seeded at the Watertown unit. Seeding was done on May 15 and harvesting completed on October 25.

Again in 1968 conditions were not ideal for row crops. Cool temperatures were a hinderance to development all season. Yields ranged from 58.2 to 27.5 bushels per acre. Quality was poor as moisture content was very high and the mean for the trial was 36.5 percent.

Entering seed producers designate the entries included in the trials. Furthur information will be found in Circular 196, 1968 Corn Performance Trials.

GRAIN SORGHUM PERFORMANCE TRIALS

The grain sorghum trials were conducted at the Watertown unit for six years. In 1968 the trials were moved to the Garden City unit, somewhat closer to the area where more grain sorghum is grown. Conditions, weatherwise, in 1968 were no more favorable than at Watertown but the end results were somewhat better.

Initial growth was very slow and stands appeared to be quite poor. Though growth was not rapid the stand was better than originally thought and yields higher than anticipated. Though very high in grain moisture in late September, all over 35% moisture, the grain was physiologically mature and the test weights are nearly normal in the dried grain.

Further information can be found in Circular 195, 1968 Grain Sorghum Performance Trials.

Table 15. Standard Variety of Oat Trials, Watertown Unit, 1968

Variety	Test Wt. lb/bu	Yield, Bu/A 1968	Yield, Bu/A 1966-1968
Burnett	34.0	83.2	81.7
Holden	33.0	77.7	71.8
Multiline E68	35.0	77.6	
Kota	32.0	76.5	74.7
Dupree	31.0	75.6	71.6
Clintford	37.0	72.8	78.6
Jaycee	32.0	69.4	72.2
Sioux	30.0	68.4	71.6
Tippecanoe	35.0	67.5	72.7
Brave	32.0	66.9	71.2
Clintland 64	34.0	66.1	74.6
Santee	33.0	66.0	73.3
Wyndmere	32.0	65.6	65.0
Orbit	30.0	65.1	73.7
Lodi	31.0	65.0	73.1
Portal	33.0	64.7	73.6
Garland	33.0	64.7	64.5
Kelsey	32.0	64.1	
Tyler	33.0	63.3	66.2
Coachman	35.0	62.4	65.8
O'Brien	35.0	62.4	72.0
Multiline M68	34.0	62.3	
Pettis	35.0	60.9	
Rodney	30.0	58.0	64.0
Dawn	34.0	54.1	60.9
	Mean	67.2	
	LSD (.05)	14.9	

Table 16. Standard Variety Spring-Seeded Wheat Trials, Watertown Unit, 1968

Variety	Test Wt. lb/bu	Yield, Bu/A 1968	Yield, Bu/A 1966-1968
Tobari 66*	59.0	39.1	
6W01493 †	57.5	38.7	
Waldron ǂ	58.0	37.5	
Inia 66*	60.0	36.6	
Red River 68 †	58.2	36.5	
Jaral 66*	59.0	35.0	
6W02188 †	61.0	34.9	
Chris ǂ	58.5	34.3	32.3
Fortuna ǂ	59.0	33.9	32.6
Ciano 67*	57.5	33.9	
Sheridan ǂ	60.0	33.8	29.2
6W01503 †	49.7	33.5	
Leeds §	61.5	33.5	35.7
Polk ǂ	61.7	33.0	33.5
Wells §	59.5	32.6	35.3
Manitou ǂ	58.5	31.9	32.2
Justin ǂ	58.0	30.3	31.0
Cris ǂ	54.0	27.4	30.4
Rushmore ǂ	58.0	27.2	30.2
Shorty ǂ	50.5	27.2	
Thatcher ǂ	56.2	17.5	36.7
	Mean	32.8	
*Mexico † World Seeds, Inc.	LSD (.05)	6.1	
ǂhard red spring § durum			

Table 17. Standard Variety Barley Trial, Watertown Unit, 1968

Variety	Test Wt. lb/bu	Yield, Bu/A 1968	Yield, Bu/A 1966-68
Liberty	45.0	55.2	52.4
Larker	42.2	52.7	46.0
Primus	45.0	51.3	48.0
Mich. 308	48.0	50.8	
Centennial	43.2	50.5	
Trophy	42.2	50.4	43.7
Galt	42.0	48.2	42.3
CI 11864	41.2	46.4	
Paragon	42.0	43.4	
Conquest	43.2	43.1	45.6
Firlbecks III	41.4	41.4	
Dickson	42.2	39.6	43.3
	Mean	47.7	
		N.S.	

Table 18. Standard Variety Flax Trials, Watertown Unit, 1968

Variety	Test Wt. lb/bu	Yield, Bu/A 1968	Yield, Bu/A 1966-68
Nored	54.0	21.8	19.8
Linott	54.0	21.7	
CI 2290	53.0	20.9	
CI 2444	54.5	19.8	
Redwood 65	54.0	19.7	19.5
Bolley	53.5	19.5	18.6
Redwood	54.0	19.4	19.1
Summit	53.5	18.5	19.1
Norland	54.0	18.4	18.2
Windom	54.5	18.3	17.7
B-5128	54.0	16.8	17.6
Noralta	54.0	16.7	18.3
	Mean	19.3	
		LSD (.05) 2.8	

Table 19. Standard Variety Rye Trial, Watertown Unit, 1968

Variety	Height, inches	Test Wt. lb/bu	Yield, B/A
Von Lochow	41	55.0	34.6
Guelzower	40	54.5	28.7
Pearl	38	54.0	28.2
Dominant	38	55.5	27.0
Dakold	37	57.0	26.9
Petkus	38	55.0	26.7
Caribou	37	55.5	25.6
Frontier	37	55.0	25.4
Zelder	39	55.5	25.2
Antelope	35	54.5	24.2
Pierre	33	56.5	23.8
Elk	41	54.0	23.2
Sangaste	39	54.0	22.4
Adams	38	54.0	21.9
Bonel	40	55.5	21.0
7276	40	55.5	20.8
N.F. #7	40	56.0	20.3
Toiva	40	54.0	19.1
Elbon	40	56.5	17.4
Tetra Petkus 4n	42	51.5	8.1
	Mean		23.5
		LSD (.05)	4.8

Table 20. Corn Performance Trial, Watertown Unit, 1968

Variety	Performance rating	Percent stalks broken	% moisture, ear corn 1968	% moisture, ear corn 1967-68	Yield, B/A 1968	Yield, B/A 1967-68
SD Exp 72 (2x)	3	35	36.6		58.2	
SD Exp 48 (M3x)	4	19	36.5	43.8	56.4	50.2
Pioneer 3956 (2x)	1	3	30.8	29.4	56.1	47.4
Sokota SK-29 (3x)	2	12	27.4		54.3	
Northrup-King PX 442 (3x)	5	3	30.8		51.2	
SD Exp 59 (2x)	6	13	34.6	29.9	50.5	46.8
SDAES PP 67409 (4x)	7	36	34.9		49.8	
SDAES PP 67408 (4x)	9	30	37.7		48.8	
SDAES PP 67407 (4x)	12	22	42.2		48.2	
SD 230 (4x)	17	38	39.5	36.3	45.3	41.1
Pioneer 3959 (3x)	11	3	35.2		45.0	
SD 240 (4x)	18	36	39.6	35.1	45.0	42.1
SD Exp 74 (4x)	8	13	25.3		44.0	
SD 248 (3x)	23	16	45.4	39.8	44.0	40.8
Northrup-King PX 426 (3x)	10	44	29.0		43.3	
Pioneer 3854 (4x)	19	15	35.8	33.5	43.2	38.7
SD 220 (4x)	20	42	35.8	30.8	42.3	39.6
Pioneer 388 (4x)	14	10	29.0	28.9	41.8	38.3
Sokota 225 (4x)	15	19	30.7	29.2	41.7	37.5
United-Hagie 6S260 (2x)	22	6	38.1		41.7	
Pioneer 3872 (4x)	13	11	28.0		41.5	
Minn. 805 (4x)	16	21	27.8	25.1	40.3	39.1
Pioneer 3889 (4x)	21	17	31.2		39.6	
Northrup-King PX 527 (3x)	27	0	45.8	40.3	38.9	35.5
Pioneer 3935 (2x)	24	17	38.9	33.4	38.7	38.5
Northrup-King PX 446 (3x)	26	9	39.9		38.7	
Northrup-King PX 525 (3x)	28	11	45.9	41.4	37.4	36.2
Sokota 233 (4x)	29	11	42.6		35.1	
Sokota 211 (4x)	25	11	29.0	26.3	34.2	35.1
Disco SX-17 (2x)	31	7	50.8		33.2	
Disco SX-7 (2x)	30	2	39.2		32.9	
United-Hagie 5S271 (2x)	32	2	59.5		27.5	
		Mean	36.7		43.4	
CV = 9.52				LSD (.05)	5.8	

Table 21. Grain Sorghum Performance Trial, Garden City Unit, 1968

Variety	Height, inches	Test Wt.* lb/bu	Yield, lb/A 1968	Yield, lb/A 1967-68
Northrup-King NK 120	44	52.5	3390	2545
Pioneer Brand 894	34	52.0	3270	2140
Northrup-King NK 115	40	53.0	3240	2675
ACCO BL 101	47	51.0	3220	2415
Northrup-King NK 127	37	53.0	3050	
SD 451	48	52.0	3040	2075
SD 503	52	51.0	2990	2055
Frontier Grassy Grain I	46	53.5	2920	
Pioneer Brand 889	37	52.0	2840	
ACCO R 94	43	52.0	2820	
NK Mini-Milo 50	45	55.0	2810	
Frontier 388a	43	50.0	2660	
SD 441	50	52.0	2570	2415
Taylor-Evans TE 44C	43	53.0	2550	1755
SD 102	41	53.0	2180	
Frontier GX 410	36	46.0	1960	
		Mean	2840	
CV = 12.7%		LSD (.05)	600	

* All varieties were above 35% moisture in the grain on 9/24/68.

PERFORMANCE TRIALS OF WINTER GRAIN, AND SPRING GRAIN,
GARDEN CITY UNIT, 1968

Variety	Yield Bu/A	Test Wt. Lb/Bu
Chris	51.9	58.5
Crim	37.7	55.5
Justin	39.3	57.0
Red River 68	50.2	59.0
Sheridan	54.5	60.0
Manitou	51.8	59.0
Polk	48.1	60.0
Rushmore	38.7	57.0
Fortuna	50.9	58.0
Durum		
Stewart 63	60.5	61.5
Wells	60.5	59.0
Leeds	56.4	61.0

Table 23. Standard Variety Barley Trials

Variety	Yield Bu/A	Test Wt. Lb/Bu
Conquest	51.2	46.5
Dickson	51.4	49.0
Firlbecks #3	65.1	51.0
Larker	50.4	48.5
Liberty	44.5	46.5
Paragon	56.4	48.0
Primus	34.5	48.0
Trophy	57.1	48.5

Table 24. Standard Variety Oat Trials

Variety	Yield Bu/A	Test Wt. Lb/Bu.
E68	63.7	40.0
Tippecanoe	71.1	39.5
Tyler	64.3	37.0
Clintford	82.0	41.0
Jaycee	71.3	39.5
Pettis	69.5	41.0
O'Brien	83.5	41.0
Dawn	75.5	38.5
Wyndmere	72.6	37.5
Brave	74.4	40.5
Clintland 64	80.3	39.5
Garland	77.3	39.5
Holden	76.2	39.0
Portal	82.8	39.0
C.I. 8178	95.6	41.0
Burnett	78.5	40.5
M68	72.9	40.5
Orbit	87.3	38.0
Kelsey	93.4	38.5
Lodi	90.7	39.0
Ortley	73.0	38.0
Rodney	76.8	39.0
Sioux	88.5	39.5

Table 25. Standard Variety Rye Trials

Variety	Yield Bu/A	Test Wt. Lb/bu
Frontier	29.3	57.0
Von Lochow	34.6	57.5
Caribou	31.2	57.0
Pierre	29.0	57.5

Table 26. Standard Variety Flax Trials

Variety	Yield Bu/A	Test Wt. Lb/Bu
Summit	26.6	51.0
Bolley	24.0	50.5
Windom	27.8	51.0
Redwood	24.0	50.5
B-5128	26.4	51.0
Caldwell	20.4	49.5
Noralta	25.8	50.0
Nored	27.9	50.5
Linott	27.0	52.5
C.I. 2290	24.0	50.5
Norland	26.5	51.0

Table 27. Standard Variety Winter Wheat Trials

Variety	Yield Bu/A	Test Wt. Lb/Bu
Minter	32.8	59.5
Rume	29.2	59.5
Lancer	41.8	61.0
Winalta	43.7	61.0
N64323	36.5	59.5

OAT BREEDING

R. S. Albrechtsen

The Watertown Unit of the Northeast Research Farm served as a testing site for 112 entries in 3 oat yield nurseries as a part of the Oat Breeding and Regional Testing Program of the South Dakota Agricultural Experiment Station in 1968. Approximately three-fourths of the entries in these nurseries were strains originating from our own breeding program and are in the early stages of yield-testing. The most promising strains available from state experiment stations are entered in Uniform Regional Nurseries which are grown throughout the U. S. and Canada in those regions where the strains are thought to be adapted. These nurseries provide data for final decision on the release of new varieties.

Data on selected high yielding experimental strains, recently released varieties and long-time checks in the Uniform Midseason Oat Performance Nursery are shown in Table 28. Entries in this nursery are primarily of the midseason to late maturity class, being equal to or later than the Clintland type oats. Most of these strains are of a maturity range suitable for growing in northeastern South Dakota. Entries are arranged in descending order of 1968 yield values. Kota, a 1969 release of the South Dakota Agricultural Experiment Station, was the highest yielding entry in 1968. An unreleased experimental strain, C.I. 8304, had the highest 2-year average yield. Kota seed is being released by the South Dakota Foundation Seed Stock Division to County Crop Improvement Associations for registered and certified seed production in 1969.

Table 28. Performance of Selected Experimental Oat Strains and Check Varieties in the Watertown Uniform Midseason Oat Performance Nursery, 1967-68

C.I. Number	Variety or Selection	Bushel Weight		Yield	
		1968	1967-68	1968	1967-68
		lbs/bushel		bushels/acre	
8187	Kota (new)	34.0	35.4	79.4	95.2
7811	Orbit	30.0	31.6	79.0	94.5
8304	II-54-109	32.5	33.5	77.3	96.1
8305	II-54-120	33.0	33.2	77.1	84.2
--	Diana	34.0	*	74.9	*
4988	Mo. 0-205	33.0	34.5	74.4	93.6
--	469	33.3	*	73.7	*
7978	Holden	34.0	33.8	73.6	83.7
--	178	33.0	*	73.6	*
--	124	34.3	*	73.4	*
--	1541	34.8	*	73.4	*
--	1596	35.0	*	73.2	*
7971	Jaycee	34.8	35.3	72.4	90.4
7463	Clintford	37.5	38.0	72.1	94.6
7561	Lodi	28.0	31.2	70.0	81.5
7639	Clintford 64	34.8	35.2	68.7	89.6
8040	Portal	32.8	33.6	67.6	87.2
7453	Garland	34.8	35.4	67.4	82.6

* First tested in Uniform Midseason Oat Performance Nursery in 1968.

FLAX BREEDING

R. S. Albrechtsen

A total of 140 entries were tested in 5 flax rod row yield nurseries at the Watertown Unit in 1968 as a part of the Flax Breeding and Regional Testing Program. Approximately two-thirds of these strains originated from our breeding program at South Dakota and are in the early stages of yield-testing. Forty entries of Minnesota and South Dakota origin were tested in more advanced cooperative nurseries grown by the two stations.

Tables 29 and 30 give agronomic and quality data for entries in the Uniform Regional Flax Nurseries grown from early seeding and from late seeding, respectively. Overall mean seed yield was reduced from 22.0 bushels per acre at the early seeding data (April 29) to 14.6 bushels per acre when seeded a month later (May 28). Entries in these nurseries are in the final stages of testing and the results of these tests will aid in making decisions on the release of new varieties.

F_1 and F_2 progeny of all possible single cross combinations among 11 parent strains plus the parental strains were grown in a small-scale yield test for the second year to study the potential of hybrid flax production and to determine high yielding combinations. Twenty 4-way cross combinations were added to the test in 1968. Preliminary data from 1967 were discussed in the 1967 Station Report. Analysis of the 1968 data has not been completed.

Twenty four rust differential strains were grown at Watertown to detect the presence of flax rust within the area and to assist in the detection and identification of new races that may have appeared. Environmental conditions were poor for the development of the rust organism in 1968.

Phenotypically superior lines were selected from plant row breeding material grown at the station. These selections will be advanced to preliminary yield tests.

Table 29. Results of the 1968 Uniform Regional Flax Nursery - Early; Watertown. (W68 URFN-E)

1967 Entry No.	C.I. or Sel. No.	Variety or Selection	Height	Oil Content	Iodine No.	Test Wt.	Yield per acre	Yield Rank
			(In.)	(%)		(Lbs.)	(Bu.)	
1	389	Bison, N.D.	24.0	40.3	176	54.0	23.7	2
2	1130	Redwood, Minn.	22.0	40.7	180	54.3	22.9	9
3	1475	Bolley, N.D.	21.5	41.8	185	53.3	22.7	16
4	1823	Windom, Minn.	21.0	39.4	181	54.3	23.8	1
5	1914	Summit, S.D.	21.0	39.7	182	54.0	23.6	4
6	2444	Rwd. x Birio, Minn.	21.5	41.2	182	54.0	23.1	7
7	2480	Rwd. x Valuta-Raja, Minn	22.0	41.8	184	53.0	22.2	10
8	2483	1085 x Bolley, N.D.	22.0	42.0	185	53.0	20.5	18
9	2522	Linott, Can.	23.0	42.0	182	54.0	23.7	3
10	2523	1605 x Minerva, N.D.	21.5	43.5	184	54.0	20.5	17
11	2524	Rwd. x 1455, Minn.	20.5	45.5	175	53.0	21.1	13
12	2525	Rwd. x Mav., Minn.	22.5	42.6	186	53.8	21.8	11
13	2534	Sel. of Norland, N.D.	22.0	41.8	189	53.8	19.3	20
14	2535	Valuta x Raja, Can.	24.5	43.0	181	54.3	23.2	8
15	64126	364 PRF-126, S.D.	24.0	41.8	184	53.5	21.0	14
16	980	B-5128, N.D.	23.5	40.9	180	54.0	20.8	15
17	2290	Rwd. x Crystal, Minn.	21.5	41.3	180	53.8	23.4	6
18	2292	Nored, Minn.	21.5	41.6	186	54.0	23.6	5
19	2430	Noralta, Can.	22.5	42.3	186	54.3	19.5	19
20	1176	Norland, N.D.	22.5	38.0	181	53.3	21.3	12

Seeded - April 29, 1968
Overall mean yield - 22.0 bushels
C.V. - 10.6%
L.S.D. = 3.3 bushels
Number of reps = 4

Table 30. Results of the 1968 Uniform Regional Flax Nursery - Late; Watertown (W68 URFN-L)

1968 Entry No.	C.I. or Sel. No.	Variety or Selection	Height (In.)	Oil Content (%)	Iodine No.	Test Wt. (lbs.)	Yield per acre (bu.)	Yield Rank
1	389	Bison, N.D.	24.3	40.8	172	53.0	16.3	3
2	1130	Redwood, Minn.	23.0	39.9	180	54.5	15.3	9
3	1475	Bolley, N.D.	22.7	42.6	190	53.5	13.8	15
4	1823	Windom, Minn.	21.7	40.8	184	55.0	16.0	6
5	1914	Summit, S.D.	21.7	39.4	180	54.0	16.3	4
6	2444	Rwd. x Birio, Minn.	22.3	41.4	178	54.5	15.9	7
7	2480	Rwd. x Valuta-Raja, Minn.	22.7	40.2	182	52.5	16.1	5
8	2483	1085 x Bolley, N.D.	21.3	42.4	186	53.5	14.9	10
9	2522	Linott, Can.	22.0	42.6	183	54.5	14.2	12
10	2523	1605 x Minerva, N.D.	22.0	43.3	176	54.0	13.4	16
11	2524	Rwd. x 1455, Minn.	21.0	43.1	173	52.5	10.9	20
12	2525	Rwd. x Mar., Minn.	23.7	43.2	186	55.0	15.6	8
13	2534	Sel. of Norland, N.D.	22.7	41.0	182	54.5	13.9	13
14	669	B66 PRF-669, S.D.	25.7	40.2	180	53.0	14.3	11
15	64126	B64 PRF-126, S.D.	23.7	40.0	180	54.0	13.9	14
16	980	B-5129, N.D.	24.7	38.5	180	53.0	12.7	18
17	2290	Rwd. x Crystal, Minn.	24.0	40.6	177	54.0	16.6	1
18	2292	Nored, Minn.	24.3	40.3	184	54.0	16.4	2
19	2430	Noralta, Can.	23.0	38.6	181	54.0	11.8	19
20	1176	Norland, N.D.	24.0	40.1	181	54.0	12.8	17

Seeded - May 28, 1968
Overall Mean Yield = 14.6 bushels
C.V. = 16.1%
L.S.D. = 3.3 bushels
Number of reps = 4

WHEAT IMPROVEMENT

D. G. Wells and C. L. Lay

Winter wheat is subjected to more severe winter weather at this Watertown station than at other test sites in South Dakota. We therefore have seeded hardiness tests here every year. During the 1967-68 crop year we had 2800 rows of breeding lines seeded in stubble and 1800 rows seeded on fall plowing. Because of the dry fall we did not obtain a satisfactory stand on fall plowing while only scattered losses of stand due to drouth occurred on stubble land. Winter survival in stubble was good, even of lines low in hardiness. We were able to evaluate the lines in stubble for winter survival, spring frost damage to leaves, general appearance, and shattering.

Table 31. Hard Red Spring Wheat

Entry	Yield in Bu.	Test Wt. in #
Marquis	16	57
Justin	28	57
Chris	32	59
Polk	34	61
Waldron	34	58
4220	38	58
6579	36	58
6261 (semi-dwarf)	37	57
Red River 68 (semi-dwarf)	34	61

Table 32. Durum Wheat

Entry	Yield in Bu.	Test Wt. in #
Mindum	20	58
Wells	34	60
Lakota	30	57
Leeds	37	61
316	41	59
6517	41	62
65100	40	60

PHYSIOLOGICAL MATURITY OF SORGHUM SEED

Garden City and Watertown Units, 1968

R. C. Kinch

Three of the earliest grain sorghum hybrids were produced at Watertown and Garden City.

Plantings were made of the three male steril lines: Reliance ms, Martin ms, and Combine 60 kafir ms. Adjacent plantings were made later of the reproductive pollinators (restorers), S.D. 102 and S.D. 100 to produce the three sorghum hybrids, S.D. 441, S.D. 451, and R.S. 501.

Weekly harvests in September and October were made, and the moisture content of the seed was determined and the heads artifically dried. The physicological maturity of the three sorghum hybrids is being determined at each harvest from the (1) moisture content, (2) yield per acre, (3) test weight and (4) germination in an effort to find the earliest possible date when sorghum heads can be harvested and still obtain maximum yields and vigorous seed germination.

Preliminary observations indicate that when grain sorghum seed has matured sufficiently in the field to dry down to about 40% moisture, the heads can be harvested without any sacrifice in seed yield or germination.

The germination was destroyed by the freeze of October 4 on all kinds of grain and forage sorghum and sudan grass seed remaining in the field with over 15% of moisture. This indicates that in order to produce sorghum seed, harvesting and drying the heads is necessary if good yields and seed quality are to be obtained year after year.

INSECT CONTROL ON POTATOES USING A SYSTEMIC INSECTICIDE

B. H. Kantack, O. S. Kingsley, and W. L. Berndt

A demonstration plot was set up on the research farm at Garden City, South Dakota for potato insect control. Treatments of Thimet (phorate) were applied to each of five replicates as planting time treatments. The potato plots were planted April 19, 1968 and harvested September 21, 1968.

The insecticide was applied in a band treatment at the rate of 2 1/2 pounds actual per acre row (25 lbs. 10% granules per acre row). Insect control was excellent in all treated replicates with light infestations of flea beetle and leaf hoppers developing in the untreated plots. No foliar sprays were applied.

Yield checks of the five treated areas as compared with the untreated areas shows a yield advantage of 20.1 bu./acre for the areas receiving the insecticide treatment. This resulted in $26.13 increased value ($2.24 per 100 lbs.) received from the treated areas.

Deducting $5.75 for insecticide cost a net profit of $20.38 was realized by using the systemic treatment for insect control. Thimet and Disyston are two systemic insecticides currently recommended for use on potatoes in South Dakota.

WEED RESEARCH

J. F. Stritzke and C. E. Stymiest

OBJECTIVE:

To compare the effectiveness of new experimental herbicides with some of the presently recommended herbicide treatments.

MATERIALS AND METHODS:

The plots were 10 ft. by 30 ft. and replicated 3 times in a randomized complete block design. Pioneer 438 hybrid seed corn was planted May 20 in 36 inch rows. Area was fertilized at rate of 58-28-0 in spring of 1968.

Herbicide treatments were applied with a tractor type sprayer applying 20 gallons spray solution per acre. Preplant incorporated treatments were applied May 17 and incorporated immediately with a tandom disk. Pre emergence treatments were applied May 20 and post emergence treatments were applied June 7 when foxtail were in 2 to 3 leaf stage of growth. The plots receiving no herbicide treatment were cultivated twice and the herbicide treated plots were cultivated once. Weed control notes were taken June 19 and plots were harvested for weed and corn yields on October 25.

RESULTS:

There was insufficient rainfall to activate most preemergence herbicides for about 1 month after application. Early estimates of weed control indicates that only preemergent treatments containing propachlor (Ramrod) and postemergent treatments with oil gave satisfactory weed control (Table 33). The best yields were obtained from plots treated with post emergence atrazine plus oil and 2.5 lbs/A atrazine preplant incorporated.

Table 33. Herbicide Performance Trials on Corn in 1968, Garden City Unit

Treatment Common Name	Trade Name	Rate lbs/A Actual	% Foxtail Control June 19	Weed Yields lbs/A	Corn Yields bu/A
Preplant + Inc. (PPI)					
Atrazine	Atrazine	2.5	12	797	78
R-1910	Sutan D	3 + 1	22	962	71
Preemerge					
CP 50144	Lasso	2	62	1148	61
GS 14260	Giegy	2½	43	1066	50
C 6313	Maloran	4	55	1317	63
Atrazine	Atrazine	2.5	22	976	54
NC 4780	Fisona	1½	17	1295	54
Propachlor	Ramrod	4	82	717	56
VCS 438	Velsicol	4	68	626	72
Combinations					
Ramrod + Atrazine		2 + 1	73	766	60
CP 50144 + Atrazine		1 + 1½	70	409	65
Ramrod + Lin	Londax	2 + 1	85	591	58
Atrazine + Lin		1 + 1	17	1093	55
Post Emergent					
Atrazine + Oil + dicamba		1 + 1 + 4 oz	80	1229	51
Atrazine		1	43	1385	51
Atrazine + Oil		1 + 1	77	703	78
Atr. + Deter.	Atr. + Tronic	1 + .5	57	878	73
Primaze + Oil		1 + 1	87	1226	39
SD 15418 + Oil		1 + 1	82	1030	57
Atr. + Oil + dalapon		1 + 1 + 6 oz	80	868	54
No treatment			00	1479	60

ATRAZINE CARRYOVER

Garden City 1967 - 1968

OBJECTIVE:

To evaluate the carry-over of 1967 applied atrazine at rates of 0, 1, 2 and 3 pounds per acre on a 1968 bioassay crop of wheat, oats, barley, and flax.

MATERIALS AND METHODS:

A grain sorghum crop was planted in spring 1967. This crop was then treated with atrazine at 0, 1, 2 and 3 pounds per acre in combination with 0, 1, and 2 gallons per acre crop oil in a 20 gallon per acre total spray solution. This crop was grown to maturity and harvested for yield. The area was fall plowed and the following spring strips of wheat, oats, barley, and flax were planted across each replication. Stand counts for each crop were then taken from center of plot in July. Harvest samples were taken from these areas on the following days. Barley July 31, Oats August 12, Wheat August 12 and Flax August 13.

RESULTS:

The number of small grain heads was decreased by the highest rate of atrazine (Table 34). This resulted in an average yield reduction in wheat and barley but did not give an average yield reduction of oats. Flax was least affected by the carryover. Essentially no stand reduction was noted and flax yields were best from the plots previously treated with 3 lb./A of atrazine.

Table 34. Stand Counts and Grain Yields as Affected by Atrazine Carryover

Treatment	Rate lbs/A	Stand Count[1] No. Plants/3 sq.ft.	Yield bu/A
Oats			
Atrazine	0	33	51
"	1	35	52
"	2	33	49
"	3	25	51
Wheat			
Atrazine	0	40	52
"	1	39	47
"	2	34	42
"	3	29	36
Barley			
Atrazine	0	29	60
"	1	27	57
"	2	29	57
"	3	21	47
Flax			
Atrazine	0	39	15
"	1	38	14
"	2	35	13
"	3	37	17

[1] Stand counts are an average of 28 plots. The oats, wheat and barley counts are number of heads per 3 square feet.
[2] Yields are an average of 7 plots.

WILD BUCKWHEAT CONTROL IN WHEAT, OATS AND BARLEY

Chris wheat, Brave oats and Larker barley were planted April 12, 1968. Herbicide treatments were applied with a tractor type sprayer applying 20 gal. spray solution per acre on June 4, 1968. Wheat and barley were in the 6-leaf stage and the oats in the 5-leaf stage at the time of spraying. The stage of growth of the wild buckwheat ranged from the 1- to 5-leaf stage. The barley plots were harvested on July 30 and the oats and wheat plots were harvested on August 8, 1968. A 3 ft. x 7 ft. area was used to estimate yields. Weed control ratings and crop yields are shown in Tables 35 and 36.

Table 35. The Effect of Herbicide on Small Grain Yields

Treatment	Rate/A ounces	Injury[4]			Wheat (Bu/A)		Oats (Bu/A)		Barley (Bu/A)	
		Wheat	Oats	Barley	Bu/A	No. WB[5]	Bu/A	No. WB	Bu/A	No. WB
Propanil + 2,4-D[1]	16 + 4	x	xx	xx	37	41	62	105	56	39
Diuron	.8 lb.	xx	x		33	15	64	7	54	6
2,4-D amine[2]	12		x		43	41	68	120	62	77
2,4-D butyl ester	8		xxxx	x	39	50	61	187	62	28
2,4-D L.V.ester[3]	8	xx	xxxx	xx	38	18	63	287	58	56
Bromoxynil + MCPA[1]	4 + 4				41	9	75	8	66	4
Dicamba + 2,4-D amine	1 + 4		x		40	18	64	40	58	18
Dicamba + 2,4-D amine	2 + 4		xxxx	xxx	40	6	66	19	61	14
Dicamba + MCPA amine[2]	1 + 4		x		39	42	73	130	61	92
Dicamba + MCPA amine	2 + 4		xxxx	xxx	38	7	64	47	63	17
Bromoxynil	4				37	10	66	20	55	14
Bromoxynil	6				37	4	63	30	57	6
Picloram ester	3/8				40	290	66	253	64	298
Picloram amine	3/8				36	135	62	843	57	205
Picloram + 2,4-D amine	3/8 + 4				40	24	73	14	62	9
Picloram + MCPA amine	3/8 + 4				39	28	59	63	57	2
No herbicide					37	256	67	730	60	414

[1] isooctyl ester
[2] alkanol amine
[3] Propylene glycol butyl ether esters
[4] Injury: one x for injury in each replication
[5] Number of wild buckwheat seed in 250 gram sample

Table 36. The Control of Annual Weeds in Small Grain With Various Herbicides

Treatment	Rate/A ounces	Infestation[1] June 28, 1968 Russian Thistle	Lambs' Quarter	Ragweed	Kochia	Average % Control Buckwheat	Weed Control at Harvest Wild Buckwheat	Other BLW
Propanil + 2,4-D	16 + 4	xxxx	xx		xx	80	58	70
Diuron	.8 lb.	xxxx	xxxx	x	xxxx	94	91	25
2,4-D amine	12	xxxx	x	xx	xxxx	19	50	60
2,4-D H.V. ester	8	xxxx	x	x	xxx	20	25	66
2,4-D L.V. ester	8	xxxx	x	x	xxx	21	38	52
Bromoxynil + MCPA	4 + 4	x		x	x	94	91	80
Dicamba + 2,4-D amine	1 + 4	xxxx	xxx	xx	xx	26	38	30
Dicamba + 2,4-D amine	2 + 4	xxxx	xxx	xx	xxxx	48	68	50
Dicamba + MCPA amine	1 + 4	xxxx	xx	xxx	xxx	15	25	42
Dicamba + MCPA amine	2 + 4	xxxx	xxx	x	xxxx	26	50	58
Bromoxynil	4	xxx		xx	xxx	90	90	41
Bromoxynil	6	xx		x	xxx	89	91	58
Picloram ester	3/8	xxxx	xxxx	x	xxxx	4	25	28
Picloram amine	3/8	xxxx	xxxx	xxx	xxxx	5	25	32
Picloram + 2,4-D amine	3/8 + 4	xxxx	xxxx	xx	xxxx	12	69	30
Picloram + MCPA amine	3/8 + 4	xxxx	xxx	xx	xxxx	11	49	30
No herbicide		xxxx	xxxx	xxx	xxxx	0	0	12

[1] Infestation: one x for presence of species in each replication.

BROADLEAF WEED CONTROL WITH BROMOXYNIL

OBJECTIVE:

To evaluate the weed control and crop injury when oil and a wetting agent is added to bromoxynil

METERIALS AND METHODS:

LOCATION: Northeast Research Farm Garden City, South Dakota

SOIL TEXTURE: Silty clay loam O.M. Content - 4%

PLOT SIZE AND DESIGN: Plots were 10 feet wide and 7 foot stripe of wheat, oats and barley were planted across the blocks. Each treatment was replicated 4 times in a randomized complete block design.

PLANTING DATE: Chris wheat, Brave oats and Larker barley were planted April 12, 1968.

METHOD AND DATE OF PLANTING: Treatments were applied with a tractor type sprayer applying 20 gallons spray solution per acre on June 7, 1968. All of the small grains were in the 6-leaf stage. The stage of growth of wild buckwheat ranged from the 1- to the 5-leaf stage.

DATA TAKEN: Early weed control notes were taken on June 28, 1968 and late weed control notes were taken July 30, 1968. Barley, wheat and oats were harvested July 30th, August 5th, and August 6th respectively. A 3 ft. x 7 ft. area was used to estimate yields.

RESULTS: The weed control ratings are shown in Table 37 and the small grain yields are shown in Table 38.

Table 37. Weed Control Ratinge From Plots Treated With Bromoxynil

Treatment	Rate oz/A	June 28 % Buckwheat Control	July 30 % Buckwheat Control	July 30 Other BLW Control
Bromoxynil	2	84	85	48
Bromoxynil + Oil	2 + 1 gal.	84	75	58
Bromoxynil + trionic	2 + 4 pt/100 gal.	89	60	83
Bromoxynil	4	94	90	78
Bromoxynil + Oil	4 + 1 gal.	98	90	70
Bromoxynil + Trionic	4 + 4 pt/100 gal.	96	90	80
Bromoxynil	6	99	90	88
Bromoxynil + Oil	6	99	90	63
Bromoxynil + trionic	6 + 4 pt.100 gal.	99	90	85
No herbicide		0	0	0
Bromoxynil Ave.	2	85.7	73.3	63.0
	4	96.0	90.0	76.0
	6	99.0	90.0	78.7
No Additive Ave.		92.3	88.3	71.3
Oil Additive Ave.		93.7	85.0	63.7
Trionic Additive Ave.		94.7	80.0	82.7

Table 38. Small Grain Yields From Plots Treated With Bromoxynil

Treatment	Rate oz/A	Yield (Bu./Acre) Wheat	Oats	Barley
Bromoxynil	2	42	74	60
" + Oil	2 + 1 gal.	44	73	61
" + trionic	2 + 4 pt/100 gal.	41	67	61
Bromoxynil	4	42	72	59
" + Oil	4 + 1 gal.	42	87	65
" + trionic	4 + 4 pt/100 gal.	41	78	58
Bromoxynil	6	39	77	59
" + Oil	6 + 1 gal.	44	78	60
" + trionic	6 + 4 pt/100 gal.	42	70	56
No herbicide		39	74	63
Bromoxynil Ave.	2	42	71	61
	4	41	79	60
	6	42	75	58
No Additive Average		41	74	59
Oil Additive Average		43	79	62
Trionic Additive Average		41	72	58

DICAMBA AND PHENOXY COMPOUNDS FOR BROADLEAF WEED CONTROL IN SMALL GRAINS, 1968

OBJECTIVE:

To compare various combinations of dicamba and phenoxy compounds for wild buckwheat control in wheat, oats, and barley.

MATERIALS AND METHODS:

LOCATION: Northeast Research Farm, Garden City, South Dakota

SOIL TEXTURE: Silty clay loam O.M. content - 4%

PLOT SIZE AND DESIGN: Plots were 10 feet wide and 7 foot strips of wheat, oats, and barley were planted across the blocks. Each treatment was replicated 4 times in a randomized complete block design.

PLANTING DATE: Chris wheat, Brave oats and Larker barley were planted April 12, 1968.

METHOD AND DATE OF SPRAYING: Treatments were applied with a tractor type sprayer applying 20 gallons spray solution per acre on June 7, 1968. The wheat and barley were in the 6-leaf stage and the oats in the 5-leaf stage at the time of spraying. The stage of growth of the wild buckwheat ranged from the 1- to the 5-leaf stage.

DATA TAKEN: Early weed control notes were taken on June 28, 1968 and late weed control notes were taken July 30, 1968. Barley, wheat and oats were harvested on July 31, August 5, and August 6 respectively. A 3 ft. by 7 ft. area was used to estimate yield.

RESULTS: Weed control with 2,4-D, OCS 21799 and MCPA amine was very similar (Table 39). In mixtures with dicamba, wild buckwheat control was also similar but control of other broadleaf weed was slightly better with OCS 21799. Final small grain yields are a result of weed control and crop injury. See Table 39 for yields of the various treatments.

Table 39. Weed Control Ratings and Small Grain Yields from the Dicamba Study

Treatment	Rate/ Acre	Average Wild Buckwheat Control - % est.	Other Weed Infestations[1] Kochia	Lambs' Quarters	Small Grain Yields, Bu/A Mustard	Wheat	Oats	Barley
2,4-D	4	16	xxx	xxx	x	30	70	56
	6	22	xxxx	xx		38	60	50
Dicamba	1	35	xx	xxxx	xx	40	76	56
	2	50	xxx	xxx	xx	42	68	57
OCS-21799	4	21	xx	xx	x	36	74	53
	6	22	xx	x	xx	37	76	55
Dicamba + OCS-21799	1 + 4	52	xxx	xx		39	68	58
	1 + 6	56	xx		x	38	73	56
	2 + 4	55	xx		x	29	63	53
Dicamba + 2,4-D Amine	1 + 4	45	xxx	x		42	73	64
	1 + 6	39	xxx	xxxx	x	40	64	53
	2 + 4	64	xxxx	xx		36	78	54
Dicamba + MCPA	1 + 4	44	xxx	xx		35	74	56
	1 + 6	38	xxx	xxx		40	74	61
	2 + 4	64	xx	x	x	40	75	59
MCPA Amine	4	41	xxxx	xxx		40	83	63
	6	21	xxx	x		38	63	53
No Herbicide		0	xxx	xxx	xx	38	72	59

[1] One x for presence of species in each replication on June 28, 1968.

WEED CONTROL IN WHEAT WITH ENDOTHOL

OBJECTIVE:

To determine the effectiveness of various endothol compounds for weed control in wheat. To determine the effect of the compounds on the wheat yields.

MATERIALS AND METHODS:

LOCATION: Northeast Research Farm, Garden City, South Dakota

SOIL TEXTURE: Silty clay loam O.M. Content - 4%

PLOT SIZE AND DESIGN: Plots were 10 feet wide and 20 feet long. Each treatment was replicated 4 times in a randomized complete block design.

PLANTING DATE: Chrie wheat was planted on April 17, 1968.

METHOD AND DATE OF SPRAYING: Treatments were applied with a tractor type sprayer applying 20 gallons spray solution per acre on June 4, 1968. The wheat was in the 5-leaf stage at the time of spraying. The etage of growth of wild buckwheat ranged from the 1- to 4-leaf stage.

DATA TAKEN: Weed control notes were taken July 12, 1968. Yields were taken August 7, 1968. A 3 foot x 8 foot area was used to determine yield for each plot.

RESULTS: See Table 40 for weed control and wheat yields.

Table 40. Weed Control and Wheat Yields from Various Herbicide Treatments in the Endothol Study

Treatment		Wild Buckwheat Control	Other Weeds[1] RT	K	LQ	Wheat Yield Bu/A
TD-6068D	2 + 4	13	xx	xx	x	50
(endothol amine	3 + 6	20	xx	xx		54
plus 2,4-D)	4 + 8	45		xxx		55
TD-6068M	2 + 4	33	xxx	xx		57
(endothol amine	3 + 6	48	xxx	xx		53
plus MCPA)	4 + 8	40	xx	x		55
TD-6500D	2 + 2	35	x	xxx	xx	52
(endothol ester plus 2,4-D)						
TD-6500M	2 + 2	23	xxx	xxx	x	55
(endothol ester plus 2,4-D)						
Penn D	8	43				56
Penn D	12	60	x			56
Bromoxynil + MCPA	4 + 4	97				56
Dicamba + MCPA	1.5 + 4	82	xx	x		59
No Herbicide		0	xx	xx	x	51

[1] RT = Russian thistle
K = Kochia
LQ = Lambsquarter
One x for presence of species in each replication.

CHEMICAL CONTROL OF WILD OATS IN BARLEY
Garden City, 1968

OBJECTIVES:

To evaluate various chemicals and various methods of applying chemicals for the control of wild oats in barley.

MATERIALS AND METHODS:

Preplant incorporated herbicide were applied April 10 and incorporated immediately by a tandom disk. The experimental area was then planted to Larker barley April 12. Post plant incorporated treatments were then applied May 26 and immediately flextined. The barley was not up yet and the wild oats was just coming through the ground on May 26. The post emergence treatments were applied May 17. Head counts of barley and wild oats were made on July 15. THese counts are recorded as average number of heads per 3 sq. ft. over 3 replications and two counts are recorded as average number of heads per 3 sq. ft. over 3 replications and two counts per plot in each replication. Yield samples were harvested from each plot on July 29. The yields are listed as average yield from 3 replications for each treatment.

RESULTS:

The field was cloddy at planting and wild oats sprouted from various depths. This resulted in uneven sprouting and most likely the failure of herbicide performance.

The most effective time of application in this experiment appeared to be post emergence at 1-2 leaf stage of the wild oat plant. Barban plus a nonphytotoxoic crop oil and MSMA appeared to do a fair job of controlling wild oats under these conditions (Table 41).

Table 41. Number of Wild Oat Heads and Barley Yield as Influenced by Various Herbicide Treatments

Treatment Common Name	Trade Name	# Rate/Acre	Average No. of heads/3 sq. ft.* Wild Oats	Barley	Barley Yield Bu/A
Preplant (Inc.)					
April 10					
Triallate with disk (PP)	Avadex BW	1 1/4	21	41	27
Post seeding (Inc.) (PS)					
April 26					
Triallate with flextine	Avadex BW	1 1/4	24	54	31
Post (PW)					
Early (102 leaf)					
May 17					
Barban	Carbyne	1/3	38	45	28
Barban + Oil	Carbyne + Crop-oil	1/3 + 1	18	46	32
BH-1455		2	21	50	29
BH-1455 + Oil		2 + 1	34	51	27
MSMA	Ansar	2 1/4	15	44	31
MSMA + Oil	Ansar + Crop-oil	(2 1/4 + 1)	21	46	29
No treatment			28	49	29

* Notes taken July 15, 1958
Yield samples harvested July 29, 1968

WEED CONTROL IN POTATOES

Garden City 1968

OBJECTIVE:

To compare effectiveness of various herbicides in controlling annual weeds in potatoes.

MATERIALS AND METHODS:

The plots were 10 ft. by 30 ft. and replicated 3 times. Preplant incorporated treatments were applied April 11 and incorporated immediately after application with a tandom disk. La Soda potatoes were planted April 19 in 40 inch rows. Preemergence treatments were applied April 26. Also on April 26 the incorporated after planting treatments were applied and incorporated with a flextine. Post-emergence treatments were applied June 4. All treatments were applied with a

tractor type sprayer applying 20 gallons spray solution per acre. All plots received a flextine operation and two cultivations. Weed control ratings, weed yields and potato yields were all taken on September 21, 1968. Weed control ratings were made on a scale of 1 - 10. A one rating indicates excellent weed control and a ten rating would indicate poor weed control.

RESULTS:

Weed yields were low and resulting potato yields were good for all of the treatments. A treatment of dalapon at emergence resulted in light red potatoes at harvest. Yields in some of the benefin plots were low indicating some possible injury. Average weed yields and potato yields are given in Table 42.

Table 42. Weed Control Rating and Potato Yields as Affected by Herbicide Treatment

Treatment		Rate	Weed	Weed	Potatoes
Common Name	Trade Name	lbs/A Actual	Control Rating Sept. 21	Yield lbs/A	Yield lbs/A
Preplant Inc.					
Trifluralin	Treflan	3/4	1.7	58	20,303
Benefin	Balan	3/4	3.0	167	18,116
EPTC	Eptam	3	1.0	8	21,192
DCPA	Dacthal	10	4.0	183	19,895
Incorp. after planting					
Trifluralin	Treflan	3/4	5.0	350	19,577
Metobromuron	Patoran	4	4.0	283	20,893
Preemerge					
CP 50144	Lasso	2	3.3	283	21,338
Linuron	Lorox	2	4.7	433	20,521
Metobromuron	Patoran	4	2.3	92	23,498
At Emergence					
Dalapon	Dowpon	2	2.0	100	21,574
Check			5.7	300	20,902

SOYBEAN AND SORGHUM BREEDING AND TESTING

Watertown and Garden City, 1968

A. O. Lunden

Three varieties (Chippewa, Hark, and Corsoy) were planted in 40", 20", and 6" rows. Seed was broadcast and disked on the fourth plot. All populations were about 130,000 plants per acre and excellent chemical weed control was obtained from treflan.

Yield differences were not analyzed because the test was not replicated but preliminary data indicate potential yield increase from narrow row planting. Six inch rows were much better than wide rows. Broadcast planting was inferior to drilling in narrow rows but was better than 20" or 40" rows.

Hark was the best variety in the narrow row test but all varieties responded to narrow row planting. Drilled planting yielded 85% more than 40 inch row planting but more thorough testing is needed. Details include dependable weed control (chemical and manual including harrow or rotary hoe), cultivation, harvest techniques, planting techniques and variety selection.

Grain sorghum yields ranged from 1200 to 3900 pounds per acre in 1968 (20 to 70 bushels). Several experimental hybrids produced excellent yields but the highest yielding hybrids were not resistant to lodging. The best hybrid in this test was of the same maturity as SD441 while outyielding this hybrid by about 20 bushels per acre. Several selected yields are listed in Table 43.

Table 43. 1968 - Sorghum - Northeast Farm, Garden City

Entry	Days to Heading	#/Acre	Test Wt.	Plant Height
SD 441	62	2720	53	49
SD 451	66	2640	50	45
SD 503	71	3800	50	47
SD 102	62	2160	53	38
SDR 331	63	3920	54	46
SDR 289	65	3660	55	49
SDR 291	61	3710	55	48
SDM 273	67	3600	52	46
	Yield LSD	819		

SD 503 yielded well but was immature at harvest with test weight of only 50#/bu.

Experimental forage sorghum entries were included in a preliminary test. Two entries appear to have a good potential in this area. They are extra leafy dwarf types which have very thick juicy stalks, fold their leaves after frost, produce considerable seed in a normal season and resist lodging. Yield tests will be grown in 1969.

CROP DISEASE CONTROL

Disease Damage, 1968 Corn Crop

C. M. Nagel

Plant Pathology Department

Corn stalk rot and root rot caused much stalk lodging, stalk breakage and ear drop in South Dakota corn fields in the fall of 1968.

Losses are estimated at 15-20% in South Dakota. Although the disease damage varies somewhat from field to field, the average damage has been estimated to be 18%. In addition to stalk breakage and lodging, the diseased ear shanks also become weakened, rotten and brittle with increases in ear drop due to shorter ears, poor kernel filling, and poorly filled kernels towards the ear tips.

Corn production based on November 1, conditions as estimated by the South Dakota Crop Reporting Service is placed at 119.8 million bushels. If this estimate is realized with final corn in the crib, this will be 29% above last year and 9% above the 1962-66 average production, indicating that as a whole, 1968 was a good year for corn production. However, with excellent moisture during the last half of the season, and were it not for the stalk and root rot diseases, yields could have been on the average field, 18% higher. A loss estimate of 18% from the total corn production estimate for 1968 of 119.8 million bushels would indicate a net bushel loss of 21,420,000 bushels due to the ravages of these two disesses. On current market prices, this would mean a net loss of $21,420,000. These figures do not take into consideration possible loss from insects.

The losses from these two diseases in the heart of the South Dakota corn belt in 1967 was estimated at 21%. These figures are based on rather extensive sampling techniques under field experiments, in which thousands of corn stalks were split and yields obtained to determine the severity of stalk rot and the yield losses resulting. In other words, the true damage of the loss due to this disease was taken as accurately as it was possible to do, based on scientific techniques. Although stalk lodging and breakage has been more severe during the last two seasons, it eould be pointed out that every year serious losses are attributable to these diseases, usually ranging in amounts of 8-12%.

Stalk and root rot loss reported by state experiment pathologists in Minnesota, Iowa, Indiana, Nebraska, and Illinois are nearly as high as those in South Dakota for 1968. Stalk and root rot are perhaps the two most important hazards of corn production in the state of South Dakota as well as in the corn belt of the nation.

Its importance is due to the fact that the disease usually effects most all plants in the field although varying somewhat in severity, by area. It does not appear as a spotty condition as some other crop hazards do. Thereby, accounting for the high average level of damage to the crop.

As was evident to most growers this past season, most hybrids appeared to show little advantage over one another to stalk rot and stalk breakage. This fact was easily observed traveling through the corn growing sections this fall.

The Plant Pathology Department of the South Dakota Experiment Station, at Brookings, has been working on this problem for a number of years and has produced what appears to be some promising parental corn lines having disease resistance to stalk and root rot. Particularily in 1967, in experiments conducted in the heart of the corn belt at the Southeast Research Farm where the disease was severe, yield and stand performance trials with these new experimental hybrids stood exceptionally good in comparison with a broad spectrum of commercial hybrids. Additional testing is still needed.

These new experimental hybrids are considered promising for eliminating some of the disease losses in the future. In addition to the disease resistance to stalk and root rot, these parental lines possess such other desirable characteristics as upright foliage characteristics, the type believed by some to be very important should close planting and high corn plant populations prove out effectively and economically on a commercial basis. Upright leaf characteristics produce less shading to lower leaves and permits a greater amount of sunlight to strike a larger leaf area per plant than present hybrids that have a drooping type of leaf posseesed by perhaps 98% of present day hybrids.

In 1968, the plant pathology department grew 84 experimental hybrids from parental lines originally developed for their resistance to a number of important diseases of corn, including stalk rot and root rot. The results are presented in Table 44. Herstofore, all experimental hybrids included in the disease tests consisted of 3-way hybrids, whereas, in 1968, all seed planted was hand produced envolving modified singles, comparable to 4-way seed or double hybrids.

Table 44. Performace Ratings of 84 Experimental Hybrids Possessing Varying Degrees of Root and Stalk Rot Resistances in Comparison with 7 Adapted Commercial Hybrids as Checks. Each Experimental Hybrid Consisted of One True Single and One Modified Single, Watertown, 1968.

Expt'l hybrid or Commercial Check	Yield Bu/A	Ear Moisture At Harvest	Performance Score Rating
Expt'l 1	63.3	28.5	1
" 2	56.1	24.8	2
" 3	55.7	29.9	3
" 4	54.5	33.8	8
" 5	53.8	33.1	9
" 6	52.6	34.6	16
" 7	52.5	30.6	6
" 8	52.5	34.9	10
" 9	52.4	26.9	4
" 10	52.2	37.5	23
" 11	52.0	39.2	19
" 12	51.8	26.6	7
" 13	51.8	32.5	15
" 14	51.7	44.2	35
" 15	51.6	28.3	5
" 16	51.2	32.6	11
" 17	51.2	32.1	17
" 18	50.7	28.5	13
South Dakota 240 (check)	50.5	32.7	14
Expt'l 19	50.5	33.0	20
" 20	50.3	36.7	22
" 21	49.9	29.7	18
" 22	49.9	37.0	36
" 23	49.8	35.7	33
" 24	49.7	37.9	29
" 25	49.6	36.0	26
" 26	49.5	35.5	24
" 27	49.0	29.8	21
" 28	49.0	35.6	27
" 29	48.9	30.6	25
" 30	48.7	36.4	48
" 31	48.6	38.5	42
" 32	48.6	44.5	70
" 33	48.4	38.3	55
" 34	48.2	31.3	30
" 35	48.2	37.5	40
" 36	48.0	37.4	44
" 37	47.8	40.7	59
" 38	47.8	41.9	65
" 39	47.7	25.9	12
" 40	47.5	36.1	41
" 41	47.4	40.0	60
" 42	47.3	36.1	58
" 43	47.1	34.7	38
" 44	47.0	33.0	31
" 45	47.0	35.1	56
" 46	46.8	32.1	49
" 47	46.8	34.8	57
" 48	46.6	28.5	32

Table 44. (Continued)

Expt'l Hybrid or Commercial Check	Yield Bu/A	Ear Moisture At Harvest	Performance Score Rating
" 49	46.5	35.6	66
" 50	45.9	41.3	72
" 51	45.7	36.5	71
Pfister SX48 (check)	45.6	26.6	34
Expt'l 52	45.6	31.3	37
" 53	45.6	32.2	43
" 54	45.6	29.1	45
" 55	45.4	32.7	47
" 56	45.4	40.8	75
" 57	44.7	31.0	46
" 58	44.7	30.3	59
" 59	44.6	43.3	80
" 60	44.5	29.2	39
" 61	44.5	27.6	51
" 62	44.5	34.9	68
" 63	44.3	34.7	73
" 64	43.7	25.6	50
" 65	43.7	37.7	76
" 66	43.5	23.9	28
" 67	43.1	25.3	53
" 68	42.9	42.8	82
" 69	42.1	24.9	62
" 70	41.9	24.8	52
" 71	41.9	27.3	54
South Dakota 220 (check)	41.9	30.3	63
Expt'l 72	41.7	24.0	61
" 73	41.7	24.3	64
" 74	40.3	45.4	88
" 75	40.2	35.9	83
South Dakota 210 (check)	39.8	26.5	74
Expt'l 76	39.6	24.4	69
" 77	39.6	27.7	79
" 78	39.1	23.3	67
" 79	38.2	41.4	90
" 80	37.7	25.6	77
" 81	37.7	32.0	85
United Hagie 108 (check)	36.3	19.6	78
Expt'l 82	35.9	36.1	89
" 83	35.3	26.2	81
Pioneer 388 (check)	35.0	27.5	84
Expt'l 84	34.9	33.6	87
DeKalb 46 (check)	33.3	24.2	86
Mean	45.9	32.3	

Planted: May 23
Harveated: November 6

In these particular tests, it was believed that the use of modified single-eight proves beneficial. The results, when compared with the 7 commercial checks included in the experiment appeared to verify this. In the top 50 hybrids only one check appeared, the other 5 checks yielded below this group.