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Agronomy Pamphlet #81

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ANNUAL PROGRESS REPORT

NORTHEAST RESEARCH FARMS

Garden City and Watertown, South Dakota

INTRODUCTION

In the spring of 1955, money was appropriated by the State Legislature to begin new research on crops, soils, and crop diseases in northeastern South Dakota. A 20-acre site waa originally selected. It is located on the Otto Orth 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.

These farms provide research facilities to obtain solutions for local problems in crop production and soil management. Experiments involving fertilizers, plant disease control, crop management, weed control, soil fertility, and crop variety testing are underway.

Evaluation of plant materials by members of the staff concerned with plant breeding are carried on at these farms. Weather conditions here aid in the natural screening of plants and the information is valuable to their research.

A field day at the Garden City Farm will be July 8, 1966 at 1:30 P.M. At this time the objectives of the new experiments will be discussed along with any other business.

NORTHEAST EXPERIMENTAL FARM COMMITTEE

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

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

BRIEF HISTORY

The relocation of the cultural practice experiments from Watertown to the Garden City Unit are completed. One large experiment, supported in part by the Farmers Union Central Exchange, was put into operation last spring. All experiments and other plantings are on the contour with roadways located in the grassed drainageways for access to the experiments.

Areas not in experiments presently were mulched with crop residues to reduce water runoff and to hold snow cover.

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

A new long term grass study was planted by Dr. James Ross this year and the old area was worked up in preparation for spring plowing. The main objectives of this experiment are evaluation and testing of introduced cool-season grasses.

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1965 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
Total Rainfall in Inches								
Watertown Unit	2.89	6.08	3.66	2.34	2.63	4.33	1.23	23.16
Garden City Unit	--	6.23	3.67	1.50	1.34	2.74	1.67	17.15
Departure from Long-Time Avg.								
Watertown Unit	+0.83	+3.21	-0.04	-0.33	-0.15	+2.48	+0.07	+6.07
Avg. Monthly Temperature in Degrees F.								
Watertown Unit	40.4	54.9	62.7	69.3	67.0	47.0	47.8	
Garden City Unit	--	58.1	64.1	68.7	68.8	--	--	
Departure from Long-Time Avg.								
Watertown Unit	-2.8	-1.1	-1.2	-3.0	-2.0	-12.9	+0.1	

Frost Free Days May 28 to September 9 = 104 days Watertown Unit
Not recorded at Garden City

The past cropping season was favorable for small grain production. Above normal rainfall in April and May came at intervals when moisture was needed for proper plant growth. The excessive rainfall during May caused soil erosion on the steeper slopes. Temperatures during both corn and small grain seasons were below normal. Cool temperatures were beneficial for small grain, but hindered the progress of corn production. The 104-day frost-free period was long enough on an average, but the cool months of June, July, and August slowed down normal performance of the crop. Sorghum was affected by the same conditions.

A study of the frost free periods at the Watertown Unit may be seen Table 2.

Rainfall and temperature recordings were not complete for the Garden City Unit this year. A weather station was erected and will be in full operation for 1966.

*The above rainfalls and temperatures were taken and recorded at the Northeast 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 Weather Station, 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
		Average Frost Free Days	123

FERTILITY AND CULTURAL PRACTICE EXPERIMENTS

Garden City Unit

Q. S. Kingsley

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

OBJECTIVES OF EXPERIMENT:

1. To compare the effect of row application with broadcast plowdown or disk-in application on crop yields.

2. To determine the relative management efficiency of the two methods of application in terms of economic returns for labor, equipment, and other input for typical South Dakota cropping sequences.

3. To determine the effect of the two methods of application on soil test levels and resulting residual carryover on the crop yield.

NEED TO STUDY:

1. Should the farmer buy equipment for row application of most of the phosphate required for small grain and row crops, which requires additional labor during busy planting time?

2. Should he eliminate the additional labor by having higher rates of phosphate applied as broadcast with the 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 would receive 50 pounds of nitrogen and wheat 30 pounds of nitrogen per acre. The phosphate levels are variable, and the rates used are of elemental phosphorus and nitrogen in pounds per acre. Conversion of phosphorus to phosphorus pentoxide may be accomplished by multiplying 2.3 times the elemental P shown in formula. To reverse this procedure multiply 0.44 times P_2O_5 to get the elemental P quantity.

Corn - 6 treatments		Wheat - 6 treatments	
N-P-K	N-P_2O_5-K_2O	N-P-K	N-P_2O_5-K_2O
0-0-0	0-0-0	0-0-0	0-0-0
0-0-0	0-0-0	30-0-0	30-0-0
50-0-0	50-0-0	30-7-0	30-16-0
50-7-0	50-16-0	30-15-0	30-35-0
50-15-0	50-35-0	30-15-0	30-35-0
50-30-0	50-70-0	30-30-0	30-70-0

Three corrective treatments were included in each experimental block, consisting of 100-0-0, 100-60-0 and 100-60-100. 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 end spring plowed.

There are 8 replications of each crop-year block and treatment, except for the corrective treatment, which was applied to 3 plots in each of the 16 blocks. These plots occur as the last three plots on one end or another of each block. Their exact location may be noted in the design 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 split. Half the plot will receive fertilizer and the other half none. Residual effects are to be determined at this time. The residual fertility will be what remains from corn for wheat or vice versa.

Data to be recorded will include yield, N and P content of grain and stover or straw of corn and wheat, nitrogen and phosphorus content of the soil at the beginning and end of the experiment. Air and soil temperature, wind velocity, and rainfall are to be recorded as equipment becomes available.

Soil moisture studies will be conducted by a representative of Farmers Union Central Exchange.

Application of fertilizer is to be initiated at three different times, namely:

1. Fall application, spring plowing.
2. Spring application after plowing, disk in.
3. Drill with the seed application.

Weed control - at the discretion of the farm manager.

Results:

Table 3. Time, Rate, and Placement of Fertilizer for Wheat*

Treatment	Time or Method of Application		
	Yield in bushels per acre		
	Broadcast Fall	Broadcast Spring	Drill with Seed
30- 0- 0	20.2	20.0	18.7
30- 7- 0	20.1	17.3	21.1
30-15- 0	22.5	21.5	22.0
30-30- 0	21.8	19.2	22.8

* The time and method of fertilizer applications are not significant at the 5% confidence level.

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

Treatment	Time or Method of Application		
	Yield in Bushels per acre		
	Broadcast Fall	Broadcast Spring	Starter with Seed
50- 0- 0	39.4	41.9	39.7
50- 7- 0	43.7	40.2	40.9
50-15- 0	39.1	43.4	43.6
50-30- 0	43.7	42.6	45.1

* The time and method of fertilizer applications are not significant at the 5% confidence level.

Discussion and Interpretation of Results:

These data in the preceding tables show differences which occurred in 1965. This is but one year's information and it is not conclusive for making a final decision.

Fertilizer applied with the grain drill or corn planter (Tables 3 and 4) increased yields with each rate increase. The localization of the fertilizer seemed to minimize the effect of soil variability and the nearness of fertilizer to the plants aided in its uniform use. Fertilizer broadcast on the soil surface did not produce this consistent yield pattern.

Results:

Table 5. Average Yields of Wheat at a Constant Nitrogen Level and Variable Phosphorus Levels.*

Treatment	Yield Bushels per acre	Percent Protein 14% H_2O	Percent total phosphorus 14% H_2O
0- 0- 0	17.6	12.0	0.31
30- 0- 0	19.6	12.2	0.32
30- 7- 0	19.5	12.5	0.31
30-15- 0	21.9	12.1	0.31
30-30- 0	21.3	12.1	0.31
Average **		13.2	0.39

* The rate of fertilizer application is highly significant at the 5% confidence level.

** Taken from Feeds and Feeding by Morrison.

Table 6. Average Yields of Corn at a Constant Nitrogen Level and Variable Phosphorus Levels*

Treatment	Yield Bushels per acre	Percent Protein 14% H_2O	Percent total phosphorus 14% H_2O
0- 0- 0	36.9	9.2	0.17
50- 0- 0	40.3	9.5	0.17
50- 7- 0	41.6	9.3	0.18
50-15- 0	42.0	9.2	0.19
50-30- 0	43.8	9.4	0.16
Average **		8.6	0.27

* The rate of fertilizer application is highly significant at the 5% confidence level.

** Taken from Feeds and Feeding by Morrison.

Discussion and Interpretation of Results:

Nitrogen applications (Tables 5 and 6) increased wheat yields 2 bushels and corn about 4 bushels. The addition of phosphorus helped increase wheat and corn yields 2 and 4 bushels, respectively.

The percent protein in corn (Table 6) is above average but the total phosphorus is low. Protein and total phosphorus in wheat are low (Table 5).

CORN AND SORGHUM FORAGE STUDIES

Q. S. Kingsley

Objectives of Experiment:

1. Determine yield of crop in 20 and 40 inch row spacings.
2. Compare yields of forage sorghum varieties and of a corn variety under similar conditions.

Results:

Table 7. Performance of Annual Forages at Northeast Research Farm, Watertown Unit

Environment:

Fertilizer - 60-16-0 elemental
Population and seeding rates:
Corn: 40" rows - 12,000 per acre
20" rows - 22,000 per acre

Sorghum and Sudan:
40" rows - 6# seed per acre
20" rows -12# seed per acre

Planting date: June 12, 1965
Harveat date: Oct. 1, 1965
Approximate sorghum seeds per pound: 22-25,000

Crop	40-in. rows				20-in. rows			
	1965		1962-65 Average		1965		1962-65 Average	
	Silage wt.	Air Dry wt.	Silage wt.	Air Dry wt.	Silage wt.	Air Dry wt.	Silage wt.	Air Dry wt.
Rancher Sorghum	5.4	2.0	8.5	2.8	8.1	3.3	11.8	4.2
Hybrid Sudan	3.8	2.4	10.2	3.7	6.2	4.1	12.8	5.0
Piper Sudan	2.6	1.4	6.1	2.3	3.5	2.1	7.3	3.0
SD 252	5.7	3.0	9.6	3.6	8.4	4.9	12.5	5.0
Volkman S100	4.7	2.5	9.0	3.3	6.5	3.8	10.9	4.3
DeKalb SX 11	6.1	4.5	11.0	4.1.	8.1	6.1	13.5	5.5
Rox Orange	9.2	5.8	13.7	6.0	12.7	7.8	16.0	6.5
Frontier FS 210	6.9	2.2	11.9	3.8	10.3	4.3	14.3	5.1
Hydan 37	4.7	2.6	9.3	3.9	7.8	5.0	11.8	5.2
High Sugar Corn	7.3	4.1	13.6	5.3	9.5	5.6	16.9	6.0
Excel Chow maker*	6.5	4.0			10.0	5.9		
Average yield	5.7	3.1	10.3	3.9	8.3	4.9	12.8	5.0

* First year tested

Discussion and Interpretation of Results:

The materials used for these forage studies are suitable for this area of the state. The crop requires ample water, but warm temperatures are also necessary for rapid growth. The rainfall during the past season was sufficient for these sorghums and corn to produce about two times more forage than they did but cool temperatures inhibited growth so the plants did not grow with the vigor that is inherent in most of them.

The average yields may be used to select the most suitable varieties. By using this method, many of the varieties which were below the average may be eliminated from consideration in a forage program.

The yield produced in 40-inch rows compared to that from 20-inch rows definitely favors the later. The 20-inch row spacing of the plants produced 31% more forage (wet weight) than the 40-inch row spacing in 1965 while the 4-year average for the 20-inch row spacing was 20% more than for the wider spacing.

Plantings in narrower rows restrict weed growth, but some weed control is necessary. References to chemical weed control in crops may be found in your Extension Agent's office for your particular cropping sequence. This study is to receive an Atrazine treatment or an Atrazine + Lorox mixture in 1966, depending on conditions at that time.

STANDARD VARIETY TRIALS OF SMALL GRAINS, NORTHEAST RESEARCH FARMS, WATERTOWN UNIT, 1965

J. J. Bonnemann

Objective of Experiment:

The purpose is to collect data so farmers, ranchers, and others in agri-business can be better informed on the relative performance of standard varieties of spring wheat, oats, barley, and flax.

Discussion of Results:

Climatic conditions favored small grain production at the Watertown Unit during 1965. Rank growth was common and lodging was a problem, especially in the barley trials. The yields were excellent for all crops though some test weights were low.

Of the spring wheat varieties recommended for the area, the newly released Chris has the best 3-year average. Selkirk, Pembina, and Crim are also quite satisfactory for yield and acceptable for milling.

The durums, Lakota and Wells, have the better average yields for this area. The new durum, Stewart 63, did not perform as well as Lakota and Wells this year but in years when rusts are serious, its greater resistance should permit it to outyield other durums.

Two malting type barleys, Larker and Trophy, have the best 4-year averages of the malting barleys. The new barley release, Dickson, did very well.

Clintland 64, a replacement of Clintland 60 has broader disease resistance. Dodge, Minhafer and Portage have the highest yield averages of the varieties recommended for the area.

The flax varieties, Summit and Windom, have the highest five-year averages of the flax varieties tested. Two new races of flax rust were first isolated in Canada in 1962. In 1964, only 5 rust resistant varieties were recommended. An abundance of rust was found in fields of susceptible varieties in 1965. To avoid further buildup, it is urged that only recommended resistant varieties be grown in 1966. The recommended varieties are: B-5128, Bolley, Redwood, Summit, and Windom.

Further information on the 1965 trials can be found in Circular 173 - 1965 Small Grain Variety Trials.

Table 8. Standard Variety Spring Wheat and Durum Trial, Northeast Research Farms, Watertown Unit, 1965.

Variety	Test weight, lb/bu	Yield. Bu/A	
		1965	1963-65
CI 13949	59.0	49.8	
CI 13655	61.5	48.8	
Chris	59.5	44.5	31.2
CI 13773	61.5	42.9	
CI 13586	59.0	42.0	27.4
CI 13779	56.5	42.0	
Lakota	54.5	41.4	27.0
Wells	57.5	39.4	26.8
Manitou	58.0	38.0	
CI 13947	56.5	35.3	
Stewart 63	59.5	35.0	
Pembina	54.0	29.1	22.0
Justin	56.0	28.8	19.7
Crim	55.0	28.0	21.3
Selkirk	52.5	26.4	19.9
Rushmore	55.0	24.1	20.4
Lee	48.5	21.3	16.9
Canthatch	52.5	18.6	17.2
Thatcher	51.0	18.0	16.3
	Mean yield	34.4	
	LSD (.05)	3.1	

Table 9. Standard Variety Barley Trial, Northeast Research Farms, Watertown Unit, 1965

Variety	Test weight lb/bu	Yield, Bu/A 1965	Yield, Bu/A 1962-65
Trophy	45.5	74.3	49.3
Dickson	46.0	73.7	
Parkland	48.0	73.1	47.9
Liberty	47.0	70.1	50.2
Larker	47.5	67.8	50.4
Betzes	47.5	66.9	48.1
Traill	45.5	65.5	46.9
Custer	44.0	64.6	43.6
Plains	46.0	62.7	44.6
Otis	46.5	59.4	43.5
Spartan	48.5	59.3	42.2
Feebar	44.5	58.8	43.3
	Mean yield	68.4	
	LSD (.05)	8.8	

Table 10. Standard Variety Oat Trial, Northeast Research Farms, Watertown Unit, 1965

Variety	Test weight, lb/bu	Yield, Bu/A	
		1965	1961-65
CI 7978	36.5	124.6	
Santee	36.0	122.8	
Clintland 64	36.0	121.9	
CI 8178	34.0	121.4	
Garland	37.5	120.4	
Tyler	34.5	119.9	
Brave	35.0	118.5	
Putnam 61	36.0	117.7	
Dupree	36.0	115.0	
Mo. 0-205	37.0	113.2	83.4
Bonkee	37.5	112.1	
Dodge	35.0	111.9	82.9
Neal	34.5	111.8	
Coachman	34.0	110.4	
Minhafer	36.0	109.8	85.5
Portage	34.0	109.3	83.8
Nodaway	38.0	109.2	80.1
Peterson 100	36.5	107.7	
Tippecanoe	36.0	106.3	
Goodfield	38.0	104.9	
Burnett	34.5	104.9	78.7
Garry	30.0	102.8	73.8
Ortley	34.0	102.1	78.9
Clintford	36.0	100.8	
Rodney	29.0	98.5	71.2
Lodi	32.0	96.0	
Andrew	34.5	90.2	75.7
	Mean yield	110.5	
	LSD (.05)	13.7	

Table 11. Standard Variety Flax Trial, Northeast Research Farms, Watertown Unit, 1965

Variety	Test weight, lb/bu	Yield, Bu/A 1965	Yield, Bu/A 1961-65
Windom	54.5	33.8	23.0
Summit	53.5	32.9	23.6
Caldwell	54.5	30.8	
CI 1909	54.0	30.5	
CI 2292	53.0	30.4	
Redwood	54.5	29.5	21.0
Arny	53.0	28.8	21.3
B-5128	54.0	28.2	19.5
Marine 62	52.0	28.2	
CI 1910	54.0	27.0	
CI 2290	53.5	26.9	
Norland	53.0	26.5	19.1
CI 2291	52.5	24.8	
CI 2426	54.0	24.7	
	Mean yield	28.8	
	LSD (.05)	4.4	

CORN PERFORMANCE TRIAL, AREA D2, NORTHEAST RESEARCH FARMS, WATERTOWN UNIT, 1965

J. J. Bonnemann

Objective of Experiment:

The purpose is to collect data so farmers, ranchers and others in agri-business can be better informed on the relative performance of corn hybrids under the same environmental conditions.

Discussion:

Thirty-eight hybrid corn entries were included in the 1965 trials. The trials are conducted on a fee basis and the entries were those designated for entry by participating companies.

The trial was seeded on May 21 and harvested on October 28. Cool temperatures and wet weather throughout the growing season greatly reduced the normal progress of the corn toward maturity. Yields ranged from 48.8 to 32.7 bushels per acre of high-moisture, low-quality corn. Few entries contained less than 30 percent moisture in the ear corn at harvest time and one entry exceeded 60 percent moisture.

Further information on the 1965 trials can be found in Circular 174 - 1965 Corn Performance Trials.

Table 12. Area D2 Corn Performance Trial, Northeast Research Farms, Watertown Unit, 1965

Variety	Performance Score	% Moisture ear corn	Yield, B/A
SD Exp. 48 (4x)	4	35.4	48.8
Pioneer 3862 (4x)	1	32.8	48.6
SD Exp. 39 (4x)	3	34.1	48.4
Sokota 225 (4x)	2	28.5	46.4
DeKalb XL-315 (3x)	18	42.5	46.4
Sokota TS-50 (2x)	10	35.8	46.2
Master F-30 (4x)	7	33.8	46.0
SD Exp. 55 (4x)	5	31.3	45.9
Pioneer 388 (4x)	12	36.4	45.9
Pioneer 3812 (4x)	17	40.0	45.6
SD 248 (3x)	23	46.3	45.6
DeKalb XL-307 (3x)	13	36.4	45.5
DeKalb XL-304 (3x)	8	33.3	45.4
Pioneer 3854 (4x)	14	35.8	45.1
Pioneer 3681 (4x)	21	42.4	45.0
Northrup-King PX 487 (3x)	20	41.1	44.7
SD 210 (4x)	6	28.6	44.4
SD 220 (4x)	9	31.3	44.2
DeKalb XL-302 (3x)	11	31.9	44.2
DeKalb 59 (4x)	25	46.7	44.2
Master F-66 (4x)	22	40.2	43.7
Northrup-King PX 481	19	38.3	43.4
Master F-34 (4x)	24	44.0	43.3
Sokota 255 (4x)	15	33.8	43.1
Pioneer 384 (4x)	26	44.5	43.1
Master F-70 (4x)	31	51.2	42.9
Master F-31A (4x)	16	32.1	42.3
Northrup-King KE 449 (4x)	27	40.3	41.0
Northrup-King KE 497 (4x)	32	49.0	40.8
SD 240 (4x)	28	39.8	40.5
Pioneer 385 (4x)	34	52.5	40.2
Master FX-450 (3x)	30	42.2	39.4
DeKalb 45 (4x)	29	35.6	36.7
United-Hagie UH X126 (2x)	33	41.8	36.7
Master FX-350 (3x)	35	46.5	36.3
United-Hagie UH X138B (2x)	38	66.0	34.0
United-Hagie UH X130 (2x)	37	57.2	33.2
Pioneer 3670 (4x)	36	51.7	32.7
		Mean Yield	42.9
		LSD (.05)	3.5

GRAIN SORGHUM PERFORMANCE TRIALS, AREA D2, NORTHEAST RESEARCH FARMS, WATERTOWN UNIT, 1965

J. J. Bonnemann

Objective of Experiment:

The purpose is to collect data so farmers, ranchers, and others in agri-business can be better informed on the relative performance of grain sorghum hybrids under the same environmental conditions.

Discussion:

Grain Sorghum Performance Trials have been conducted on a fee basis for four years at the Watertown unit. The entries included in the trials have been the choice of the entering producers.

Twenty-six entries were included in the 1965 trial. The trial was seeded on May 21 and harvested on October 1.

The climatic conditions of 1965 were detrimental for good sorghum production. Cool, wet conditions prevailed through most of the summer and growth was seriously retarded. Many of the later maturing entries had barely reached the milk stage when the first fall frost stopped growth. The low test weights of all entries were caused by the early frost which occurred before the grain was mature.

Further information on the 1965 trials can be found in Circular 175- 1965 Grain Sorghum Performance Trials.

Table 13. Area D2 Grain Sorghum Performance Trial, Northeast Research Farms, Watertown Unit, 1965

Variety	Height, inches	Date headed	Test wt. lb/bu	Yield, 100lb/A 1965	Yield, 100lb/A 1963-65
NK 115	43	8/4	46.0	25.3	
PAG 275	45	8/4	50.0	24.4	
SD 503	58	8/10	43.0	23.1	32.9
NK 120	48	8/4	46.0	22.7	31.4
NK 125	51	8/9	41.0	22.3	30.4
SD 441	48	8/4	47.0	21.1	27.1
RS 501	59	8/11	41.0	20.8	33.2
NK 133	44	8/15	37.0	20.5	
SD 502	54	8/10	40.5	20.0	
Pawnee	51	8/9	43.5	19.5	
DeKalb B-32	49	8/10	43.0	19.4	
Excel 202	52	8/10	40.0	19.2	
Pronto	56	8/6	44.0	19.2	
SD 102	45	8/4	43.0	17.9	22.9
SD 451	52	8/10	42.0	17.7	
Colo. 585	54	8/7	44.0	17.5	
PAG 304	39	8/10	38.5	17.1	
Nebr. 504	52	8/10	40.5	17.0	
T-E 44	46	8/14	28.5	15.8	
Frontier GX373	41	8/14	22.0	11.5	
PAG Exp. 3637	48	8/12	28.0	11.2	
Frontier GX104	47	8/16	16.0	9.7	
Frontier 388	50	8/13	33.5	8.3	
Pioneer 885	46	8/15	20.0	8.6	
Tasco	48	8/14	21.0	8.0	
Rico	46	8/17	15.0	6.0	
			Mean yield	17.1	
			LSD (.05)	4.3	

COMPARATIVE TESTS OF NEW WHEAT, OATS AND FLAX STRAINS OF COMMERCIAL VARIETIES

WHEAT

D. G. Wells

The Experiment Station at Watertown usually experiences such severe winters that it is a useful test site for winter wheat breeding materials from which hardier winter wheats are being sought. The winter of 1964-65 was so severe that virtually all of the winter wheat nursery there winter killed.

Plants from crosses of wheat with wheatgrass were tested. Some survived very well. A collection of wheat grass species was tested also and some of these survived. All surviving plants were transplanted to Brookings to be used in the program of breeding for greater winter hardiness.

Cooperative regional tests of hard red spring and durum wheat were grown with very good results. The nurseries were well cared for and helped evaluate new strains of these crops.

Rates of seeding spring wheat were tested at three locations including Waterton. There were 5 rates which varied from 15# to 75# per acre. To help distribute the live seed uniformly over the 4 rows of each plot, different amounts of live seed varying from 11 grams to 45 grams, were increased to a uniform volume by adding heat-killed seed. Thus, the plots were seeded uniformly regardless of the experimental rate. The results are shown in Table 14.

Table 14. Seeding rates of Chris and Wells spring wheats at Eureka, Watertown, and Highmore.[a/]

Varieties	# Seed per acre	Eureka	Watertown	Highmore	Av.	Readings by replicates at Highmore Lodging 7/19 I	II	III	Av.	Test weights Eureka	Watertown	Highmore
		bu.	bu.	bu.	bu.	%	%	%	%	#	#	#
Chris red wheat	15	25.9	33.4	40.7	33.3	0	0	0	0	55.4	59.8	60.6
" " "	30	29.7	45.0	47.8	40.8	2	5	0	2	56.6	60.0	60.4
" " "	45	29.6	47.7	50.9	42.7	20	5	40	22	57.1	60.8	61.5
" " "	60	26.3	49.0	52.2	42.5	60	40	20	40	55.7	60.3	60.3
" " "	75	26.1	45.9	47.5	39.8	50	80	60	63	55.1	60.4	60.4
Wells durum, wheat	15	24.0	36.1	41.7	33.9	0	0	0	0	54.3	58.1	59.4
" " "	30	25.6	38.4	56.8	40.3	0	5	0	2	54.8	56.9	59.7
" " "	45	24.5	43.1	55.4	41.0	20	5	5	10	53.0	56.5	60.1
" " "	60	26.1	45.2	48.5	39.9	40	70	80	63	53.5	56.5	58.7
" " "	75	28.5	46.3	53.3	42.7	60	20	5	28	55.3	56.8	59.6

a/

Germination test: Chris 99% tested 4/19
Wells 87% teated 4/19

Dates of seeding: Watertown 4/28
Eureka 5/4
Highmore 4/16

Seeded plot size 4' x 18' in 3 replicates and a completely randomized design.
Harveated plot size 2' x 12'

Scab 7/19 in Wells - 1% at Watertown
" " " Chris - trace at Watertown

Table 15. Partial Summary of Highest Yielding Entries from Uniform Regional Spring Wheat tests at Brookings, Watertown and Highmore.[a/]

Name or No.	C.I. No.	Date half headed	BROOKINGS Lodging 7/24	Lodging 9/2	Shattering 9/2	Rust 7/21 Leaf	Rust 7/21 Stem	Ht. 7/7	Scab 7/15	HIGHMORE Test wt.	HIGHMORE Yield	WATERTOWN Test wt.	WATERTOWN Yield
		June	%	%	%	%	%	in.	%	#	bu.	#	bu.
Marquis	3641	27	0	0	0	S-100	S-100	42	5	53.6	20.5	47.0	12.7
Thatcher	10003	22	0	0	1	S-100	S-25	42	10	56.7	27.2	51.8	19.5
Selkirk	13100	24	0	0	1	S-100	R-0	39	10	54.1	31.0	51.2	22.7
Lee	12488	22	0	0	5	MS-45	S-100	41	30	57.5	34.8	48.2	18.7
Pembina	13332	21	0	1	1	S-100	R-0	40	15	57.2	34.3	54.7	28.5
Crim	13465	22	0	0	5	S-100	R-0	41	20	58.8	36.5	54.6	29.9
Justin	13462	26	0	5	0	MS-65	R-0	42	15	58.6	39.4	56.4	29.7
Chris	13751	25	50	80	5	R-0	R-0	41	5	60.7	45.0	60.2	44.7
Manitou	13775	24	0	5	1	R-5	R-0	44	3	59.3	39.1	58.3	36.5
B61-95	13586	25	0	30	1	R-0	R-0	46	5	59.6	44.8	60.0	42.3
860-82	13823	24	0	20	0	R-1	R-t	47	5	58.6	37.6	58.9	39.8
II54-30	13655	25	0	10	10	R-0	R-0	44	2	61.8	47.1	61.6	45.8
II55-11	13773	25	0	5	20	R-0	R-0	44	1	61.7	45.2	62.0	42.7
II59-9	13826	22	0	1	1	R-10	R-0	42	5	59.4	45.0	54.8	40.3
60-54	13596	23	0	20	1	R-0	R-0	40	30	60.7	49.7	59.7	41.8
SD625	13948	21	0	20	10	R-1	R-0	39	5	62.1	44.0	61.0	45.4
SD626	13949	24	0	1	10	S-25	R-0	43	1	59.1	43.3	58.6	48.3
ND405	13779	25	0	1	70	R-0	R-0	44	1	58.9	41.9	56.8	44.6
ND363	13828	21	0	0	1	R-5	MS-10	43	15	60.6	50.6	57.3	44.5

a/ Seeded at Watertown 4/28 and Highmore 4/16.
Legend: R = resistant
S = susceptible
MS = moderately susceptible

Table 16. Partial Summary of Highest Yielding Entries from Uniform Regional Durum Wheat tests at Brookings, Watertown and Eureka.[a/]

Name or No.	Sel. or C.I. No.	BROOKINGS Date half headed June	Ht. 7/7 in.	Rust 7/21 Leaf %	Rust 7/21 Stem %	Lodging 9/2 %	Shattering 9/2 %	BROOKINGS Test wt. #	BROOKINGS Yield bu.	WATERTOWN Test wt. #	WATERTOWN Yield bu.
Mindum	5296	28	57	MR-5	S-100	5	0	42.0	3.2	54.0	5.0
Wells	13333	25	46	R-1	MS-10	0	0	57.1	36.9	53.8	30.4
Lakota	13335	24	46	R-5	MS-5	0	0	52.9	35.1	53.2	29.5
Stewart 63	13771	29	58	R-0	R-0	5	0	60.3	35.9	57.7	24.0
60-114	60114	24	41	R-0	R-0	0	0	61.2	45.2	61.4	36.4
61-42	61042	26	42	R-0	R-0	0	0	60.0	45.2	59.0	36.4
61-48	61048	24	43	MR-25	MS-10	0	0	59.5	42.4	59.2	36.5
62-51	62051	23	47	R-0	R-0	20	0	58.0	40.4	58.4	35.4
62-73	62073	26	47	R-0	R-0	20	0	60.6	41.1	59.6	38.1
62-120	62120	24	43	R-5	R-0	5	0	58.6	48.0	57.5	37.1
62-214	62214	26	40	R-0	R-0	0	0	55.2	37.5	58.6	35.7
DT-188	188	27	44	R-1	R-0	0	0	57.8	33.3	58.3	36.5

[a/] Seeded at Eureka 5/5 and Watertown 4/28

Legend: R = resistant
S = susceptible
MS = moderately susceptible
MR = moderately resistant

Table 17. Partial Summary of Highest Yielding Entries from Advanced Spring Wheat I tests at Watertown & Highmore

	Black chaff	Date half headed	Height 7/7	Lodging* 9/2	Watertown leaf	Watertown stem	Brookings leaf	Brookings stem	Yields W	Yields H	Test wts. W	Test wts. H
	%	June	in.	%	%	%	7/7	7/24	bu.	bu.	#	#
Pembina	0	22	40	5	S-65	R-0	MS-25	R-0	31.4	39.2	54.9	59.2
Lee	0	22	42	0	S-100	S-10	S-40	S-100	21.0	39.8	50.1	57.1
SD636	0	21	45	0	R-0	R-0	R-0	MR-10	42.7	50.7	60.5	61.0
SD6353	0	20	41	20	S-100	R-0	S-40	MR-2	23.1	44.7	55.7	61.5
SD645	1	23	44	5	R-0	R-0	R-Tr	R-t	38.9	41.4	61.9	61.1
SD646	0	22	40	0	S-65	R-0	MS-45	MR-10	33.2	46.4	58.1	60.4
CI513	0	22	42	10	S-40	R-0	MS-10	mix	31.9	41.4	56.3	58.9
SD649	0	22	43	0	S-100	R-0	MS-65	R-0	32.3	47.2	57.5	60.7
Chris	0	23	45	20	R-0	R-0	R-0	R-t	42.5	49.4	60.5	60.0

Seeded at Watertown & Highmore 4/28

* No lodging July 24

Legend: R = resistant
S = susceptible
MS = moderately susceptible
MR = moderately resistant

OATS

R. S. Albrechtsen

Four nurseries of experimental oats were grown at the Watertown Unit in 1965. Strains included in these nurseries represent various stages in the development of new varieties in the Oat Breeding Program at the South Dakota Agricultural Experiment Station and other cooperating agencies, primarily in the North Central Region of the United States and in Canada.

The earliest stage of this breeding program at the Watertown Unit in 1965 was the growing of plants in two Preliminary Oat Yield Nurseries. These nurseries had 144 new strains which were being yield-tested for the first time by comparing their yields with those of appropriate check varieties. Only a few of the best entries in these two nurseries were retained and these will be advanced to the next stage of testing in 1966. No data are reported here for either of the Preliminary Oat Nurseries since most entries were discarded prior to harvest.

Fourteen new strains developed at the South Dakota Agricultural Experiment Station were grown in a yield nursery (Rod Row Oats I) with four standard varieties as checks. These 14 strains are those which were selected from a much larger number grown previously in individual plant rows and preliminary yield tests. Entries in this nursery which are potentially suitable for release as a new variety will be advanced to the next stage of testing. Table 18 shows data on the highest yielding experimental strains and check varieties included in this yield nursery at the Watertown Unit in 1965.

The next step in the oat breeding program (after testing in the Rod Row Nursery) is the testing of new strains and standard check varieties in one of two Uniform Regional Oat Nurseries. The growing of these nurseries is coordinated by the Crops Research Division of the United States Department of Agriculture. The best new strains available from all states in the North Central Region of the United States and from Canada are normally grown in these nurseries for a period of 2 to 4 years prior to release as a new variety. The nurseries are grown at approximately 20 locations throughout the North Central Region and Canada. This regional program tests the suitability of new varieties for release and determines the areas of adaptation for these varieties. Through such a cooperative testing program, varieties developed in one state or region may be found suitable for production in other states or areas as well.

Data on the highest yielding experimental strains and standard check varieties in the Uniform Midseason Oat Performance Nursery are shown in Table 19. Entries in this nursery are primarily of the midseason to late maturity class, being as late as, or later than, the Clintland type oats.

Table 18. Partial Summary of Results of the 1965 Rod Row Oats I Nursery; Watertown. (W65RROI).

1965 Entry No.	Selection No.	Variety	Lodging %	Height in.	Stem rust *	Test wt. lbs.	Yield per acre bu.	Yield rank
1	C.I.4170	Andrew	10	49	50-S	34.5	105.2	8
2	C.I.7269	Dodge	0	52	10-S	36.8	104.1	9
3	C.I.7639	Clintland 64	0	48	tr-MR	35.5	103.2	10
4	C.I.6662	Garry	10	53	10-S	29.5	101.8	11
5	64 RROI-6		10	49	20-S	31.8	110.2	4
9	64 RROI-16		10	48	5-S	35.2	114.9	2
10	64 RROI-18		10	50	10-MS	33.8	117.2	1
11	64 RROI-21		0	53	40-S	34.7	111.4	3
12	64 RROI-22		10	54	40-S	35.3	105.8	7
13	64 RROI-23		10	51	20-S	32.0	107.5	6
14	64 RROI-24		0	52	30-S	35.2	108.6	5

*Letters indicate type of reaction shown by plants; 0 = no observable infection, tr = trace of infection, R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, X = heterogeneous reaction. Numbers indicate percentage of stem surface covered by rust pustules.

Seeded April 28, 1965
Overall mean yield = 103.1 bushels
C.V. = 8.81%
L.S.D. = 14.8 bu. or 14.3%
Number of reps = 3

Table 19. Partial Summary of Results of the 1965 Uniform Midseason Oat Performance Nursery; Watertown. (W65 UMOPN).

1965 Entry No.	C.I. No.	Variety	Lodging %	Height in.	Stem rust *	Test wt. lbs.	Yield per acre bu.	Yield rank
1	8170	Stormont	0	45	20-S	31.8	109.3	8
2	8171		0	51	20-S	30.8	107.6	13
3	6662	Garry	8	54	10-S	29.5	102.1	23
5	8068		0	45	10-S	38.6	111.1	5
8	8168		2	46	20-S	35.4	108.7	10
11	8174		0	50	2-MR	39.5	113.8	2
14	4170	Andrew	10	46	40-S	35.3	103.7	19
15	2027	Gopher	15	49	10-S	33.5	102.3	22
16	4988	Mo.0-205	5	49	30-S	35.6	101.1	24
21	8029		8	51	5-MS	36.6	108.9	9
23	8151		0	44	20-S	36.3	112.9	3
24	7463	Clintford	0	42	60-S	33.0	92.9	27
25	7679	Tyler	0	44	40-S	34.9	103.8	18
26	7680	Tippecanoe	0	44	40-S	38.0	107.9	11
28	7639	Clintland 64	8	46	tr-MR	38.9	89.1	28
29	8178		2	48	5-S	36.5	109.9	6
30	7978		2	47	20-S	37.8	111.4	4
31	8040		0	48	2-X	37.4	114.1	1
32	8072		2	47	5-MR	36.1	109.9	7
33	7989	Harmon	32	54	2-S	26.1	67.8	30

*Letters indicate type of reaction shown by plants; 0 = no observable infection, tr = trace of infection, R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, X = heterogeneous reaction. Numbers indicate percentage of stem surface covered by rust pustules.

Seeded April 28, 1965
Overall mean yield = 99 2 bushels
C.V. = 6.88%
L.S.D. = 9.7 bu. or 9.8%
Number of reps = 4

OATS

R. S. Albrechtsen

Two nurseries were grown at the Garden City Unit in 1965 to study the influences of seeding rate and fertility level upon the components of seed yield and associated characteristics in oats. Each nursery had six varieties (Andrew, Tippecanoe, Garland, Mo.0-205, Lodi and Rodney) representing a range in maturity and agronomic characteristics.

In one test (Oat Seeding Rate Experiment), the six varieties were each seeded at the four rates of approximately 1, 2, 3, and 4 bushels per acre. The seeding rate of each variety was adjusted for seed size and germination percentage to

give an equal number of viable seeds per foot of row within a seeding rate. A uniform application of fertilizer (30 pounds of N and 20 pounds of P_2O_5 per acre) was used over the entire nursery. Data were obtained on stand count, heading date, maturity date, plant height, lodging, number of panicles per plant, number of seeds per panicle, seed size, seed yield, and bushel weight.

In the Oat Fertilizer Experiment, the six varieties were fertilized at the three rates of 0-0-0, 30-20-0, and 60-40-0 of N, P_2O_5 and K. A uniform seeding rate (approximately 2 bushels per acre when adjusted for seed size and germination percentage) was used in this nursery. Data were obtained on the same characteristics as described for the Seeding Rate Experiment.

No data are presented for either of these experiments since analyses of the data are incomplete at the time of writing this report.

FLAX

R. S. Albrechtsen

Four experimental flax nurseries were grown at the Watertown Unit in 1965. One of these was a Flax Rust Differential Nursery which is grown annually to serve as an indicator of the races of flax rust that are prevalent in the surrounding area. This nursery had 20 differential varieties (indicators), which reacted differently to the various races of the flax rust organism. Through an analysis of the rust infection on this set of differential varieties it is possible to determine which of the known rust races are prevalent in the area and also to detect new races that may arise.

The relatively new race "300" of flax rust was observed in the Rust Differential Nursery and in commercial fields of susceptible varieties grown in South Dakota in 1965. This new race was found in isolated areas of Canada in 1962. By 1963 the infected Canadian areas had grown in size and the race had spread into North Dakota. It was observed in South Dakota in 1965 when severe infections were found in many fields of susceptible varieties. This emphasizes the importance of growing only resistant varieties in an effort to avoid immediate losses and as a long-time control measure to reduce the abundance of the organism so that new races will be less likely to develop.

A second nursery (Preliminary Flax Nursery) contained 88 new strains developed at the South Dakota Agricultural Experiment Station which were being yield-tested for the first time in comparison to yields of appropriate check varieties. Only strains having desirable agronomic appearance and immunity to the flax rust organism were retained for the next stage of testing (Rod Row Flax Nursery) in 1966. No data are reported here for the Preliminary Flax Nursery since most entries were discarded prior to harvest.

A State Rod Row Flax Nursery of 33 entries was grown in 1965. This is a nursery grown cooperatively by the Minnesota and South Dakota Agricultural Experiment Stations. A few of the most promising strains in this nursery will be advanced to the next stage of testing (Uniform Regional Flax Nursery) in 1966. Data on the highest yielding experimental strains and check varieties in the State Rod Row Flax Nursery are shown in Table 20.

Two Uniform Regional Flax Nurseries were grown at Watertown in 1965. These nurseries normally serve as the final testing of new strains prior to their release as new named varieties. The growing of these nurseries is coordinated by the Crops Research Division of the United tates Department of Agriculture. The beat new strains available, primarily from states in the North Central Region of the United States and from Canada, are grown in these nurseries for a period of 2 to 4 years prior to release as new varieties. This extensive testing program tests the suitability of new strains for release as new varieties and determines the areas of adaptation for these varieties. Through such a cooperative testing program, varieties developed in one state or region may be found suitable for production in other states or areas as well. The nursery is seeded at two dates to evaluate the performance of strains from different dates of seeding. Data on the experimental strains and standard check varieties in the early seeded Uniform Regional Flax Nursery are shown in Table 21. Data for the late seeded nursery are shown in Table 22.

Table 20. Partial Summary of Results of the 1965 State Rod Row Flax Test; Watertown Unit. (W65 SRRFT).

1965 Entry No.	C.I. or Sel. No.	Variety	Height in.	Test Wt. lbs.	Yield per acre bu.	Yield rank
1	C.I. 2426	BC Bison	23.7	52.5	28.0	28
2	C.I. 1130	Redwood	25.3	54.5	31.8	18
3	C.I. 1823	Windom	23.7	53.3	31.9	16
4	Minn. II 56-20		27.0	53.2	28.6	26
8	" 61-2004		24.0	54.2	33.2	5
10	" 61-2036		24.7	52.7	33.2	6
13	" 61-2099		25.3	53.7	34.3	2
14	" 61-2978		25.3	53.5	33.0	8
15	" 61-2231		25.3	53.3	32.6	12
16	" 61-2152		23.3	52.8	32.7	11
18	" 61-2477		25.0	54.2	32.6	13
20	" 61-2342		25.3	53.5	35.3	1
24	" 61-2867		26.0	54.0	33.0	9
25	" 61-2590		23.3	53.0	33.3	4
26	" 61-2619		25.0	52.8	33.2	7
28	C.I. 1412		22.3	51.0	26.0	33
29	Minn. L^6M^3		25.0	52.7	29.7	22
31	" N^1L^6		25.7	52.3	32.8	10
32	" 8W		23.7	50.8	33.9	3

Seeded April 28, 1965
Overall mean yield = 31.0 bushels
C.V. = 7.4%
L.S.D. = 3.78 bu. or 12.2%
Number of reps = 3

Table 21. Results of the 1965 Uniform Regional Flax Nursery, Watertown Unit, Early Seeded (W65 URFN-E)

1965 Entry No.	C.I. No.	Variety	Height	Test Wt.	Seed yield per acre		Yield rank
			in.	lbs.	lbs.	bu.	
1	389	Bison	27.0	52.4	1491	26.6	22
2	1130	Redwood	27.0	52.6	1623	29.0	15
3	1478	Bolley	25.5	52.9	1735	31.0	6
4	1823	Windom	25.5	53.1	1763	31.5	4
5	1914	Summit	26.0	52.0	1779	31.8	3
6	1908	Caldwell	23.5	53.8	1715	30.6	10
7	1909	Dillman	22.0	53.6	1723	30.8	9
8	1910		21.5	52.8	1563	27.9	17
9	2290		27.0	52.8	1631	29.1	14
10	2291		27.0	53.1	1695	30.3	12
11	2292		28.0	53.5	1855	33.1	1
12	2426		24.5	51.8	1543	27.6	18
13	2427		24.5	52.9	1663	29.7	13
14	2429		26.0	53.1	1727	30.9	7
15	2430	Noralta	26.0	53.2	1755	31.3	5
16	2444		25.0	52.8	1707	30.5	11
17	2445		26.0	54.1	1803	32.2	2
18	2446		26.0	53.1	1731	30.9	8
19	2447		27.5	52.6	1611	28.8	16
20	320	Redwing	26.5	53.5	1519	27.1	19
21	980	B-5128	29.0	52.0	1511	27.0	20
22	1638	Arny	30.5	52.9	1507	26.9	21
23	1661	Marine 62	26.0	53.1	1455	26.0	23

Seeded April 28, 1965
Overall mean yield = 1656 lbs., 29.6 bu.
C.V. = 7.05%
L.S.D. = 165 lbs., 2.9 bu., or 10.0%
Number of reps = 4

Table 22. Results of the 1965 Uniform Regional Flax Nursery, Watertown Unit, Late Seeded. (W65 URFN-L).

1965 Entry No.	C.I. No.	Variety	Test Wt.	Seed Yield per acre		Yield rank
			lbs.	lbs.	bu.	
1	389	Bison	50.0	1095	19.6	19
2	1130	Redwood	52.4	1519	27.1	2
3	1478	Bolley	49.5	1235	22.1	16
4	1823	Windom	51.5	1371	24.5	12
5	1914	Summit	50.9	1355	24.2	13
6	1908	Caldwell	50.6	1543	27.6	1
7	1909	Dillman	51.1	1467	26.2	5
8	1910		50.8	1295	23.1	14
9	2290		51.4	1375	24.6	10
10	2291		50.4	1379	24.6	11
11	2292		51.9	1499	26.8	4
12	2426		50.6	1383	24.7	9
13	2427		51.9	1275	22.8	15
14	2429		52.3	1511	27.0	3
15	2430	Noralta	52.8	1171	20.9	18
16	2444		52.0	1415	25.3	6
17	2445		51.3	1215	21.7	17
18	2446		51.8	1407	25.1	7
19	2447		51.5	1387	24.8	8
20	320	Redwing	49.8	728	13.0	22
21	980	B-5128	50.6	1035	18.5	20
22	1658	Army	50.0	716	12.8	23
23	1661	Marine 62	50.0	888	15.8	21

Seeded May 19, 1965
Overall mean yield = 1271 lbs., 22.7 bu.
C.V. = 14.65%
L.S.D. = 263 lbs., 4.7 bu., or 20.7%
Number of reps = 4

WEED RESEARCH

Wild Buckwheat Control in Small Grains

W. G. Wright

Objectives

1. To determine what herbicides will control wild buckwheat.
2. To determine the effective application rate of herbicides for wild buckwheat control.
3. To determine injury and/or tolerance of wheat, oats, and barley to these herbicides at their effective application rates.

Description of Experiment

Justin wheat, Trophy barley and Clintland 60 oats were treated when the small grain was in the 3- to 4-leaf stage and the wild buckwheat was in the 2- to 3-leaf stage. A uniform stand of 25 wild buckwheat plants per square foot was present over the entire plot area.

Results

Table 23. Wild Buckwheat Control in Small Grains

Treatment	Rate oz/A	% Wild Buckwheat control	Yield bu/A		
			Wheat	Oats	Barley
Bromoxynil ester	4	96	27.9	96.5	56.3
Bromoxynil ester	6	98	21.5	102.4	55.6
Bromoxynil ester	8	98	24.3	104.5	53.5
Bromoxynil ester + MCPA	4+4	97	25.7	88.0	49.7
Bromoxynil K salt	4	84	24.0	84.6	51.4
Bromoxynil K salt	6	94	26.4	84.4	54.9
Bromoxynil K salt	8	96	27.4	96.7	62.3
Ioxynil ester	4	80	23.3	96.7	59.0
Ioxynil ester	6	91	23.2	97.0	58.6
Ioxynil ester	8	91	26.5	100.7	52.9
Ioxynil ester + MCPA	4+4	82	22.6	83.7	55.1
Ioxynil Na salt	4	75	23.2	99.4	52.2
Ioxynil Na salt	6	83	23.4	100.9	56.8
Ioxynil Na salt	8	91	25.9	98.6	57.2
Picloram* + MCPA	3/16+3	61	22.8	97.9	52.5
Picloram + MCPA	1/4+4	92	24.5	105.7	53.5
Picloram + MCPA	3/8 +6	80	24.6	88.5	54.6
Picloram + MCPA	1/2+8	95	26.6	99.2	54.2
Picloram + 2,4-D	3/16+3	86	23.5	92.9	52.6
Picloram + 2,4-D	1/4+4	97	25.7	101.1	58.5
Picloram + 2,4-D	3/8+6	98	21.2	100.4	62.2
Picloram + 2,4-D	1/2+8	99	26.2	89.7	60.5
Dicamba* + MCPA	2+4	98	25.3	101.5	55.9
Dicamba + MCPA	3+6	98	20.6	100.7	61.6
Dicamba + 2,4-D	2+4	95	23.1	89.9	53.7
Dicamba + 2,4-D	3+6	98	20.6	85.3	59.6
Check	--	--	21.9	94.5	57.7
2,4-D ester	8	84	21.5	97.7	58.6

*Trade names Tordon and Banvel D, respectively

Discussion

All herbicides tested did an excellent job of controlling wild buckwheat. Due to the large size of the experiment there were wide yield variations between some treatments but the differences are not significant. This is probably due to some variation in the plot soil condition.

The bromoxynil ester formulation at 4 ounces per acre (1/4 pound) controlled wild buckwheat as well or better than bromoxynil potassium salt, ioxynil ester, or ioxynil sodium salt formulations at 8 ounces per acre. All crops were tolerant to this application rate of bromoxynil ester. Picloram and dicamba need MCPA or 2,4-D mixed with them to control "easy to kill" broadleaf weeds such as wild mustard or lambsquarters. Bromoxynil alone will control these weeds in addition to wild buckwheat.

The combination of 1/4 oz/acre of picloram and 4 oz/acre of MCPA as well as a combination of 3/8 oz/acre picloram and 6 oz/acre of 2,4-D gave excellent buckwheat control. However, the 2,4-D combination did give more consistent control.

The Dicamba 2,4-D and Dicamba MCPA combinations also gave excellent control. The MCPA combination caused less crop injury than the 2,4-D combination, especially in oats and barley.

The 2,4-D ester treatment did a commendable job of controlling wild buckwheat this year. However, this control treatment has not been reliable in all years.

Weed Control in Flax

W. G. Wright

Objectives

To determine potential weed control properties, required rates, and crop tolerances of numerous experimental herbicides for possible use in flax.

Description of experiment

Windom flax was planted April 29, 1965. Pre-emergence treatments were made April 30 and post-emergence treatments were made June 13 when the flax was 5 to 6 inches tall.

Results

Table 24. Weed Control in Flax

Treatment	Rate lb/A	% Wild Buckwheat Control	% Wild Mustard Control	% Crop Kill	Maturity Delay Days	Yield bu/A
			Pre-emergence			
Amiban	3	90	23	0	1-2	23.7
Ramrod	2	21	25	0	0	20.3
Ramrod	4	0	0	0	2-3	13.9
TD-1015**	4	0	25	0	2-3	18.0
TD-1015**	8	20	0	0	2-3	18.8
			Post-emergence			
NI 11092	1/2	48	60	0	2-3	19.0
NI 11092	1	73	93	0	3-4	22.1
Daxtron	2*	88	99	tr	3-4	22.9
Daxtron	4*	85	99	tr	6-7	19.7
GS-13528	2	99	98	33	5-6	14.6
GS-13528	4	100	89	99	--	0.0
GS-13529	2	100	53	84	7-8	11.1
GS-13529	4	100	97	63	7-8	13.9
NE 7452	1/2	0	53	tr	3-4	18.2
NE 7452	1	75	88	tr	5-6	17.2
Dicamba + MCPA	1.5 + 3*	99	99	tr	7-8	20.3
Dicamba + MCPA	2 + 4*	99	98	tr	8-9	18.5
Picloram + MCPA	3/16+ 3*	96	98	tr	3-4	21.7
Picloram + MCPA	1/4 + 4*	99	97	tr	3-4	18.9
Picloram + MCPA	3/8 + 6*	99	99	tr	3-4	20.9
Dalapon + MCPA	3/4 + 1/4	0	99	tr	3-4	19.0
Check	---	0	0	0	0	17.6

* rate/A in ounces

**not a uniform application due to emulsification problem

Discussion

Both rates of GS-13528 and GS-13529 as well as Ramrod at 4 pounds per acre severely injured the flax as measured by the lower yields. All treatments delayed the maturity of the flax, however, those providing good weed control increased yields above the check. Amiben and Daxtron controlled over 90 percent of the annual grassy weeds while Amiben, Ramrod, and Dalapon plus 2,4-D controlled approximately 70 percent. However, the grass stand was not uniform so these readings cannot be considered conclusive. The pre-emergence herbicides tested were not entirely satisfactory for use in flax since broad spectrum weed control was not achieved. Of the post-emergence herbicides, daxtron gave the widest weed control spectrum and dicamba or picloram in combination with MCPA produced satisfactory control of wild buckwheat and other annual broadleaf weeds.

Post-Directed Weed Control in Corn

W. G. Wright

Objectives

To determine potential weed control properties, required rates, and crop tolerances of numerous experimental herbicides for possible use as post directed herbicides in corn. Post-directed herbicides are those which are used to control growing weeds in the corn row.

Description of Experiment

SD 250 corn was planted May 28, 1965, and received 2 cultivations prior to treatment. Herbicides were applied July 7 in 14-inch bands using special leaf lifter equipment. The corn was 10 inches tall and the weeds 3 to 5 inches tall at the time of application. A uniform stand of wild mustard, pigweed, and foxtail was present in the corn rows.

Results

Table 25. Post-Directed Weed Control in Corn

Treatment	lb/A	% Grass Control	% Broad-leaved Control	Yield Bu/A
S-6000	1.5	93	99	42.7
S-6000	2	91	98	52.3
S-6000	3	93	99	45.3
Lorox + X-77*	2	95	99	54.2
Prometryne + X-77	2	91	64	49.0
Prometryne + X-77	4	95	92	43.8
Ametryne + X-77	2	97	99	51.1
Ametryne + X-77	4	98	94	50.2
GS-36393 + X-77	2	96	94	56.4
GS-36393 + X-77	4	94	98	49.7
Daxtron	1/4	85	98	57.3
Daxtron	1/2	93	98	59.1
Daxtron	3/4	94	98	48.1
NI 11092 + X-77	1.5	55	63	41.1
NI 11092 + X-77	3	90	97	38.1
NI 7452 + X-77	1.5	45	79	41.2
NI 7452 + X-77	3	74	97	44.6
GS-14260 + X-77	2	41	65	37.1
GS-14260 + X-77	4	79	72	44.6
Dalapon + 2,4-D	2 + 3/4	94	97	44.8
GS-13528 + X-77	3	20	51	35.6
GS-13529 + X-77	3	21	37	36.7
Check	-	0	0	35.9
LSD .05 level				11.3

* X-77, a surface active agent added at the rate of 1 quart per 100 gallons spray solution

Discussion

Lorox, Prometryne, Ametryne, GS-36393 and Daxtron all controlled grass and broadleaved weeds with the lowest rate of application and gave significant increases in yield. At the higher rates, all of these herbicides tended to reduce yields which would indicate the higher rates are close to the maximum rate that corn will tolerate without injury.

Grass control with dalapon in combination with 2,4-D is misleading because most plants, although stunted and malformed, were not dead. They made no vegetative growth after treatment but did produce some seed.

CORN BREEDING

D. B. Shank and D. W. Beatty

Objectives of Experiment

To develop new corn hybrids which will possess superior yielding and performance abilities and are adapted to the area represented by the Northeast Research Farm.

Results

Four yield trials were conducted in 1965. In these approximately 150 different hybrids were evaluated, with most of them being new experimental hybrids.

A test of 3- and 4-way crosses averaged 51.3 bushels per acre. The three best hybrids were all new experimental entries and all yielded over 60 bushels per acre. A partial list of the results appears in Table 26.

Table 26. Yield and Performance of Selected Experimental Corn Hybrids in 1965.

Hybrid	Yield (Bu./A)	Percent Moisture	Percent Dropped Ears	Percent Stalk Lodged
65520	61.4	29.3	1.4	12.4
65507	61.6	33.3	1.0	16.8
65514	60.5	36.3	0.0	23.3
SD220*	49.6	29.4	0.0	8.1
SD248*	50.9	47.1	0.0	6.7
SD240*	43.1	43.2	0.5	16.8

*Standard hybrid used as a check

Yields were good in 1965 but the cool season, especially in late summer and early fall produced very wet corn. As may be seen in Table 26, the percentage of moisture at harvest time on some entries was still very high.

A test was conducted on single crosses which contained all hybrids resulting from crossing 10 inbred lines in all possible combinations. Such a test can serve two purposes. It gives yield and performance information on hybrids which might be used as such, i.e., as single crosses. It also allows the

prediction of how 3- and 4-way hybrids made from these same inbred lines might have performed had they been included in the same test. This aids in selecting new hybrid combinations for the future. Yields were good from the single-cross test and several promising combinations were found. They will be evaluated in future tests.

Under a project in the Department of Plant Pathology, several inbred lines of corn have been developed which possess resistance to root rot organisms. Some of these resistant lines and inbreds supplied by the Agronomy Department were grown in another single-cross test in 1965. Twelve crosses out-performed the top check hybrid, SD220. Eleven of these twelve hybrids had a resistant inbred parent developed by Plant Pathology.

A fourth test was South Dakota's part of a region-wide cooperative effort among states to evaluate a number of new inbred lines for wide adaptation and possible use in future hybrids. Twenty-two inbreds crossed to a common single-cross parent were evaluated in comparison with the best check hybrids available. In this test 18 of the 3-way hybrids out-performed the best check, SD220.

Discussion and Interpretation of Results:

As indicated above, in 1965 yields were good but moisture percentages were too high in the corn at harvest. The extremely high moisture content of some hybrids may be misleading since several of the hybrids would mature satisfactorily most years. Thus, these might have been discarded in 1965, if this were the only criterion when they should have been saved for future study.

During the past several years, yields have gradually increased in these tests indicating that better performing hybrids are being developed and are being made available in this area by the corn breeding research program.

CROP DISEASES, POTATOES AND CORN

Potato Disease and Variety Trials

Lester W. Carlson
Plant Pathology Department

The production of potatoes is an important farm operation in northeastern South Dakota. A number of varieties have been developed throughout the United States in recent years. Sixteen named varieties and four numbered lines were evaluated for yield and scab reaction at the Northeast Research Unit near Garden City. Results of these trials are shown in Table 27. The potatoes were planted May 7 and harvested on October 9. While the yields are variable, it appears that a few of the new potato lines may be suited to South Dakota growing conditions.

Table 27. Disease Reaction, Maturity, and Yield of Sixteen Varieties and Four New Lines Grown at Garden City. 1965.

Variety	Color	Maturity[1]	Yield cwt. acre	Scab rating[2]		Performance rating	Comments
				Area	Type	Top 5	
Neb 4.56-9		M	142.8	1	2	5	
I-57410	Red	M-L	140.0	2	1	1	
Snow Flake	White	L	137.5	1	1		
Red Pontiac	Red	M-L	135.5	3	3		Very scabby
Ontario	White	L	133.3	1	1	2	
Red LaSoda	Red	L	131.3	1	2		
Kennebec	White	L	125.7	1	1	3	
Redskin	Red	L	125.5	3	2		
Saranac	White	VL	125.1	3	1		
Wisc. 563	Red	M-L	124.1	3	2		Russet type scab
Red Warba	Red	L	114.3	2	2		
Lal2-4	Red	E-M	118.2	T	1	4	
Russet Rural	White	L	113.6	3	2		
Katadhin	White	M-L	102.7	1	1		
Merrimack	White	L	98.7	1	2		
Blanca	White	L	93.8	3	1		
Norgold Russet	White	M	92.9	2	1		Mosaic susceptible
White Cloud	White	E	53.2	1	2		Mosaic susceptible
Dazoc	White	E	38.0	2	2		Mosaic susceptible
Early Ohio	Pink	E	13.8	3	3		Mosaic susceptible

[1]Maturity ratings: E - Early, M - Medium, L - Late

[2]Scab rating:

Area

T - Trace tuber surface scabby
1 - 1-20% " " "
2 - 21-40% " " "
3 - 41-60% " " "
4 - 61-100% " " "

Lesion type

1 - small, superficial
2 - large, superficial
3 - large, raised, rough
4 - pit type scab

LODGING AND ROOT ROT CONTROL IN HYBRID CORN

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Plant Pathology Department

Seventy-three 3-way experimental hybrids and four commercial hybrids used to check their performance were grown in two experiments at the Watertown Research Unit in 1965. Many of these 3-way experimental hybrids had one inbred parent with good disease resistance to stalk rot (lodging) and/or to root rot. During the past several seasons over 900 3-way experimental hybrids have been field tested for their performance, not only for yield, but primarily for their disease resistance to determine the influence of various disease resistant inbred lines when crossed on the same single cross. Although the data from the 1965 experiments, which were planted on May 20 and harvested on October 26, are not completely analyzed as of this date, these data indicate that the top experimental hybrids in the tests, containing inbreds with the greatest disease resistance, out-performed all of the commercial checks. The commercial checks consisted of the top-ranking adapted hybrids for the area based on yield performance tests.