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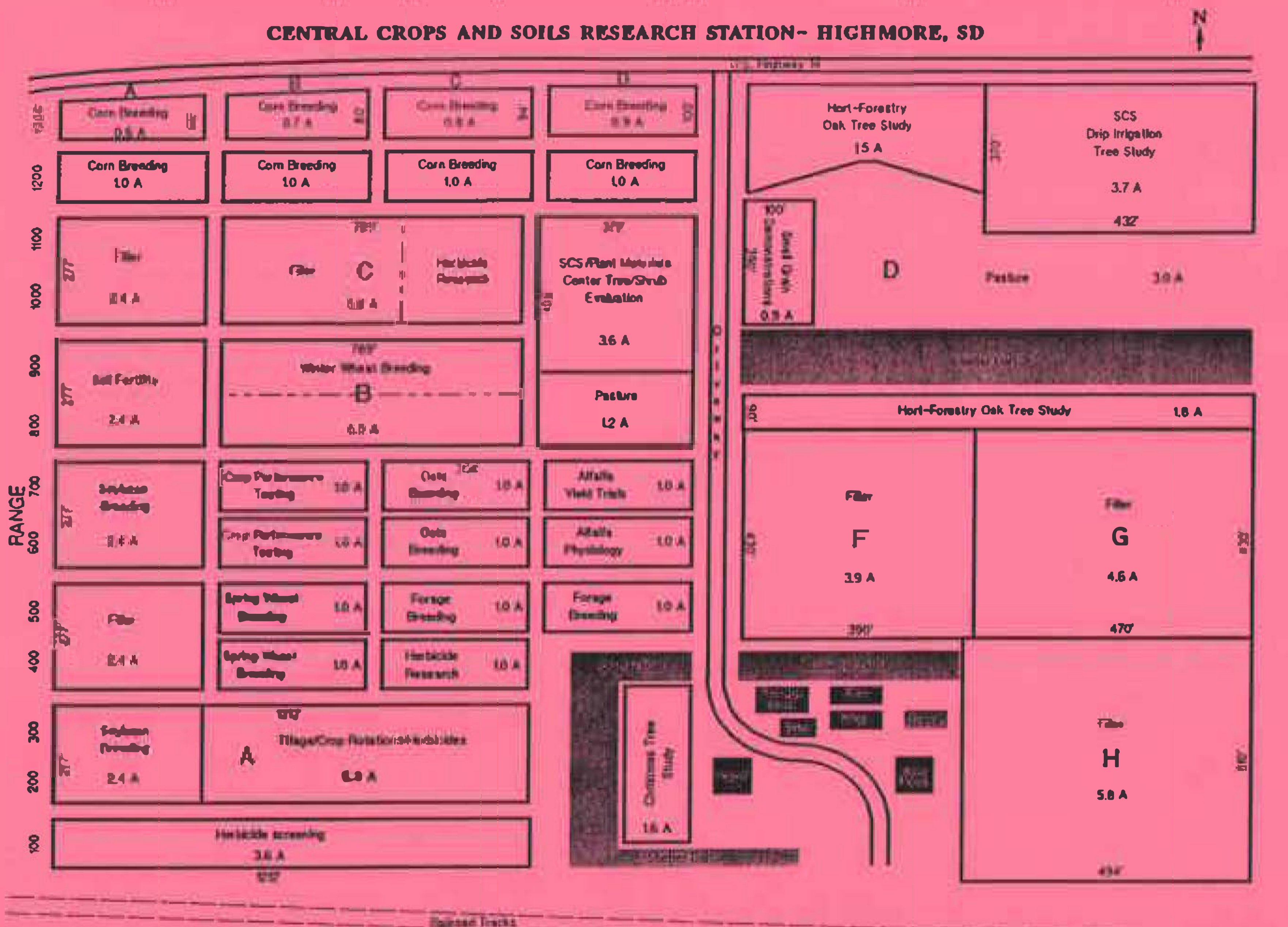
Central Crops and Soils Research Station
Highmore, South Dakota

Plant Science Department
South Dakota State University
Brookings, South Dakota 57007

SDSU

CENTRAL CROPS AND SOILS RESEARCH STATION– HIGHMORE, SD



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This report of the Central Crops and Soils Research Station at Highmore, South Dakota is a progress report and, therefore, the results presented are not necessarily complete nor conclusive. Any interpretation given is tentative because additional data from continuation of these experiments may produce conclusions different from those of any one year. The data presented in this report reflect the 1996 growing season.

Commercial companies and trade names are mentioned in this publication solely for the purpose of providing specific information. Mention of a company does not constitute a guarantee or warrantee of its products by the Agricultural Experiment Station or an endorsement over products of other companies not mentioned.

This publication also reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and Federal agencies before they can be recommended. A complete set of 1996 results from SDSU herbicide demonstrations is available as Extension Circular 678 from your County Agent or SDSU.

South Dakota Agricultural Experiment Station
Brookings, South Dakota 57007

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1996
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Introduction..Brad G. Farber

South Dakota Agricultural Experiment Station Bulletin No. 124 dated November 1910 is titled "Progress of Grain Investigations." In this report, the Superintendent of Substations, Clifford Willis, and Scientific Assistant, Manley Champlin, describe the Highmore Research Farm based on their experiences of the prior eleven years of investigations.

> "This location is particularly desirable. The Substation is situated near the divide between the James and Missouri River valleys, having an altitude of 1840 feet. The soil is a glacial loam to sandy loam, representative of that found in a large part of the east half of the state. The precipitation, as nearly as can be determined from existing records, is from one to four inches less than on surrounding valleys and prairies. A change of fifty degrees in temperature in twenty-four hours is not uncommon. Winds of considerable velocity prevail at all seasons of the year. It has been found that results obtained here are conservative and reliable for that part of the state between the Sioux Valley and the Missouri River, and that varieties proving valuable here may be depended upon in the tributary territory."

This description, even though written nearly ninety years ago, is still applicable today. We have modified and updated the soil classification and have many more years of weather data to more accurately describe temperature and precipitation variability. However, their account of the conditions and their statement that "results obtained here are conservative and reliable... and that varieties proving valuable here may be depended upon in the tributary territory" is still the basis for continuing research at the Highmore Research Farm. Many of SDSU's plant breeders and other researchers continue to test experimental materials here, indicating that if they do well at Highmore, they may be worth pursuing further. For decades, nearly all varieties released by the South Dakota Agricultural Experiment Station have undergone testing at Highmore to determine yield stability and resistance to various stresses. This station continues to serve the producers of South Dakota through varietal testing and development of small grains, forages and row crops and research on production methods, crop management and strategies to optimize returns to producers.

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Planting conditions in 1996 were much improved over the record rainfall year of 1995. Good soil moisture conditions and favorable planting conditions throughout most of the spring allowed timely planting of small grains and row crops. Temperatures for the months of April, May and July were on average 5 to 6 degrees below normal and were responsible for excellent tillering, plant development and filling of small grains. Rainfall was below average in the months of April, June and August but subsoil reserves coupled with timely rains and cool temperatures reduced any problems. Winter wheat also yielded very well, but some areas suffered from drown-out and winterkill, somewhat reducing overall yields. The cool temperatures delayed development of row crops, but corn and beans yielded extremely well because a killing frost did not occur until October 18th, about one month later than normal. More than 7 inches of rain fell in September, about 4 times the normal amount, and this delayed and hampered winter wheat planting in the area. October had more than double the normal precipitation and row crop harvest was delayed in some areas.

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The annual twilight tour of research plots was held on June 27, 1996 at 5:30 in the evening. Lunch was served prior to and after the tours. Approximately 75 participants listed to talks on small grain varieties, side-by-side herbicide comparisons, spring and winter wheat breeding, and soil fertility research. I would like to thank Dixie Volek and her crew for preparation of the lunch and Pioneer Garage in Highmore for the use of pickups and trailers for tour participants.

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The research conducted each year and included in this report involves long hours by staff from many disciplines at SDSU and the Highmore Research Farm. Their efforts in contributing to this publication each year are greatly appreciated. Support and input from area producers, ranchers, Advisory Board members and County Agents is also greatly appreciated and encouraged.

If anyone has comments or suggestions pertaining to research on the farm or questions and input on any other matter, please write or call.

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Special thanks to Nancy Kleinjan for her assistance in preparing this report.

Table 1. Temperatures at the Central Research Farm - 1996.

Month	1996 Average Temperatures[a] Max.	Min.	Average	Normal[b]	Departure from normal
	°F				
January	20.1	-0.7	9.6	14.3	-4.7
February	33.0	12.2	22.6	20.6	+2.0
March	33.8	13.1	23.4	32.0	-8.6
April	53.8	28.9	41.4	46.5	-5.1
May	62.2	43.0	52.6	57.9	-5.3
June	79.8	55.9	67.8	67.7	+0.1
July	81.8	55.4	68.6	74.5	-5.9
August	87.3	58.0	72.7	72.6	+0.1
September	72.2	48.2	60.2	61.8	-1.6
October	59.3	35.3	47.3	49.6	-2.3
November	27.9	13.2	20.5	32.6	-12.1
December	16.5	-0.3	8.1	18.5	-10.4

[a] Calculated from daily observations.
[b] 30 year average (1961-1990).

Table 2. Precipitation at the Central Research Farm - 1996.

Month	1996 Precipitation	Normal[a]	Departure from norm	Greatest amount	Date
	inches				
January	0.62	0.33	+0.29	0.20	25
February	0.70	0.49	+0.21	0.40	23
March	1.13	1.25	-0.12	0.30	16
April	0.95	2.32	-1.37	0.45	12
May	3.70	2.77	+0.93	0.70	27
June	1.52	3.19	-1.67	0.40	14
July	3.55	3.01	+0.54	1.85	21
August	0.70	2.32	-1.62	0.30	2
September	7.15	1.65	+5.50	2.75	19
October	3.17	1.35	+1.82	1.30	29
November	0.85	0.57	+0.28	0.65	16
December	1.11	0.42	+0.69	0.60	15
TOTAL	25.15	19.67	+5.48		

[a] 30 year average (1961-1990).

ALFALFA CULTIVAR YIELD TEST

K.D. Kephart, Vance N. Owens, R. Bortnem, S. Selman, and A. Boe

Average daily temperatures were normal during June and August, slightly below normal in April and September, and well below normal during May and July. Precipitation was near normal during July, well below normal for April, June, and August, and above normal during May and September. The amount of precipitation received in September was more than three times higher than normal.

Three harvests were obtained from this experiment. It is common for only 2 harvests to be taken at Highmore. Forage was harvested at the early-bud to early-flower stage of maturity. Average yields for the three cuttings ranged from 1.35 T/A for the first cutting to 1.88 T/A for the second cutting. Significant cultivar differences were observed within each cutting.

Three-cut total yields ranged from 4.04 to 5.25 T/A, with significant differences found among cultivars. Average total-season yield in 1996 was about 2.1 T/A lower than that obtained in 1995. The lower total yield in 1996 was due primarily to taking three rather than four cuttings. In addition, first cut yields were about 1.2 T/A higher in 1995 than in 1996.

Two-year average yields ranged from 5.16 to 6.26 T/A, with significant cultivar differences observed. The public varieties Baker and Riley were near the bottom in productivity relative to the other cultivars while Vernal was very near the two year average yield.

Forage yield of 24 alfalfa cultivars planted May 11, 1994, at the Central Crops and Soils Research Station, Highmore, SD.

Cultivar	1995 4-Cut Total	1996 Cut 1 4-Jun	Cut 2 8-Jul	Cut 3 13-Aug	3-Cut Total	95-96 Averag	% of 2-year Averag
	tons DM / acre						- % -
Multi-plier	7.42	1.32	2.06	1.71	5.09	6.26	109
ICI Brand 620	7.31	1.46	1.95	1.62	5.03	6.17	107
ICI631	7.06	1.37	2.09	1.80	5.25	6.16	107
ICI Brand 645	7.06	1.42	2.06	1.72	5.19	6.12	106
LegenDairy	7.02	1.42	1.96	1.68	5.08	6.05	105
ICI 630	7.15	1.39	1.95	1.60	4.94	6.05	105
Magnum III-Wet	7.16	1.37	1.85	1.53	4.75	5.95	103
Proof	7.07	1.26	1.99	1.53	4.77	5.92	103
3452-ML	7.05	1.44	1.90	1.39	4.72	5.89	102
Evolution	7.06	1.40	1.87	1.44	4.71	5.88	102
Magnum IV	7.06	1.34	1.83	1.41	4.58	5.82	101
MS9301 (experimental entry[a])	6.69	1.27	1.88	1.58	4.73	5.71	99
Avalanche	6.49	1.47	1.96	1.47	4.90	5.70	99
PC431 (experimental entry)	6.47	1.34	2.07	1.49	4.89	5.68	99
MS9304 (experimental entry[a])	6.72	1.14	1.90	1.58	4.62	5.67	99
Saranac AR	6.60	1.39	1.92	1.39	4.69	5.64	98
Vernal	6.82	1.33	1.76	1.33	4.42	5.62	98
DK 122	6.71	1.31	1.86	1.35	4.51	5.61	98
91-12 (experimental entry)	6.69	1.28	1.79	1.33	4.40	5.54	96
Flagship 75	6.54	1.34	1.69	1.31	4.33	5.44	95
Spredor 3	6.26	1.29	1.84	1.44	4.57	5.42	94
Defiant	6.46	1.38	1.70	1.24	4.32	5.39	94
Riley	6.16	1.34	1.72	1.23	4.29	5.22	91
Baker	6.29	1.37	1.60	1.07	4.04	5.16	90
AVERAGE	6.81	1.35	1.88	1.47	4.70	5.75	
Maturity[b]		3.0	5.2	4.2			
CV(%)	8.5	6.6	10.1	17.7	9.3	7.3	
LSD (P=0.05)	NS[c]	0.12	0.27	0.37	0.62	0.64	

(a) Data for experimental lines should be used with caution. Commercial seed for these lines may not perform similarly.

(b) Kalu and Fick (1983) maturity index, mean stage by count.

(c) Yields among cultivars are not statistically different at the 0.05 level of probability.

SPRING WHEAT BREEDING

Jackie Rudd and Brad Farber

The spring wheat breeding Advanced Yield Trial is made up of experimental lines that have completed at least 2 years of extensive testing and have all of the characteristics needed to become a new variety. We include the most widely grown varieties (Sharp, Butte 86, 2375, and Prospect) as checks. Table 1 presents data from the Central Crops and Soils Research Station (Highmore) and data averaged across all 9 locations. The Highmore trial was planted April 22. The timely rains and favorable temperatures produced very good yields and test weights (50.1 bu/a and 62.0 lbs/bu). Foliar diseases were minor this year, reducing yield by less than 5%. Scab caused minor yield reductions in some areas of Northeast South Dakota but was not observed at Highmore.

Two new spring wheat varieties from the breeding program will soon be available to producers. 'Russ', released in 1995, is a Hessian fly resistant line that is similar to Butte 86 in height and appearance and is 1 or 2 days later maturity. 'Oxen' is an early semi-dwarf that was approved for 1996 release. Originating from Pioneer Hi-bred International, the name Oxen was chosen to symbolize the success attainable when public and private industry work together as a 'team'. Russ and Oxen have both averaged 2 bushels per acre greater grain yield than Butte 86 with a similar test weight and protein content. Two experimentals are currently being increased for potential release in the future. SD3156, a possible 1997 release, is 1 to 2 days earlier than Butte 86 with a better yield and test weight. SD3249 (target release in 1998) is early with very high test weights and has moderate resistance to ***Fusarium*** head scab.

Table 1. Spring wheat breeding 1996 advanced yield trials.

	-----------Yield (bu/a)---------		Test Weight	Heading	Height
	Highmore	State Average	lb/bu	days	cm
SD3219	57.8	59.6	61.0	+1	85
Oxen	54.6	58.6	61.5	+2	81
SD8108	52.4	58.3	62.8	-1	91
Russ	56.6	56.8	61.1	+2	88
SD3156	51.1	54.9	62.0	-1	84
2375	50.6	53.4	61.7	+2	83
Prospect	48.8	53.4	60.9	+3	81
SD3249	48.1	53.3	63.5	-1	91
Butte 86	47.6	52.9	61.4	0	85
Sharp	51.1	52.3	62.1	0	85
Chris	37.0	41.7	59.2	+4	96
Mean	50.1	53.6			
CV(%)	4.5	6.8			
LSD(.05)	3.7	3.4			

WINTER WHEAT BREEDING AND GENETICS

Scott D. Haley and Steven A. Kalsbeck

SUMMARY OF ACTIVITIES

The Winter Wheat Breeding and Genetics Program utilizes the Highmore Research Station primarily for testing of early-generation bulk-breeding populations and evaluation of advanced-generation lines developed during the course of the breeding process. The breeding program also conducts field-testing at several other sites throughout South Dakota (Brookings, Highmore, Selby, Bison, Winner, Wall, and the Dakota Lakes Research Station near Pierre), for both early-generation selection and determination of the potential of experimental lines for cultivar release.

The winter wheat testing conducted at the Highmore Research Station during 1996 included:

i) The Crops Performance Testing (CPT) Variety Trial, under the overall coordination of Bob Hall. The trial included 37 entries, consisting of 23 released varieties (including new releases from other states), 10 advanced experimental lines from our program, and 4 experimental lines from the University of Nebraska. This trial was also grown at 12 other sites in South Dakota. Prior to cultivar release, promising elite lines must be grown in the CPT Variety Trial for three years to accurately measure the potential performance across a range of environmental conditions;

ii) The South Dakota Advanced Yield Trial (AYT). The AYT included 45 entries, consisting of 35 advanced experimental lines and 10 checks. The AYT is also grown at seven other sites in South Dakota and one site in each Nebraska and North Dakota. Each year, 3-5 superior experimental lines are selected from this nursery and advanced to the CPT Variety Trial and the Regional Testing Program;

iii) Early-generation breeding populations consisting of 455 different cross combinations in the F_3 generation (F_3-bulk). Undesirable F_3 populations are eliminated from the program based largely on visual observations, pedigree, and bulk yield; desirable F_3 populations are advanced to the F_4 head row nursery by selecting approximately 100 heads from each F_3 population;

iv) Large- and small-scale seed increases of advanced and preliminary experimental lines;

v) A winter wheat phosphorous fertilizer management trial, in cooperation with Ron Gelderman (SDSU Soil Testing Lab) and Jim Gerwing (SDSU Extension Soil Fertility Specialist).

METHODS AND RESULTS

The nurseries at Highmore were planted into black fallow with good soil moisture conditions on 9/19/95. Fall stand establishment was adequate and winter survival of the nurseries was excellent considering the overall severity of the winter in many areas of the state. Unfortunately, winter annual weed pressure (both cheatgrass and tansy mustard) became both excessive and uncontrollable (particularly the cheatgrass) and the yield nurseries were abandoned. Fortunately, the F_3-bulk populations were salvagable and were combine harvested. For information purposes, grain yield data for the other locations of the 1996 CPT Variety Trial are reported in Table 1.

Despite the problems we've had over the last few years (hail in 1994, flooding in 1995, cheatgrass in 1996), the Highmore Research Station will continue to be an important location for the winter wheat breeding efforts. With planting in fall 1996, we have moved to another part of the farm where at least the flooding and winter annual weed pressure should not be an immediate concern.

EXPERIMENTAL LINES ON INCREASE

Two winter wheat experimental lines are under increase with the intent to release in fall 1997. The first of these, SD89119, is a medium-height and medium-maturing (similar to Arapahoe) line with good winterhardiness, exceptional end-use quality characteristics and good yield performance in its maturity range. In four years of testing in the CPT Variety Trial, the average yield of SD89119 has been roughly equal to Arapahoe with about a 1.5 lbs/bu test weight advantage over Arapahoe. SD89119 is moderately resistant to prevalent races of the stem rust pathogen, and susceptible to leaf rust, tan spot, *Septoria* leaf blotch, and wheat streak mosaic virus. The coleoptile length (considered important for optimum fall stand establishment) of SD89119 is very long (similar to Scout66) and the straw strength is considered medium (similar to Roughrider and Arapahoe). This experimental line would be positioned as a high-end use quality replacement for Siouxland and complement to Arapahoe.

The second experimental line on large-scale increase, SD89153, is a medium-late maturity, standard height (very similar to Rose) line with good winterhardiness, exceptional end-use quality characteristics, and superior yield performance in its maturity range. In three years of testing in the CPT Variety Trial, the average yield of SD89153 has been about 1-2 bu/acre greater than Rose and Seward with a higher test weight than any other entry in the trials (0.5 lbs/bu advantage over Rose, 2.5 lbs/bu advantage over Seward). SD89153 is moderately susceptible to prevalent races of the stem rust pathogen and susceptible to leaf rust. SD89153 is resistant in greenhouse seedling screening with isolates of the *Septoria* leaf blotch pathogen and has shown good leaf spotting scores in field nurseries. Greenhouse seedling screening with South Dakota isolates of wheat streak mosaic virus suggest a moderate level of resistance (slightly less than Dawn, but greater than most available varieties). The coleoptile length of SD89153 is very long (similar to Scout66) and the straw strength is considered good (slightly better than Rose). This experimental line would be positioned as a high-end use quality replacement for both Rose and Seward.

Table 1. Grain yield means for the 1996 Winter Wheat Crops Performance Testing (CPT) Variety Trial.

Entry	Winner	Platte	Oelrichs	Hayes-RT[§]	Martin	Bison	Hayes-CT[§]	Selby	96 AVG	94-96 AVG
	bushels/acre									
SD92107	65.2	54.1	58.0	60.2	58.3	86.1	62.5	74.8	62.4	—
Quantum 566 (hybrid)	63.3	56.9	55.8	61.1	56.0	69.1	54.3	77.1	61.7	56.2
Arapahoe	62.8	51.1	56.2	55.3	49.2	62.7	55.8	75.5	58.6	51.8
SD92191	54.8	56.8	52.9	56.4	56.1	60.6	60.7	68.6	58.4	—
Windstar	60.0	47.7	60.2	56.3	53.4	62.5	52.7	72.8	58.2	—
SD89119	62.9	57.3	53.8	56.3	43.1	54.0	58.0	76.5	57.7	51.3
Siouxland	66.6	59.4	53.9	56.6	43.6	57.7	55.9	65.8	57.4	48.3
Roughrider	56.6	55.0	46.0	58.2	57.2	59.7	54.6	71.5	57.4	44.5
Quantum AP7510 (hybrid)	64.1	58.8	58.3	54.6	47.1	53.2	51.3	70.6	57.3	—
SD92266	53.5	46.2	54.3	56.9	55.7	60.6	59.9	70.2	57.2	—
SD92227	56.7	49.0	58.2	56.4	48.1	59.3	56.0	70.4	56.8	—
Elkhorn	53.6	46.9	47.7	54.2	58.7	58.5	58.4	73.0	56.4	—
SD89153	65.9	61.5	52.6	54.6	48.5	53.5	50.6	63.8	56.4	50.6
Rose	59.0	60.9	50.3	47.6	54.0	60.8	47.8	67.3	56.0	48.8
Seward	47.9	54.1	45.5	56.8	48.7	62.2	57.7	71.3	55.5	49.2
SD92174	57.7	48.1	50.6	54.1	57.8	60.3	52.6	62.6	55.5	—
2137	62.3	60.2	50.0	51.3	45.7	55.3	47.8	65.5	54.8	—
Nekota	63.5	56.9	49.9	50.5	45.5	53.1	49.6	67.9	54.6	51.5
SD91192	59.0	48.5	52.5	49.8	48.1	58.2	56.0	64.7	54.6	—
NE91648	57.8	59.0	50.8	54.9	33.9	58.2	50.8	71.4	54.6	—
Redland	57.7	46.7	50.7	54.8	45.9	57.5	51.0	72.1	54.6	49.7
Niobrara	54.3	48.4	55.4	56.4	48.3	58.6	49.0	62.6	54.1	50.2
Alliance	62.8	47.0	54.6	50.6	41.1	60.7	47.9	67.3	54.0	51.9
NuWest	53.5	46.4	46.3	59.8	39.8	59.5	54.2	68.2	53.5	—
SD92124	60.8	45.7	51.5	44.3	47.1	54.2	54.0	64.5	52.8	—
Pronghorn	56.6	53.0	55.4	55.3	33.7	60.2	43.2	62.4	52.5	—
NE91631	50.9	43.3	51.6	50.3	43.3	60.2	49.7	67.4	52.1	—
Sage	52.6	43.2	54.6	54.3	46.6	59.8	39.3	58.0	51.1	46.5
NE90479	53.0	56.1	47.9	51.1	37.6	51.0	51.3	53.1	50.1	—
Dawn	57.0	50.5	46.7	53.4	34.9	59.3	39.1	59.1	50.0	47.0
Scout66	49.6	41.0	47.3	49.0	45.5	54.5	50.3	58.7	49.5	44.9
SD89205	60.8	52.6	46.8	51.6	37.1	43.0	39.6	59.8	48.9	48.3
Vista	53.9	43.8	52.6	50.8	33.1	52.9	42.5	58.1	48.5	48.1
TAM 107	55.7	49.9	46.9	46.1	31.9	43.3	48.0	54.5	47.0	48.0
Quantum AP7501 (hybrid)	60.3	54.5	47.0	44.5	30.0	49.2	32.8	57.2	46.9	—
Halt	61.5	46.7	54.5	40.8	23.8	42.9	35.5	47.5	44.2	—
Jagger	63.9	52.9	46.9	38.3	12.5	54.0	32.0	47.7	43.5	—
Mean	58.3	51.6	51.7	52.8	44.3	56.9	50.1	65.4	53.9	
CV (%)[†]	11.7	9.7	7.2	10.7	11.5	9.6	13.7	9.0		
LSD (0.05)[‡]	9.5	7.0	5.4	7.9	7.1	7.7	9.6	8.3		

[†] The CV (coefficient of variability) is a statistical measure of experimental error. In general, yield trials with a CV of 16% or greater are considered to contain too much experimental error for reliable data interpretation.

[‡] The LSD (least significant difference) is the minimum value by which two entries must differ in order for that difference to be meaningful (and not due to random chance alone). If the difference between two entries is equal to or less than the LSD value, the entries are not statistically different.

[§] Hayes-RT: reduced tillage; Hayes-CT: conventional tillage.

OAT BREEDING

Dale Reeves and Lon Hall

The oat breeding program has several objectives. The main ones being increased yield and/or test weight In order to get these increases a line either has to have other improved traits or an increased yield potential to become a variety The traits that affect yield aside from genetic yield potential are straw strength, leaf rust, stem rust, and barley yellow dwarf resistance. Heat and drought tolerance would fall under genetic yield potential.

Some other traits that are desirable for specific purposes are high groat percentage, high oil, low oil, high protein, hull color, hulless, and plant height. Millers like a high groat%, low oil, high protein, and possibly a hulless oat The racehorse industry traditionally likes a white hulled oat Feed oats should have a high groat%, high oil, high protein, and possibly hulless The hulless oats could be fed directly to baby pigs and poultry without being dehulled or ground Plant height may be important if the oats are going to used as forage, straw, or as a cover crop for a legume.

On an average year approximately 600-700 crosses are made in the spring with genetically variable lines and varieties About 400 crosses are selected to be increased in the greenhouse in the fall, the rest are used for backcrosses, thesis's, and special studies. The year after making the cross, we test for yield, test weight, height, heading date, crown rust, stem rust, barley yellow dwarf, lodging, protein%, and oil% on a single replication of the crosses increased in the greenhouse Selected crosses will be replicated and planted at two locations the following year Based on the data collected, approximately 40 crosses will be selected to go into 12,000 head rows, each row being a potential variety. The process of elimination is continuous with inferior lines being discarded each generation The number of replications and locations increase as the lines are advanced to increase the probability of selecting the best lines. The ten best remaining lines are then tested at several locations in South Dakota (one of them Highmore), North Dakota, and Minnesota in the Tristate Regional Nursery Three to five of these lines will entered in the Uniform Midseason Oat or Uniform Early Oat regional nurseries where they will be tested at several locations in the USA and Canada At the same time they will be tested in the Standard Oat Variety Test across South Dakota. After at least two years in the SVO test they may be released as a variety The release of a variety will take at least 10 years from the time of crossing

CROP PERFORMANCE TRIALS
HARD RED SPRING WHEAT, OAT AND BARLEY

R G. Hall

HARD RED SPRING WHEAT:

Test results for 1996 are shown in Table 1. Yields averaged 44 bushels for 1996. The top-yielders for 1996 include '2398', 'Nordic'and 'Russ' and the experimentals 'SD3219' and 'SD8108'. Due to seeding problems in 1994 and hail in 1995 there are no three-year agronomic performance averages for this location

The better bushel weight varieties for 1996 include 'Bacup', 'Kulm' and the experimentals 'SD3156', 'SD3219', 'SD3249, and 'SD8108'

OAT:

Test results for 1996 are shown in Table 2 Yields averaged 107 bushels for 1996. The top-yielders for 1996 include 'Don', 'Monida','Newdak', 'Troy', 'Valley' and the experimentals 'SD92057' and 'SD92287' Due to seeding problems in 1994 and hail in 1995 there are no three-year agronomic performance averages for this location

The best bushel weight varieties for 1996 include the experimentals 'SD92057' and 'SD92287'

SPRING BARLEY:

Test results for 1996 are shown in Table 3 Yields averaged a very high 95 bushels per acre for 1996 There are no significant yield difference among the varieties tested at this location in 1996

The better bushel weight varieties for 1996 include the varieties 'Conlon', 'Logan and 'Stark'.

Table 1. Hard red spring wheat yield and bushel weight averages, 1994-96.

Variety	Yield - Bu/Acre 1996	Yield - Bu/Acre 1994-96	Bushel Wt - Lbs 1996	Bushel Wt - Lbs 1994-96
2375	46		59	
2398	52		59	
Bacup	34		60	
Butte 86	45		59	
Chris, CK	36		57	
Ernest	37		58	
Grandin	44		58	
Hamer	43		59	
Keene	43		58	
Kulm	41		61	
Lars	41		57	
Nordic	51		59	
Norlander	46		57	
Oxen	46		58	
Prospect	44		58	
Russ	48		59	
Sharp	43		58	
Trenton	43		58	
Verde	41		58	
SD3156	46		60	
SD3219	49		61	
SD3236	41		59	
SD3249	42		61	
SD8089	50		58	
SD8108	46		61	
Test Average:	44		59	
LSD (5%):	6		2	
CV (%):	10		2	

Table 2. Oat yield and bushel weight averages, 1994-96.

Variety	Yield - Bu/Acre 1996	Yield - Bu/Acre 1994-96	Bushel Wt - Lbs 1996	Bushel Wt - Lbs 1994-96
Belle	108		34	
Dane	107		31	
Don	125		34	
Hazel	99		34	
Hytest	78		34	
Jerry	110		36	
Jim	108		35	
Monida	117		32	
Newdak	121		33	
Settler	105		36	
Troy	112		35	
Valley	125		35	
SD91008	105		34	
SD91228	98		36	
SD92057	113		37	
SD92125	81		35	
SD92287	111		38	
Test Average	107		34	
LSD (5%)	14		2	
CV (%)	10		4	

Table 3 Spring barley yield and bushel weight averages, 1994-96

Variety	Yield - Bu/Acre 1996	Yield - Bu/Acre 1994-96	Bushel Wt - Lbs 1996	Bushel Wt - Lbs 1994-96
Bowman	92		47	
Conlon	95		48	
Excel	98		45	
Foster	92		46	
Gallatin	96		46	
Logan	96		48	
Robust	90		46	
Stander	96		46	
Stark	96		49	
Test Average:	95		47	
LSD (5%):	NS*		2	
CV (%):			3	

* Value differences within a column are not significant (NS) at the 5% level

THE EFFECT OF HARVEST DATE ON FORAGE PRODUCTION OF SORGHUM AND PEARL MILLET

A. Boe, R. Bortnem, K. Kephart, and S. Selman

When perennial cool-season grasses become dormant during mid to late summer in the northern Great Plains, pastures decline in amount and quality of forage produced. Summer annuals, which grow best under warm conditions, can be used to meet immediate feed shortages during the summer and also provide high yields of hay or silage for later use.

Selection of summer annual cultivars should be based on adaptation, yield potential, and nutritive quality. Summer annual species differ in growth rate, recovery after cutting, forage yield and quality, height, and leaf-to-stem ratio. Because of these inherent differences, sudangrass and pearl millet are well suited for pasture and hay, and forage sorghum is best used for silage.

Summer annual grasses are important components of forage production systems for many livestock producers in the northern Great Plains. Unfortunately, limited research has been conducted on their yield and quality characteristics under different harvest management schemes in that region. Therefore, our objective was to determine the effect of harvest date on forage yield and quality of one sudangrass cultivar, one sorghum-sudangrass hybrid cultivar, three forage sorghum cultivars, and two pearl millet cultivars at two locations in eastern South Dakota.

MATERIALS AND METHODS

'Piper' sudangrass, '877F' sorghum-sudangrass hybrid, '841F' and '849F' grain- bearing forage sorghums, '811F' sterile forage sorghum, and 'Mil-Hy 100' and '3-Mil-X' pearl millet were planted at Aurora and Highmore, SD, on May 30 and June 4, 1996, respectively. Seeding rates were 20 lbs PLS/acre for Piper, '877F', and the pearl millets and 8 lbs PLS/acre for the forage sorghums. Planting depth was about 1 inch. Row spacings were 6 inches for the pearl millets (5 rows), 12 inches for Piper (4 rows), and 36 inches for '877F' and the three forage sorghums (4 rows). Buffer strips (5 rows) of 3-Mil-X were planted between plots. Row length was 20 feet. Experimental design was four replicates of a split plot with three harvest dates as whole plots and seven cultivars as subplots. The first harvest was on August 8 at Aurora and August 13 at Highmore. Piper was in early reproductive development, but all other cultivars were vegetative. The second harvest was on August 21 at Aurora and August 27 at Highmore. All of the cultivars, other than 811F, were in late vegetative or early reproductive stages of development. On the third harvest (September 17 at Aurora and October 3 at Highmore), 811F was the only cultivar not in some stage of seed development (Table 1).

Harvesting was done by hand with rice knives. The middle 10 feet of the center two rows were taken for the 4-row plots, and the middle 10 feet of all five rows were taken for the pearl millet plots. Stubble height was about 4 inches. Total wet forage from each plot was weighed in the field. Dry matter concentrations and plot yields were determined from subsamples that were oven dried until constant weight. Plant height was determined by measuring the length of five randomly-chosen culms from each plot After heading, the measurement was from the base of the severed culm to the top of the panicle Prior to heading, the measurement was from the base of the culm to the tip of the blade of the uppermost vertically-extended leaf. Forage yield and plant height data were subjected to analyses of variance All effects were considered random Complex F-tests were used to determine significance of the main effects (cultivar, location, and harvest date) Fisher's least significant difference (P=0 05) was used to separate significant interaction means

Table 1. Maturity stages on each harvest date

		Aurora			Highmore	
Cultivar	Harvest 1	Harvest 2	Harvest 3	Harvest 1	Harvest 2	Harvest 3
811F	Veg	Veg	Veg	Veg	Veg	Veg
841F	Veg	Veg	Milk	Veg	Veg	Sft. dough
849F	Veg	Veg	Milk	Veg	Anthesis	Sft. dough
877F	Veg	Early head	Milk	Veg	Anthesis	Md dough
Piper	Late boot	Anthesis	Hd dough	Early head	Anthesis	Hd. dough
MilHy 100	Veg	Boot	Milk	Veg	Anthesis	Md. dough
3MilX	Veg	Veg	Anthesis	Veg	Early head	Sft. dough

RESULTS

Analysis of variance across harvest dates and locations indicated highly significant (P<0 01) harvest date and cultivar x location x harvest date interaction effects for dry matter forage yield Forage yields, averaged across cultivars and locations, increased by 81% between harvests 1 and 2 and by 25% between harvests 2 and 3 The location x harvest date interaction was significant (P<0 05), and the effect of cultivar was significant at the 0 10 level The highest-yielding cultivars (Mil-Hy 100, 877F, and 849F) produced 60 to 70% more forage than the lowest yielders (811F and 3-Mil-X) (Table 2) Location, location x cultivar interaction, and cultivar x harvest date interaction effects were all nonsignificant (P>0 05).

Inspection of the cultivar x location x harvest date interaction means (Table 2) reveals the following. The sudangrass (Piper), sudangrass x sorghum hybrid (877F), and pearl millets (Mil-Hy 100 and 3- Mil-X) tended to grow faster initially and consequently produced about 45% more forage than the forage sorghums (811F, 841F, and 849F) on the first harvest in early August. On the second harvest (late August), the sudangrass and pearl millet entries produced about 30% more forage than the sorghum entries However, on the third harvest (Sept. and Oct.), forage yields of the three sorghum entries were 20% higher than those of the sudangrasses and millets. The 841F and 849F exhibited increases in forage yield of 65 and 54%, respectively, between the second and third harvests compared to only 24% for 877F Although the forage production of 811F increased by 53%

between the second and third harvests, its slow growth for the first 80+ days after planting resulted in yields considerably lower than those of 841F, 849F, and 877F in September and early October. Since 811F is not recommended for use in the northern Great Plains, but is well adapted to the higher temperatures and longer growing season of the southern Great Plains, its yield potential was likely not realized in our study.

All entries, other than Piper, showed increases in forage yield between successive harvests at Aurora, with average increases of 53% between harvests 1 and 2 and 57% between harvests 2 and 3. However, at Highmore heavy infestations of grasshoppers during September contributed to yield losses for Mil-Hy 100 and Piper between the second and third harvests (Table 2). The forage sorghums were not fed upon as heavily, and consequently showed an average increase of 39% in yield between harvests 2 and 3 at Highmore. Mil-Hy 100 and 3-Mil-X appear to have good growth potential in late August and early September, since their average increase in forage yield between harvests 2 and 3 was 60% at Aurora.

Table 2. Dry matter forage yields (tons/acre) of seven summer annual grasses on three harvest dates in South Dakota in 1996.

	Harvest					
	1		2		3	
Cultivar	Aurora	Highmore	Aurora	Highmore	Aurora	Highmore
811F	0.74	0.99	1.14	2.26	2.37	2.93
841F	1.00	1.40	1.59	3.01	3.00	4.54
849F	1.12	1.54	1.81	3.42	3.33	4.69
877F	1.42	1.69	2.47	3.44	3.60	3.63
Mil-Hy 100	1.39	1.92	2.48	4.88	4.13	3.00
3-Mil-X	1.43	1.33	1.77	2.42	2.75	2.33
Piper	1.95	1.92	2.55	2.87	2.47	2.32
LSD(0.05)	0.67					

The seven cultivars evaluated in this study varied for growth pattern, morphology, and suitability for silage, hay, or pasture. The forage yield data we obtained revealed differences among the cultivars for adaptability to the northern Great Plains and supported the developers' management and utilization recommendations for each.

This research is being supported by a research award from Pioneer Hi-Bred International, Inc.

EFFECT OF ADDED CHLORIDE TO WINTER WHEAT

Ron Gelderman, Jim Gerwing, Clair Stymiest and Scott Haley

INTRODUCTION

A number of studies in South Dakota on spring wheat and barley have shown a yield response to added chloride. Work in Montana and Kansas have shown winter wheat responses to added chloride as well. The objective of these studies was to determine if yield responses from added chloride are found on winter wheat in South Dakota.

PROCEDURE

Ten studies were conducted over two years. The treatments consisted of a check and a 60 lb/A chloride treatment replicated four or five times. The chloride treatment (KCl) was broadcast over the wheat in early spring. No other nutrients were applied to these plots. Plot size was 4' x 15' and the entire plot was harvested to estimate grain yield. The winter wheat varieties used were TAM 107 in 1995 and Arapahoe in 1996. Residual chloride levels to two feet and four feet are listed in Table 1.

RESULTS

Soil chloride levels are considered very low (< 30 lb/a for 2 foot depth) for all but two sites based on SDSU's guidelines for spring wheat (Table 1). The results indicate no yield response to added chloride (Table 1). Possible reasons include lack of disease pressure or non-responsive varieties. Spring wheat and barley studies have indicated some varieties do not respond to added chloride. Studies in Montana and Kansas have also indicated that the varietal component may be important for winter wheat as well. However, in a separate study at Wall, SD, no grain yield responses were seen from added chloride to a number of common winter wheat varieties (Table 2). There was considerable leaf disease pressure at this site.

SUMMARY

To date added chloride has not significantly increased winter wheat yields in South Dakota. Another variety study will again be conducted near Wall, SD in 1997.

Table 1. Effect of added chloride on grain yields of winter wheat[1], 1995 and 1996, South Dakota.

Cl Trt.[2]	Ideal 95	Selby 95	High. 95	Wall 95	Platte 96	Selby 96	Ideal 96	Olrchs 96	Bison 96	Martin 96
	---site---									
	---bu/acre---									
Cl-	60	58	53	65	48	76	45	57	57	50
Cl+	60	58	52	68	49	74	48	57	57	51
C.V.%	5	15	19	6	5	5	6	2	14	8
Pr>F	0.99	0.94	0.87	0.21	0.67	0.54	0.19	0.74	0.95	0.63
soil Cl lb/a 0-2'/0-4'	22/-	17/-	22/-	29/-	35/86	15/19	32/51	19/35	5/23	20/41

[1]Variety, 1995= TAM 107, 1996=Arapahoe.
[2]Cl- = check, Cl+ = 60 lb chloride per acre.

Table 2. CHLORIDE - WINTER WHEAT VARIETY STUDY , WALL SD. 1996.

Variety	M^2	Yield		Test Wt.		Plant Ht.		Leaf disease[1] rating: Flag leaf		Leaf disease[1] rating: Flag -1[5]	
		Cl treatment									
		no	yes	no	yes	no	yes	no	yes	no	yes
		------bu/a----		----lb/bu----		---inches---		-% of leaf-		-% of leaf-	
Abilene	2	44	44	58.6	60.6	26	25	15	10	41	45
Alliance	2	50	51	59.7	60.0	29	30	17	13	58	63
Arapahoe	3	48	47	59.1	59.1	31	31	13	9	58	55
CDC Kestrel	7	53	52	55.2	57.2	34	35	4	3	27	20
Dawn	4	39	40	58.4	59.6	28	28	7	7	48	43
Elkhorn	7	50	48	57.1	58.1	37	37	4	3	33	20
Jagger	0	41	40	59.0	57.1	28	28	3	3	11	12
Nekota	2	50	50	59.3	60.0	29	28	4	5	30	24
Rose	5	49	50	58.4	58.5	34	33	3	3	12	12
Sage	2	46	46	59.4	59.2	32	33	16	15	78	74
SD 89119	3	46	47	58.9	59.4	32	31	5	4	36	28
Siouxland	3	41	40	55.2	56.2	33	32	5	4	50	35
TAM 107	0	45	43	57.8	57.8	28	27	16	17	57	61
Vista	2	43	45	59.2	58.8	28	27	7	5	50	52
2163	0	39	38	55.2	55.5	28	26	15	13	48	53
Mean		45.5	45.4	58.0	58.5	30.5	30.0	8.8	7.4	42.4	39.7
CV %		5.2		1.8		4.1		33		29	
Pr > F											
Var		0.0001		0.0001		0.0001		0.0001		0.0001	
Trt		0.7000		0.0040		0.0090		0.0375		0.2640	
Var x Trt		0.6300		0.0040		0.2500		0.3090		0.6140	
L.S.D.[3]		2.7		0.7		1.44		3.1		13.7	
L.S.D.[4]		4.1		1.7		1.82		4.6		19.2	

* 40 lbs of Cl applied , Soil test Cl lbs/a (0- 2', 0-3', 0-4')=10,24,40 Soil Series - Ottumwa (from shale)
[1] Primarily Tanspot as percent of leaf affected [2] M = Relative Maturity rating (0=early, 7=late)
[3] Between columns [4] Within columns [5] First leaf below flag leaf.

CORRELATION OF PHOSPHORUS SOIL TESTS FOR WINTER WHEAT

R. Gelderman, J. Gerwing, C. Stymiest, and S. Haley

INTRODUCTION

The correlation of phosphorus soil tests for spring wheat in South Dakota has been previously determined. This data shows very little yield response after soil P tests (Bray 1) reach 18-20 ppm. The data for winter wheat looks similar to spring wheat. However, there is a lack of data above 15 ppm P. The purpose of this study is to obtain data to complete this correlation for the Bray 1 and Olsen soil tests for winter wheat.

PROCEDURE

A number of sites with medium to high soil P test levels were needed to complete the correlation. Eleven studies were completed in 1995. In 1996 thirteen studies were established at the winter wheat variety testing program sites located primarily in central and western South Dakota (Table 1). Seven sites were not harvested because of winter kill.

Site characteristics are listed in Table 1. Soil test P levels are given in Table 2. The range of soil tests was from 6-16 and 9-24 for the Olsen and Bray, respectively.

Phosphorus treatments consisted of 0, 25, 50, 75, and 100 lb/acre of P_2O_5 (as 0-46-0). The material was applied with the seed at planting. The treatments were arranged in a randomized complete block design with four replications.

Nitrogen was applied to be sufficient for a 50-60 bushel yield goal. All other nutrients were judged to be adequate. Grain harvest was completed with a small plot combine. The area harvested for each site is given in Table 1.

RESULTS

Estimated grain yields for each site is given in Table 2. Yields were above average for all sites. Site yield means ranged from 51 to 79 bu/acre.

Response to added phosphorus was seen at all sites except Selby and Martin. The soil test at Martin is very high so a response was not expected. The Selby site had a low P test and very high yields. The lack of response at this site can not be explained. The responsive sites had soil tests from low to high and some response was expected considering the high yields.

When the relative yields (check/maximum yields x 100) are plotted against soil tests, the 1996 data fits nicely with previous studies (Figures 3 and 4).

SUMMARY

A casual observation of this data would indicate a critical Bray P soil test of 20-22 ppm and a critical

Olsen test of about 16 ppm. This value represents the test where additional fertiizer phosphorus will no longer give an economical yield increase These critical soil tests agree very well with critical values for other crops

Table 1 Selected characteristics of winter wheat phosphorus correlation sites, 1996.

Site	County	Tillage	Soil	Previous Crop	Row Width	Planting Date	Harvest Area
		Parameter					
					inches		
Platte	Chas. Mix	Surface Tillage	Ethan	Sp. Wht.	7	9/25/95	4.1' x 15'
Selby	Walworth	No-till	Highmore	Pea	7	9/20/95	"
Ideal	Tripp	No-till	Millboro	Alfalfa	7	9/22/95	"
Oelrichs	Fall River	Surface Tillage	Savo	fallow	10	9/25/95	5' x 25'
Bison	Perkins	"	Morton	Fallow	10	9/17/95	"
Martin	Bennett	"	Keith	Fallow	10	9/25/95	"

Table 2. Winter wheat grain yields due to P treatment, 1996.

P_2O_5	Platte	Selby	Ideal	Oelrichs	Bison	Martin
	Site					
lb/acre	bu/acre					
0	40	77	51	52	55	52
25	53	82	50	57	61	54
50	53	78	60	56	65	51
75	56	82	58	58	67	51
100	53	77	58	58	65	49
X	51	79	55	56	62	51
C.V.[1] %	12	8	10	5	6	10
Pr>F[2]	0.03	0.58	0.07	0.10	0.01	0.63
Bray P ppm	9.1	11.4	13.8	17.1	20	29.4
Olsen P ppm	6.1	6.7	14.1	11.2	11.6	16.4

[1]Coefficient of variation.
[2]Probability of greater F.

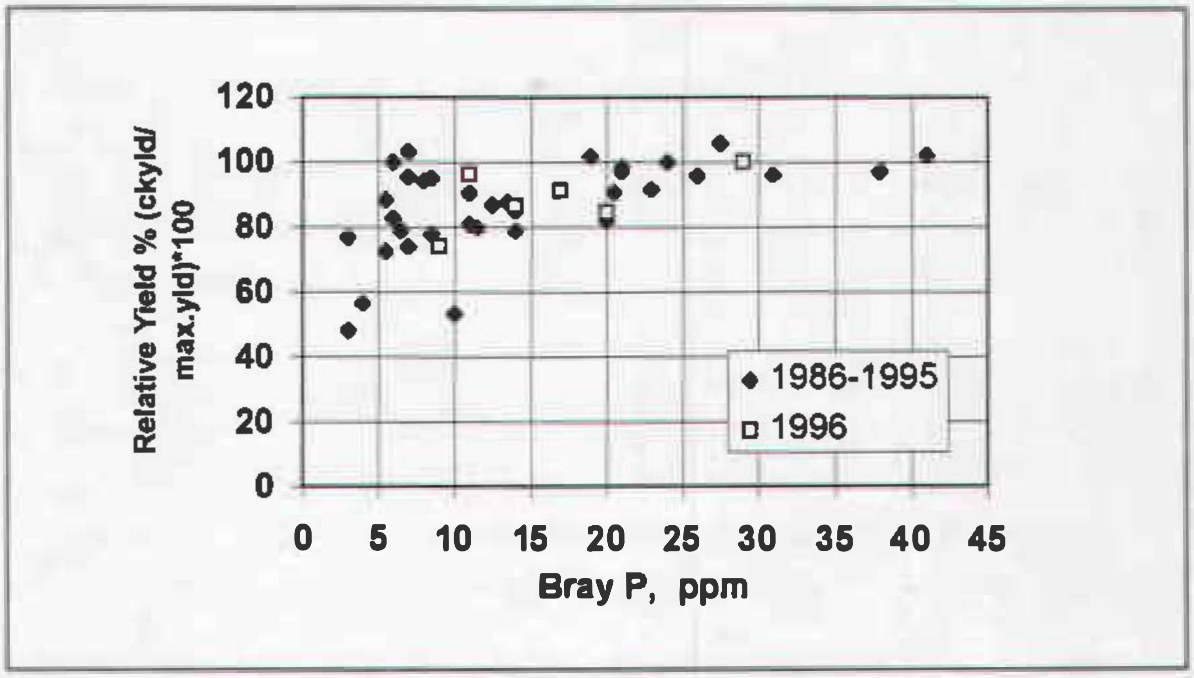

Figure 1. Correlation of Bray P soil test with relative yield of winter wheat in South Dakota, 1986-1996.

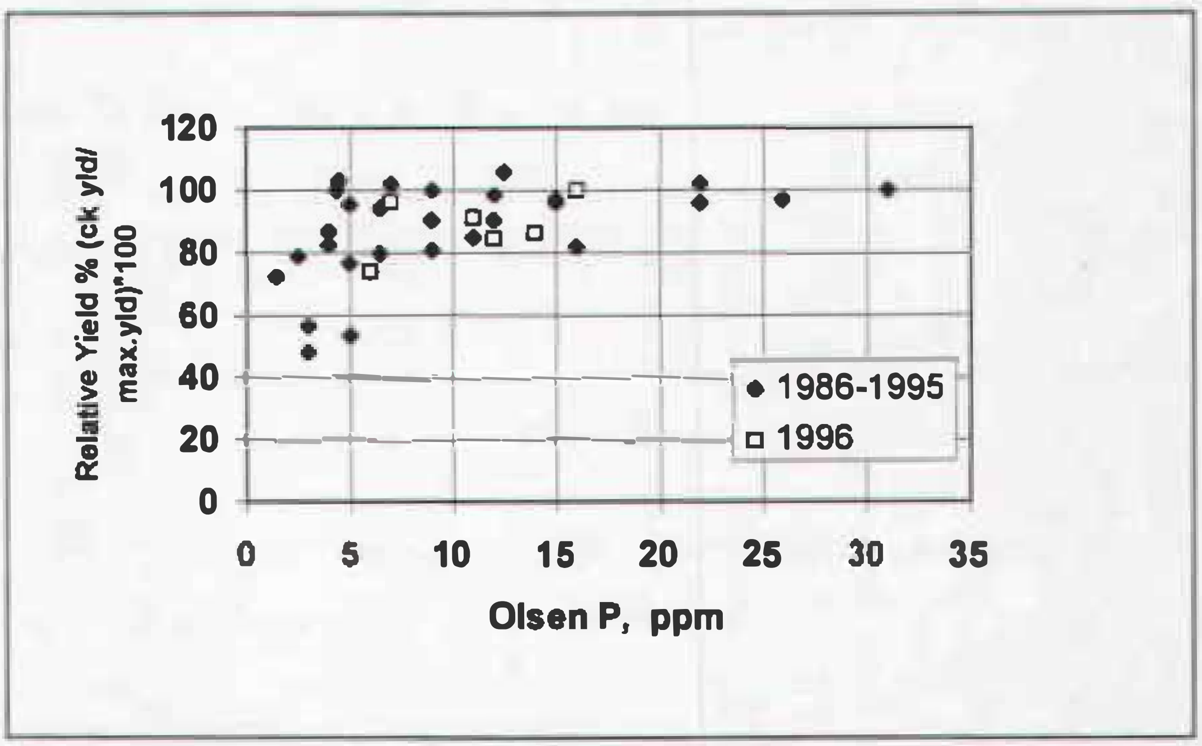

Figure 2. Correlation of Olsen P soil test with relative yield of winter wheat in South Dakota, 1986-1996.

WEED CONTROL

L. J. Wrage, P. O. Johnson, D. A. Vos, S. A. Wagner, and B. Stahl

The experiment station provides a strategic location for several weed control field evaluation and demonstration trials. The plots provide data used in the statewide weed control extension program. They are also used for field tours.

The station location has been the primary site for evaluating downy brome (cheatgrass) control in winter wheat. A block is devoted to maintaining the weed infestation and provides the winter wheat crop for comparing herbicides, including experimental products. Data are reported as part of the following tables.

No-till evaluations were continued in 1996. The tests provide comparative performance data for herbicides in corn and sorghum. Data are reported in the following tables.

The location is also used to evaluate herbicide carryover from experimental herbicides. These data are an important part of the evaluation program for potential commercial products and become a part of the data base and to define label restrictions.

Additional studies in 1996 included special oilseed evaluations in safflower. Data are reported in the following tables.

The contribution of station personnel in plot area preparation and maintenance is acknowledged.

Table 1. Evaluation of Cheatgrass Control in Winter Wheat

RCB; 3 reps
Variety: Seward
Planting Date: 9/22/95
PPI, SPPI: 9/22/95
PRE: 9/22/95
SPOS: 4/23/96
Soil: Clay loam; 2.9% O.M.; 6.7 pH

Precipitation: 1st week 0.00 inches
2nd week 3.35 inches

Dobr = Downy brome

VCRR = Visual Crop Response Rating;
(0 = no injury; 100 = complete kill)

COMMENTS: Moderate downy brome. Winter stress weakened winter wheat; thin stand, crop variability reflected in yield inconsistencies. Excellent control with Mon 37536. Excessive injury noted for some experimental treatments.

Treatment	Rate/A	% VCRR Stunting 6/25/96	% Dobr 6/25/96	Yield bu/A
Check	----	0	0	7
PREPLANT INCORPORATED				
Hoelon	2.67 pt	48	75	10
Treflan 10G	7.5 lb	33	48	7
Far-go 10G	15 lb	0	42	8
Sen/Lex	.67 lb	0	27	8
SHALLOW PREPLANT INCORPORATED				
Treflan	1.5 pt	50	65	4
Amber	.56 oz	0	63	15
Amber + Sen/Lex	.56 oz + 2 oz	0	68	14
SHALLOW PREEMERGENCE				
Treflan 10G	7.5 lb	30	40	9
PREEMERGENCE				
Amber	.56 oz	0	57	14
Amber + Sen/Lex	.56 oz + 2 oz	10	72	14
Finesse	.4 oz	3	63	16
Treflan	1.5 pt	28	28	8
Frontier	1.6 pt	88	99	6
SPRING POSTEMERGENCE				
Finesse	.3 oz	0	25	11
Sen/Lex	.33 lb	22	57	11
Sen/Lex	.67 lb	30	70	10
Amber + X-77	.56 oz+.25%	0	12	8
Amber + Sen/Lex + X-77	.56 oz+.33 lb+.25%	0	32	11
Amber + Sen/Lex + X-77	.56 oz+2.67 oz+.25%	7	27	10
Finesse + Sen/Lex + X-77	.4 oz+.33 lb+.25%	0	32	9
Finesse + Sen/Lex + X-77	.4 oz+2.67 oz+.25%	25	42	10
MON-37536 + X-77	.5 oz + .5%	0	94	21
MON-37536 + X-77	.67 oz+.5%	5	97	21
LSD (.05)		7	10	6

Table 2. No-Till Corn Demonstration

RCB: 3 reps
Variety: NK 3808
Planting Date: 5/13/96
FALL: 11/15/95
EPP: 4/23/96
PRE: 5/13/96
EPOST: 6/7/96
POST: 6/21/96

Grft = Green foxtail
KOCZ = Kochia

Precipitation:

FALL	1st week	0.00 inches
	2nd week	0.30 inches
EPP	1st week	Trace
	2nd week	0.45 inches
PRE	1st week	0.95 inches
	2nd week	1.15 inches
EPOST:	1st week	0.30 inches
	2nd week	0.70 inches
POST:	1st week	0.17 inches
	2nd week	0.80 inches

COMMENTS: Moderate foxtail. No-till in wheat stubble.

Table 3. No-Till Sorghum Demonstration

RCB: 3 reps
Variety: AgriPro ST 3280
Planting Date: 6/6/96
FALL: 11/15/95
EPP: 4/23/96
PRE: 6/7/96
POST: 6/21/96
Soil: Clay loam; 2.4% OM; 7.2 pH

Precipitation:

FALL:	1st week	0.00 inches
	2nd week	0.30 inches
EPP:	1st week	Trace
	2nd week	0.45 inches
PRE:	1st week	0.30 inches
	2nd week	0.70 inches
POST:	1st week	0.17 inches
	2nd week	0.80 inches

VCRR = Visual Crop Response Rating;
0 = no injury; 100 = complete kill
Grft = Green foxtail
KOCZ = Kochia

COMMENTS: Purpose to evaluate weed control and crop tolerance. Yield reflects weed control and crop injury. The lack of tolerance to 2,4-D is apparent in the 1996 and 2-year data. Concep safened seed usedfor the test.

Table 2. No-Till Corn Demonstration

FALL	EARLY PREPLANT	PREEMERGENCE	EARLY POSTEMERGENCE	POSTEMERGENCE	% Grft 8/28/96	% KOCZ 8/28/96	2-Yr. Avg. % Gr	2-Yr. Avg. % Kocz
Check					0	0	0	0
Dual II(2.75 pt)				Atrazine(.56 lb)+Banvel(.5 pt)	55	75	66	75
Atrazine(1.1 lb) + Dual II(2.75 pt)					81	95	84	96
Atrazine(1.1 lb)	Dual II(2.75 pt)				86	93	91	96
Atrazine(1.1 lb)		Dual II(2.75 pt)			91	98	94	98
	Atrazine(1.1 lb) + Dual II(2.75 pt)				84	95	91	97
	MicroTech(3.25 qt)			Atrazine(.56 lb) +Banvel(.5 pt)	63	76	77	81
	Frontier(1 qt)			Atrazine(.56 lb)+ Banvel(.5 pt)	74	75	83	82
	TopNotch(8 pt)			Atrazine(.56 lb)+ Banvel(.5 pt)	79	82	---	---
	Harness(2.75 pt)			Atrazine(.56 lb) +Banvel(.5 pt)	77	81	82	87
	Dual II(2.75 pt)			Atrazine(.56 lb)+ Banvel(.5 pt)	83	88	90	87
	Broadstrike/Dual(2.6 pt)				85	80	89	89
	Bladex(2.2 lb)			Banvel(.5 pt)	74	87	84	92
		Roundup(1 pt)+ 2,4-D ester(1 qt)+ AS(17 lb)+		Atrazine(.56 lb) +Banvel(.5 pt)	37	82	---	---
		Roundup(1 qt) + AS(17 lb)+ Balance(2 oz) +Surpass(1.25 pt)		Buctril(1 pt) + atrazine(.56 lb)	95	98	---	---
		Gramoxone Extra(1.6 pt) + X-77(.5%) + Extrazine II(2.2 lb) + TopNotch(5 pt)			90	95	94	97
		Gramoxone Extra(1.6 pt) +X-77(.5%)		Accent(.33 oz)+ Beacon(.375 oz) + COC(1 qt) + 28% N(4 qt)	80	85	80	91
		Gramoxone Extra(1.6 pt)+X-77(.5%)		Accent(.67 oz) + Banvel(.5 pt) +X-77(.25%) + 28% N(4 qt)	83	83	85	81
		Gramoxone Extra(1.6 pt) + X-77(.5%)	Prowl(3.65 pt)+ atrazine(.56 lb) + Banvel(.5 pt)		78	88	72	89
		Touchdown(.67 qt) + X-77(.5%) + AS(17 lb)	Prowl(2.75 pt) + Accent(.33 oz) + Beacon(.38 oz) + X-77(.25%) + X-77(.25%) +28% N(4 qt)		91	92	---	---
LSD (.05)					9	6	[illegible]	5

Table 3. No-Till Sorghum Demonstration

FALL	EARLY PREPLANT	PREEMERGENCE	POSTEMERGENCE	% VCRR 8/28/96	% Grft 8/28/96	% KOCZ 8/28/96	Yield bu/A	2-Yr. Avg. % Gr	2-Yr. Avg. % Bdlf	2-Yr. Avg. bu/A
Check				0	0	0	3	0	0	9
Atrazine(1.1 lb)+ Dual II(2.5 pt)				0	83	96	46	73	97	45
Atrazine(1.1 lb)	Dual II(2.5 pt)			0	92	98	57	94	98	56
Atrazine(1.1 lb)		Dual II(2.5 pt)		0	80	97	59	89	98	58
	Dual II(2.5 pt)		Buctril(1.5 pt)+ atrazine(.56 lb)	0	84	95	64	90	95	61
	Dual II(2.5 pt)		Atrazine(1.1 lb)+COC(1 qt)	0	92	87	56	93	89	53
	Dual II(2.5 pt)		Atrazine(.56 lb)+ Tough(1 pt)+COC(1 qt)	0	92	73	49	94	81	52
	Dual II(2.5 pt)		Banvel(.5 pt)+atrazine(.56 lb)	22	90	78	38	90	83	41
	Dual II(2.5 pt)		2,4-D amine(1 pt)	18	93	52	30	92	71	35
	Dual II(2.5 pt)		Ally(.05 oz)+2,4-D ester(.5 pt)	32	87	90	23	91	90	32
	Dual II(2.5 pt)+atrazine(1.1 lb)			0	93	97	71	95	98	64
	Lasso(3 qt)+atrazine(1.1 lb)			0	85	96	63	91	97	57
	Frontier(1 qt)+atrazine(1.1 lb)			0	83	96	56	90	97	57
		Gramoxone Extra(1.6 pt)+ X-77(.5%)+Ramrod(4 qt)	Shotgun(2 pt)	0	79	95	65	—	—	—
		Gramoxone Extra(1.6 pt)+ X-77(.5%)	Atrazine(1.4 lb)+COC(1 qt)	0	68	92	54	47	94	47
		Roundup(1 pt)+AS(17 lb)+ Ramrod(4 qt)	Peak(.75 oz)+COC(1 qt)	0	77	96	57	—	—	—
		Roundup(1 pt)+AS(17 lb)+ Ramrod(4 qt)	Permit(.67 oz)+X-77(.25%)	0	89	96	82	79	87	47
		Gramoxone Extra(1.6 pt)+ X-77(.5%)+Ramrod(4 qt)+ atrazine(1.1 lb)		0	80	95	60	86	97	55
LSD (.05)				7	8	8	17	12	9	14

Table 4. Broadleaf Weed Control in Sorghum

RCB: 3 reps
Variety: AgriPro ST 3280
Planting Date: 6/6/96
PRE: 6/6/96
POST: 7/17/96
Soil: Clay loam; 2.6% OM; 6.5 pH

Precipitation: 1st week 0.30 inches
2nd week 0.70 inches

VCRR = Visual Crop Response Rating
Grft = Green foxtail
Prpw = Prostrate pigweed

COMMENTS: Purpose to evaluate weed control and crop tolerance. Yields reflect pigweed control. Dicamba and 2,4-D caused slight early season crop stunting/lodging.

Treatment	Rate/A	% VCRR 7/30/96	% VCRR 8/28/96	% Grft 8/28/96	% Prpw 8/28/96	Yield bu/A
Check	----	0	0	0	0	56
PREEMERGENCE						
Dual II	2.5 pt	0	0	81	30	73
PREEMERGENCE & POSTEMERGENCE						
Dual II&Peak+COC	2.5 pt&1 oz+2 pt	0	0	79	86	70
Dual II&Peak+COC	2.5 pt&.75 oz+2 pt	0	0	76	82	69
Dual II&Peak+COC	2.5 pt&.5 oz+2 pt	0	0	81	81	77
Dual II&Peak+ Atrazine+COC	2.5 pt&.5 oz+ .83 lb+2 pt	3	0	87	95	72
Dual II&Peak+ Banvel+X-77	2.5 pt&.5 oz+ .5 pt+.25%	18	27	83	87	59
Dual II&Banvel+X-77	2.5 pt&.5 pt+.25%	17	22	85	80	49
Micro-Tech+Permit+COC	3 qt&.67 oz+2 pt	0	0	94	82	73
Dual II&2,4-D amine	2.5 pt&1 pt	13	0	79	79	84
Dual II&Buctril	2.5 pt&1.5 pt	3	0	76	81	65
Dual II&Leddok S-12	2.5 pt&1.5 pt	0	0	79	80	88
LSD (.05)		6	4	4	7	17

Table 5. Small Grain Herbicide Carryover to Other Crops

RCB: 2 reps
POST: 5/24/95
Soil: Clay loam; 3.3% OM; 6.4 pH

COMMENTS: Herbicides applied at X and 2X normal rates to winter wheat in 1995; rotation crop planted in 1996. No stand reduction or stunting was noted to proso millet, soybeans, sunflower, corn, or canola. Conditions apparently favored rotational crops, even at double rates.

Treatment	Rate/A
Check	---
POSTEMERGENCE	
Ally + 2,4-D ester + X-77	.1 oz + .5 pt + .25%
Ally + 2,4-D ester + X-77	.2 oz + .5 pt + .25%
Amber + 2,4-D ester + X-77	.3 oz + .5 pt + .25%
Amber + 2,4-D ester + X-77	.6 oz + .5 pt + .25%
Finesse + 2,4-D ester + X-77	.3 oz + .5 pt + .25%
Finesse + 2,4-D ester + X-77	.6 oz + .5 pt + .25%

Table 6. Safflower Demonstration

RCB: 3 reps
Variety: 3013
Planting Date: 5/13/96
PPI, SPPI: 5/13/96
PRE: 5/13/96
POST: 6/12/96

Precipitation: 1st week 0.95 inches
2nd week 1.15 inches

Grft = Green foxtail
KOCZ = Kochia

COMMENTS: Uniform test; light weed pressure. Excellent stand. Yield for treatments were similar except for the check and treatment with visual crop response rating (VCRR) indicating crop injury. Experimental herbicides included to evaluate potential use.

Treatment	Rate/A	% VCRR 8/28/96	% Grft 8/28/96	% KOCZ 8/28/96	Yield lbs/A
Check	----	0	0	0	2990
PREPLANT INCORPORATED					
Treflan	1 qt	0	99	95	3639
Sonalan	3 pt	0	99	93	3954
SHALLOW PREPLANT INCORPORATED					
Dual II	2.5 pt	0	91	57	3511
Frontier*	2 pt	50	88	77	3047
PREEMERGENCE					
Dual II	2.5 pt	0	98	83	3913
POSTEMERGENCE					
Ultima 160* + COC	20 oz + 1 qt	7	96	0	3585
Pinnacle* + X-77	.25 oz + .25%	12	0	83	3717
Pinnalce* + X-77	.5 oz + .25%	23	0	84	3394
LSD (.05)		8	4	11	782

* Experimental

FIELD EVALUATION OF WOODY PLANT MATERIALS

Russell J. Haas - Plant Materials Specialist - USDA/ARS

OBJECTIVES

1. Assemble and evaluate the adaptation and performance of selected woody plant materials for field and farmstead windbreaks and wildlife plantings in the Northern Great Plains.

2. Select and cooperatively release, superior cultivars for increase by commercial nurseries.

ACTIVITIES IN 1996

144 accessions of 93 species are currently under evaluation.

April 15 - Two accessions of two species were added and spring survival and animal injury were noted.

September 23 - Each surviving plant of accessions planted in 1977, 1987, 1990, 1992, 1994, and 1996, was measured for crown spread and plant height; and rated for disease and insect damage, drought and cold tolerance, fruit production, survival and vigor. Photographs were taken to document performance, noted plot locations available for future plantings and replacement stakes needed and performed minor pruning. Also rogued volunteer seedlings of "tree weeds" such as mulberry, chokecherry, green ash etc. out of rows in shrub block.

* 906330 river birch, 'Streamco' purpleosier willow, ND-3902 sandbar willow and 9008041 false indigo show superior qualities for riparian restoration; and streambank and lake shore stabilization.

* Based on superior performance in field evaluation and field plantings, ND-1134 plum and ND-83 villosa lilac were selected as the next varieties to be cooperatively released.

* 'Regal' Russian almond was released in cooperation with the North Dakota, South Dakota and Minnesota Agricultural Experiment Station.

SUMMARY OF ACCOMPLISHMENTS

Based on observations and data collected at this site, the released cultivars in the following table are recommended for use in South Dakota. Numbered experimental selections will be placed in field plantings for further evaluation when planting stock becomes available.

'Cardan' green ash
'Centennial' cotoneaster
'Sakakawea' silver buffaloberry
'Indigo' silky dogwood
ND-1134 plum
ND-3902 sandbar willow
ND-1879 honeylocust
ND-83 late lilac
'Streamco' purple osier willow
9058862 tamarack
ND-170 cotoneaster
'Bighorn' skunkbush sumac
14272 hybrid poplar
9069081 littleleaf linden
'Oahe' hackberry
'Scarlet' mongolian cherry
'McDermand' ussurian pear
ND-283 Russian almond
ND-21 nannyberry
9047238 seabuckthorn
9008041 false indigo
ND-1863 honeylocust
'Freedom' blueleaf honeysuckle
'Meadowlark' forsythia
'Midwest' manchurian crabapple
323957 chokeberry
ND-2103 highbush cranberry

This field evaluation planting was established in 1978. Data from this planting has been used to document the cooperative release of the cultivars listed below. These are currently in large scale production and use in conservation and wildlife plantings in the Northern Great Plains. Several more releases are anticipated in the near future. Data has also assisted nurserymen and plant researchers from several agencies determine the range of adaptation and performance of many other cultivars.

'Cardan' green ash
'Sakakawea' silver buffaloberry
'Centennial' cotoneaster
'Homestead' Arnold hawthorn
'Midwest' manchurian crabapple
'Oahe' hackberry
'Scarlet' mongolian cherry
'McDermand' ussurian pear
'Regal' Russian almond