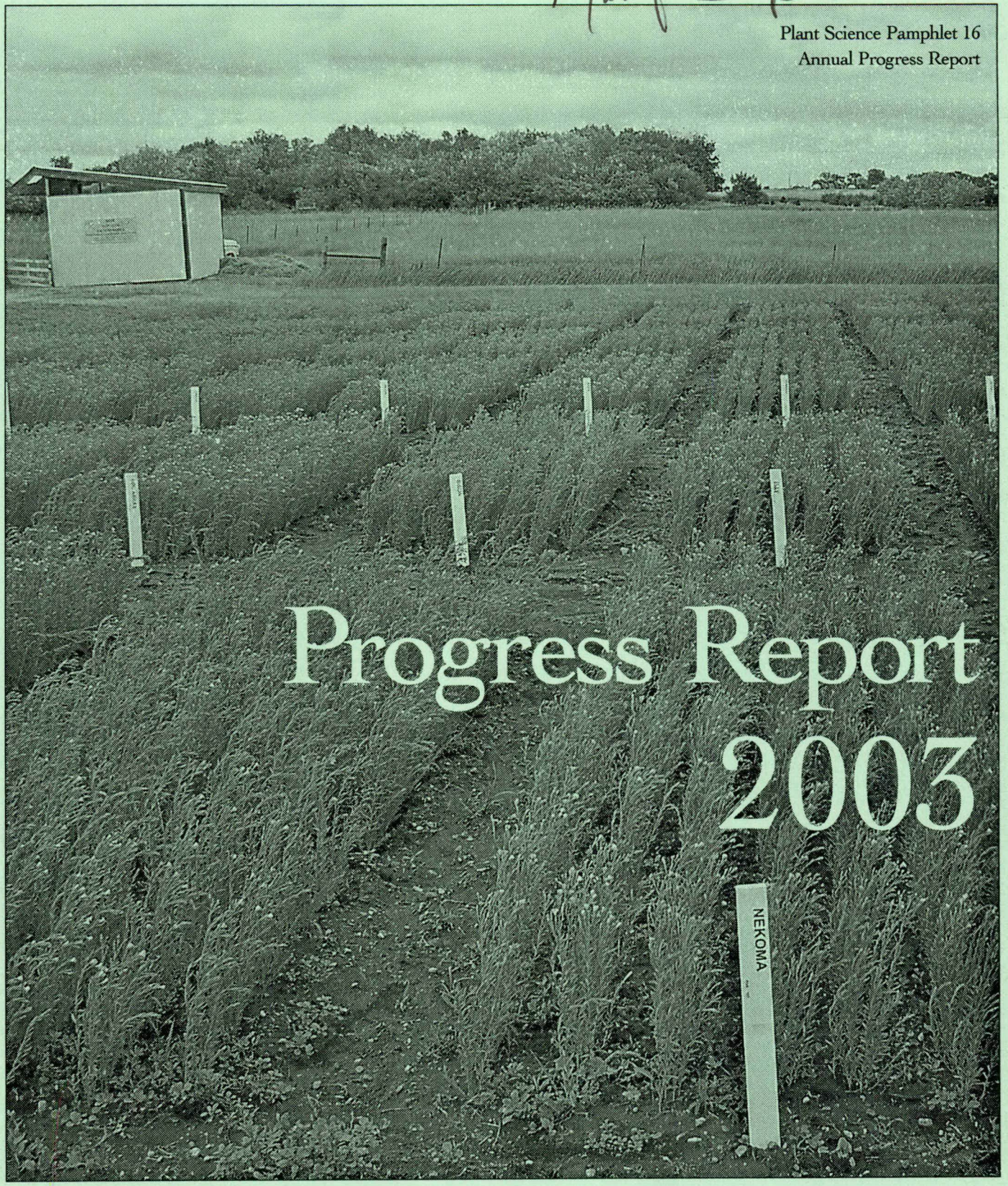
Plant Science Pamphlet 16
Annual Progress Report



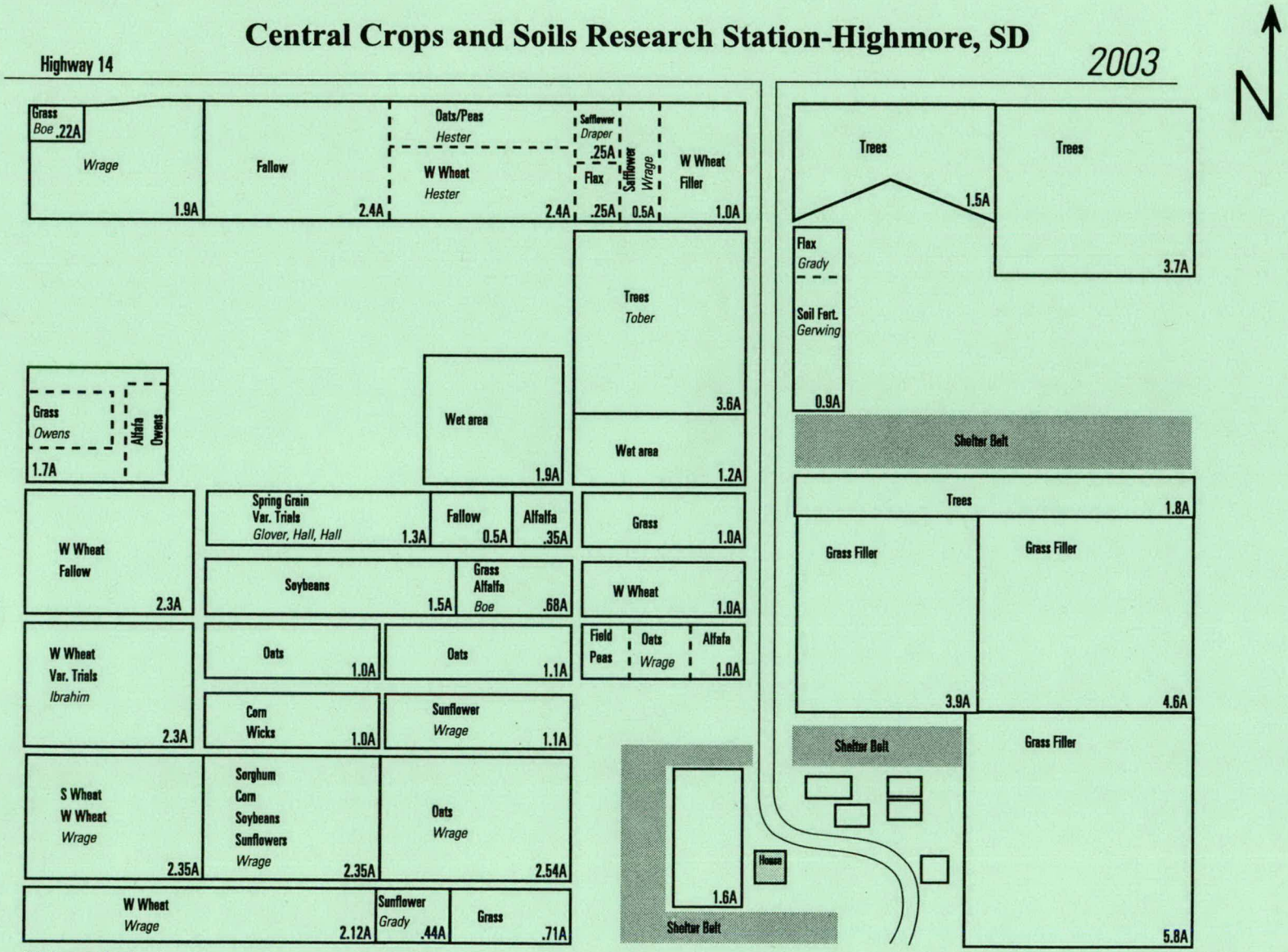
Progress Report 2003

Central Crops and Soils Research Station
Highmore, South Dakota

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

Central Crops and Soils Research Station-Highmore, SD

2003



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

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Greetings

Dale Gallenberg
Head, Plant Science Department, SDSU

On behalf of the Plant Science Department at SDSU, welcome to this annual report on activities at the Central Crops and Soils Research Station during 2003. As often seems to be the case for both producers and scientists, weather was once again a significant factor last year at the farm.

I feel we have a very active Research Farm at Highmore and that we address needs and issues important to producers in the region. I appreciate the cooperation of the faculty and staff in the Plant Science Department, other departments, NRCS, and others in the conduct of activities. For many years we have had a very active mix of programs.

I want to thank Mike Volek for his continued hard work in keeping the farm running in an effective and efficient fashion on a day-to-day basis. Also, thanks to Robin Bortnem for her continued commitment in coordinating with Mike from campus.

But primarily, I want to thank you for taking the time to read this report and become involved in activities at the farm. We appreciate any and all input to our program and hope you will share your ideas with us.

Welcome

Robin Bortnem
Manager, Central Crops and Soils Research Station

The 2003 Field Day started early this year with the addition of an afternoon (3:00 p.m.) tour of ongoing weed research conducted by Leon Wrage (SDSU Extension agronomist - weeds) and Darrell Deneke (IPM coordinator). The tour addressed weed control programs for numerous crops grown in central South Dakota (no-till corn, soybean, sunflower, milo, flax, safflower, field pea, old and new stands of alfalfa, oat, and winter and spring wheat). This was followed by a meal and the traditional twilight tour. The twilight tour included a Woody Plant Materials Walking Tour led by Dwight Tober
(plant materials specialist, USDA/NRCS, Bismarck, N.D.), and visits to plots of winter wheat (Amir Ibrahim), flax and sunflower (Kathy Grady), spring wheat, oat, and barley (Bob Hall) and soil fertility (Jim Gerwing). Though there may have been some confusion with the new format since the afternoon tour was not repeated at twilight, initial response was positive and hopefully conditions will enable us to continue the practice.

A significant amount of time and hard work went into making our tour a success. I'd like to take this time to thank all who were involved: Mike Volek and crew, several Plant Science personnel and all the speakers, Dixie Volek and daughters Shandra and Sherise who prepared the desserts and helped serve the meal, and Pioneer Garage of Highmore who provided the pickups and trailers used for the tour.

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 Extension educators is also greatly appreciated.

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

2003
Central Substation Advisory Board

Name	*Position*	*Address*	*Phone*	*County*
Gregg Yapp	NRCS	200 4th St SW, Huron SD 57350	352-1238	Beadle
Todd Weinmann	Extension	PO Box 36, 3rd & Lincoln SW, Huron SD 57350	353-8436	Beadle
Slade Roseland		Box 97, Faulkton SD 57438	598-4450	Faulk
Lyle Stewart		29945 200th St, Pierre SD 57501	224-5682	Hughes
Ken Wonnenberg	Extension	102 E Blaine Ave Suite 101, Gettysburg SD 57448	765-9414	Potter
Larry Nagel		15392 US Hwy 83, Gettysburg SD 57442	765-2874	Potter
Randy Hague (Chair)		19325 340th Ave, Highmore SD 57345	852-2874	Hyde
Jerry Johnson		904 E Donlin St, Miller SD 57362-1654	853-2297	Hand
Dennis Beckman		23268 383rd Ave, Wessington Springs SD 57382	539-9613	Jerauld
Lee Dougan		37879 237th St, Wessington Springs SD 57382	539-9523	Jerauld
Charles Todd		Box 129, Onida SD 57564	258-2419	Sully
Laura Anderson (Sec)	NRCS	Box 484, Highmore SD 57345	852-2221	Hyde
Ryan Forbes	NRCS	Box 484, Highmore SD 57345	852-2221	Hyde
Mike Volek	Station Superintendent	Highmore Research Station, PO Box 495, Highmore SD 57345-0495	852-2829	
Chris Onstad	Extension Supervisor	Ag Hall 134, Brookings SD 57007	688-5132	
Dale Gallenberg	Head, Plant Science Department	Ag Hall 219, Brookings, SD 57007	688-5123	
Robin Bortnem	Station Manager	NPB 247 Box 2140, Brookings SD 57007	688-4958	
Kevin Kephart	Director, South Dakota Agricultural Experiment Station	Box 2207, Brookings SD 57007	688-4149	

Contents

Growing season temperature and precipitation data for the research station during 2003.

Month	*Temperature (oF)* *Maximum*	*Average*	*Minimum*	*No. days Max > 90o*	*Precipitation (inches)*
April	63		36	0	2.06 (+ 2.0" snow)
May	69		45	0	2.45
June	78		54	4	4.87
July†	91		62	13	2.54
August	91		61	13	1.35
September	78		48	5	0.75

† The weather station located on the farm was not operating for several days in July. Missing data for temperature and precipitation were obtained from nearby stations.

Field Evaluation of Woody Plant Materials at Highmore

Dwight Tober
Plant Materials Specialist, USDA/NRCS, Bismarck, N.D.

Objectives

1. Assemble and evaluate the adaptation and performance of selected woody plant material for field and farmstead windbreaks, wildlife habitat, and streambank and lakeshore plantings in the Northern Plains.
2. Select and cooperatively release superior woody conservation plants for increase by commercial nurseries.

Activities in 2003

A total of 140 accessions of 87 different species are now under evaluation. The latest entries were planted on May 14, 2001, and included black currant (*Ribes americanum*), redleaf rose (*Rosa rubrifolia*), rugosa rose (*Rosa rugosa*), and Meyer's spruce (*Picea* spp.).

Planting of new entries will be limited in the future because of shading and lack of room. Significant information can still be documented from existing entries, and data collection will continue on a scheduled annual basis.

The first entries were planted at the Highmore site on April 11, 1978. Data is summarized annually and documented in the Annual Technical Report. For the latest technical report from Highmore, contact me at (701) 530-2075, or at Dwight.Tober@nd.usda.gov The report is about 40 pages in length. We anticipate completing a 25-year report this winter with data summary information for all species tested at this site.

Weed control and maintenance have been consistently good. A major renovation effort in 2000 included removal of broken branches and limbs resulting from snow damage; removal and pruning of natural dieback of some species (primarily shrubs); and cutting and removal of contaminant species (primarily Siberian elm and mulberry).

All of the apricot (8 entries) and some entries of crabapple, poplar, Russian olive, and other species have been removed at various times by station staff. Some remaining apricot stumps have resprouted. In the four rows where the apricot were removed there is an opportunity to plant some additional entries between the stumps.

Selected trees and shrubs were evaluated on September 4, 2003, with assistance from Aaron Knox, Hyde County Conservation District at Highmore, and Greg Yapp, NRCS resource conservationist at Huron. Measurements and notes were taken on crown spread and plant height; disease and insect damage; drought and cold tolerance; fruit production; survival; vigor; and snow and animal damage.

Most mature entries continued to perform well; however; some winter dieback or other problems were noted on ND-3773 willow, Mich-433 Laurel willow, Roselow sargent crabapple, ND-1567 hawthorn, ND-995 prairie willow, Japanese cherry, and Streamco willow.

Two shrubs scheduled for release

Data collected from this site will be used to support the formal release of two new shrubs scheduled for this winter: ND-3209 sandbar willow which was planted in 1990; and 998041 false indigo which was planted in 1987. They both had 100% survival and superior performance for at least the first 5 years, even though both species are subject to occasional winter dieback.

I had the opportunity to lead a tour of the tree plots during field days at the station this year on June 25. Approximately 30 people with a high level of interest in some of the less commonly used tree and shrub species, especially for wildlife plantings, attended.

Summary of Accomplishments

Selected accessions/cultivars that have performed well at the Highmore site and show promise for additional testing and/or promotion for conservation use include the following:

'Cardan' green ash
'Centennial' cotoneaster
'Sakakawea' silver buffaloberry
'Indigo' silky dogwood
ND-1134 hybrid plum
ND-3902 sandbar willow
ND-1879 honeylocust
'Legacy' late lilac
9058862 tamarack
ND-170 cotoneaster
'Bighorn' skunkbush sumac
14272 hybrid poplar
9069081 littleleaf linden
9063130 river birch
9016318 Siberian elm
ND-46 Timm's juneberry
Arnold's Red honeysuckle
9057409 American hazel
ponderosa pine (ND-1763, 9067413)
Scot's pine (9063156, 9063154)
9063148 corktree
'Oahe' hackberry
'Scarlet' Mongolian cherry
'McDermand' Ussurian pear
'Regal' Russian almond
ND-21 nannyberry
9047238 sea buckthorn
9008041 false indigo
ND-1863 honeylocust
'Meadowlark' forsythia
'Midwest' Manchurian crabapple
323957 chokeberry
ND-2103 highbush cranberry
hybrid poplar 9069086 (Theves)
9047228 pygmy caragana
ND-3744 Korean barberry
Siberian larch (SL–383, ND-1765)
9057411 lodgepole pine
9057410 hackberry
9063116 black ash

Data from this planting has been used to document the cooperative release of the cultivars listed below. These cultivars are generally available from local conservation nurseries and are used in conservation plantings throughout the Northern Plains. Several more releases are anticipated in the near future.

Information gathered concerning plant performance assists cooperating nurseryman and plant researchers in determining the range of adaptation of many other accessions/cultivars also included in the test planting.

Formal Releases with Supporting Documentation from the Highmore Site

'Cardan' green ash (1979)
'Oahe' hackberry (1982)
'Sakakawea' silver buffaloberry (1984)
'Scarlet' Mongolian cherry (1984)
'Centennial' cotoneaster (1987)
'McDermand' Ussurian pear (1990)
'Homestead' Arnold hawthorn (1993)
'CanAm' hybrid poplar (1995)
'Regal' Russian almond (1997)
'Legacy' late lilac (1999)

2003 Alfalfa Production

Vance Owens and *Eva Omdahl*
South Dakota State University

Alfalfa cultivars are tested at several South Dakota research stations. Our objective is to provide producers with yield data to aid in cultivar selection.

Even though our yield trial does not contain all available cultivars, it should be a helpful tool in identifying cultivars suitable for a grower's specific needs.

Table 1 provides forage production data from 17 different cultivars planted at Highmore in 2003. Tons of dry matter yield are shown for one cutting in the seeding year. A second cutting was not possible due to inadequate moisture for growth.

Cultivars are ranked from highest to lowest based on total yield. The least significant difference (LSD) listed at the bottom of the table identifies significant differences between the cultivars. If the difference in yield between two cultivars exceeds the given LSD, then the cultivars are significantly different.

Alfalfa was planted in 28 April 2003 at a seeding rate of 18 lbs pure live seed (PLS)/acre. Experimental design was six replications in a randomized complete block. Fifty pounds of super phosphate (P_2O_5) were applied preplant, as was Treflan for weed control.

Plots were harvested once in the establishment year with a sickle-type harvestor equipped with a weigh bin for obtaining fresh plot weights. Random subsamples from the fresh herbage were taken to determine percent dry matter. Alfalfa cultivars were evaluated for maturity prior to harvest. Yield differences among cultivars were tested using the LSD at the 0.05 level of probability when significant F-tests were detected by analysis of variance (Table 1).

Table 1. Forage yield of 17 alfalfa cultivars entered in the SDSU alfalfa testing programat the Central Research Station at Highmore. Alfalfa was planted 28 April 2003 in plots arranged in a randomized complete block design with six replicates.

Entry	*14 July 2003 Tons DM/A*
Hybriforce-420/Wet	1.23
Somerset	1.22
Setter	1.21
Alfastar II	1.18
Hybriforce-400	1.17
FK 421	1.15
WL 357HQ	1.15
Husky Supreme	1.13
Multiplier 3	1.13
Gold Rush 747	1.11
Vernal	1.09
DKA 42-15	1.07
Maverick	1.05
Journey Brand 204	1.04
Notice II	1.04
A 30-06	1.03
54V54	0.98
Mean	1.12
Maturity (Kalu & Fick)	4.5
LSD (P=0.05)	0.23
CV (%)	19.2

This research was sponsored by various alfalfa seed companies, the SDSU Agricultural Experiment Station, and the SDSU Plant Science Department.

Winter Wheat Breeding and Genetics

Amir Ibrahim, Steve Kalsbeck, and **Rich Little**
South Dakota State University

Summary of Activities

The Winter Wheat Breeding and Genetics Program utilizes the Central Research Station at Highmore primarily for early-generation testing and evaluation of advanced-generation lines. The breeding program also conducts field trials at several other sites throughout South Dakota.

Highmore trials conducted in 2003 by the winter wheat program included:

1. The CPT Variety Trial, under the overall coordination of Bob Hall. The trial included 30 entries, consisting of 17 released varieties (including new releases from other states) and 13 advanced experimental lines from our program. This trial was also grown at 13 other sites in South Dakota.

   Prior to cultivar release, promising elite lines must be grown in the CPT variety trial for 3 years to accurately measure performance across a range of environmental conditions.

2. The South Dakota Advanced Yield Trial (AYT), with both hard red and hard white lines. The AYT nursery included 45 entries, consisting of 37 advanced experimental lines and 8 checks. Sixteen of the experimental lines have the white bran color. The AYT nurseries were also grown at six other sites in South Dakota.

   Each year, 3 to 6 superior experimental lines are selected from these nurseries and advanced to the CPT Variety Trial and the Northern Regional Testing Program.

3. Early-generation F_2-bulk populations, consisting of 268 different cross combinations. Undesirable F_2 populations are eliminated from the program based largely on visual observations, pedigree and parental characteristics, and bulk yield. Desirable F_2 populations are advanced to the F_3 bulk nursery for further evaluation prior to head selection the following year.

Trial Conditions

The nurseries at Highmore were planted 0.75 inches deep into fallow soil with excellent moisture conditions on September 19, 2002. Plots were sprayed on April 25, 2003, with 5 quarts Ramrod per acre and in early May with 1.5 pints Bronate per acre. Yield and test weight data for Highmore and other CPT locations are presented in Table1.

Acknowledgements

Each year, 600 to 800 new cross combinations are made and 600 to 800 new experimental lines are developed by the winter wheat breeding program. In addition to the excellent support of our wheat pathology programs (small grains pathology and virology), the solid and consistent financial support from the South Dakota Wheat Commission and the South Dakota Crop Improvement Association are vitally important to ensuring continued availability of improved winter wheat varieties for producers in South Dakota.

Table 1. Yield results of entries in the 2003 Crop Performance Testing (CPT) nursery.

ID	GY AVG	TW AVG	Grain Yield bu/ac											
			Bis§	Oel	Mar	Hay	Stu	DLP	Bro	Wal	Win	Pla	Hig	Ken
SD97W604	60.8	60.9	57.2	66.1	68.0	63.8	45.4	35.8	89.6	40.4	49.9	72.6	51.2	89.8
SD97W609	60.2	60.3	51.8	68.7	64.3	57.1	44.3	38.5	82.9	43.0	53.5	73.0	60.8	84.8
JAGALENE	60.1	60.9	55.2	76.6	67.7	61.5	43.9	33.1	90.2	35.0	45.8	65.3	57.4	89.2
MILLENNIUM	59.7	60.7	55.6	62.6	68.6	62.5	43.6	37.8	91.3	41.6	50.2	68.9	56.8	77.0
WAHOO	59.3	58.2	53.5	70.7	75.2	53.8	44.9	36.6	85.7	40.1	48.7	65.4	56.8	80.6
SD97538	58.3	59.3	49.4	68.9	72.0	55.5	47.4	36.0	86.5	40.9	44.4	64.7	50.9	83.6
WESLEY	58.2	59.2	51.9	64.9	70.8	61.5	40.7	36.4	83.1	44.3	43.1	66.1	55.4	79.9
SD98102	58.1	59.6	49.3	67.9	67.8	47.1	46.5	36.3	84.0	44.3	50.0	71.3	54.1	79.2
EXPEDITION	58.0	59.8	54.5	72.3	68.0	58.4	43.8	37.5	78.6	39.5	46.9	63.5	51.2	82.0
SD97059-2	58.0	58.9	52.7	61.4	65.8	44.3	44.1	36.3	98.9	43.0	46.9	62.7	53.6	86.4
SD97380-2	57.9	58.9	49.9	68.5	67.1	57.3	46.1	39.4	89.4	37.0	46.6	59.9	56.0	78.0
SD99W015	57.4	59.5	51.8	66.5	65.3	54.1	46.0	36.5	76.9	41.3	49.3	70.8	54.4	76.1
FALCON	57.3	59.4	56.5	66.8	61.5	50.7	43.5	35.9	83.3	41.1	47.3	60.3	55.7	85.1
ARAPAHOE	57.2	59.3	52.8	64.5	67.8	57.2	45.8	38.0	85.3	35.9	45.1	59.6	57.0	77.9
SD97049	56.6	58.8	51.3	66.6	65.9	50.4	42.7	31.4	87.4	43.4	43.5	69.4	56.4	70.7
SD97W671-1	56.2	60.2	52.8	71.0	63.6	43.9	43.7	35.6	77.9	43.0	52.8	62.9	54.6	73.0
SD97088	56.2	59.8	48.1	65.0	66.6	48.2	44.4	33.8	88.5	45.4	43.8	65.1	53.6	72.2
TREGO	56.0	60.2	56.9	69.8	69.6	55.0	43.2	33.5	75.6	38.3	42.9	61.3	51.9	73.5
ALLIANCE	55.4	58.5	52.6	70.7	69.3	54.0	43.6	37.4	70.9	43.6	41.3	55.5	53.4	72.8
SD92107-5	55.3	60.3	49.7	66.3	66.8	47.3	42.2	31.4	83.3	44.4	43.5	59.4	54.8	74.3
HARDING	54.8	59.9	52.8	68.0	64.6	45.9	39.5	37.6	88.4	39.2	41.6	55.3	54.5	70.3
NEKOTA	54.7	59.9	50.5	69.6	60.0	51.6	41.8	34.4	79.0	41.7	48.5	61.7	49.3	68.5
SD97250	54.4	59.2	50.6	66.8	61.4	51.3	44.3	34.5	79.3	36.9	45.9	62.5	53.0	66.6
JERRY	54.3	59.7	50.4	56.6	59.0	47.3	40.0	36.2	86.5	41.4	46.2	57.0	56.9	74.8
CRIMSON	53.8	61.2	53.0	68.7	60.0	38.2	40.2	42.5	84.8	42.4	45.8	55.2	48.4	66.3
TANDEM	53.5	61.2	52.4	65.6	67.5	48.9	41.5	35.4	74.7	42.9	45.4	51.0	52.2	65.1
SD92107-3	53.4	59.5	48.0	60.7	65.0	43.8	43.4	35.6	86.7	37.6	41.8	56.0	53.2	69.4
NUPLAINS	53.2	61.2	48.6	65.0	58.5	49.7	41.3	37.9	86.6	43.9	44.9	51.2	50.4	60.1
AP502CL	53.0	57.5	50.7	72.8	60.6	60.3	37.6	36.3	63.3	39.5	42.6	61.1	40.2	71.2
RANSOM	49.6	58.7	47.0	54.5	55.5	44.9	39.2	33.5	77.6	36.8	45.0	49.0	48.4	63.8
Mean	56.4	59.7	51.9	66.8	65.4	52.2	43.1	36.0	83.2	40.9	46.0	61.9	53.4	75.4
CV%‡			8.0	6.5	4.3	10.9	5.9	11.6	8.8	12.1	8.5	10.7	8.1	9.8
LSD (0.05) †			5.8	6.1	3.9	8.0	3.6	6.0	10.3	6.9	5.9	9.4	6.2	2.0

§ Bis=Bison, Oel=Oelrichs, Mar=Martin, Hay= Hayes, Stu=Sturgis, DLP=Dakota Lakes Pea Stubble, Bro=Brookings, Wal=Wall, Win=Winner, Pla=Platte, Hig=Highmore, Ken=Kennebec.

‡ 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 be 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.

Oat Research

Lon Hall
South Dakota State University

Yield, yield stability, and test weight are the most important characteristics associated with the identification and eventual release of oat varieties.

There are, however, several additional factors that contribute to the expression of these primary characteristics. Resistance to lodging, Barley Yellow Dwarf Virus (BYDV), stem rust, and crown rust all affect yield potential and test weight.

Other traits considered prior to varietal release include hull (or lack of it), protein, oil percentages, maturity, hull color, and plant height.

Consumers desire different characteristics for specific needs. Millers generally want oats with high protein, high beta-glucan content, and low oil. Livestock producers prefer tall varieties with high levels of protein and oil. The racehorse industry demands a high quality, white-hulled or hulless oat variety. Tall varieties, such as Loyal, are popular forage oats.

The main emphasis of the oat breeding programs is development of hulled varieties. Market demand for milling and feed oats isn't affected by hull color except for the racehorse industry. Therefore, we stress development of white-hulled varieties with desirable traits for milling and/or feed. The recent interest in hulless oats for feed and other specialty uses has prompted us to increase effort to develop a high oil, hulless oat.

Plant breeding is a long, drawn out process. The bulk breeding method takes, on average, at least 10 years from initial cross to variety release. This process may be shortened by 2 years by using the single seed descent method, which involves two extra generations in the greenhouse. Each year approximately 37,000 non-segregating plants and head rows are observed.

In 2003, 3,902 unique non-segregating lines were yield tested. Out of a project total of 6,570 yield plots, 72 were tested at Highmore. Highmore is a moisture-stress location for the Tri-State Regional Nursery.

Data collected from regional nurseries provide valuable information for variety release and germplasm selection for crossing in our program. The Tri-State Regional Nursery is made up of 30 hulled lines and 6 checks. The 30 lines consist of 10 advanced lines each from Minnesota, North Dakota, and South Dakota.

Advanced increase lines are entered in the Uniform Early Regional Nursery, Uniform Midseason Regional Nursery, Quaker Uniform Oat Nursery, and/or South Dakota Standard Variety Oat Trials (SVO). Hulless lines are tested in the Cooperative Naked Oat Trial and/or SVO.

SD96024A, a white-tan hulled line, had the highest average yield and placed second in the top yield group percentage rating in the 2003 SVO. Along with exceptional yield potential, it has an average test weight, good disease resistance, and excellent milling qualities. It has been increased with the intent to release for the 2004 growing season pending approval.

SD000366 was the second highest yielder and it had the highest yield group percentage rating. SD000366 has a very high-test weight, a white hull, large seed size, and excellent crown rust and BYD resistance. Four out of 96 purified derivations from SD000366 were selected for increase in New Zealand. They were

screened in the field for BYD resistance and for crown rust resistance in the greenhouse. These four lines will be increased to approximately 150 bushels and tested in the 2004 Standard Variety Oat Test.

Production research included a naked oat herbicide test at the Brookings location and a successful dormant seeding test at the Northeast Farm.

This research is funded in part by annual grants from The Quaker Oats Company. We also appreciate the financial support of the SDSU Agricultural Experiment Station, Crop Improvement Association, and the SDSU Plant Science Department.

Spring Wheat Breeding

Karl D. Glover
South Dakota State University

Our primary objective is to improve the agronomic, milling, and baking characteristics of spring wheat varieties that are well adapted to South Dakota. Prior to the release of a new variety to growers, its advantageous features must be well documented. Characterization of material within the breeding program begins during the second growing season after a cross has been made. Thousands of breeding lines, each representing a potential variety, are created yearly and are subject to removal from consideration based on their susceptibility to disease and lack of agronomic promise.

Lines chosen for additional testing are more heavily scrutinized with each successive testing year. Therefore, the number of lines included in preliminary and advanced yield tests is relatively few compared to early generation tests.

Spring wheat production environments in our state can be dramatically different from year to year and even from location to location within a year. Unfortunately, this prevents varieties from being optimally adapted to all production environments. This necessitates that preliminary and advanced yield tests also be conducted in several environments throughout the state.

The Central Crops and Soils Research Station is one of eight locations used for testing material in our Advanced Yield Trial (AYT) test. Generally, breeding lines that do very well over 2 or 3 years of consideration in our AYT test are the most likely to be released as varieties.

Dry conditions at the Central Crops and Soils Research Station led us to completely abandon our AYT plots in 2002.

Plots were harvested in 2003. The coefficient of variation (CV) associated with this test, however, was greater than 30. The validity and quality of data generated from yield trials where CV values are greater than 15 is very questionable. Data gathered from this test was therefore not analyzed further and are not included in this report.

Twenty-seven lines that appear to hold the most potential for varietal release are grown each year in our AYT test along with nine released varieties used for comparative purposes. Not all 27 entries are advanced to a second year of AYT testing. Table 1 presents yield and test weight observations collected from nine experimental entries, along with check varieties, that were grown in both the 2002 and 2003 AYT tests.

Among these potential varieties, SD3546 appears most promising as it has above-average yield potential, high test weight, moderate scab resistance, and a high level of leaf rust resistance (disease data not presented). SD3546 is slated for release to growers as a new variety available in 2004.

The financial support provided by the South Dakota State University Plant Science Department, South Dakota Wheat Commission, and South Dakota Crop Improvement Association is appreciated.

Table 1. Yield and test weight observations of nine check entries and nine potential hard red spring wheat varieties evaluated in 2002 and 2003 Advanced Yield Trials at six South Dakota locations and ranked in order of descending average yield calculated over all six locations.

	State	Aurora		Brookings		Groton		Redfield		Selby		Watertown	
Line	YLD	YLD	TW	YLD	TW	YLD	TW	YLD	TW	YLD	TW	YLD	TW
SD3546	49.5	43.6	56.5	57.7	58.0	52.5	58.9	48.3	57.9	51.5	59.9	39.7	55.8
SD3618	49.5	43.2	55.9	60.2	63.2	50.2	58.8	48.0	55.3	50.9	58.1	38.7	54.0
SD3687	49.0	41.3	53.5	57.0	56.5	47.3	56.5	47.0	54.7	54.2	56.4	41.3	53.6
SD3668	48.8	43.5	56.0	56.3	57.1	49.3	59.2	50.0	57.1	51.3	59.1	40.2	55.6
SD3540	48.8	44.0	55.9	57.1	58.2	50.5	58.8	50.6	57.0	47.7	59.2	38.7	54.9
SD3720	48.5	41.8	56.0	52.2	54.7	48.4	60.1	55.0	58.6	46.3	57.4	40.8	52.3
BRIGGS	48.4	44.4	56.5	56.8	55.9	48.4	58.9	49.4	56.3	50.5	56.6	40.5	52.8
RUSS	48.2	42.4	55.4	56.3	55.4	46.5	57.9	48.0	55.3	51.2	57.9	38.5	54.5
SD3635	48.0	41.6	55.6	61.5	55.9	47.8	58.9	46.9	56.8	51.3	59.4	39.4	54.4
WALWORTH	47.2	42.6	55.2	56.5	56.4	44.7	58.0	45.0	54.3	46.2	57.3	39.3	54.6
FORGE	47.1	40.8	55.5	54.7	55.5	41.1	57.2	48.7	57.4	50.9	59.6	39.0	53.5
SD3641	46.1	42.2	55.1	47.5	58.8	45.9	57.5	48.1	56.7	51.3	58.8	42.0	55.3
OXEN	45.9	40.6	55.2	53.1	56.7	45.6	57.3	49.6	54.8	45.0	56.7	40.0	54.2
BUTTE 86	45.8	40.6	55.4	54.5	56.3	39.7	56.5	45.6	56.7	46.9	57.4	37.7	53.2
SD3696	45.5	34.4	56.8	55.1	60.7	44.4	60.5	48.6	59.1	48.3	61.2	38.9	56.3
2375	43.3	37.3	53.8	52.8	57.9	37.3	57.6	42.7	57.7	40.2	59.7	38.2	56.4
CHRIS	34.9	30.3	52.2	40.1	47.4	34.1	55.8	34.4	49.9	32.7	55.1	29.9	50.3
Average	47.7	40.9	55.4	54.6	56.7	45.6	58.2	47.4	56.2	48.0	58.2	39.0	54.2
LSD	1.8	3.8	1.8	6.1	5.6	3.7	1.0	5.6	1.2	5.0	1.2	2.5	2.1
CV	8.9	7.9	2.4	9.6	8.4	7.6	1.6	10.3	1.8	9.0	1.8	6.5	3.8

Resistance of Sunflower Germplasm to the Red Sunflower Seed Weevil

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Jerry Miller and ***Larry Charlet,*** USDA-ARS, Northern Crop Science Lab, Fargo, N.D.

The red sunflower seed weevil, *Smicronyx fulvus* LeConte, is a serious pest of sunflower in North and South Dakota. Adult females lay eggs in immature seeds, the eggs hatch, and larvae consume a portion of the kernel.

Economic damage is in the form of lost yield and oil content in the case of oilseed sunflower and both yield and quality losses in the case of confection sunflower. The goal of this project was to identify sunflower germplasm with genetic resistance to the red sunflower seed weevil.

This was the second year of a cooperative trial by the South Dakota Experiment Station, South Dakota State University, and the USDA-ARS Sunflower Research Unit, Fargo, N.D. Sunflower germplasm tested were lines developed by the USDA-ARS through a recurrent selection breeding procedure and Plant Introductions (PI) obtained from the Plant Introduction Station, Iowa State University, Ames, Iowa.

In 2002, 41 lines and 15 accessions were screened at Highmore. Treatments were replicated four times in a randomized block experiment. Up to four heads from each row (treatment) were threshed and a pooled sample of seed was sent to the USDA-ARS, Northern Crop Science Laboratory, Fargo, N.D., for evaluation of seed damage. A random sample of 200 seeds from each plot was examined and the percentage of seeds damaged by larval feeding determined.

Red seed weevil infestation levels were high at Highmore in 2002, and seed damage levels ranged from 8 to 55%.

The 2003 trials at Highmore retested 20 lines and 4 accessions that showed low numbers of damaged seeds in the 2002 trials, plus 8 new accessions. Four replications were planted on May 16, 2003, and five sunflower heads were harvested from each plot. Heads were threshed individually, and seed from each head was shipped to the USDA-ARS sunflower insect laboratory. Seed damage evaluations have not yet been completed.

Data from this study will be distributed to public and industry sunflower plant breeders for incorporation into their breeding programs to develop lines and hybrids resistant to this insect.

This research was sponsored by the USDA-ARS. We also appreciate the financial support provided by the SDSU Agricultural Experiment Station, the SDSU Plant Science Department, the National Sunflower Association, and the South Dakota Oilseeds Council.

Table 1. Mean percentage of seed damaged by red sunflower seed weevil from sunflower lines and accessions evaluated at Highmore, S.D., in 2003.

Line or Accession	*ID*	*% Damaged Seed* 2002	2003*
HYB 894	Hybrid 894(check)	29.8 ± 13.8	
98 1854	USDA RSSW	13.1	
98 1855	USDA RSSW	17.0	
98 1859	USDA RSSW	22.8 ± 5.2	
98 1860	USDA RSSW	19.8 ± 9.9	
98 1864	USDA RSSW	21.0	
98 1865	USDA RSSW	26.3 ± 12.8	
98 1867	USDA RSSW	18.8 ± 0.8	
98 1871	USDA RSSW	13.5	
98 1873	USDA RSSW	22.0 ± 8.1	
98 1875	USDA RSSW	24.2 ± 14.9	
98 1879-4	USDA RSSW	13.8 ± 5.9	
98 1881	USDA RSSW	12.6 ± 3.6	
98 1882	USDA RSSW	8.1 ± 4.1	
98 1883	USDA RSSW	23.8 ± 5.3	
98 1884	USDA RSSW	7.8 ± 1.8	
98 1885	USDA RSSW	9.3 ± 1.8	
98 1892	USDA RSSW	15.6 ± 11.4	
98 1893	USDA RSSW	22.0	
98 1898	USDA RSSW	13.0 ± 6.2	
98 1868	USDA RSSW	36.8 ± 3.1	
HYB 894	Hybrid 894(check)	29.8 ± 13.8	
TUB-346	TUB-346		
STR-1622-2	STR-1622-2		
STR-1622-1	STR-1622-1		
TUB-1709-2	TUB-1709-2		
RF-TUB-346	RF-TUB-346		
GIG-1616-2	GIG-1616-2		
HIR-828-3	HIR-828-3		
HYB 894	Hybrid 894(check)		
AMES 3269	PURPUREUS	18.2 ± 1.3	
PI 251465	NO. K1918	24.7 ± 4.6	
PI 486366	CAKSISKIJ 269	8.0 ± 4.0	
PI 294658	SMENA (SUS)		
PI 431506	T 6651-1-2 (SUS)	42.3 ± 20.9	

* Seed damage evaluations from 2003 are in process.

Flax Variety Trials

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South Dakota State University

A yield trial of released flax varieties and experimental lines from South Dakota, North Dakota, and Canada was grown at the Highmore Research Station, Brookings, and Webster in 2003. The trial provided performance data on released flax varieties and compared performance of experimental lines to established checks to identify possible new varieties.

In 2003, seven experimental lines from the NDSU or Canadian flax breeding programs were tested against 28 released varieties (checks). The Webster and Brookings early-seeded trials were planted on May 2nd. Highmore was seeded on May 7 and a late-seeded trial was planted at Brookings on June 4, 2003. An additional trial was planted at Brookings on June 4 in a field infested with the flax wilt fungus, *Fusarium oxysporum* f.sp *lini*, to test varietal resistance to wilt.

Experimental design at each location was a randomized complete block with three replications. Plots consisted of seven rows 14 feet long, with rows spaced 7 inches apart. Plots at all locations were harvested by cutting the middle three rows of each plot with a bundle cutter, then drying and threshing the bundles.

Stands were fair to good at Webster and Highmore. Both early- and late-seeded trials at Brookings had reduced stands and loss of plant vigor due to wilt infection. The early-seeded trial showed more severe wilt symptoms, with some plots totally killed by the fungus. Yield results are not reported for this trial because data were too variable to make valid comparisons.

Topsoil and subsoil moisture were adequate at Webster and Brookings at the start of the growing season, but short at Highmore. All stations had close to normal precipitation in April and May. Webster and Highmore were wetter than normal in June but drier than normal in July and August. Brookings was drier than normal in June through August.

Average temperatures were cooler than normal in May and June but warmer than normal in April and August at all three locations.

Seed yield and agronomic data on the 35 varieties tested are presented in Table 1. Yields averaged over varieties were highest at Webster (29.6 bu/A). There were no statistically significant differences in yield among the varieties when averaged over all three locations in 2003.

The highest yielding variety at Webster was AC Emerson (35.6 bu/A) and the highest yielder at Highmore was AC Carnduff (23.6 bu/A).

We appreciate the financial support for this research provided by the SDSU Agricultural Experiment Station and the SDSU Plant Science Department.

Table 1. Results of the 2003 flax regional trial at several South Dakota locations.

ID No.	Variety or Pedigree	Origin (Year)	Seed Yield (bu/acre) Web-ster	High-more	Brkgs Late	3-loc Mean	Oil % Hghmr	Plant Hght (cm) -4-*	Days to Flwr	Wilt (1-9,1=best) Brkgs Early	Brkgs Late	Wilt Nursery	3-loc Mean	Stand (1-9,1=best) Brkgs Early	Brkgs Late	2-loc Mean
CI 3411	AC Carnduff	CAN-99	31.7	23.6	18.9	24.8	39.1	49	49	4.8	1.3	8.4	4.8	4.8	2.7	4.0
CI 3318	AC Emerson	CAN-95	35.6	20.8	18.2	25.3	38.4	49	46	4.6	0.5	5.7	3.6	4.4	0.7	2.9
FP1094	AC Hanley	CAN-02	30.9	16.3	18.2	22.4	36.7	46	47	4.6	1.6	7.4	4.5	3.7	3.1	3.4
CI 3397	AC Watson	CAN-97	30.8	22.2	16.6	23.2	38.0	52	45	5.9	1.7	7.2	4.9	3.3	0.6	2.2
CI 389	Bison	ND-27	27.5	19.2	16.0	21.0	39.3	53	43	4.0	1.0	5.7	3.6	2.7	2.1	2.5
CI 3327	Cathay	ND-97	29.2	18.8	18.9	22.7	39.2	52	48	2.8	1.3	6.3	3.5	0.7	1.5	1.0
CI 3425	CDC Arras	CAN-00	31.8	19.5	23.1	25.4	38.0	52	50	7.3	1.4	8.5	5.7	4.6	1.2	3.2
CI 3424	CDC Bethune	CAN-00	30.8	21.0	19.7	24.1	39.6	50	48	4.8	1.7	7.9	4.8	3.8	3.1	3.5
FP2044	CDC Mons	CAN-03	30.6	--	15.7	--	--	--	50	4.3	1.6	--	--	5.0	3.5	4.4
CI 3332	CDC Normndy	CAN-96	29.8	21.5	24.0	25.5	38.9	52	44	5.0	1.4	7.4	4.6	3.2	1.4	2.4
CI 3399	CDC Valour	CAN-97	26.3	18.2	18.0	21.1	37.6	51	43	4.6	2.1	8.0	4.9	3.2	3.4	3.3
CI 3243	Day	SD-90	27.4	20.4	19.1	22.5	39.4	51	43	4.5	1.5	7.4	4.5	4.1	3.1	3.7
CI 3293	Flanders	CAN-90	35.3	--	22.3	--	--	--	47	3.4	2.0	--	--	1.5	3.1	2.1
CI 3270	Linora	CAN-92	29.0	19.5	26.8	25.7	38.2	51	44	4.3	1.1	5.7	3.7	3.1	1.6	2.5
CI 2522	Linott	CAN-66	26.9	21.0	18.9	22.3	38.2	53	46	1.4	1.3	7.1	3.3	0.1	0.0	0.0
CI 3309	McDuff	CAN-93	28.8	--	16.1	--	--	--	49	6.8	0.9	--	--	3.2	0.6	2.1
CI 2921	McGregor	CAN-82	28.1	17.4	20.7	22.6	37.2	50	51	4.2	2.0	8.6	4.9	2.2	3.4	2.7
CI 3096	Neche	ND-88	32.3	18.5	19.4	23.9	38.0	53	46	3.5	0.7	9.1	4.4	1.7	0.0	0.9
N9719	Nekoma	ND-02	28.6	18.8	23.5	24.2	39.0	49	47	2.1	1.0	8.4	3.8	0.9	0.6	0.8
CI 3259	Omega	ND-90	30.1	19.5	18.9	23.1	38.7	50	44	5.3	3.4	7.8	5.5	4.9	4.7	4.8
CI 3358	Pembina	ND-97	26.3	14.3	22.3	21.7	38.3	51	47	5.6	1.2	5.6	4.1	2.8	0.7	1.9
FP2024	Prairie Blue	CAN-03	29.0	21.6	20.6	23.9	39.3	50	46	3.3	1.1	6.6	3.7	1.6	0.0	1.0
CI 3131	Prompt	SD-89	25.5	19.8	21.6	22.5	38.2	46	41	3.3	1.3	8.7	4.4	3.1	2.9	3.0
CI 3297	Rahab 94	SD-94	33.8	19.0	22.0	25.6	38.7	49	47	3.3	2.7	8.9	5.0	3.1	3.3	3.2
CI 3404	Selby	SD-00	26.3	20.6	22.7	23.5	39.5	54	46	3.2	1.5	9.3	4.7	3.7	3.0	3.4
CI 3296	Verne 93	SD-93	27.2	20.3	21.5	23.2	40.0	50	43	5.5	1.6	5.1	4.0	1.8	2.0	1.9
CI 3353	Webster	SD-98	29.4	17.1	20.4	22.8	38.6	55	50	4.5	0.3	7.8	4.2	4.2	0.5	2.7
CI 3423	York	ND-02	29.6	17.2	23.4	24.1	38.5	49	47	3.7	2.0	6.8	4.2	4.4	3.2	3.9
FP1096		CAN-exp.	30.5	20.7	20.0	24.0	39.1	50	48	4.6	0.2	4.6	3.1	3.4	-0.0	2.0
FP2112		CAN-exp.	30.9	--	23.1	--	--	--	47	5.1	2.9	--	--	6.3	5.3	5.9
FP2114		CAN-exp.	27.3	--	22.8	--	--	--	43	0.9	0.9	--	--	0.0	1.4	0.5
FP2118		CAN-exp.	24.4	--	25.3	--	--	--	44	1.8	1.0	--	--	0.0	0.5	0.1
FP2119		CAN-exp.	34.8	--	20.3	--	--	--	42	6.1	2.0	--	--	5.5	1.6	3.9
N0009		ND-exp.	26.7	20.4	21.5	23.1	38.9	51	47	6.3	2.8	7.9	5.6	5.5	4.9	5.3
N0010		ND-exp.	32.0	19.3	15.3	22.5	38.4	49	45	5.2	2.0	8.1	5.1	3.1	3.4	3.2
	Grand Mean		29.6	19.5	20.4	23.5	38.6	51	46	4.3	1.5	7.3	4.4	3.1	2.1	2.7
	LSD 5%		5.5	3.9	ns	ns	1.4	3	2	2.4	ns	1.5	1.7	2.7	2.2	1.9
	C.V.		11.4	9.7	14.6	13.3	1.8	7	2.3	34.5	67.7	12.7	26.3	52.4	52.9	57.8

Weed Control

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The Highmore station provides a strategic location for several weed control field evaluation and demonstration trials. The plots provide data for the statewide Extension weed control program and are used for field tours.

2003 Projects

Several weed control evaluations and demonstrations were added in 2003. Alfalfa burndown, flax, and field pea tests were new tests. Wild oat and wild buckwheat tests were treated for both winter and spring wheat. Corn, soybean, oat, grain sorghum, safflower, and sunflower weed plots were initiated.

2003 Season

Spring precipitation was adequate for early crops; however, cold temperatures delayed weed and early row crop emergence. Very dry mid and late season conditions followed. Winter wheat yield was considerably higher than spring grains.Yields were not harvested on some tests where stress severely affected the crop.

2003 Reports

Wild Buckwheat in Winter Wheat
Wild Oat in Winter Wheat
Fertilizer and Herbicide Carrier in Winter Wheat
Wild Buckwheat in Spring Wheat
Wild Oat in Spring Wheat
Oat Herbicide Tolerance
No-Till Soybean Herbicide Demonstration
No-Till Corn Herbicide Demonstration
No-Till Grain Sorghum Demonstration
Field Pea Weed Control
Safflower Weed Control Demonstration
Flax Herbicide Demonstration
Alfalfa - New Seeding Weed Control
Established Alfalfa Demonstration
Alfalfa Burndown

The cooperation and direct assistance from station personnel is acknowledged. Field equipment and management of the plot areas are important contributions to the project. Extension educators identify needs, assist with tours and utilize the data in education programs.

Program input and partial support for field programs is also acknowledged:
South Dakota Soybean Utilization Council
South Dakota Corn Utilization Council
South Dakota Oilseed Council
National Sunflower Association
Consortium for Alternative Crops
National Canola Research/NDSU Agricultural Experiment Station
Crop Protection Industries

NOTE:

Data reported in this publication are results from field tests that include product uses, experimental products or experimental rates, combinations or other unlabeled uses for herbicide products. Tradenames of products used are listed; there frequently are other brand products available in the market. Users are responsible for applying herbicide according to label directions. Refer to the appropriate weed control fact sheet available from county Extension offices for herbicide recommendations.

Table 1. Wild buckwheat in winter wheat.

RCB; 3 reps
Variety: Wesley
Planting Date: 9/11/02
POST: 4/11/03
Soil: Clay loam; 2.5% OM; 6.2 pH

Precipitation:
POST: 1st week 0.73 inches
2nd week 0.45 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Wibw=Wild buckwheat
KOCZ=Kochia

COMMENTS: Moderate wild buckwheat and kochia pressure; competitive winter wheat canopy. Bronate and Clarity treatments were effective on both weeds. Yield differences not consistent. Puma broadcast for wild oat control.

Treatment	*Rate/A*	*% VCRR 7/11/03*	*% Wibw 7/11/03*	*% KOCZ 7/11/03*	*Yield bu/A*
Check	----	0	0	0	46
POSTEMERGENCE					
2,4-D ester	.5 pt	5	58	66	40
Bronate Advanced	.8 pt	3	94	99	45
Bronate Advanced	1.2 pt	0	97	99	50
Clarity+2,4-D amine	2 oz+8 oz	3	94	96	46
Clarity+2,4-D amine	4 oz+8 oz	0	98	98	44
Aim EW+2,4-D amine	.5 oz+8 oz	0	88	86	45
Harmony GT XP+ 2,4-D ester+NIS	.4 oz+ 8 oz+.25%	3	97	80	47
Curtail	2 pt	0	84	83	42
Ally XP+Express XP+ Harmony GT XP+ 2,4-D ester+NIS	.075 oz+.075 oz+ .15 oz+ .8 pt+.25%	0	98	83	46
LSD (.05)		6	14	11	9

Table 2. Wild oat in winter wheat.

RCB; 3 reps
Variety: Wesley
Planting Date: 9/11/02
POST: 4/11/03
Soil: Clay loam; 2.5% OM; 6.2 pH

Precipitation:
POST: 1st week 0.73 inches
2nd week 0.45 inches

Wioa=Wild oat

COMMENTS: Intended to develop data base for wild oat herbicides in winter wheat. Includes reduced full and 2X rates of Puma and Discover. Early wild oat seedlings did not develop into season. All treatments provided excellent control; suggesting crop competition effect is a factor in reduced rates. No adverse crop response at 2X rates. Bronate Advanced applied for broadleaf control in check and grass only plots.

Treatment	*Rate/A*	*% Wioa 7/22/03*	*Yield bu/A*
Check	----	0	38
POSTEMERGENCE			
Discover+DSV Adjuvant	4 oz+1%	99	41
Discover+DSV Adjuvant	2.4 oz+1%	99	37
Puma	.66 pt	98	37
Puma+Bronate Advanced	.66 pt+.88 pt	98	38
Discover+Harmony GT XP+DSV Adjuvant	2.4 oz+.3 oz+1%	99	37
Discover+DSV Adjuvant	8 oz+1%	99	39
Puma	1.33 pt	99	38
LSD (.05)		1	8

Table 3. Fertilizer and herbicide carrier in winter wheat.

RCB; 3 reps
Variety: Wesley
Planting Date: 9/1/102
POST: 4/11/03
Soil: Clay loam; 2.5% OM; 6.2pH

Precipitation:
POST: 1st week 0.73 inches
2nd week 0.45 inches

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

Carrier:
A = 20 gallons H2O
B = 10 gallons H2O
10 gallons 28% N
C = 20 gallons 28% N

COMMENTS: Purpose to evaluate the effect of 28% N rates and carrier on visual crop response. Total N carrier tended to increase crop response for Bronate, Aim and Starane; recommended 50/50 dilution caused less leaf burn. Clarity and 2,4-D treatments were not affected. Increase in lodging noted for 2,4-D and Clarity treatments. Yield not harvested due to variability across plot area.

Treatment	*Carrier*	*Rate/A*	*% VCRR Leaf Burn 5/12/03*	*% VCRR Lodging 5/12/03*
Check	----	----	0	0
POSTEMERGENCE				
2,4-D ester	A	1 pt	0	7
2,4-D ester	B	1 pt	0	13
2,4-D ester	C	1 pt	0	12
Bronate Advanced	A	1.2 pt	0	0
Bronate Advanced	B	1.2 pt	2	0
Bronate Advanced	C	1.2 pt	10	0
Aim EW+2,4-D ester+NIS	A	.5 oz+.5 pt+.25%	5	0
Aim EW+2,4-D ester+NIS	B	.5 oz+.5 pt+.25%	8	0
Aim EW+2,4-D ester+NIS	C	.5 oz+.5 pt+.25%	12	0
Clarity+MCPA amine	A	4 oz+.5 pt	0	23
Clarity+MCPA amine	B	4 oz+.5 pt	0	22
Clarity+MCPA amine	C	4 oz+.5 pt	0	17
Starane+2,4-D ester	A	.67 pt+.5 pt	3	0
Starane+2,4-D ester	B	.67 pt+.5 pt	8	0
Starane+2,4-D ester	C	.67 pt+.5 pt	7	0
Harmony Extra XP+2,4-D ester+NIS	A	.5 oz+.5 pt+.25%	7	0
Harmony Extra XP+2,4-D ester+NIS	B	.5 oz+.5 pt+.25%	3	0
Harmony Extra XP+2,4-D ester+NIS	C	.5 oz+.5 pt+.25%	15	0
28% N	20 gallons	.5 oz+.5 pt+.25%	7	0
LSD (.05)			7	0

Table 4. Wild buckwheat control in spring wheat.

RCB; 3 reps
Variety: Ingot
Planting Date: 4/14/03
POST: 5/23/03
Soil: Clay loam; 2.5% OM; 6.2 pH

Precipitation:
POST: 1st week 0.10 inches
2nd week 0.60 inches

Wibw=Wild buckwheat
KOCZ=Kochia

COMMENTS: Moderate weed pressure; very dry mid and late season. Wide treatment differences for kochia control. Variability in wild buckwheat across plot area. Drought reduced yield response.

Treatment	*Rate/A*	*% Wibw 7/11/03*	*% KOCZ 7/11/03*	*Yield bu/A*
Check	----	0	0	20
POSTEMERGENCE				
2,4-D ester	.5 pt	32	13	18
2,4-D amine	1 pt	43	18	16
Bronate Advanced	.8 pt	94	93	15
Bronate Advanced+Clarity	1.2 pt+1.5 oz	94	95	16
Clarity+MCPA amine	2 oz+8 oz	60	15	21
Clarity+MCPA amine	4 oz+8 oz	73	22	18
Aim EW+2,4-D ester	.5 oz+8 oz	56	91	18
Harmony GT XP+2,4-D ester+NIS	.3 oz+8 oz+.25%	62	12	20
Harmony GT XP+2,4-D ester+NIS	.5 oz+8 oz+.25%	60	12	17
Starane+Harmony GT XP+ 2,4-D ester+NIS	.5 pt+.3 oz+ 8 oz+.25%	90	95	19
Curtail	2 pt	60	15	17
LSD (.05)		20	11	5

Table 5. Wild oat control in spring wheat.

RCB; 3 reps
Variety: Ingot
Planting Date: 4/14/03
POST: 5/12/03
Soil: Clay loam; 2.5% OM; 6.2 pH

Precipitation:
POST: 1st week 0.32 inches
2nd week 0.22 inches

Wioa=Wild oat
KOCZ=Kochia

COMMENTS: Heavy wild oat pressure. Dry mid and late season conditions reduced yield. Puma and Discover alone and in combination provided excellent wild oat control. No apparent antagonisms. Approximately 10 bu/A yield response for treatments with at least 90% control and 15 bu/A increase over check.

Treatment	*Rate/A*	*% Wioa 7/11/03*	*% KOCZ 7/11/03*	*Yield bu/A*
Check	----	0	0	10
POSTEMERGENCE				
Puma	.66 pt	98	0	26
Puma	.4 pt	90	0	22
Discover+DSV Adjuvant	4 oz+1%	99	0	28
Discover+DSV Adjuvant	2.4 oz+1%	99	0	25
Everest+NIS	.6 oz+.25%	48	7	18
Everest+NIS	.36 oz+.25%	62	22	17
Assert+NIS	1.2 pt+.25%	35	52	18
Puma+Aim EW	.66 pt+.5 oz	97	90	26
Puma+Clarity	.66 pt+4 oz	97	92	27
Puma+Bronate Advanced	.66 pt+.8 pt	98	98	29
Puma+Harmony GT XP+Starane	.66 pt+.3 oz+.5 pt	99	93	28
LSD (.05)		10	11	4

Table 6. Oat herbicide tolerance.

RCB; 3 reps
Variety: Jerry
Planting Date: 4/14/03
POST: 6/5/03
Soil: Clay loam; 2.3% OM; 6.5 pH

Precipitation:
POST: 1st week 0.37 inches
2nd week 0.25 inches

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

COMMENTS: Dry conditions; variable stand. No adverse crop response; limited weed emergence after early season. Broadleaf control very good. Yield not harvested due to site variability.

Treatment	*Rate/A*	*% VCRR 7/22/03*	*% BDLF 7/22/03*
Check	----	0	0
POSTEMERGENCE			
2,4-D amine	1 pt	0	96
Salvo	.8 pt	0	96
2,4-D ester	1 pt	0	95
MCPA amine	1 pt	0	94
MCPA ester	1 pt	0	95
Bronate Advanced	.8 pt	0	98
Clarity+MCPA amine	3 oz+.5 pt	0	95
Starane+LI-700	.67 pt+.25%	0	99
Aim EW+NIS	.5+.25%	0	96
Callisto+COC	1.5 oz+1 pt	0	92
Harmony GT XP+NIS	.3 oz+.25%	0	88
Stampede CM+COC	1 pt+1 pt	0	91
LSD (.05)		0	4

Table 7. No-till soybean herbicide demonstration.

RCB; 3 reps
Variety: AG 1301
Planting Date: 6/9/03
EPP: 4/26/03
PRE: 6/9/03
EPOST: 7/8/03
POST: 7/15/03
Soil: Clay loam; 2.8% OM; 6.3 pH

Precipitation:

EPP:	1st week	0.63 inches
	2nd week	1.80 inches
PRE:	1st week	0.37 inches
	2nd week	0.95 inches
EPOST:	1st week	0.00 inches
	2nd week	0.00 inches
POST:	1st week	0.00 inches
	2nd week	0.00 inches

FXTL=Yellow and green foxtail mix
BDLF=Redroot pigweed

COMMENTS: Excellent weed control. Dry mid and late season limited extended weed flush.

Treatment	*Rate/A*	*% FXTL 7/23/02*	*% BLDF 7/23/03*
Check	----	0	0
EARLY PREPLANT & POSTEMERGENCE			
Authority&Assure II+COC	5.3 oz&7 oz+1 qt	84	94
EARLY PREPLANT & PREEMERGENCE & POSTEMERGENCE			
Authority&Authority+Assure II+COC	2 oz&5.3 oz&7 oz+1 qt	87	94
EARLY PREPLANT & POSTEMERGENCE			
Authority&Roundup UltraMax+AMS	4 oz&25.6 oz+2.5 lb	96	97
Valor&Roundup UltraMax+AMS	3 oz&25.6 oz+2.5 lb	97	94
Valor+FirstRate& Roundup UltraMax+AMS	3 oz+.6 oz& 25.6 oz+2.5 lb	98	97
POSTEMERGENCE			
Roundup UltraMax+ Harmony GT XP+AMS	25.6 oz+ .083 oz+2.5 lb	98	98
Roundup UltraMax+AMS	25.6 oz+2.5 lb	98	94
EARLY POSTEMERGENCE			
Roundup UltraMax+AMS	25.6 oz+2.5 lb	99	97
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup UltraMax+AMS& Roundup UltraMax+AMS	25.6 oz+2.5 lb& 25.6 oz+2.5 lb	99	97
Roundup UltraMax+AMS& Roundup UltraMax+AMS	12.8 oz+2.5 lb& 12.8 oz+2.5 lb	99	99
LSD (.05)		7	5

Table 8. No-till corn demonstration.

RCB; 3 reps
Variety: DeKalb DKC 44-46 (Roundup Ready)
Pio 37H27 (Liberty Link)
Planting Date: 5/12/03
FALL: 11/22/02
EPP: 4/11/03
EPOST: 6/9/03
POST: 6/10/03
POST1: 6/18/03
Soil: Clay loam; 2.8% OM; 6.3 pH

Precipitation:

PRE:	1st week	0.73 inches
	2nd week	0.45 inches
EPOST:	1st week	0.37 inches
	2nd week	0.95 inches
POST:	1st week	0.37 inches
	2nd week	0.95 inches
POST1:	1st week	1.90 inches
	2nd week	1.75 inches

FXTL=Yellow, some green foxtail
BDLF=Redroot pigweed/kochia mix

COMMENTS: Adequate precipitation for early preplant, but cold delayed weed/crop emergence. Some weed variability across reps. Split programs provided the best control in most programs.

Treatment	*Rate/A*	*% FXTL 7/23/03*	*% BDLF 7/23/03*
Check - ROUNDUP READY	----	0	0
FALL			
Dual II Magnum	1.67 pt	43	61
Dual II Magnum+atrazine	1.5 pt+1.5 pt	37	73
FALL & POSTEMERGENCE			
Atrazine&Roundup WeatherMax+AMS	1.5 pt&21 oz+2.5 lb	83	88
EARLY PREPLANT			
Balance Pro	2.25 oz	20	56
G-Max Lite	3 pt	55	69
KIH-485	6 oz	65	66
Lumax	2.5 qt	58	72
EARLY PREPLANT & POSTEMERGENCE			
Outlook&Distinct+NIS+28% N	21 oz&4 oz+.25%+2 qt	82	90
Dual II Magnum&Callisto+ NIS+28% N	1.67 pt&3 oz+ .25%+2 qt	64	67
EARLY POSTEMERGENCE			
Steadfast+atrazine+COC+28% N	.75 oz+1 pt+1%+2 qt	79	76
Option+Clarity+atrazine+ MSO+28% N	1.5 oz+6 oz+1 pt+ 1.5 pt+2 qt	80	86
EARLY PREPLANT & POSTEMERGENCE			
Basis+Clarity+atrazine+ COC+28% N& Steadfast+Callisto+ COC+28% N	.33 oz+2 oz+1 pt+ 1 gal/100 gal+2 qt& .75 oz+3 oz+ 1%+2 qt	90	84

Table 8 (continued)

Treatment	*Rate/A*	*% FXTL 7/23/03*	*% BDLF 7/23/03*
EARLY POSTEMERGENCE			
Roundup WeatherMax+AMS	21 oz+2 lb	77	68
POSTEMERGENCE1			
Roundup WeatherMax+AMS	21 oz+2 lb	90	79
EARLY POSTEMERGENCE & POSTEMERGENCE1			
Roundup WeatherMax+AMS&	21 oz+2 lb&		
Roundup WeatherMax+AMS	21 oz+2 lb	90	90
Check - LIBERTY LINK	----	0	0
EARLY POSTEMERGENCE			
Liberty+atrazine+AMS	32 oz+1 pt+3 lb	81	83
EARLY POSTEMERGENCE & POSTEMERGENCE1			
Liberty+atrazine+AMS&	24 oz+1 pt+3 lb&		
Liberty+AMS	24 oz+3 lb	89	91
EARLY PREPLANT & POSTEMERGENCE			
Balance Pro&Liberty+AMS	2.25 oz&28 oz+3 lb	88	83
LSD (.05)		17	18

Table 9. No-till grain sorghum demonstration.

RCB; 3 reps
Variety: Legend LM 4335
Planting Date: 6/9/03
EPP: 5/12/03
POST: 7/8/03
POST1: 7/15/03
Soil: Clay loam; 2.8% OM; 6.3 pH

Precipitation:

EPP:	1st week	0.35 inches
	2nd week	0.22 inches
POST:	1st week	0.00 inches
	2nd week	0.00 inches
POST1:	1st week	0.00 inches
	2nd week	0.00 inches

Grft=Green foxtail
Wibw=Wild buckwheat
Rrpw=Redroot pigweed

COMMENTS: Comparison of grain sorghum herbicides. Roundup burndown. Marginal precipitation for preemergence activation. Atrazine, Buctril, Clarity, Shotgun, and Starane provided adequate wild buckwheat control. Combination and split treatments provided very good pigweed control.

Treatment	*Rate/A*	*% Grft 7/23/03*	*% Wibw 7/23/03*	*% Rrpw 7/23/03*
Check	----	0	0	0
EARLY PREPLANT				
Bicep Lite II Magnum	1.5 qt	73	78	86
Outlook	19 oz	69	25	64
POSTEMERGENCE				
Atrazine+COC	1 qt+.75 qt	35	84	93
Paramount+COC+28% N	5.3 oz+1 qt+2 qt	77	18	63
Paramount+atrazine+ COC+28% N	5.3 oz+.75 qt+ 1 qt+2 qt	89	82	91
EARLY PREPLANT & POSTEMERGENCE				
Dual II Magnum&Permit+NIS	1.5 pt&.67 oz+.25%	76	32	76
Dual II Magnum&Buctril+atrazine	1.5 pt&1 pt+.75 qt	78	84	94
Dual II Magnum&Aim EW+ atrazine+NIS	1.5 pt&.5 oz+ .75 qt+.25%	79	83	92
Dual II Magnum&Clarity	1.5 pt&6 oz	86	62	88
Dual II Magnum&2,4-D amine	1.5 pt&.75 pt	81	68	84
Dual II Magnum&Shotgun	1.5 pt&2 pt	81	91	94
Dual II Magnum&Starane+LI-700	1.5 pt&.67 pt+.25%	80	89	92
Dual II Magnum&Starane+ atrazine+LI-700	1.5 pt&.67 pt+ .75 qt+.25%	83	91	94
EARLY PREPLANT & POSTEMERGENCE1				
Dual II Magnum&Buctril	1.5 pt&1 pt	76	83	88
Dual II Magnum&2,4-D amine	1.5 pt&.75 pt	69	76	87
Dual II Magnum&Clarity	1.5 pt&6 oz	70	87	82
Dual II Magnum&Starane+LI-700	1.5 pt&.67 pt+.25%	70	90	95
LSD (.05)		20	26	19

Table 10. Field pea weed control.

RCB; 3 reps
Variety:
Planting Date: 4/14/03
PPI/PRE: 4/14/03
POST: 6/5/03
Soil: Clay loam; 2.1% OM; 6.4 pH

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

Precipitation:

PPI/PRE:	1st week	1.18 inches
	2nd week	0.00 inches
POST:	1st week	0.37 inches
	2nd week	0.25 inches

FXTL=Green foxtail
KOCZ=Kochia
Colq=Common lambsquarter

COMMENTS: Moderate weed pressure. Ample precipitation for soil herbicides. Treatment differences for lambsquarters and kochia control. Sonalan, Spartan, and Sencor provided the best control of both species. Some variability in yield associated with plot harvesting. However, yields reflect weed control with most treatments.

Treatment	*Rate/A*	*% VCRR 7/8/03*	*% FXTL 7/8/03*	*% KOCZ 7/8/03*	*% Colq 7/8/03*	*Yield lbs/A*
Check	----	0	0	0	0	1527
PREPLANT INCORPORATED						
Dual II Magnum	2 pt	0	88	19	45	881
Prowl	2.5 pt	0	77	55	65	1646
Treflan	1.5 pt	0	83	68	90	1635
Sonalan	2 pt	0	80	84	89	2105
PREEMERGENCE						
Spartan	5.33 oz	0	85	94	95	1884
Sencor	.5 lb	0	84	93	94	1984
POSTEMERGENCE						
Pursuit DG+NIS	1.08 oz+2 pt/100 gal	0	88	48	35	1937
Raptor+NIS	4 oz+2 pt/100 gal	0	90	27	68	1655
Raptor+Basagran+NIS	4 oz+2 pt+2 pt/100 gal	0	90	33	52	1758
Basagran+Poast+COC	2 pt+1.5 pt+1 pt	0	78	40	40	1832
Assure II+NIS	7 oz+1 pt	0	95	0	0	1816
Peas/Oats	----	0	90	90	90	-----
LSD (.05)		0	13	19	23	621

Table 11. Safflower weed control demonstration.

RCB; 3 reps
Variety: Finch
Planting Date: 4/14/03
PPI/PRE: 4/14/03
POST: 6/5/03
Soil: Clay loam; 2.1% OM; 6.7 pH

Precipitation:

PPI/PRE:	1st week	1.18 inches
	2nd week	0.00 inches
POST:	1st week	0.37 inches
	2nd week	0.25 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
FXTL=Green foxtail
BDLF=Redroot pigweed, kochia

COMMENTS: Light weed pressure, however treatment yields were 300 lb/A over check where both grass and broadleaves were controlled. Experimental Valor and Spartan appear to have adequate crop tolerance and merit continued evaluation.

Treatment	*Rate/A*	*% VCRR 7/22/03*	*% FXTL 7/22/03*	*% BDLF 7/22/03*	*Yield lbs/A*
Check	----	0	0	0	604
PREPLANT INCORPORATED					
Treflan	1 qt	0	98	97	942
Sonalan	1.5 qt	0	99	97	934
PREEMERGENCE					
Outlook	19 oz	0	99	96	869
Dual II Magnum	2 pt	0	98	88	880
PREEMERGENCE & POSTEMERGENCE					
Valor&Poast Plus+COC	3 oz&1 pt+1 qt	0	99	92	860
Spartan&Poast Plus+COC	4 oz&1 pt+1 qt	0	99	99	884
Spartan&Poast Plus+COC	8 oz&1 pt+1 qt	0	99	99	877
POSTEMERGENCE					
Poast Plus+COC	1 pt+1 qt	0	99	0	737
Pinnacle+NIS	.25 oz+.25%	0	0	96	671
LSD (.05)		0	1	3	213

Table 12. Flax herbicide demonstration.

RCB; 3 reps
Variety: Webster
Planting Date: 4/14/03
POST: 6/5/03
Soil: Clay loam; 2.1% OM; 6.7 pH

Precipitation:
POST: 1st week 0.37 inches
2nd week 0.25 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
FXTL=Green foxtail
Colq=Common lambsquarters
KOCZ=Kochia

COMMENTS: Evaluation of postemerge herbicides in flax. Select and Poast controlled foxtail; Buctril controlled lambsquarters and kochia. Dry summer; limited extended weed flush. Yield not harvested.

Treatment	*Rate/A*	*% VCRR 7/22/03*	*% FXTL 7/22/03*	*% Colq 7/22/03*	*% KOCZ 7/22/03*
Check	----	0	0	0	0
POSTEMERGENCE					
MCPA ester	.5 pt	0	0	99	67
Buctril	1 pt	0	0	99	99
Curtail M	1.33 pt	0	0	99	82
Select+COC	5 oz+1%	0	99	0	0
Poast+Buctril+COC	1 pt+1 pt+1 qt	0	99	99	99
LSD (.05)		0	3	0	3

Table 13. Alfalfa: new seeding weed control.

RCB; 3 reps
Variety: Legend 8888
Planting Date: 4/14/03
PPI/PRE: 4/14/03
EPOST: 6/5/03
POST: 6/9/03
Soil: Clay loam; 3.5% OM; 7.5 pH

Precipitation:

PPI/PRE:	1st week	1.18 inches
	2nd week	0.02 inches
EPOST:	1st week	0.37 inches
	2nd week	0.25 inches
POST:	1st week	0.57 inches
	2nd week	0.95 inches

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

FXTL=Green foxtail
BDLF=Kochia and redroot pigweed

COMMENTS: Comparison of herbicide performance in new alfalfa seeding. Foxtail control was very good for most treatments. Oat cover controlled broadleaf emergence. Plots will be evaluated and harvested in 2004 to determine second year effect.

Treatment	*Rate/A*	*% VCRR Stunt 7/22/03*	*% FXTL 7/22/03*	*% BDLF 7/22/03*
Oats/Alfalfa	----	10	35	93
EARLY POSTEMERGENCE				
Oats+Poast Plus+COC	1.5 pt+1 qt	5	91	86
Check	----	0	0	0
PREPLANT INCORPORATED				
Treflan	1.5 pt	0	99	84
PREEMERGENCE				
Dual II Magnum	1.75 pt/100 gal	0	93	43
EARLY POSTEMERGENCE				
Poast Plus+COC	1.5 pt+1 qt	0	97	0
Select+COC	7 oz+1 qt	0	99	0
Pursuit DG+MSO+28% N	1.44 oz+1 qt+1 qt	0	91	37
Raptor+MSO+28% N	4 oz+1 qt+1 qt	0	99	87
POSTEMERGENCE				
Buctril	1.5 pt	0	0	97
Buctril+Poast Plus+COC	1 pt+1.5 pt+1 qt	0	97	82
LSD (.05)		3	29	18

Table 14. Established alfalfa demonstration.

RCB; 2 reps
Variety:
PRE: 4/11/03
VEPOST: 4/26/03
EPOST: 5/12/03
Soil: Clay loam; 2.7% OM; 6.3 pH

Precipitation:

PRE:	1st week	0.73 inches
	2nd week	0.45 inches
VEPOST:	1st week	0.63 inches
	2nd week	0.85 inches
EPOST:	1st week	0.35 inches
	2nd week	0.22 inches

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

FXTL=Green foxtail
BLDF=Kochia

COMMENTS: Crop tolerance evaluation for established alfalfa. Dry season; alfalfa competition held plots essentially weed free – note 99% control in check. However the 2,4-D and Roundup treatments very early post (1-2 inches) that damaged the alfalfa allowed weed emergence. Pre and post treatments did not affect crop visual response. Excellent demonstration of crop competition.

Treatment	*Rate/A*	*% VCRR 6/25/03*	*% FXTL 6/25/03*	*% BDLF 6/25/03*
Check	----	0	99	99
PREEMERGENCE				
Sencor	.66 lb	8	99	99
Kerb	2 lb	0	98	99
Velpar	1 lb	5	99	99
Sinbar	1 lb	8	98	99
Pursuit DG	1.44 oz	5	99	99
VERY EARLY POSTEMERGENCE				
Gramoxone Extra+NIS	1.5 pt+.25%	0	98	99
2,4-D ester	1 pt	55	80	78
Roundup UltraMax+AMS	12.8 oz+2.5 lb	54	65	78
EARLY POSTEMERGENCE				
Pursuit DG+MSO+28% N	1.44 oz+2 pt+2 qt	8	99	99
Raptor+MSO+28% N	5 oz+2 pt+2 qt	0	99	99
Select+COC	8 oz+1%	0	99	99
Butyrac 200	3 pt	5	98	99
LSD (.05)		14	5	9

Table 15. Alfalfa burndown.

RCB; 2 reps
FALL: 9/20/02
Soil: Clay loam; 2.7% OM; 6.3 pH

ALFZ=Alfalfa
FXTL=Green foxtail
BDLF=Kochia

COMMENTS: Full alfalfa regrowth 3 to 6 inches. Stinger, 2,4-D ester & Clarity, Roundup UltraMax (1.6 qt) and RT Master provided 85 to 99% control. 2,4-D was not effective. Weed control reflects lack of alfalfa stand (check 97 and 99% control) rather than implying residual effects from treatments.

			% Control		
Treatment		*Rate/A*	*ALFZ 6/25/03*	*FXTL 6/25/03*	*BDLF 6/25/03*
	Check	----	0	97	99
FALL					
	2,4-D amine	1 qt	10	97	99
	2,4-D ester	1 qt	35	65	55
	Roundup UltraMax+AMS	.8 qt+2 lb	70	45	40
	Roundup UltraMax+AMS	1.6 qt+2 lb	88	50	40
	RT Master+AMS	2 qt+2 lb	86	30	20
	Roundup UltraMax+ 2,4-D ester+AMS	.8 qt+ 1 pt+2 lb	69	60	35
	Roundup UltraMax+ 2,4-D amine+AMS	.8 qt+ 1 pt+2 lb	68	65	40
	Curtail	2 pt	64	55	40
	Stinger	.75 pt	99	10	15
	2,4-D ester+Clarity	1 qt+6 oz	85	25	30
	LSD (.05)		19	41	27

Fertilizer and Soil Test Effects on Soybean

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Soil testing research has shown that knowledge of soil test levels can improve the profitability of fertilizer use. Profits increase if more fertilizer is used when soil test levels are low and little or no fertilizer is used when test levels are high. Frequently, however, the major nutrients (NPK) and sometimes zinc and sulfur are applied without a current soil test.

This experiment was initiated to demonstrate the long-term effects of applying phosphorus, potassium, zinc and sulfur regardless of soil test. The intent is to continue the experiment on the same location at the Highmore experiment station for a number of years. The planned rotation is soybean and wheat.

The objective is to demonstrate soil testing's ability to predict crop response to fertilizer and fertilizer influence on soil tests.

Materials and Methods

The experiment was established on a Glenham loam soil series on the Highmore Experiment Station in 1997. Glenham soils are deep, well drained soils formed in friable glacial till. Fertilizer treatments consisted of a check where no fertilizer was applied, 50 lb/a nitrogen and 50 lb/a nitrogen plus either 35 lb phosphorus (0-46-0), 50 lb/a potassium (0-0-60), 25 lb sulfur (21-0-0-24), or 5 lb Zn/a (ZnSO4 – 35%). The nitrogen source used was urea except in the sulfur treatment where the nitrogen was applied as part of the ammonium sulfate.

Dry conditions in 2002 resulted in low wheat yields and a very high carryover nitrate soil test of 105 lb/a for 2003. Fertilizer was broadcast onto the untilled wheat residue from 2002 on April 29 and incorporated by disking. SD 1091 RR soybeans were planted in mid-May.

Results and Discussion

Soil analysis on samples taken on October 28, 2002, is reported in Table 1. The 25 lb of nitrogen applied to the previous wheat crop did not increase soil residual nitrate over the check where no nitrogen had been applied since the start of the study in 1997.

No nitrogen would have been recommended for soybeans. For this study, however, 50 lb of N had been applied to determine its influence on soybean yield.

The sulfur soil test was high, and no sulfur would have been recommended. Previous applications of sulfur increased sulfur soil test by 42 lb/a. The 25 lb of phosphorus and 50 lbs of potassium applied each year since 1997 increased phosphorus soil test from 9 ppm in the check to 23 ppm and potassium soil test from 386 to 523 ppm.

The phosphorus test (9 ppm) was in the medium range and 10 lb of phosphorus fertilizer would have been recommended for a 40-bu soybean yield goal. The potassium soil test was very high and none would have been recommended.

The zinc soil test was raised from 0.75 ppm to 6.20 ppm by the annual addition of 5 lb of zinc for 5 years. The check zinc soil test (0.75 ppm) was in the high soil test range. No zinc would have been recommended regardless of soil test since soybeans are usually not responsive to zinc.

Soybean yields are reported in Table 2. Yields were severely limited by drought conditions and high temperatures during the last half of the growing season. Compounding dry conditions was the lack of subsoil moisture due to the very dry summer and fall of 2002. Soybean yields averaged about 7 bu/a for all treatments and were not statistically different. Yields were variable due to extreme drought conditions.

This site will be rotated back to wheat in 2004. Similar fertilizer treatments (N rate will change) will be applied to the same plots. Yields and soil tests from the previous years of this study can be found in the 1997 - 2002 Highmore annual reports or in the 1997 - 2002 SDSU Plant Science Department Soil/Water Science Research Annual Report, TB 99.

This research was sponsored by the South Dakota Cooperative Extension Service, the SDSU plant Science Department, and the SDSU Soil Testing Lab.

Table 1. Soil test levels, Highmore, 2003.

Soil test[1]	*Check*	*Treated*
Nitrate-N, lb/a		
0 – 6 in.	51	51
6 in. – 24 in.	53	56
Sulfate-S, lb/a		
0 – 6 in.	16	28
6 in. – 24 in.	36	66
Phosphorus, ppm	9	23
Potassium, ppm	386	523
Zinc, ppm	0.75	6.20
OM, %	2.8	
pH	6.7	
Salts, mmho/cm	.06	

[1] Sampled 10/28/02

Table 2. Soybean yield, fertilizer trial, Highmore, 2003.

Fertilizer Treatment lb/a	*Soybean Yield bu/a*
1. none	9
2. 50 N	7
3. 50 N + 35 phosphorus	7
4. 50 N + 50 potassium	6
5. 50 N + 25 sulfur	8
6. 50 N + 5 zinc	6
Pr. > F	0.29
CV %	29.3
LSD	NS

Aphid Infestations, Barley Yellow Dwarf Incidence, Plant Growth, and Yield of Winter Wheat in Relation to Planting Date and Seed Treatment

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Summary

1. Winter wheat was planted over four dates in 2002 (Aug. 29, Sep. 9, 20, and 30), and seed in each planting was treated with either Gaucho XT (insecticide + fungicide) or Raxil MD (fungicide only). Cereal-aphid infestations, incidence of barley yellow dwarf, and plant growth and yield were measured.

2. Hand-harvest data revealed that yield and yield components gradually increased for the first three planting dates, with a maximum for the Sep. 20 planting. A dramatic decrease in total heads per foot of row, total seeds per foot of row, and yield (but not individual kernel weight) was observed for the last planting (Sep. 30). Seed treatment had no effect upon yield and yield components. Combine harvest data revealed that yields and test weights, 51.9 bu/a and 59.6 lb/bu, respectively, did not differ among plantings of winter wheat across the first two planting dates or by seed treatment.

3. Measurements of the ratio of wheat canopy leaf area to the ground area upon which the wheat was grown (leaf area index – LAI) revealed that seed treatment had no effect upon leaf area index. Leaf area index gradually increased for the first three planting dates with a maximum reached on the Sep. 20 planting date. A dramatic decrease in leaf area index was observed in plots planted on the last date (Sep. 30). LAI (measured May 29) was significantly correlated with hand-harvest grain yield (measured July 14).
4. Cereal aphid infestations in fall 2002 were low (≤1.5 aphid per 20 tillers) across all plantings and seed treatments. These low infestations would not have impacted yield directly. Counts of cereal aphids in the spring of 2003 were low overall, but greater in plots treated with Raxil MD.

5. Incidence of barley yellow dwarf varied with planting date but not seed treatment. Incidence was least for the Sep. 30 planting (3.6%) and greatest in the Aug. 29 (11.6%) and Sep. 9 (12.3%) plantings. Cereal aphid counts at 20 and 40 d after planting were correlated with BYD incidence.

Our previous research has shown that delayed planting of winter wheat can lower cereal aphid numbers and the incidence of barley yellow dwarf (BYD) disease in South Dakota. The virus that causes BYD is transmitted by cereal aphids. Insecticides can also limit cereal aphid infestations and barley yellow dwarf incidence in wheat.

Treating seed is one method of delivering insecticide for aphid control. However, the benefit of using insecticide-treated seed may decline with later plantings of winter wheat as cereal aphid pressure declines. Thus, our objective was to compare cereal-aphid infestations, barley yellow dwarf incidence, and the growth and yield of winter wheat at various planting dates of wheat with and without insecticide-treated seed.

Materials and Methods

Winter Wheat

Winter wheat ('Crimson') was sown at four planting dates (Aug. 29, Sep. 9, Sep. 20, Sep. 30, 2002) into eight 12-by-60 ft^2 plots at Highmore. This set of eight

plots was replicated four times for a total of 32 plots. For each planting date, half of the number of plots were planted with seed treated with Gaucho XT (insecticide + fungicide) and half with seed treated with Raxil MD (fungicide). Seed was sown about 1 in deep using a Kirschman drill in furrows about 12 in apart. Fertilizer was applied just before (46-0-0 (NPK), 100 lb ac^{-1}) and at planting (14-36-13, 52 lb ac^{-1}).

Insect Sampling
We sampled 20 tillers (four groups of five plants) per plot for cereal aphids at approximately 20 and 40 d after each planting in each plot. We also sampled 20 tillers per plot for aphids in May 2003.

Barley Yellow Dwarf
We sampled for barley yellow dwarf (BYD) in wheat during late spring by walking through plots in a W-pattern and classifying about 300 randomly selected plants per plot as either having or not having visual BYD symptoms (flag leaves with yellow or purple tips but base remaining green). The incidence was expressed as a percentage of plants infected per plot. Data were arcsine-transformed and subjected to a factorial analysis of variance (PROC ANOVA, SAS).

Leaf Area Measurements
The ratio of wheat-leaf area to the ground area upon which the wheat was grown was measured using the leaf-area index (LAI) feature of the LAI-2000 crop canopy analyzer. Data were analyzed for statistical significance using GLM and CORR procedures in SAS software.

Yield Data
Plots were harvested by hand (July 14) and with a Massey-Ferguson 8XP combine (July 15). Hand-harvested yield was derived by taking three 1-foot sections of row per plot. Plants were cut at ground level with scissors. Leaves, stems, and grain heads were placed into paper bags and dried to ambient humidity in a greenhouse. Number of heads and seeds were measured. Total grain weight and 100-kernel weight were measured after the grain was manually separated from the chaff. Data were analyzed for statistical significance using GLM and CORR procedures in SAS software. Combine yield was assessed for the first two planting dates, but wheat was inadvertently harvested without yield samples from the last two planting dates. Combine yield was taken from two 6-ft wide combine strips within each plot; exact measurements of strips were made immediately after each combine pass. Moisture was measured for each combine strip sample, and yield data were adjusted to the equivalent weight at 13.5 percent moisture. Test weight and moisture content of combined grain were measured using a Dickey-John seed tester. Combine yield data were subjected to a factorial analysis of variance using SAS software.

Results and Discussion
Insects
Cereal aphid infestations in fall 2002 were low (≤1.5 aphid per 20 tillers) across all plantings and seed treatments. These low infestations would not have directly impacted growth and yield of wheat.

Counts of cereal aphids in the spring of 2003 were greater in plots treated with Raxil MD (19.9 ± 3.5 aphids per 20 tillers) than in Gaucho XT plots (5.3 ± 1.2 aphids per 20 tillers), but aphid counts did not vary by planting date. Spring aphid counts were also low and would not have directly impacted growth and yield of wheat.

Barley Yellow Dwarf
Incidence of barley yellow dwarf varied with planting date but not seed treatment. Incidence was least in the Sep. 30 planting (3.6%) and greatest in the Aug. 29 (11.6%) and Sep. 9 (12.3%) plantings. BYD incidence in the Sep. 20 planting (9.3%) was intermediate to that in other plantings, but did not differ statistically from incidence in the early planting. Cereal aphid counts at 20 and 40 d after planting were correlated with BYD incidence (r_P = 0.51 and r_P = 0.57, respectively, Table 1). Spring aphid counts were not correlated to BYD incidence.

Leaf Area
Seed treatment had no effect upon leaf area index (3.11 units for the Gaucho XT treatment; 3.12 units for the control treatment). Date of planting had significant (P=0.003) effects upon leaf area index (Table 2). There were no interactions between seed treatment and date of planting. The data presented in Table 2 suggest that leaf area index gradually increased for the first three planting dates with a maximum reached on the Sep. 20 date. A dramatic decrease in leaf area index was observed in plots planted on the last date (Sep.

30). A plot of hand-harvest grain yield (as measured on July 14) as a function of LAI (as measured on May 29) across all planting dates and seed treatments reveals a relatively close correlation between these two parameters (Fig 1).

Yield

Statistical analysis of hand-harvest data revealed that seed treatment had no effect upon yield and yield components. Date of planting had significant effects upon the number of seeds per foot of row (P=0.002), individual kernel weight (P=0.0001), and total yield per foot of row (P=0.003). There were no significant interactions between insecticide seed treatment and date of planting treatment for these dependent variables.

The data in Table 2 suggest that yield and yield components gradually increased for the first three planting dates with a maximum reached for the Sep. 20 planting. Dramatic decreases in total heads per foot of row, total seeds per foot of row, and yield (but not individual kernel weight) were observed in plots planted on the last planting date (Sep. 30).

Results from combine-harvest samples showed no statistical differences in yield (51.9 bu/a) or test weight (59.6 lb/bu) due to planting date or seed treatment for the first two plantings.

Acknowledgments

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Table 1. Cereal-aphid infestations and barley yellow dwarf incidence in winter wheat at the Central Research Station, Highmore, S.D.

	Number of aphids per 20 tillers		
Planting date (2002)	*20 d after planting*	*40 d after planting*	*BYD incidence, May 2003*
Aug. 29	0.1 ± 0.1	0.3 ± 0.2	11.6 ± 0.7
Sep. 9	1.5 ± 0.6	0.8 ± 0.4	12.5 ± 1.2
Sep. 20	0.6 ± 0.3	0.3 ± 0.3	9.4 ± 0.8
Sep. 30	0.0	0.0	3.5 ± 0.3

Values represent mean ± standard error for four replicates within winter wheat date of planting treatments and across seed treatments.

Table 2. Yield results from winter wheat hand harvest (July 14, 2003) at the Central Research Station, Highmore, S.D.

Planting	*Crop canopy* [a] *(LAI)*	*Total heads* ---- *(per foot of row)* ----	*Total seeds*	*Kernel weight (g per seed)*	*Yield (g foot^{-1})*
Aug. 29	3.1 ± 0.1 [b]	63 ± 4	1392 ± 67	0.0231 ± 0.0003	32.1 ± 1.6
Sep. 9	3.2 ± 0.2	62 ± 2	1428 ± 60	0.0241 ± 0.0004	34.3 ± 1.5
Sep. 20	3.6 ± 0.3	67 ± 3	1501 ± 62	0.0251 ± 0.0002	37.6 ± 1.4
Sep. 30	2.5 ± 0.3	59 ± 3	1203 ± 62	0.0251 ± 0.0003	30.3 ± 1.7

[a] Crop canopy characteristics were measured with a LAI-2000 leaf area index (LAI) meter on May 29, 2003, at the late boot – early head crop development stage.

[b] Values represent average ± standard error for four replicate samples within winter wheat date of planting treatments and across insecticide treatments.

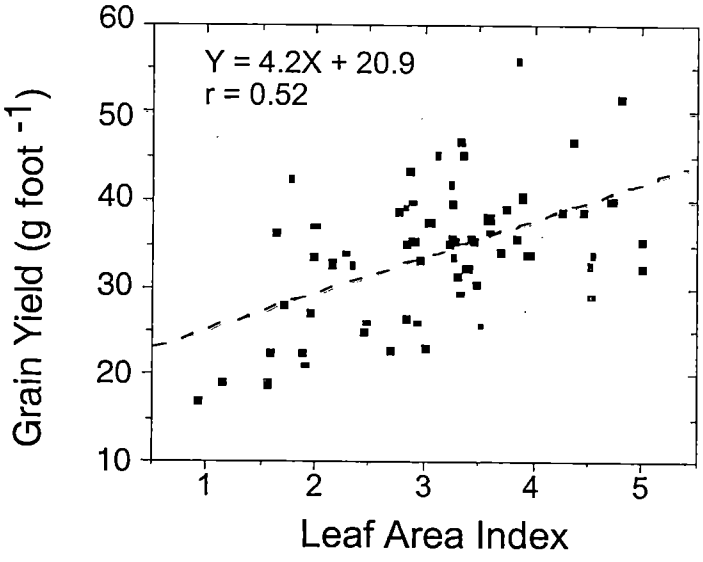

Figure 1. Plot of the LAI vs. hand-harvest grain yield data. The dashed line is a graphical representation of the linear equation Y = 4.2X + 20.9. The correlation coefficient was 0.52.

Small Grain Variety Performance Trials

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This reports the 2003 Highmore Research Farm performance trials for hard red spring wheat, spring oat, spring barley, and winter wheat varieties conducted by the South Dakota State University Crop Performance Testing (CPT) program. These spring grain trials were seeded and harvested by L. Hall, research associate, SDSU Oat Breeding Project, and Amir Ibrahim, SDSU Winter Wheat Breeding Project leader.

Experimental Procedures

Four replicates of each entry were seeded into plots measuring 5 by 20 feet and later cut back to a uniform dimension prior to harvest. Either a cone-drill seeder (spring grain trials) or a no-till seeder (winter wheat trial) with a spinner directing seed to seven seed tubes spaced on 7-inch rows was used to seed the trials. The pure-live-seed for each entry was determined and all plots were seeded at 1.2 million PLS seeds per acre. Spring trials were seeded on April 10, 2003, into a Trent silt loam previously cropped to soybeans. The winter wheat trial was seeded on September 19, 2002.

Measurements of Performance

Yield (bu/a) and bushel weight (lb) values are an average of four replicates. Yields are adjusted to 13.5% grain moisture (dry matter basis) and bushel weights of 60 lb (wheat), 32 lb (oat), or 48 lb (barley). Grain protein values are obtained from one sample per entry. Yield, bushel weight, and grain protein values are reported for year 2003 and for 3 years (2001-2003).

In each yield column, all entries within one least significant difference (LSD) of the highest yielding entry are in the top yield group and are indicated by a + sign. You can determine if two entries differ in yield by subtracting their yield values and comparing the difference to the LSD value. If the yield difference is less than or equal to the LSD value the two entries do not differ in yield. In contrast, if the yield difference between two entries is greater than the LSD value, then the two entries differ significantly in yield. If the yield values within a column do not differ significantly, "not significant" (NS) is given in place of an LSD value. In such cases, all the entres in the test would be in the top yield group because they do not differ significantly in yield.

Performance Results

Hard red spring (HRS) wheat yields in 2003 (Table 1) averaged 28 bu/a at Highmore, 60 bu/a at Spink Co., and 53 bu/a at Selby. There were six entries in the top-yield-group (TYG) at Highmore, five at Spink Co., and seven at Selby in 2003. There were 11 entries at Spink Co. and 12 at Selby in the TYG for the longer 3-year term. On a statewide basis, the 2003 yield averages 45 bu/a while the 3-year yield averaged 42 bu/a. The statewide average for protein was 14.5%, bushel weight was 60 lb, and plant height was 32 inches. Statewide, ten entries were above average in protein, ten entries were above average in bushel weight, and nine entries were above average in plant height.

On a statewide basis, as indicated by their top yield group percentages (right two columns in Table 1), the top performing entries for 2003 were Alsen, Briggs, Norpro, Reeder, Russ, and eight experimental lines.

The top yield percentage indicates the percent of test locations where an entry was in the top yield group across all of the locations the entry was tested. For the longer 3-year term, the top performing varieties included all the varieties tested for 3 years except the old check variety Chris.

The top yield group varieties for year 2003 were the experimental line SD3623 at 75%, the varieties Alsen and Forge at 63%, and the varieties Reeder, Russ, and the experimental line BZ998-447WP at 50%. Over the 3-year term, the top yield group varieties were Forge, Reeder, Russ, and the experimental line SD3546 at 100%, the varieties Oxen, Parshall, and experimental line SD3540 at 83%, the varieties Alsen, Briggs, Ingot, Norpro, and Walworth at 63%, and the variety Hanna at 50%. Ingot has consistently exhibited the highest statewide bushel weight in recent years.

Oat yields in 2003 (Table 2) averaged 38 bu/a at Highmore and 101 bu/a at Selby. There were six entries in the top-yield-group (TYG) at Highmore and six entries at Selby in 2003. There was only one entry, SD92024, in the TYG at Selby for the 3-year term. On a statewide basis, the 2003 yield averages 83 bu/a while the 3-year yield averaged 80 bu/a. In addition, the state-wide average for protein was 17.0%, bushel weight was 38 lb, and plant height was 35 inches. Statewide, seven entries were above average in protein, four entries (Hytest, Buff, Paul, and SD580-hulless) were above average in bushel weight, and seven entries were above average in plant height.

On a statewide basis, as indicated by their top yield group percentages (right two columns in Table 2), the top yield group varieties for year 2003 were the experimental lines SD366 at 88%, SD96024 at 75%, SD744 at 63%, and the varieties Don, HiFi, and Jerry at 50%. Over the 3-year term, the top yield group varieties were the experimental line SD96024 at 100%, the variety Jerry at 80%, and the varieties Don, Loyal, and Reeves at 60%. NOTE: This year the variety HiFi exhibited the lowest test weight among the varieties or experimental lines tested.

Barley yields in 2003 (Table 3) averaged 45 bu/a at Highmore and 101 bu/a at Selby. There were two entries in the top-yield-group (TYG) at Highmore and three entries at Selby in 2001. All entries tested for 3 years were in the TYG at Selby because yield values were not significantly different.

On a statewide basis, the 2003 yield averages 68 bu/a while the 3-year yield averaged 63 bu/a. In addition, the statewide average for protein was 12.9%, bushel weight was 49 lb, and plant height was 30 inches. Statewide, four entries (Conlon, Drummond, Robust, and Valier) were above average in protein, three entries (the two-row varieties Conlon, Haxby, and Valier) were above average in bushel weight, and three entries (Drummond, Excel, and Robust) were above average in plant height.

On a statewide basis, as indicated by their top yield group percentages (right two columns in Table 3), the top yield group varieties for year 2003 were the two-row variety Haxby and experimental line MT960228 at 75% followed by the two-row barley Valier at 63%. Over 3 years, the top yield group varieties were Lacey at 100%, Robust at 80%, and Conlon, Drummond and Excel at 60%.

Hard red winter (HRW) wheat yields in 2003 (Table 4) averaged 53 bu/a at Highmore, 36 bu/a at Pierre, and 52 bu/a at Hayes. There were 21 entries at Highmore, all the entries at Pierre, and ten entries at Hayes in the top-yield-group (TYG) in 2003. There were nine entries at Highmore in the TYG for the 3-year term.

On a statewide basis, the 2003 yield average was 56 bu/a, the average for protein was 13.5%, and the average for bushel weight was 60 lb. Numerically, the higher yielding entries included SD97W604 at 61 bu/a, Jagalene, Millennium, and SD97W609 at 60 bu/a, Wahoo at 59 bu/a, Expedition, Wesley, SD97059-2, SD97380-2, SD97538, and SD98102 at 58 bu/a, and Arapahoe, Falcon, SD97049, and SD991015 at 57 bu/a. Statewide, 11 entries were above average in protein and six entries were above average in bushel weight.

This research was sponsored and financial support was provided by the SDSU Agricultural Experiment Station, the SDSU Plant Science Department, and the South Dakota Crop Performance Testing Program.

Table 1. HRS wheat variety test averages - Highmore, Spink County, Selby, and statewide.

Variety	Highmore '03	Highmore 3-yr	Spink Co. '03	Spink Co. 3-yr	Selby '03	Selby 3-yr	State wide 2003 Prot. pct	State wide 2003 Bu. Wt. lb	State wide 2003 Ht. in.	State wide Yield - bu/a - '03	State wide Yield - bu/a - 3-yr	State wide Top Yield Group -- % -- '03	State wide Top Yield Group -- % -- 3-yr
	bu/a												
Alsen	30+	.	65+	46+	45	37	15.2	61	31	45	41	63	67
Briggs	28	.	60	46+	54	43+	14.5	61	33	46	43	38	67
Chris,CK	21	.	49	36	37	32	15.2	58	35	36	33	0	0
Dapps	26	.	53	.	50	.	15.6	60	34	42	.	0	.
Forge	30+	.	60	47+	60+	45+	13.4	61	32	48	45	63	100
Hanna	28	.	57	45+	45	38	14.2	60	35	43	41	13	50
Ingot	28	.	54	43	58	43+	14.6	62	35	44	42	25	67
Knudson	22	.	64	48+	55	44+	14.6	61	29	44	43	25	33
Norpro	27	.	57	48+	54	45+	14.2	58	28	44	43	25	67
Oklee	25	.	58	.	45	.	15.1	61	30	41	.	0	.
Oxen	30+	.	65+	50+	46	40+	14.7	59	29	44	42	38	83
Parshall	27	.	55	43	62+	43+	15.0	60	34	45	42	25	83
Reeder	28	.	60	49+	61+	47+	14.7	60	31	46	44	50	100
Russ	35+	.	63	48+	60+	45+	14.1	60	33	48	44	50	100
Walworth	29	.	58	43	59+	44+	14.6	60	31	46	42	38	67
Experimental lines:													
SD 3540	28	.	65+	51+	52	43+	14.2	61	32	46	44	25	83
SD 3546	28	.	59	50+	57	46+	14.5	61	32	45	44	13	100
SD 3618	28	.	64	.	59+	.	14.3	60	32	46	.	25	.
SD 3623	32+	.	69+	.	63+	.	13.9	61	35	50	.	75	.
SD 3635	31+	.	63	.	57	.	13.4	60	33	46	.	13	.
SD 3641	28	.	55	.	55	.	14.3	60	30	44	.	25	.
SD 3720	25	.	69+	.	50	.	14.1	61	32	45	.	38	.
BZ998-447WP	27	.	63	.	41	.	14.5	57	31	45	.	50	.
MN97803A	26	.	59	.	54	.	14.9	60	31	44	.	13	.
ND 741	33+	.	63	.	58	.	14.9	60	32	48	.	38	.
Test avg.:	28	.	60	46	53	42	14.5	60	32	45	42	.	.
LSD (5%):	5	.	5	6	5	7							
CV (%):	11	.	5	8	6	8							

+ In top-yield group - see yield comments. $ Lsd(5%) - see yield comments.

Table 2. Oat variety test averages - Highmore, Selby, and statewide.

Variety	Highmore '03	Highmore 3-yr	Selby '03	Selby 3-yr	State wide 2003 Prot. %	State wide 2003 Bu. Wt. lb	State wide 2003 Ht. in.	State wide Yield '03 bu/a	State wide Yield 3-yr bu/a	State wide Top Yield Group '03 %	State wide Top Yield Group 3yr %
	bu/a		bu/a								
Standard varieties:											
Don	28	.	119+	84	15.9	36	30	91	86	50	60
HiFi	37	.	106	.	15.2	35	34	87	.	50	.
Hytest	44+	.	90	72	18.4	40	37	76	74	13	20
Jerry	38	.	114+	87	16.4	38	35	93	88	50	80
Loyal	25	.	95	88	16.6	36	36	84	87	25	60
Morton	39	.	108	.	16.3	36	36	86	.	0	.
Reeves	41+	.	103	78	17.7	38	36	84	82	13	60
Hulless varieties:											
Buff	49+	.	91	72	17.8	43	32	73	69	13	0
Paul	30	.	55	44	19.4	41	34	52	49	0	0
Experimental lines:											
SD 366	41+	.	115+	.	16.5	38	36	96	.	88	.
SD 580 Hls	32	.	58	.	19.1	43	36	57	.	0	.
SD 731	40	.	114+	.	17.0	38	34	85	.	38	.
SD 744	39	.	120+	.	15.9	37	33	94	.	63	.
SD 813	44+	.	107	.	17.1	38	30	82	.	25	.
SD 915	39	.	106	.	17.4	37	38	89	.	25	.
SD96024	44+	.	122+	105+	15.8	36	35	99	98	75	100
Test avg.:	38	.	101	79	17.0	38	35	83	80		
LSD (5%):	8	.	8	15							
CV (%):	15	.	6	8							

+ In top-yield group - seed yield comments. $ Lsd(5%) - see yield comments.

Table 3. Barley variety test averages - Highmore, Selby, and statewide.

					State wide						
					2003					Top yield Group	
	Highmore		Selby		Prot.	Bu. Wt.	Ht.	Yield bu/a		%	
Variety	'03	3-yr	'03	3-yr	%	lb	in.	'03	3-yr	'03	3-yr
	bu/a										
Conlon	39	.	95	72+	13.2	50	29	63	60	38	60
Drummond	46	.	100	76+	13.3	48	32	64	61	0	60
Excel	46	.	108+	79+	12.2	47	31	70	65	38	60
Haxby	54+	.	111+	.	12.6	52	28	74	.	75	.
Lacey	46	.	103	80+	12.8	49	30	69	65	25	100
Robust	46	.	81	68+	13.4	48	32	64	60	25	80
Valier	47+	.	102	.	14.0	50	28	71	.	63	.
MT960228	46	.	111+	.	12.6	49	28	76	.	75	.
ND16301	38	.	100	.	12.4	47	29	65	.	13	.
Test avg.:	45	.	101	75	12.9	49	30	68	63		
LSD (5%):	7	.	6	NS							
CV (%:	11	.	4	10							

+ In top-yield group - seed yield comments. $ Lsd(5%) - see yield comments.
NS- Differences within a column are not significant.

Table 4. HRW wheat variety test averages - three locations and statewide.

	Highmore		Pierre	Hayes	----- Statewide 2003 ------		
	'03	3-yr	'03	'03	Yield b/a	TWT lb	Prot.# pct
	----------bu/a ----------						
AP502 CL	40	.	36+	60+	53	57	13.4
Alliance	50	38	37+	54	55	58	13.2
Arapahoe	57+	43+	38+	57+	57	59	13.7
CDC Falcon	53+	43+	36+	51	57	59	13.5
Crimson	48	37	42+	38	54	61	14.4
Expedition	51	35	37+	58+	58	60	13.5
Harding	54+	38	38+	46	55	60	14.1
Jagalene	58+	.	33+	62+	60	61	13.3
Jerry	57+	.	36+	47	54	60	13.8
Millennium	57+	41+	38+	63+	60	61	13.3
Nekota	49	35	34+	52	55	60	12.9
NuPlains~W	50	37	38+	50	53	61	13.8
Ransom	48	38	33+	45	50	59	14.1
Tandem	52+	39+	35+	49	54	61	13.9
Trego~W	52+	35	33+	55	56	60	13.1
Wahoo	57+	42+	37+	54	59	58	13.4
Wesley	55+	38	36+	62+	58	59	14.0
Experimental lines:							
SD92107-3	53+	39+	36+	44	53	60	14.0
SD92107-5	55+	40+	31+	47	55	60	14.4
SD97049	56+	37	31+	50	57	59	13.0
SD97059-2	54+	.	36+	44	58	59	13.6
SD97088	54+	.	34+	48	56	60	13.5
SD97250	53+	39+	34+	51	54	59	13.3
SD97380-2	56+	.	39+	57+	58	59	13.3
SD97538	51	.	36+	56+	58	59	13.6
SD97W604	51	34	36+	64+	61	61	13.5
SD97W609	58+	38+	39+	57+	60	60	13.1
SD97W671-1~W	55+	.	36+	44	56	60	13.0
SD98102	54+	.	36+	47	58	60	13.2
SD99W015	54+	.	37+	54	57	59	13.3
Test avg.:	53	38	36	52	56	60	13.5
LSD (5%) :	6	5	NS	8	.	.	.
CV (%) :	9	13	12	11	.	.	.

+ In top yield group. ~W- White variety. # Seven locations.
NS - differences within a column are not significant.

Suppression of Alternaria Blight of Safflower with Foliar Fungicides

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Safflower is a relatively pest-free crop under a semi-arid production environment. The crop has shown great promise as a rotational alternative to wheat in western South Dakota. It has good yield potential, and crops with high test weight qualify for a bonus for oil content.

However, as moisture and humidity increase, Alternaria blight, caused by the fungus *Alternaria carthami* can become a serious disease. Alternaria blight typically appears late in the season and may lead to premature death of the crop. Test weight of the seed can be reduced and infections of the head can lead to discoloration of the oil. In 1997 and 1998, Alternaria blight was devastating, preventing the harvest of safflower fields near Wall and Kadoka. Since that time, diseases has been erratic across the state, but localized fields have sustained losses.

Materials and Methods

Trials were planted at a single location at the Highmore Research Farm. A widely planted birdseed cultivar, Finch, was used in the study. Finch was planted on April 14, treated on July 1, and harvested September 16, 2003.

Three of the most promising fungicide treatments, Quadris (azoxystrobin), Folicur (tebuconazole), and Dithane Rainshield (mancozeb), and an untreated check (Table 1) were evaluated in the study. Treatments were replicated four times. Plots were harvested and oil content was measured with NMR.

Results and Discussion

No treatments led to a significant increase in yield or oil content. Only Quadris led to a numerical increase in yield and test weight (Table 1). Quadris plots showed significantly better green leaf score than the other fungicide plots, but the score was not different from the untreated check.

In previous years, when disease pressure has been high, both Folicur and Quadris have produced significant increases in yield over the untreated. However, in 2003, disease developed late in the season and did not lead to extensive crop damage. Under the conditions of 2003, no treatment was profitable (Table 2).

Studies will be continued to determine the potential of fungicide use on safflower for the control of Alternaria blight. When significant yield losses have occurred in earlier years, fungicides have typically produced improved yield and grain quality. Montana received a Section 18 from EPA for Quadris on safflower to control this disease and is expected to pursue the same special label in 2004. Studies will be continued in 2004 to better determine rates of products to apply and the crop stage that offers the most favorable disease control and yield result for the dollar input.

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Table 1. Yield and test weight response of safflower to various fungicide treatments.

	Rate[a] (product/A)	*Whole plot disease rating (0-9)[b]*	*Yield (lb/A)*	*Oil Content (%)*
Untreated	n/a	6.0 a*	1573.2	39.5
Quadris	9 fl oz/A	5.7 a	1708.2	39.6
Folicur	4 fl oz/A	6.2 ab	1442.6	39.0
Dithane Rainshield	2 lb/A	6.9 a	1510.6	39.2
LSD (P=0.05)		0.6	NS	NS

a Full rate applied on July 1

b Whole plot rating of 0-9 where 0= no disease (fully green) and 9=completely necrotic

* Unlike letters are significantly different than one another at P0.05

Table 2. Economic benefit of fungicide treatment of safflower for suppression of Alternaria blight at Highmore, S.D., in 2003.

	Yield advantage (#/A)	*Economic yield benefit (loss)[a] ($/A)*	*Treatment cost[b] ($/A)*	*Net gain (loss) ($/A)*
Untreated	n/a	n/a	n/a	n/a
Quadris (9 fl oz/A)	135	$16.20	$23.50[c]	($7.30)
Folicur (4 fl oz/A)	(130.6)	($15.67)	$15.50	($31.17)
Dithane Rainshield (2 lb/A)	(62.6)	($7.51)	$12.50	($20.01)

a Assumes $0.12/# as the commodity price

b Cost includes product and $5.50 aerial application costs

c Reflects estimated cost of product

Corn Breeding

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Interest exists among organic farmers and conventional corn producers to grow open-pollinated corn for four main reasons: economic considerations, grain quality, self-reliance, and independence from agricultural conglomerates.

Commercial seed is costly, especially if it is genetically modified. Producers growing open-pollinated varieties (including synthetic populations) can produce their own seed from year to year, thus reducing their out-of-pocket costs for hybrid seed purchase.

Unrelated open-pollinated varieties may have the potential to produce varietal hybrids that have economic yields comparable to single-cross commercial hybrids, and varietal hybrids are simple and inexpensive for growers to produce. For organic producers, this is especially important because of the substantial premium received for their product. There is also a concern among some farmers about single company control over pesticides, seed, and marketing.

Many producers grow corn solely to feed to their own livestock. For them, nutrition is the most important factor. Most commercially available single-cross hybrids are developed solely for grain yield, with little attention given to nutritional qualities. Open-pollinated varieties can easily be improved for nutritional traits such as protein, oil, and trace elements.

We were awarded a grant through the North Central Regional SARE program to address these needs and to examine the economic and agronomic potential of open-pollinated corn varieties. This effort involves cooperation from producers, university Extension personnel, and public corn breeders in South Dakota, North Dakota, Iowa, Minnesota, and Wisconsin. Based on preliminary 2002 data, economic feasibility could be demonstrated. This year, the SDSU corn project once again evaluated, at three locations, three strip-trial replications of a NC+ hybrid check, a variety of choice, plus three open-pollinated populations adapted to our region (including one developed by our program). All entries were evaluated for yield, plant population, lodging, and overall agronomic health.

Preliminary yield data show that the Dekalb hybrid was superior at the Highmore Station in terms of yield and lodging. Yields for the check hybrid ranged from 40.52 bu/a to 46.47 bu/a, while the open-pollinated populations ranged from 14.08 bu/a to 37.94 bu/a.

These results are not inconsistent with prior findings. In terms of economic feasibility, however, open-pollinated populations when compared to commercial hybrids under high-stress and low-yield conditions may prove to be a profitable alternative. This is precisely why we chose the Highmore Research Station. The area is often a high-stress environment.

We expect to analyze the economic feasibility of growing these populations before identifying the most promising one. These populations are also being evaluated at Brookings and in several sites throughout North Dakota, Minnesota, Iowa, and Wisconsin. Differences in input costs and yield revenues will be calculated over all the locations during 2002 and 2003. Determinations will then be made as to whether any of these populations would be profitable for farmers to utilize in their operations.

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