2003 Annual Progress Report

Plant Science Pamphlet No. 15

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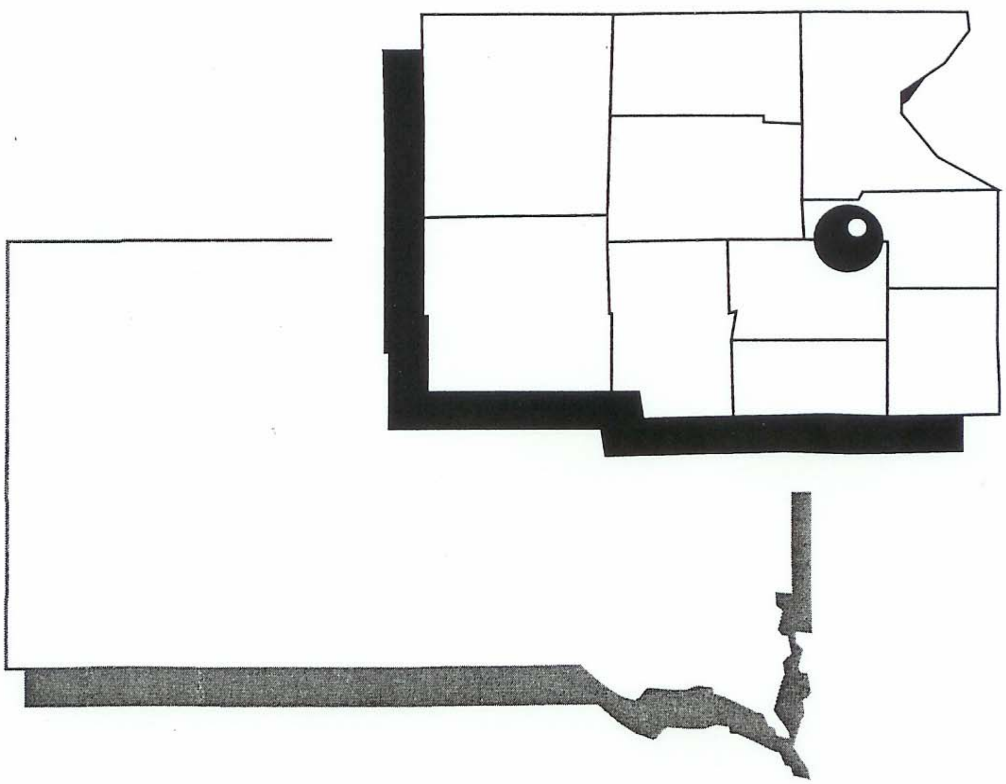
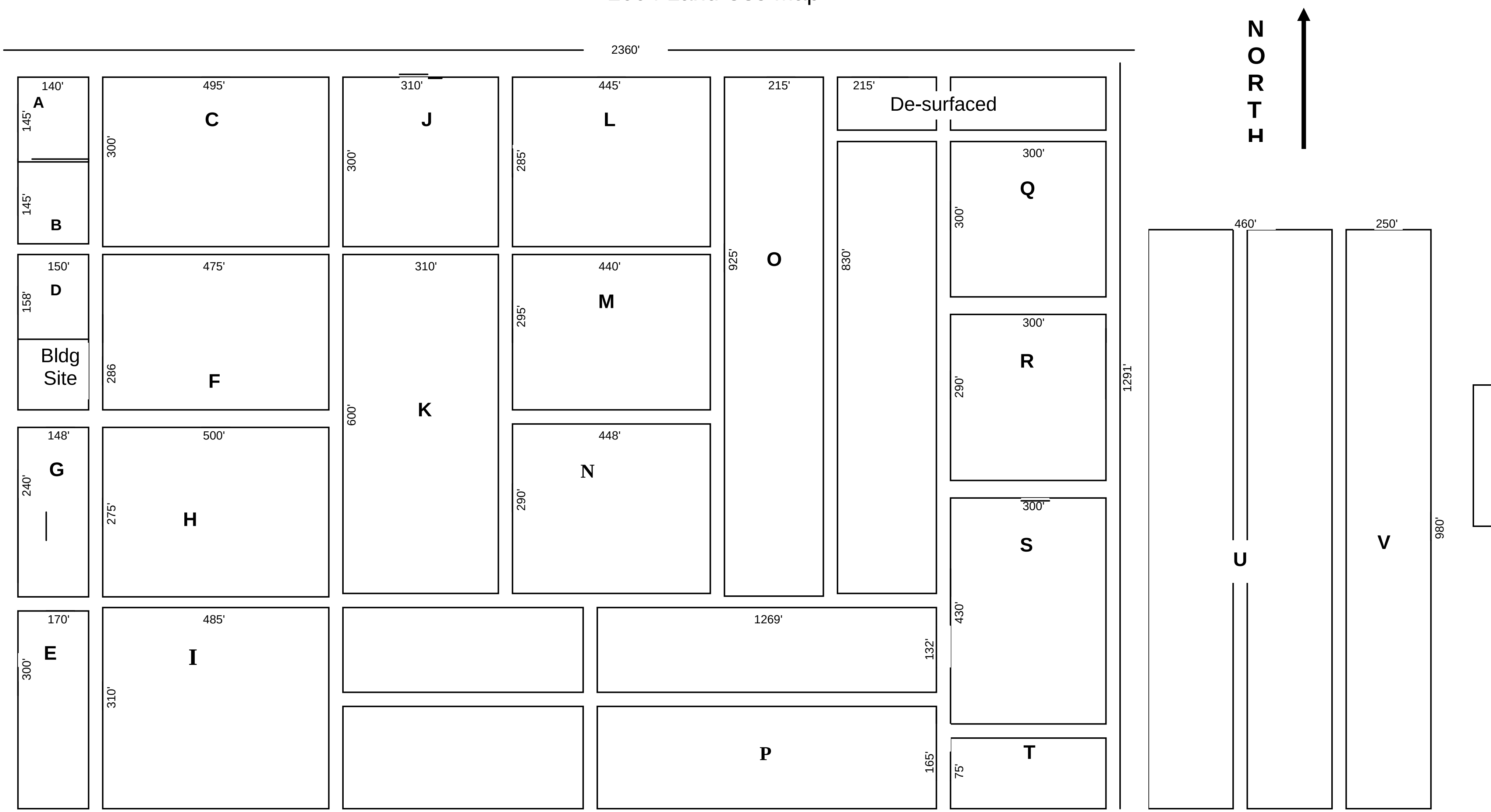


Northeast Research Station

Watertown, South Dakota

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

Northeast Research Station (Watertown)
2004 Land Use Map



Plot Acreage:

A	0.49	H	3.15	O	9.57	V	5.5
B	0.49	I	3.44	P	8.65		
C	3.40	J	2.13	Q	2.06		
D	0.54	K	4.27	R	2.00		
E	1.20	L	3.00	S	3.00		
F	3.12	M	3.00	T	0.51		
G	0.86	N	2.98	U	9.72		

Roadways: 25 feet wide
Acreage in farm: 86
Experimental Acreage: 74

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2004
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**SDSU Representatives

Annual Progress Report, 2003

Northeast Research Station
J. D. Smolik

The 2003 growing season was two weeks longer than average (Table 1). Growing season precipitation (April-October) was the fifth lowest in the 48-year history of the station and was more than 6 inches below average. Precipitation and temperatures were near normal in April and May, but precipitation for the remainder of the growing season was well below normal. Growing season precipitation over the past 48 years is summarized in Figure 1.

Crops were planted in a timely manner, and early season development was generally good. The moderate temperatures and near normal precipitation in the early portion of the growing season aided the small grains, and yields were good. Spring wheat yields were 22 bushels per acre above last year, oat yields were 28 bushels higher, and average barley yields were 30 bushels above last year. The dry conditions in June and July slowed development of foliar diseases and scab. Row crops were severely stressed by low precipitation. Average soybean yields were 27 bushels per acre lower than last year, and corn yields were 60 bushels lower. Alfalfa yields were about ¾ T/A higher than last year. Yields in the switchgrass trial were variable. Several of the cultivars were injured over winter and their yields were low, however, two South Dakota selections survived very well and their yields were only 0.4 T/A lower than last year.

Two tours were held in 2003. The summer tour included herbicide studies, small grain varieties and diseases, soil fertility studies, spring wheat breeding, corn and soybean insects, and alfalfa varieties. The fall tour emphasized row crops and included corn and soybean performance, soybean breeding, corn and soybean insects, herbicide studies, and plant disease updates. We thank the area Crop Improvement Associations for sponsoring the lunch following the summer tour. Thanks also to Orrin Korth and family for assistance with harvest operations. We also thank Jessie Schroeder for his assistance over the summer months.

Note: Much of the information in this report is based on ongoing studies and results should therefore be considered tentative. The use of trade names in this publication is not an endorsement of the product by either the Plant Science Department or the Agricultural Experiment Station.

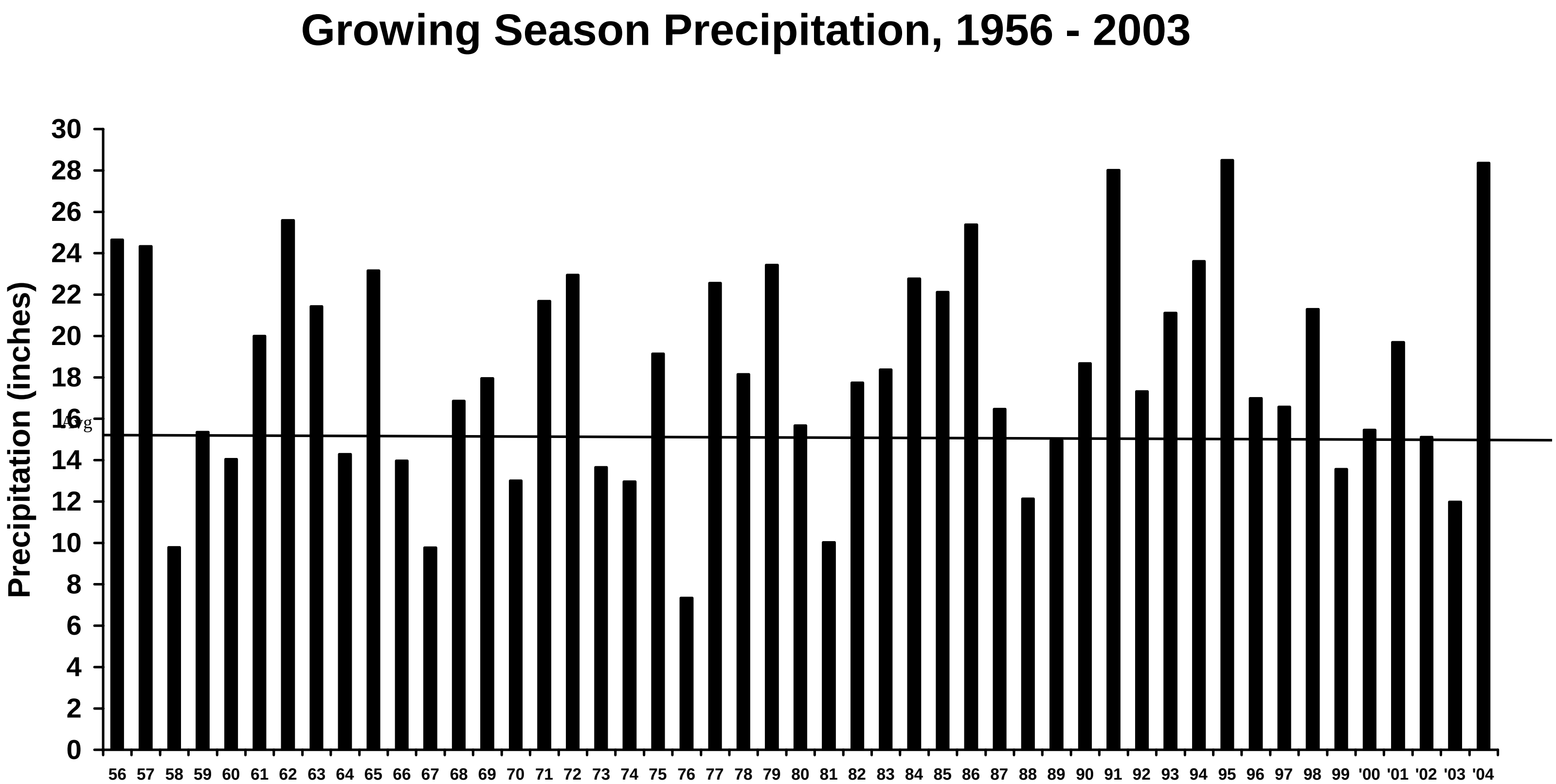
Special thanks to Lucinda Olson for her assistance in preparing this report.

Table 1. Growing Season Precipitation* (inches) 1956 - 2003

Year	April	May	June	July	Aug.	Sept.	Oct.	Total	Frost-Free Days
1956	1.80	2.88	6.56	4.02	6.25	0.70	2.44	24.65	125
1957	4.26	5.98	2.85	0.74	5.26	2.12	3.12	24.33	119
1958	1.41	1.49	2.65	2.68	0.57	0.81	0.18	9.79	116
1959	0.58	3.47	1.91	1.66	4.69	1.10	1.95	15.36	110
1960	1.53	3.84	4.05	0.79	1.03	1.30	1.50	14.04	123
1961	2.16	5.75	4.01	4.62	0.62	1.84	1.00	20.00	138
1962	1.39	5.48	3.98	10.36	1.89	1.39	1.11	25.60	143
1963	1.41	3.54	3.22	5.74	2.51	4.33	0.68	21.43	158
1964	2.39	1.07	3.62	2.01	4.22	0.93	0.04	14.28	92
1965	2.89	6.08	3.66	2.34	2.63	4.33	1.23	23.16	104
1966	1.49	0.77	1.88	2.19	4.59	1.53	1.52	13.97	138
1967	0.92	0.69	4.58	1.05	1.13	1.06	0.35	9.78	129
1968	3.04	2.15	3.18	2.39	1.53	2.56	2.00	16.85	132
1969	1.52	3.44	1.96	4.52	2.48	1.86	2.18	17.96	109
1970	2.00	1.98	1.07	2.29	1.00	1.66	2.01	13.01	148
1971	1.33	1.78	7.61	1.02	2.93	1.46	5.56	21.69	168
1972	1.90	7.73	2.92	6.35	2.57	0.11	1.37	22.95	172
1973	1.14	2.87	1.12	2.05	1.27	3.81	1.39	13.65	183
1974	1.22	3.37	1.45	2.09	3.70	0.22	0.91	12.96	141
1975	4.15	2.18	4.76	1.25	2.89	2.28	1.64	19.15	139
1976	1.10	1.26	1.49	0.51	0.79	1.62	0.57	7.34	144
1977	2.64	2.24	5.78	2.47	2.70	3.67	3.06	22.56	180
1978	3.38	5.15	2.26	2.08	2.43	2.32	0.53	18.15	178
1979	3.14	2.17	5.78	3.10	5.21	0.53	3.50	23.43	162
1980	0.43	3.09	4.97	1.96	3.82	0.72	0.68	15.67	150
1981	0.48	0.99	2.73	2.23	1.20	0.52	1.88	10.03	136
1982	0.35	5.50	1.37	4.05	0.64	2.73	3.11	17.75	175
1983	0.70	1.64	3.43	5.45	3.00	2.86	1.30	18.38	140
1984	2.88	1.66	7.45	1.85	3.09	1.14	4.69	22.76	147
1985	1.93	3.90	2.07	5.21	3.65	3.77	1.59	22.12	167
1986	5.55	4.64	3.62	4.14	3.11	4.19	0.13	25.38	159
1987	0.55	2.03	1.20	4.16	5.64	2.44	0.45	16.47	162
1988	0.59	2.76	0.69	0.86	4.03	2.98	0.22	12.13	144
1989	2.95	1.15	1.74	2.41	4.58	1.56	0.56	14.95	147
1990	1.04	2.26	5.13	3.73	2.58	2.16	1.78	18.68	136
1991	4.01	4.41	10.45	2.69	4.37	1.45	0.63	28.01	146
1992	0.91	1.45	7.95	3.08	0.75	3.17	0.02	17.33	154
1993	1.69	2.53	6.58	6.70	1.40	2.05	0.17	21.12	149
1994	2.48	2.12	6.11	4.65	3.67	2.47	2.11	23.61	162
1995	2.92	3.66	2.89	8.05	6.09	2.45	2.43	28.49	152
1996	0.18	4.20	1.36	3.43	2.92	2.34	2.57	17.00	154
1997	2.20	0.97	0.76	4.77	4.23	1.39	2.25	16.57	152
1998	0.69	4.18	2.96	1.93	3.94	0.02	7.58	21.30	167
1999	1.45	2.57	4.96	1.56	0.49	2.29	0.25	13.57	165
2000	1.20	2.35	3.29	4.29	0.88	1.00	2.45	15.46	157
2001	6.96	2.75	3.94	2.85	0.18	2.35	0.67	19.70	165
2002	1.75	1.67	2.57	2.48	4.44	0.75	1.45	15.11	135
2003	1.78	3.26	1.18	1.94	1.40	1.75	0.67	11.98	160
Avg:	1.97	2.98	3.60	3.17	2.80	1.91	1.67	18.12	146

*1960-1962, 1973-1976, 1978 and 1979 data obtained from Watertown FAA station.

Figure 1.



Growing Season Precipitation, 1956 - 2003
Precipitation (inches)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Avg
56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 '00 '01 '02 '03 '04

Grain Variety Performance Trials

R. G. Hall, K. K. Kirby, and L. Hall

This is a report of the 2003 NE Research Farm performance trials hard red spring wheat, oat, and barley varieties conducted by the South Dakota State University Crop Performance Testing (CPT) program. These trials were seeded and harvested by L. Hall, Research associate, SDSU Oat Breeding Project.

Experimental Procedures

Four replicates of each entry were seeded into plots measuring 5 X 20 feet and later cut back to a uniform dimension prior to harvest. A cone-drill seeder with seven seed tubes spaced on 7-inch rows was used. The pure-live-seed for each entry was determined and all plots were seeded at 1.2 million PLS seeds per acre. Plots were seeded on April 15, 2003 into a Trent silt loam previously cropped to soybeans.

Measurements of Performance

Yield (bu/a) and bushel weight (lbs.) values are an average of four replicates. Yields are adjusted to 13.5% grain moisture (dry matter basis) and bushel weights of 60 (wheat), 32 (oats), or 48 lbs. (barley). Grain protein values are obtained from one sample per entry and are determined by NIRS methods.

Performance Results

HRS Wheat: At the N.E. Research Farm, the top performing entries for 2003 were Alsen, Briggs, Norpro, Reeder, Russ, and eight experimental lines. For the longer 3-year term, the top performing varieties included all the varieties tested for three years except the old check variety Chris. On a state-wide basis (right two columns of table 1), 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 longer three 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: At the N.E. Research Farm, the top performing entries for 2003 was the variety Don and the experimental lines SD731, SD744, and SD96024. For the longer 3-year term, the top performing varieties included the varieties Don, Jerry, Loyal, Reeves and the experimental line SD96024. On a state-wide basis (right two columns of 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 longer three 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: At the N.E. Research Farm, the top performing entries for 2003 were the two-row varieties Conlon, Haxby, and the experimental line MT960228. For the longer 3-year term, the top performing varieties included the two-row variety Conlon and the six-row varieties Drummond and Lacey. On a state-wide basis (right two columns of 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 the longer three year term, the top yield group varieties were Lacey at 100%, Robust at 80%, and Conlon, Drummond and Excel at 60%. The two-row varieties, Conlon, Haxby, and Valier tended to have higher a bushel weight than the six-row varieties across South Dakota in 2003.

Table 1. Spring wheat variety testing - N.E. Research Farm, South Shore and state-wide averages.

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

+ Entry is in top-yield group.

* Percent of time a variety appears in the top-yield group across eight (2003) or six (2001-2003) test sites.

Table 2. Oat variety testing - N.E. Research Farm, South Shore and state-wide averages.

	South Shore		State wide						
			2003					Top Yield Group	
	-- bu/a --		Prot.	Bu. Wt.	Ht.	-- Yield bu/a --		--- % ---	
Variety	'03	3-yr	%	lb.	in.	'03	3-yr	'03	3yr
Standard varieties:									
Don	106+	88+	15.9	36	30	91	86	50	60
HiFi	68	.	15.2	35	34	87	.	50	.
Hytest	84	77	18.4	40	37	76	74	13	20
Jerry	97	87+	16.4	38	35	93	88	50	80
Loyal	81	88+	16.6	36	36	84	87	25	60
Morton	92	.	16.3	36	36	86	.	0	.
Reeves	99	91+	17.7	38	36	84	82	13	60
Hulless varieties:									
Buff	73	70	17.8	43	32	73	69	13	0
Paul	42	43	19.4	41	34	52	49	0	0
Experimental lines:									
SD 366	93	.	16.5	38	36	96	.	88	.
SD 580 Hls	56	.	19.1	43	36	57	.	0	.
SD 731	102+	.	17.0	38	34	85	.	38	.
SD 744	103+	.	15.9	37	33	94	.	63	.
SD 813	91	.	17.1	38	30	82	.	25	.
SD 915	84	.	17.4	37	38	89	.	25	.
SD96024	112+	102+	15.8	36	35	99	98	75	100
Test avg.:	86	81	17.0	38	35	83	80		
Lsd (5%):	10	16							
Cv (%):	8	7							

+ Entry is in top-yield group.
* Percent of time a variety appears in the top-yield group across eight (2003) or five (2001-2003) test sites.

Table 3. Barley variety testing - N.E. Research Farm, South Shore and state-wide averages.

	South Shore		State wide						
			2003					Top yield	
				Bu.		Yield		Group	
	-- bu/a --		Prot.	Wt.	Ht.	- bu/a -		--- % ---	
Variety	'03	3-yr	%	lb.	in.	'03	3-yr	'03	3-yr
Conlon	85+	80+	13.2	50	29	63	60	38	60
Drummond	74	75+	13.3	48	32	64	61	0	60
Excel	68	70	12.2	47	31	70	65	38	60
Haxby	86+	.	12.6	52	28	74	.	75	.
Lacey	75	74+	12.8	49	30	69	65	25	100
Robust	74	71	13.4	48	32	64	60	25	80
Valier	78	.	14.0	50	28	71	.	63	.
MT960228	84+	.	12.6	49	28	76	.	75	.
ND16301	64	.	12.4	47	29	65	.	13	.
Test avg.:	76	74	12.9	49	30	68	63		
Lsd (5%):	6	7							
Cv (%):	5	5							

+ Entry is in top-yield group.

* Percent of time a variety appears in the top-yield group across eight (2003) or five (2001-2003) test sites.

2003 Soybean Variety Performance Trials

R. G. Hall and K. K. Kirby

This is a report of the 200 NE Research Farm performance trials for both non-Roundup-Ready and Roundup-Ready soybean varieties conducted by the South Dakota State University Crop Performance Testing (CPT) program.

Soybean entries were placed in either a maturity group-0 or group-I test trial according to maturity ratings reported by a given seed company. Three replications of each entry were seeded with a plot of each variety randomly located within each of three blocks. Plots consisted of four 30-inch rows, 20 feet long. Plots were seeded on May 27, 2003 at 165,000 pure-live-seeds per acre using a Monosem precision row crop planter to obtain a final population of about 150,000 plants per acre following emergence. Soybean inoculation was accomplished by applying granular Nitragin brand Soybean Soil Implant down the seed tube, according to label, during seeding. Use of the Monosem precision planter resulted in very uniform seed spacing within the seed row. The center two rows of each plot were harvested for yield.

Weed control (labeled directions) in the non-Roundup Ready soybean trials consisted of pre-emergence Lasso-II. Weed control in the Roundup Ready test consisted of an application of Roundup Ultra (32 oz/acre) when weeds were 4-5 inches tall followed by the same application again 21 days later.

Measurements of Performance

Yield values (bu/a) were adjusted to 13% moisture (dry-matter basis) and a bushel weight of 60 pounds. Yield, least significant difference (LSD), and minimum top-yield values printed at the bottom of each yield column are rounded off to the nearest whole bushel per acre. Protein and oil values are for the 2002 season. One replication of every variety was tested using near-infrared-reflectance-spectroscopy (NIRS). Plant height was measured in inches from the soil surface to the top node of the main stem. Lodging score values are an average of how erect the main stem of all the plants were at maturity within each variety. 1 = all plants erect, 2 = slight lodging, 3 = lodging at a 45^{o} angle, 4 = severe lodging, and 5 = all plants flat.

Check for the "least significant difference" (LSD) value at the bottom of each yield column. These values indicate how much the yield average must differ between two varieties before there is a real yield difference. If there are no real differences among the yield values within a column then variety yield differences are non-significant (NS).

This value may be used to identify the top yield group (TYG) for each test trial. For example, in the non-Roundup Ready combined maturity group-0&I trial (Table 1) the highest 2003 yield was 28 bu/a. In order to determine whether this entry is the only top yielding variety use the LSD value of 4 bu/a at the bottom of the 2003 yield column. In order for varieties to be in the TYG they must yield 24 bu/a (28 - 4 = 24) or higher. Technically, a yield of 24 bu/a is not in the TYG while a yield of 25 bu/a qualifies for the TYG. However, since all yield and LSD values are rounded to the

nearest whole number, we can say 24 bu/a, because of the rounding-off, is the more appropriate minimum value for top-yield varieties in this test. This value is indicated as the min. top yield value at the bottom of each yield column. Top yield varieties are those that are equal or higher than the minimum top yield value indicated at the bottom of each yield column. In this case seven varieties are in the TYG for the 2003 year yield column (Table1). The LSD values may also be used to determine whether two varieties differ in performance. If the yield difference between any two varieties exceeds the LSD value they differ significantly in yield. If their yield difference is equal to or less than the LSD value their yield difference is not significant.
Entries are numerically sorted from highest to lowest yields according to whether they have been tested for a 3-year, 2-year, and 1-year time period. Entries tested for three years may also have a top yield group value in the 2-year (2002-03) and 2003 year yield columns. Likewise, entries tested for two years may also have a top yield group value in the 2003 year yield column.

Performance Trials Results

Non-Roundup Ready soybeans:

Combined Group- 0 & I (Table 1): The group-0 and –I tests were combined because there were few entries this year. Yield averages for the three-year, two-year, and one-year data were 34, 35, and 25 bushels per acre, respectively. Varieties had to average at least 24 bushels to be in the top yield group for one-year. There were no significant differences among the varieties tested for three-year or two-year periods. The top yield group for three-, two-, and one-year (s) include 2, 4, and 7 entries, respectively. *Note: If yield values within a yield column do no differ significantly then the LSD value is listed as NS (non-significant). In such cases, the minimum top yield value is also the lowest yield and qualifies for the top yield group because yield differences are not significant.*

Roundup Ready soybeans:
Group-0 (Table 2): Yield averages for the three-year, two-year, and one-year data were 37, 35, and 21 bushels per acre, respectively. Varieties had to average at least 20 bushels to be in the top yield group for one-year. There were no significant yield differences among the varieties tested for three-year or two-year periods. The top yield group for three-, two-, and one-year(s) include 10, 23, and 41 entries, respectively.

Group-I (Table 3): Yield averages for the three-year, two-year, and one-year data were 32, 32, and 19 bushels per acre, respectively. Varieties had to average at least 28 bushels for the three-year and two-year periods or 16 bushels per acre for the one-year period to be in the top-yield group. There were no significant differences among the varieties tested for the two-year period. The top-yield groups for three-, two-, and one-year(s) include 8, 17, and 63 entries, respectively.

Table 1. Combined maturity group-O & -I non-Roundup Ready soybean test results, seeded May 27.

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	2003 Ht. in.	2003 Ldg. Sc.~	2003 Maturity: Days after seeding
	Entries tested three years							
GOLD COUNTRY/BISCAY	37	36	26	35.6	18.7	28	1	119
PUBLIC/STRIDE	32	31	26	34.2	19.6	27	1	113
	Entries tested two years							
PRAIRIE BR./PB178	.	38	27	36.4	18.1	24	1	120
SANDS/SOI 187	.	37	24	33.8	19.1	30	1	120
	Entries tested one year							
PRAIRIE BR./PB183	.	.	28	.	.	26	1	117
GOLD COUNTRY/2318	.	.	27	.	.	23	1	120
PUBLIC/SURGE	.	.	24	.	.	25	1	113
PUBLIC/SPINK	.	.	23	.	.	29	1	109
PUBLIC/HENDRICKS	.	.	23	.	.	24	1	113
PUBLIC/MN 0901	.	.	21	.	.	29	1	107
Test average:	34	35	25	35.0	18.9	26	1	114
LSD(5%) value ($):	NS	NS	4					
Min.top yield value ($):	32	31	24					
Coef. of variation:	10	9	9					

$/+ See yield / protein & oil comments in methods section, respectively.
~ Lodging: 1= all plants erect, 3= some at 45 degrees, 5= all plants flat.
NS- column values do not differ significantly.

Table 2. Maturity group-0 Roundup Ready soybean test results, seeded May 27.

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	------- 2003 ------- Ht. in.	Ldg. Sc.~	Maturity: Days after seeding
	Entries tested three years							
DEKALB/DKB10-51	39	39	22	34.5	18.5	24	1	115
NORTHSTAR/NS 0954RR	39	38	23	35.9	18.6	23	1	114
KRUGER/091-1RR	37	36	22	35.1	18.4	24	1	113
KRUGER/099+RR	37	36	23	36.2	18.8	24	1	112
ASGROW/AG0801	37	34	19	33.7	18.7	25	1	111
MUSTANG/M-091RR	36	36	22	35.6	18.5	23	1	112
PRAIRIE BR./PB-0920RR	36	35	23	35.7	18.7	24	1	114
PRAIRIE BR./PB-1030RR	36	36	20	34.9	18.5	27	1	116
DEN BESTEN/DB0900RR	35	34	21	35.5	19.2	24	1	112
SODAK GENETICS/SD1091R	34	34	19	36.6	18.9	25	1	114
	Entries tested two years							
MUSTANG/M-083RR	.	37	23	36.6	19.1	25	1	116
PRAIRIE BR./PB-0732RR	.	37	20	35.1	18.9	19	1	113
DAIRYLAND/DSR-040/RR	.	36	21	34.2	18.9	26	1	111
KRUGER/060RR	.	36	23	35.1	18.6	24	1	110
MUSTANG/M-092RR	.	36	22	36.0	18.8	24	1	114
STINE/S0846-4	.	35	21	36.0	19.2	25	1	113
WENSMAN/W 2093RR	.	35	19	35.8	18.7	23	1	114
PRAIRIE BR./PB-0812RR	.	34	22	35.6	19.1	27	1	113
BIO GENE/BG091RR	.	34	19	35.4	18.6	25	1	112
TOP FARM/6102RR	.	34	21	35.2	19.4	22	1	114
SODAK GENETICS/SD1081R	.	33	21	33.9	19.9	25	1	113
DAIRYLAND/DSR-050/RR	.	32	21	33.5	19.2	21	1	113
TOP FARM/6072RR	.	30	18	34.6	18.9	22	1	113
	Entries tested one year							
GOLD COUNTRY/2409RR	.	.	24	.	.	24	1	116
MUSTANG/M-053RR	.	.	24	.	.	27	1	112
NORTHSTAR/NS 0923RR	.	.	24	.	.	25	1	114
DESOY/077RR	.	.	23	.	.	22	1	114
KRUGER/121+RR	.	.	23	.	.	23	1	116
MUSTANG/M-094RR	.	.	22	.	.	23	1	115
SANDS/SOI 0931RR	.	.	22	.	.	22	1	113
KRUGER/066RR	.	.	22	.	.	22	1	111

Table 2. Maturity group-0 Roundup Ready test results (continued).

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	2003 Ht. in.	2003 Ldg. Sc.~	2003 Maturity: Days after seeding
			Entries tested one year					
WENSMAN/W 2085RR	.	.	22	.	.	21	1	118
KRUGER/100RR	.	.	21	.	.	24	1	116
SANDS/SOI 1050RR	.	.	21	.	.	24	1	116
PRAIRIE BR./EXP1003RR	.	.	21	.	.	24	1	116
DEKALB/DKB07-52	.	.	21	.	.	25	1	110
PRAIRIE BR./PB-0623RR	.	.	21	.	.	20	1	112
WENSMAN/W 2062RR	.	.	21	.	.	26	1	111
PRAIRIE BR./PB-0923RR	.	.	21	.	.	22	1	115
KRUGER/101RR	.	.	21	.	.	23	1	116
ZILLER/BT 7084R	.	.	21	.	.	22	1	114
GARST/0901RR	.	.	20	.	.	24	1	116
DAIRYLAND/DSR-075/RR	.	.	20	.	.	23	1	113
DESOY/090RR	.	.	20	.	.	23	1	115
WENSMAN/W 2103RR	.	.	20	.	.	23	1	116
PRAIRIE BR./PB-1063RR	.	.	20	.	.	23	1	115
DESOY/055RR	.	.	19	.	.	23	1	110
PRAIRIE BR./PB-1043RR	.	.	19	.	.	22	1	116
KRUGER/091RR	.	.	19	.	.	23	1	113
DESOY/041RR	.	.	19	.	.	22	1	111
KRUGER/077RR	.	.	18	.	.	23	1	111
PETERSON/EXP 0307RR	.	.	18	.	.	23	1	111
MUSTANG/M-073RR	.	.	18	.	.	20	1	114
MUSTANG/M-054RR	.	.	17	.	.	20	1	114
KRUGER/082+RR	.	.	17	.	.	20	1	114
PETERSON/PFS 0408RR	.	.	17	.	.	18	1	113
Test average:	37	35	21	35.2	18.9	24	1	113
LSD(5%) value ($):	NS	NS	4					
Min.top yield value ($):	34	30	20					
Coef. of variation:	10	11	13					

$/+ See yield / protein and oil comments in methods section, respectively.
~ Lodging: 1= all plants erect, 3= some at 45 degrees, 5= all plants flat.
NS- column values do not differ significantly.

Table 3. Maturity group-I Roundup Ready soybean test results, seeded May 27.

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	2003 Ht. in.	2003 Ldg. Sc.~	2003 Maturity: Days after seeding
Entries tested three years								
DEN BESTEN/DB1902RR	35	36	21	33.6	19.7	22	1	123
DAIRYLAND/DSR-130/RR	34	32	18	35.0	18.9	26	1	115
ZILLER/BT 7150R	34	33	21	33.3	19.3	29	1	117
PRAIRIE BR./PB-1620RR	34	35	22	33.5	18.8	29	1	116
MUSTANG/M-151RR	33	35	20	33.1	19.2	27	1	116
GOLD COUNTRY/6016RR	33	33	21	33.5	19.1	27	1	118
PRAIRIE BR./PB-1241RR	31	29	20	36.3	19.2	21	1	115
MUSTANG/M-101RR	30	30	18	35.4	19.0	24	1	115
Entries tested two years								
KRUGER/211+RR	.	37	21	34.3	18.9	23	1	122
KRUGER/166RR	.	35	18	35.2	18.6	22	1	120
ZILLER/BT 7106R	.	34	21	34.6	18.8	22	1	115
KRUGER/202+RR	.	34	19	33.9	19.2	19	1	122
ASGROW/AG1401	.	34	22	32.8	19.8	26	1	115
KRUGER/155+RR	.	34	19	36.3	19.2	25	1	116
EXCEL/8120RR	.	33	16	35.1	19.0	27	1	115
MUSTANG/M-153RR	.	33	19	35.2	18.8	23	1	119
PRAIRIE BR./PB-1921RR	.	33	19	35.0	18.9	23	1	124
NORTHSTAR/NS 1407RR	.	32	19	36.4	18.6	25	1	116
DESOY/191RR	.	32	18	34.1	19.5	22	1	124
DYNA-GRO/DG 38J12RR	.	32	18	37.0	17.5	26	1	116
PRAIRIE BR./PB-1552RR	.	32	18	35.6	18.6	23	1	120
ASGROW/AG1701	.	32	16	34.4	19.3	22	1	119
DEN BESTEN/DB1303RR	.	30	18	36.7	18.8	23	1	116
PRAIRIE BR./PB-1452RR	.	30	18	36.7	18.8	25	1	117
MUSTANG/M-163RR	.	30	19	36.0	18.1	22	1	120
GOLD COUNTRY/2315RR	.	30	18	34.5	18.9	23	1	120
DYNA-GRO/DG 33M14RR	.	29	19	37.0	19.1	23	1	116

Table 3. Maturity group-I Roundup Ready test results (continued).

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	2003 Ht. in.	2003 Ldg. Sc.~	2003 Maturity: Days after seeding
	Entries tested one year							
MIDWEST SEED/GR1710	.	.	22	.	.	26	1	117
PRAIRIE BR./PB-1943RR	.	.	21	.	.	21	1	122
SANDS/SOI 1515RR	.	.	21	.	.	26	1	118
MUSTANG/M-174RR	.	.	21	.	.	23	1	121
STINE/S1100-4	.	.	21	.	.	22	1	116
SABRE/145RR	.	.	21	.	.	24	1	118
KRUGER/223+RR	.	.	21	.	.	21	1	123
NORTHSTAR/NS 1207RR	.	.	21	.	.	26	1	115
KRUGER/149RR	.	.	21	.	.	26	1	116
KRUGER/171RR	.	.	20	.	.	21	1	121
DEKALB/DKB19-52	.	.	20	.	.	24	1	121
STINE/S0943-4	.	.	20	.	.	24	1	116
TOP FARM/EXP34043BRR	.	.	20	.	.	24	1	116
SANDS/EXP 1751RR	.	.	19	.	.	22	1	121
DAIRYLAND/DSR-132/RR	.	.	19	.	.	26	1	119
MUSTANG/M-124RR	.	.	19	.	.	22	1	116
KRUGER/223RR	.	.	19	.	.	21	1	124
SANDS/SOI 1441RR	.	.	19	.	.	24	1	116
GARST/XR18P04	.	.	19	.	.	26	1	121
PETERSON/PFS 0410RR	.	.	19	.	.	22	1	114
ZILLER/BT 7143R	.	.	19	.	.	23	1	115
DESOY/161RR/SCN	.	.	19	.	.	22	1	121
SABRE/195RR	.	.	19	.	.	23	1	123
SANDS/SOI 1730RR	.	.	19	.	.	21	1	121
TOP FARM/EXP35260RR	.	.	19	.	.	24	1	123
KRUGER/171ARR	.	.	19	.	.	22	1	121
ASGROW/AG2106	.	.	19	.	.	22	1	124
NORTHSTAR/NS 1624RR	.	.	18	.	.	25	1	124
DYNA-GRO/DG 3190RR	.	.	18	.	.	23	1	125
KRUGER/222A	.	.	18	.	.	25	1	125

Table 3. Maturity group-I Roundup Ready test results (continued).

Brand / Entry	Yield - bu/a (13% moisture) 3yr	2yr	2003	2002 Prot. pct+	2002 Oil pct+	2003 Ht. in.	2003 Ldg. Sc.~	2003 Maturity: Days after seeding
Entries tested one year								
PRAIRIE BR./PB-2112RR	.	.	18	.	.	23	1	123
DESOY/194RR	.	.	18	.	.	23	1	124
TOP FARM/6202RR	.	.	17	.	.	22	1	121
DYNA-GRO/DG 31C15RR	.	.	16	.	.	22	1	120
Test average:	32	32	19	35.1	19.0	24	1	119
LSD(5%) value ($):	NS	NS	NS					
Min.top yield value ($):	28	28	16					
Coef. of variation:	8	10	11					

$/+ See yield / protein and oil comment section, respectively.
~ Lodging: 1= all plants erect, 3= some at 45 degrees, 5= all plants flat.
NS- column values do not differ significantly.

2003 Corn Hybrid Performance Trials

R. G. Hall and K. K. Kirby

This is a report of the 2003 NE Research Farm performance trials for the non-Roundup Ready and Roundup Ready corn hybrids conducted by the South Dakota State University Crop Performance Testing (CPT) program.

Experimental Procedures

Entries were placed into either an early or late maturity trial according to ratings reported by a given seed company. The break between the early and late test was 95-day for the conventional non-Roundup Ready hybrid trials. Entries were seeded in three replications with each hybrid randomly located within a replication. Plots consisted of four 30-inch rows, 20 feet long. Plots were seeded on May 8, 2003 into a Brookings silty loam previously cropped to oats. A Monosem precision row crop planter was used for seeding plots. The precision planter was calibrated and delivered 29,260 seeds per acre, regardless, of seed quality and germination percentage. Therefore, the acre harvest population is an indication of initial seed quality and the ability of the seed to cope with the production environment from seeding to harvest. Force insecticide was applied down the seed tube at its label rate for corn rootworm control this year. In addition, Pounce granular was applied at its label rate down the whorl with a tractor mounted granular applicator just prior to canopy closure.

The experimental procedures described above apply both to the non-Roundup Ready and the Roundup Ready hybrid corn trials with one exception: Weed control in the Roundup Ready trials consisted of two post emergence applications of Roundup Ultra (32 oz/acre). The first when weeds were 2-4 inches tall, followed by a second application when weed growth was again 2-4 inches tall. In the non-Roundup Ready test trials, pre-emergence weed control consisted of Lasso followed by a post emergence application of Accent/Buctril. All herbicides were applied according to label.

Measurements of Performance

Yield values are an average of three replicates (plots), and expressed as bushels per acre, at 15.5% moisture on a dry-matter basis and a bushel weight of 56 pounds.

Moisture content is expressed as the percentage of moisture in the shelled corn at harvest. Moisture is inversely related to maturity. Because maturity is of prime importance in South Dakota, moisture figures are of considerable importance in the evaluation of the trial entries. Hybrids with satisfactory yields and low harvest moisture values indicating little if any need for additional drying are desirable.

Check for the "least significant difference" (LSD) value at the bottom of each column of data values. If there are no real differences among the values within a given column, then "non-significant" (NS) is noted.

The reported LSD values can be used in two ways. First, the LSD value indicates how much a variable such as yield must differ between two hybrids before there is a real yield difference. For example, in the late non-Roundup Ready test (Table 2), the year 2003 LSD value of 8 bu/a can be used to compare the yields of any two hybrids in the early maturity trial. If hybrid A yields 80 bu/a and hybrid B yields 73 bu/a the yield difference is 7 bu/a (80 -

73 = 7). In this case the two hybrids do not differ in yield because their yield difference of 7 bu/a is less than the reported LSD value of 8 bu/a. In contrast, if hybrid C yields 69 bu/a the yield difference between hybrid A and hybrid C would be 18 bu/a (80 - 69 = 11). In this case the yield difference of 11 bu/a is more than the reported LSD value of 8 bu/a and therefore hybrid A would have a significantly higher yield than hybrid C. Similarly, the LSD values for bushel weight, grain moisture, green snap, and stalk lodging below the ear percentages can be used to determine if any two hybrids differ in these performance factors.

A second use for the LSD value is to identify the top group for the current year yield, two-year yield, bushel weight, grain moisture at harvest, green snap percentage, and stalk lodging below the ear percentage. For example, in the non-Roundup Ready hybrid late maturity trial (Table 2) the highest current year yield was 81 bu/a for Dekalb/DKC50-18. In order to determine whether it is the only top yielding hybrid in this trial use the LSD value of 8 bu/a at the bottom of the 2003 yield column. In order for hybrids to be in the top yield group they must yield 73 bu/a (81 - 73 = 8) or higher. Technically, a yield of 74 bu/a is in the top yield group while a yield of 73 bu/a would not be in the top yield group. However, since all yields and LSD values are rounded to the nearest whole number. We can say 73 bu/a, because of the rounding-off, is the more appropriate minimum value for top yield hybrids in this late maturity test in 2003. This value is indicated as the minimum top yield group value at the bottom of the 2003 yield column. Top yield hybrids for 2003 are those hybrids that are equal or higher than the minimum top yield group value. In addition, the minimum top yield group value for the longer 2-year period is 97 bu/a. In this case, the minimum yield is in the top yield group because the test statistics indicated there was no significant (NS) difference among the hybrids tested for two years.

Similarly, the top group for other performance factors like bushel weight, grain moisture at harvest, green snap percentage, and stalk lodging below the ear percentage can be determined. For example, in the late maturity test (Table 2), the minimum bushel weight value to qualify for the top group was 56 lbs. Note the yield and bushel weight values needed to qualify for the top group are reported as a minimum top group yield or weight. In contrast, the grain moisture, green snap, and lodging below the ear percentage values needed to qualify for the top group are reported as a maximum top group percentage. In other words, yield and bushel weight top-group values must exceed a certain value while grain moisture, green snap, and lodging below ear percentages must be equal to or less than certain percentages to qualify for the top group depending on the performance factor being considered. In the late maturity test (Table 2), current year yields must equal 73 bu/a or higher, bushel weight must equal 56 lbs. or higher, grain moisture must be 17% or lower, and stalk lodging below the ear must equal 17% or lower to be in the top group for these factors in Table 2. In addition, hybrids with an acre harvest population of 27,565 plants or higher were in the top group for harvest population. Hybrids with populations below 27,565 plants per acre were likely lower in seed quality since all hybrids were planted at the same population.

Performance Trial Results

Non-Roundup Ready hybrids:

Early Maturity Trial (Table 1), 24 hybrid entries. The 2-year yield average was 117 bu/a; but yield differences among hybrids were not significant. The 2003 average was 78 bu/a, but yield differences among the 24 hybrids tested were not significant. Therefore, the lowest yield of 71 bu/a was the minimum yield value needed to qualify for the top group for yield in 2003. In addition, bushel weight had to equal 59 lbs. or higher (6 hybrids), grain moisture had to equal 15% or less (2 hybrids), and stalk lodging below the ear had to equal 12% or less (14 hybrids) to be in the top group for these factors. The acre harvest population had to equal 28,137 plants per acre or 96% of the seeding population to be in the top group (13 hybrids) for harvest population.

Late Maturity Trial (Table 2), 23 hybrid entries. The 2-year average was 108 bu/a; but yield differences among hybrids were not significant. The 2003 average was 65 bu/a, hybrids had to average 73 bu/a or higher to be in the top yield group, 8 hybrids qualified for the top yield group, and hybrids had to differ by 8 bu/a to be significantly different in yield. In addition, bushel weight had to equal 56 lbs. or higher (10 hybrids) and grain moisture had to equal 17% or less (9 hybrids), and stalk lodging below the ear had to equal 17% or less (17 hybrids) to be in the top group for these factors. The acre harvest population had to equal 27,565 plants per acre or 94% of the seeding population to be in the top group (16 hybrids) for harvest population.

Roundup Ready hybrids:

Early Maturity Trial (Table 3), 30 hybrid entries. The 2-year yield average was 116 bu/a; but yield differences among hybrids were not significant. The 2003 average was 78 bu/a, hybrids had to average 77 bu/a or higher to be in the top-yield group, 20 hybrids qualified for the top yield group, and hybrids had to differ by 11 bu/a to be significantly different in yield. In addition, bushel weight had to equal 57 lbs. or higher (18 hybrids), grain moisture had to equal 16% or less (26 hybrids), and stalk lodging below the ear had to equal 9% or less (23 hybrids) to be in the top group for these factors. The acre harvest population had to equal 27,404 plants per acre or 94% of the seeding population to be in the top group (10 hybrids) for harvest population.

Late Maturity Trial (Table 4), 14 hybrid entries. The 2-year average was 104 bu/a; but yield differences among hybrids were not significant. The 2003 average was 69 bu/a, hybrids had to average 67 bu/a or higher to be in the top yield group, 10 hybrids qualified for the top yield group, and hybrids had to differ by 10 bu/a to be significantly different in yield. In addition, bushel weight had to equal 58 lbs. or higher (4 hybrids), grain moisture had to equal 18% or less (5 hybrids), and stalk lodging below the ear had to equal 6% or less (10 hybrids) to be in the top group for these factors. The acre harvest population had to equal 26,769 plants per acre or 91% of the seeding population to be in the top group (6 hybrids) for harvest population.

Table 1. Non-Roundup Ready, early corn test, maturity is 95-day or less.

Brand / Hybrid	+Rel. Mat.	Yield- bu/a @15.5% mst. 2-yr	2003	2003 Bu. wt. lb	Grain moist. pct	Acre harvest pop.	Green snap pct	Lodged below ear pct
			Entries tested two years					
KRUGER/K-9392 YGCB	89	125	95	58	16	28,023	0	4
WENSMAN/W 5212BT	95	125	83	57	16	27,878	0	19
SEEDS 2000/2953BT	95	124	84	57	16	27,443	0	21
WENSMAN/W 4212	95	121	78	58	16	27,733	0	12
DEKALB/DKC44-42 (YGCB	94	120	84	55	16	28,169	0	20
WENSMAN/W 5117BT	92	119	75	59	16	28,314	0	7
GOLD COUNTRY/94-01CB	94	117	73	57	16	28,024	0	20
SABRE/3555CB	95	111	71	58	16	28,750	0	21
KRUGER/K-9396 YGCB	92	95	68	59	17	28,459	0	2
			Entries tested one year					
JUNG/6432BT	95	.	87	57	17	28,314	0	21
CROW'S/1703 B	95	.	85	58	16	28,314	0	13
SABRE/3554BT	94	.	83	59	16	28,605	0	4
KRUGER/K-9496 YGCB	94	.	82	58	16	28,169	0	12
SEEDS 2000/2921BT	92	.	81	58	16	26,136	0	7
WENSMAN/W 5085BT	85	.	79	55	14	26,427	0	6
KRUGER/K-9492 YGCB	92	.	78	58	16	27,298	0	6
MIDWEST/G 6963 B	95	.	76	57	16	29,330	0	18
CROW'S/1695 B	92	.	75	58	16	28,750	0	8
MIDWEST/G 6921 B	92	.	75	58	16	27,443	0	9
EPLEY/E1150BT	95	.	74	61	17	29,621	0	5
HEINE/H640YGCB	94	.	73	60	17	28,459	0	3
SABRE/3110BT	91	.	71	60	17	26,427	0	3
WENSMAN/W 5081BT	83	.	71	57	15	29,040	0	15
DAIRYLAND/STEALTH-5194	94	.	71	58	16	27,153	0	14
Test average:		117	78	58	16	28,012	0	11
LSD (5%) values:		NS	NS	2	1	1,484	.	10
Top group value*- Minimum:		95	68	59		28,137		
Maximum:					15		.	12
No. entries in top group:		9	24	6	2	13	.	14
Coef. of variation:		8	13	2	2	3	.	

+ Maturity reported by company. NS- column values do not differ significantly.

* Within one LSD value of the highest yield, bushel weight, or harvest population; or the lowest grain moisture, green snap or lodging values.

Table 2. Non-Roundup Ready, late corn test, maturity is 96-day or more.

Brand / Hybrid	+Rel. Mat.	Yield- bu/a @15.5% mst. 2-yr	2003	2003 Bu. wt. lb	Grain moist. pct	Acre harvest pop.	Green snap pct	Lodged below ear pct
Entries tested two years								
DAIRYLAND/STEALTH-1497	96	119	78	55	16	28,024	0	23
SANDS/SOI 9013	100	107	73	54	16	29,330	0	6
SANDS/SOI 9962	96	107	74	55	16	27,878	0	11
EPLEY/E1493	105	97	64	58	29	27,588	0	6
Entries tested one year								
DEKALB/DKC50-18 (YGCB	100	.	81	56	19	28,314	0	4
DEKALB/DKC52-45 (YGCB	102	.	80	56	16	29,185	0	12
DEKALB/DKC48-84 (YGCB	98	.	79	56	19	28,459	0	6
DAIRYLAND/STEALTH-5497	97	.	74	55	16	26,862	0	14
SEEDS 2000/2991	99	.	73	56	20	27,152	0	45
WENSMAN/W 5314BT	101	.	69	53	19	27,878	0	21
GOLD COUNTRY/96-04CB	96	.	69	58	17	27,007	0	3
GARST/8787YG1	102	.	67	58	18	28,604	0	1
KRUGER/K-9203 YGCB	100	.	66	54	18	28,459	0	13
SANDS/SOI 103YGCB	103	.	65	55	19	29,040	0	4
TOP FARM/TFSX 2301	100	.	64	59	17	24,974	0	3
KRUGER/K-9002+ YGCB	100	.	64	55	23	24,829	0	1
EPLEY/E1180BT	100	.	62	54	25	29,476	0	80
KRUGER/K-9403 YGCB	100	.	61	57	22	25,991	0	6
GARST/8716	100	.	51	52	16	27,733	0	33
TOP FARM/EXP 3100C	96	.	49	55	21	28,459	0	3
EPLEY/E1491	105	.	49	55	26	27,152	0	9
KRUGER/K-9404 YGCB	101	.	47	54	16	28,895	0	6
EPLEY/E1420BT	101	.	45	57	25	28,314	0	24
Test average:		108	65	56	19	27,776	0	15
LSD (5%) values:		NS	8	3	1	1,911	.	16
Top group value*- Minimum:		97	73	56		27,565		
Maximum:					17		.	17
No. entries in top group:		4	8	10	9	16	.	17
Coef. of variation:		7	7	3	4	4	.	.

+ Maturity reported by company. NS- column values do not differ significantly.
* Within one LSD value of the highest yield, bushel weight, or harvest population; or the lowest grain moisture, green snap or lodging values.

Table 3. Roundup Ready, early corn test, maturity is 95-day or less.

Brand / Hybrid	+Rel. Mat.	Yield- bu/a @15.5% mst. 2-yr	2003	2003 Bu. wt. lb	Grain moist. pct	Acre harvest pop.	Green snap pct	Lodged below ear pct
			Entries tested two years					
INTEGRA/INT 6193RRYGCB	93	119	78	55	15	27,007	0	8
DEKALB/DKC44-46 RRYGCB	94	118	80	54	18	27,588	0	15
CHANNEL/6925RB	92	113	78	57	16	23,377	0	2
WENSMAN/W 6212RR	95	113	77	58	16	27,733	0	6
			Entries tested one year					
DEKALB/DKC42-95 RRYGCB	92	.	88	56	17	29,040	0	3
WENSMAN/W 6089RRBT	84	.	86	58	15	27,152	0	6
JUNG/6418RR/BT	92	.	86	58	16	26,862	0	9
SABRE/3555RR	95	.	84	57	16	25,991	0	11
KRUGER/K-9491 RR/YGCB	91	.	84	56	15	26,717	0	2
SABRE/3554RRBT	94	.	84	59	16	27,443	0	7
WENSMAN/W 6117RRBT	92	.	82	58	16	25,120	0	9
KAYSTAR/KX-4250RRBT	93	.	81	58	16	28,314	0	7
GOLD COUNTRY/94-01RR	94	.	81	57	16	27,152	0	6
KRUGER/K-9392 RR/YGCB	90	.	81	57	17	24,248	0	3
WENSMAN/W 6116RR	91	.	80	57	16	26,717	0	2
HEINE/H625RR/YGCB	93	.	80	55	15	27,297	0	9
INTEGRA/INT 6395RR	95	.	79	57	16	27,588	0	10
SEEDS 2000/2953RR	95	.	79	57	17	26,281	0	13
KAYSTAR/KX-4000RRBT	91	.	79	54	15	27,153	0	4
CHANNEL/6939RB	93	.	78	56	15	25,991	0	1
KAYSTAR/KX-5150RR	95	.	76	56	16	27,733	0	13
KRUGER/K-9496 RR	94	.	76	57	16	28,459	0	8
HEINE/H650RR/YGCB	93	.	76	58	16	27,153	0	1
DEKALB/DKC39-48 RRYGCB	89	.	76	57	16	23,232	0	9

Table 3. South Shore, Roundup Ready, early test results (continued).

Brand / Hybrid	+Rel. Mat.	Yield- bu/a @15.5% mst. 2-yr	Yield- bu/a @15.5% mst. 2003	2003 Bu. wt. lb	2003 Grain moist. pct	2003 Acre harvest pop.	2003 Green snap pct	2003 Lodged below ear pct
Entries tested one year								
TOP FARM/8395RR	95	.	76	58	16	24,394	0	9
KRUGER/K-9392 RR	90	.	76	57	16	26,426	0	3
TOP FARM/8391R	91	.	75	56	15	26,136	0	1
DEKALB/DKC40-63 (RR)	90	.	70	56	15	27,733	0	9
JUNG/6205RR/BT	82	.	68	55	15	26,572	0	31
INTEGRA/INT 6290RR	92	.	56	52	16	28,314	0	13
Test average:		116	78	57	16	26,697	0	8
LSD (5%) values:		NS	11	2	1	1,636	.	8
Top group value*- Minimum:		113	77	57		27,404		
Maximum:					16		.	9
No. entries in top group:		4	20	18	26	10	.	23
Coef. of variation:		8	9	2	4	4	.	.

+ Maturity reported by company. NS- column values do not differ significantly.
* Within one LSD value of the highest yield, bushel weight, or harvest population; or the lowest grain moisture, green snap or lodging values.

Table 4. Roundup Ready, late corn test, maturity is 96-day or more.

Brand / Hybrid	+Rel. Mat.	Yield- bu/a @15.5% mst. 2-yr	Yield- bu/a @15.5% mst. 2003	2003 Bu. wt. lb	2003 Grain moist. pct	2003 Acre harvest pop.	2003 Green snap pct	2003 Lodged below ear pct
			Entries tested two years					
DEKALB/DKC46-28 (RR)	96	119	77	58	16	28,024	0	9
CHANNEL/6999RB	99	90	70	54	19	28,605	0	8
			Entries tested one year					
WENSMAN/W 6315RRBT	101	.	75	55	23	28,024	0	5
GARST/8812YG1/RR	97	.	75	56	18	26,862	0	3
GOLD COUNTRY/1016RRBT	104	.	74	55	23	28,024	0	6
INTEGRA/INT 6300RRYGCB	100	.	73	56	25	24,539	0	7
KRUGER/K-9203 RR/YGCB	100	.	70	55	22	26,717	0	9
CHANNEL/7091RB	101	.	70	58	23	28,604	0	2
GARST/8782RR	100	.	70	56	17	26,426	0	5
KRUGER/K-9299A RR	99	.	69	56	17	27,007	0	5
KRUGER/K-9002 RR/YGCB	100	.	64	59	22	26,426	0	0
TOP FARM/8200RY	100	.	61	57	18	24,684	0	3
KRUGER/K-9404 RR/YGCB	102	.	60	60	21	28,023	0	1
KRUGER/K-9300 RR/YGCB	96	.	59	54	20	27,298	0	4
Test average:		104	69	56	20	27,090	0	5
LSD (5%) values:		NS	10	2	2	1,836	.	6
Top group value*- Minimum:		90	67	58		26,769		
Maximum:					18		.	6
No. entries in top group:		2	10	4	5	6	.	10
Coef. of variation:		2	8	2	6	4	.	.

+ Maturity reported by company. NS- column values do not differ significantly.
* Within one LSD value of the highest yield, bushel weight, or harvest population; or the lowest grain moisture, green snap or lodging values.

Winter Wheat Breeding and Genetics

Amir Ibrahim, Steve Kalsbeck, Rich Little

Summary of Activities

The Winter Wheat Breeding and Genetics Program utilizes the Northeast Research Station primarily to conduct winterhardiness evaluations and for the state Crop Performance Testing (CPT) Variety Trial. The breeding program also conducts field-testing at several other sites throughout South Dakota (Brookings, Selby, Winner, Wall, and the Dakota Lakes Research Station near Pierre), for both early-generation selection and determination of the potential of experimental lines for cultivar release.

The winter wheat testing conducted at the Northeast Research Station during 2003 included:

i) 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 three years to accurately measure the potential performance across a range of environmental conditions.

ii) A Winter Wheat Fusarium Head Blight Trial, in cooperation with Marty Draper, Extension Plant Pathologist.

iii) The Southern Regional Performance Nursery (SRPN), consisting of 46 advanced experimental lines from Kansas, Nebraska, Colorado, Texas, Okahoma, as well as Goertzen and Agripro Seed Businesses.

iv) A two-row winterhardiness nursery, consisting of short-row evaluations of several different breeding nurseries: the Regional Germplasm Observation Nursery (RGON, 310 entries); Nebraska Interstate Nursery (NIN, 63 entries); the Facultative and Winter Wheat Observation Nursery (FAWWON) from CIMMYT-Turkey (140 entries); the Uniform Barley Winterhardiness (UBWHN, 16 entries); and the Western Regional Hard Winter Wheat (WRHWW, 16 entries).

Trial Conditions

The nurseries at the Northeast Research Station were planted into soybean stubble with adequate soil moisture conditions on 22 November 2003. Starter fertilizer (10-34-0) was applied with the planter. Bronate was applied on 5 May 2003 at 1.5 pints per acre. Cheat grass competed with winter wheat, causing uneven stand, which resulted in the abandonment of the nursery. Grain yield data for the CPT Variety Trial in other locations is presented in Table 1.

Acknowledgements

Each year, 800-1000 new cross combinations are made and 800-1000 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 SD Wheat Commission and the SD 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.

	GY	TW						Grain Yield bu/ac						
ID	**AVG**	**AVG**	**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.

Spring Wheat Breeding

Karl D. Glover

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 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 Northeast Research Station is one of two locations used for testing material in both early- and advanced-selection stages.

Twenty-seven lines that appear to hold the most potential for release as varieties are grown each year in our Advanced Yield Trial (AYT) test along with nine released varieties used for comparative purposes. Not all twenty-seven entries are advanced to a second year of AYT testing. Table 1 presents agronomic and disease resistance observations collected from ten experimental entries that were grown in both the 2002 and 2003 Northeast Research Station AYT tests. Yield data for each entry calculated as its average over seven AYT locations (Aurora, Brookings, Buffalo, Groton, Redfield, Selby, and Watertown) in both 2002 and 2003 are also presented.

Average yield among these entries was low in 2002 due to the dry conditions (Table 1). Similar conditions in 2003 also prevented the incidence of any appreciable amount of Fusarium Head Blight (FHB) or leaf rust at the Northeast Research Station in both years. FHB resistance data presented in Table 1 were consequently collected at our Brookings screening nursery and leaf rust ratings were collected in 2002 at Groton. 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. SD3546 is slated for release to growers as a new variety that will be available in 2004.

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

Table 1. Agronomic and disease resistance performance data of ten potential hard red spring wheat varieties evaluated in 2002 and 2003 Advanced Yield Trials.

Entry	Yield bu/ac 2003	2002	2yr.	TW lb/bu 2yr.	Height cm	Heading days	FHB*	LR**	Ave*** Yield
SD3546	48.7	30.7	39.7	55.8	67.0	173.8	M	R	49.5
SD3618	45.9	31.5	38.7	54.0	68.3	175.0	MS	S	49.5
SD3687	48.7	34.0	41.3	53.6	67.5	174.5	M	MS	49.0
SD3668	49.0	31.3	40.2	55.6	65.8	173.8	M	R	48.8
SD3540	47.3	30.0	38.7	54.9	67.3	173.3	M	S	48.8
SD3720	46.9	34.6	40.8	52.3	69.0	173.8	M	MS	48.5
BRIGGS	47.6	33.3	40.5	52.8	68.5	173.3	MS	R	48.4
RUSS	45.5	31.6	38.5	54.5	68.0	175.5	MS	MS	48.2
SD3635	46.3	32.5	39.4	54.4	68.0	174.8	M	S	48.0
WALWORTH	48.2	30.4	39.3	54.6	68.8	174.3	M	MR	47.2
FORGE	45.9	32.0	39.0	53.5	66.0	174.0	M	MS	47.1
SD3641	48.5	35.5	42.0	55.3	62.8	172.5	M	MR	46.1
OXEN	48.7	31.2	40.0	54.2	63.0	174.5	M	MR	45.9
BUTTE-86	47.2	28.2	37.7	53.2	69.5	175.3	M	MS	45.8
SD3696	45.0	32.9	38.9	56.3	71.5	174.3	MR	MS	45.5
2375	46.3	30.1	38.2	56.4	65.3	175.5	S	MS	43.3
CHRIS	36.1	23.7	29.9	50.3	70.5	176.8	S	MS	34.9
Average	46.6	31.1	38.6	54.2	67.3	174.4	-	-	46.4
LSD	2.9	3.8	2.6	2.2	4.7	1.0	-	-	1.8
CV	4.3	8.4	6.6	3.9	4.9	0.4	-	-	8.9

* Scab and Leaf Rust resistance ratings; R = Resistant, MR = Moderately Resistant, M ** Moderate, MS = Moderately Susceptible, S = Suseptible
*** Yield performance based on 14 AYT locations grown in 2002 and 2003.

Oat Research

Lon Hall

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 that are considered prior to varietal release include: hull, protein, and oil percentages, as well as maturity, hull color, plant height, and whether it is hulled or hulless.

Consumers desire different characteristics for specific needs. Millers generally want oats with high protein, high beta-glucan content, and low oil, whereas, 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 a 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; however, the racehorse industry desires white-hulled varieties. Therefore, emphasis is placed on development of white-hulled varieties with desirable traits for milling and/or feed. Recently there has been interest in hulless oats for feed and other specialty uses, therefore, we have increased our 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 the initial cross to variety release. This process may be shortened by two years bay using the single seed descent method, which involves two extra generations in the greenhouse. Each year there are approximately 37,000 non-segregating plants and head rows observed within this program. In 2003, there were 3902 unique non-segregating lines yield tested. Out of a project total of 6570 yield plots, 2728 were grown at the Northeast Research Farm.

Data collected from regional nurseries provides 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 in crease lines are entered in the Uniform Early Nursery, Uniform Midseason 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. SD00366 was the second highest yielder and it has the highest yield group percentage rating. SD00366 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 SD00366 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 Northeast farm.

Northeast Research Farm Annual Report

2003 Alfalfa Production

Vance Owens and Eva Omdahl

Alfalfa cultivars are tested at several South Dakota research stations. Our objective is to provide producers with yield data from currently available alfalfa cultivars to aid them 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 your specific needs.

Materials and Methods

Six replications of each cultivar were planted at 15 lbs pure live seed/acre. Fifty pounds of super phosphate (P_2O_5) was applied preplant. Later fertilizer application was made when necessary as recommended by the South Dakota State Soil Testing Laboratory. Forage was harvested with a sickle-type harvester 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.

Results

Table 1 provides forage production data for 15 alfalfa cultivars planted in 2001. Tons of dry matter yield are shown for two individual cuttings in 2003, total production for 2002, and a cumulative total for 2001 through 2003. Average cumulative yield in 2003 was 2.38 tons dry matter/acre (DM/A), up about 3/4 of a ton from 2002. However, yields in both years have been lower than past averages at this location due to inadequate precipitation.

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

Table 1. Forage yield of 15 alfalfa cultivars entered in the South Dakota State University alfalfa testing program. Trial was planted 3 May 2001 at the Northeast Research Farm.

	2003			2002	2001-03
Entries	13 June	8 July	Total	Total	Total
	-------------------- Tons dry matter/acre --------------------				
WL327	1.99	0.52	2.51	1.85	4.36
HybriForce 400	1.95	0.58	2.53	1.81	4.34
54V54	2.02	0.57	2.59	1.51	4.10
WL342	1.92	0.53	2.45	1.64	4.09
Reliance	1.96	0.50	2.46	1.59	4.05
Feast + EV	2.00	0.46	2.46	1.58	4.04
Macon	1.88	0.50	2.37	1.63	4.00
Monument II	1.83	0.54	2.37	1.63	4.00
Frontier 2000	1.86	0.52	2.37	1.58	3.95
4 Traffic	1.81	0.44	2.25	1.66	3.91
Husky Supreme	1.83	0.47	2.30	1.59	3.89
Maverick	1.84	0.51	2.35	1.47	3.83
GoldRush 747	1.87	0.45	2.32	1.37	3.69
Vernal	1.82	0.38	2.20	1.46	3.66
Somerset	1.81	0.41	2.22	1.31	3.53
Average	1.89	0.49	2.38	1.58	3.96
Maturity (Kalu & Fick)	4.5	4.0			
LSD (P=0.05)	NS	NS	NS	NS	NS
CV (%)	14.2	24.4	14.4	21.9	15.4

NS = not significant at 0.05 level of probability

Biomass Production of Switchgrass Cultivars in Single-cut Management Systems

Arvid Boe and Robin Bortnem

Introduction

The United States Department of Energy (USDOE) identified northeastern South Dakota as an area of excellent potential for profitable production of biomass/biofuel crops. In addition, USDOE chose switchgrass (*Panicum virgatum* L.) as a model species for biomass production research in the eastern one-half of the USA and southern Canada. In 1999 we received support from USDOE Bioenergy Feedstocks Development Program to evaluate biomass production of several cultivars of switchgrass in northeastern South Dakota. In 2002 we received additional funds from the Great Plains Institute for Sustainable Development to continue the evaluation through 2004.

Materials and Methods

On June 7, 1999 we planted eight switchgrass cultivars (Table 1) into a conventionally prepared seedbed at a rate of 50 pure live seeds/ft.^{2}. Experimental designs were two sets of four replications of each cultivar in completely randomized blocks. One set was intended for a single harvest annually during mid to late September, whereas the other set was intended for a single harvest annually shortly after a killing frost (normally mid October to early November) for up to 10 years. Individual plot size was 4 feet by 20 feet. Row spacing was 6 inches. Atrazine was applied pre-emergence at 2 pounds active ingredient/acre (experimental treatment). No harvests were taken during the establishment year, but harvests were taken during September and October of 2000, 2001, and 2002. During 2003 all of the plots were harvested on October 9.

Results and Discussion

Biomass yield, averaged across cultivars, for the October 9, 2003 harvest was 1701 pounds/acre (Table 1), which was about one-half of the 2002 production, which was about 75% lower than the production in 2001 and 30% lower than the production in 2000. The low biomass yields in 2003 were undoubtedly related to below normal precipitation during the growing season. However, in addition, several of the cultivars, most notably Cave-In-Rock, Shawnee, and OKNU 94-2, sustained considerable loss of stand during the 2002-2003 winter. In contrast, at the end of four growing seasons, Sunburst, Summer, Forestburg, and Dacotah had excellent stands (i.e., 75 to 98%). Highly significant differences were found among cultivars for biomass yield in 2003, with Summer and Sunburst ranking first and second, respectively (Table 1). Sunburst and Summer were developed by South Dakota State University and appear to be well adapted for sustainable biomass production in the northeastern part of the state. On the other hand, after four years it became evident that cultivars from more southern origins, such as Cave-In-Rock from southeastern Illinois, were very productive for the first two years of the experiment, but lacked the necessary winterhardiness to persist.

Table 1. Dry matter biomass production of seven cultivars and one experimental population of switchgrass harvested on October 9, 2003.

Cultivar	**DM Biomass Production (lbs/acre)**
Summer	3352
Sunburst	3040
Forestburg	2123
Dacotah	1690
Trailblazer	1350
Shawnee	908
OKNU 94-2	613
Cave-In-Rock	532
Grand Mean	1701
LSD (0.05)	819

Soybean Breeding Summary

Project Leader: Roy Scott

Research Associate: Curt Reese
Research Manager: Steve Stein

In 2003 we tested 500 maturity group 0 and 1 lines in second year yield trials, and 700 group 0 and 1 lines in first year yield trials at Northeast research farm. In addition, we grew 6 yield trials to test maturity group 0 and 1 materials for the Northern Regional Uniform Test. About 90% of the lines tested were Roundup Ready, and 10% conventional. This report gives a brief summary of results from two-year yield trials of Roundup Ready lines.

Yields of 96 maturity group 0 lines at Northeast Farm ranged from 20-36 bushels/acre, compared to 21-41 at Sinai, 29-46 at Estelline, 11-24 at Tolstoy, and 29-52 at Brookings for the same set of lines. Except for Tolstoy, overall mean yields were 8-13 bushels per acre lower at Northeast farm than the other locations.

Two sets of group 1 Roundup Ready lines were tested, comprising of 104 and 107 entries in set 1 and 2, respectively. In set 1, yields at Northeast Farm ranged from 12-35 bushels per acre, compared to 27-45 at Brookings, and 28 to 47 at Estelline. Overall mean yields were 14 bushels per acre lower at Northeast Farm than the other locations. In set 2, yields at Northeast Farm ranged from 5-31 bushels per acre, compared to 24-52 at Brookings, 16-33 at Tolstoy, and 23-40 at Sinai. Overall mean yields were 3-20 bushels per acre lower at Northeast Farm than the other locations.

To summarize, early, mid, and late season water stress contributed to low yields at Northeast Farm in 2003. Early stresses contributed to poor stand establishment, mid-season stresses resulted in poor vegetative growth and poor flowering, while late season stresses resulted in poor pod set and seed fill. The results reported here were representative of our overall testing at this site. The data we collected will be useful for selection of performance of these lines under extreme stress conditions.

Comparison of BT-Corn and Insecticides For Use Against the Univoltine Ecotype European Corn Borer

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INTRODUCTION

The use of Bt-corn as a means of controlling the European corn borer in South Dakota started in 1996. Bt-corn hybrids containing the so-called Cry 1 Ab gene have performed very well against the larvae of the univoltine ecotype European corn borer. However, because European corn borers do not always occur in damaging numbers every season, and Cry 1 Ab Bt-corn hybrids are highly specific to certain lepidopterous pests, there may be instances where the flexibility and broader spectrum of insecticidal sprays may be more desirable than Bt-corn in corn insect pest management.

There are over fifty different species of insects that can potentially infest corn in SD. Bt-corn, because of its designed selectivity, will only control a few of these potential pests. Thus, if previously minor insect species replace the major pests that were effectively controlled by Bt-corn, there may be a need for effective broad-spectrum insecticides in the near future.

This research was conducted to compare the performances of liquid and granular insecticides with Bt-corn in controlling larvae of the univoltine ecotype European corn borer. This is the second year of a two-year study comparing insecticides with Bt-corn for use against the European corn borer in SD. Please refer to Catangui et al. (2003) for last year's (2002) results.

MATERIALS AND METHODS

All experiments were conducted at the SD Northeast Research Station near South Shore during the 2003 growing season. The treatments tested are summarized in Table 1. All insecticide treatments were applied on July 22 on corn that were tasseling.

The corn seeds were planted using a John Deere MaxEmerge 2 planter on May 16, 2003. Plant population was at 25,677 per acre. Each treatment listed in Table 1 was replicated 4 times and assigned in a randomized complete block fashion on each experimental unit. Each experimental unit was composed of four rows (80 ft. long) spaced 30 inches apart. One row per plot was destroyed and dissected for corn borer injuries. Three rows were kept intact then harvested at the end of season (October 14, 2003). Ten consecutive plants on one row were dissected from September 30 to October 2, 2003 using a curved knife and examined for corn borer larval tunnels, tunnel length, and live corn borer larvae in the stalk, ear shank, and ear. Data were analyzed using

SAS (SAS Institute 1989) after appropriate data transformations to normalize the data (Gomez and Gomez .1984).

Activities of corn borer moths at night were monitored with a light trap equipped with a 15-watt “black light” fluorescent bulb. An insecticide-impregnated rubber strip (dichlorvos) was placed in the collection container of the trap to quickly kill all insects attracted to the light trap. The light trap operated 24 hours a day from May 14 to September 14 during the growing season. Corn borer moths collected by the trap were counted regularly.

Table 1. Bt corn and insecticide treatments tested against the univoltine ecotype European corn borer larvae at the NE Research Station during the 2003 growing season.

Corn hybrid	Treatment	Product per acre	Formulation
H-6573	Untreated	-----	-----
H-6648	Bt (YieldGard)	-----	-----
H-6573	Intrepid	4.00 fluid ounces	Liquid
H-6573	Mustang	4.00 fluid ounces	Liquid
H-6573	Pounce 1.5G	8.00 pounds	Solid
H-6573	Tracer	2.00 fluid ounces	Liquid
H-6573	Warrior	3.84 fluid ounces	Liquid
H-6573	Proaxis	3.84 fluid ounces	Liquid
N-25-Y2	Untreated	-----	-----
N-2555	Bt (YieldGard)	-----	-----

RESULTS AND DISCUSSION

Corn borer moth flight. Peak corn borer moth flight appears to have occurred on July 22 with about 19 moths captured per light trap in one night (Figure 1). This number is lower than the peak number of the previous season. Historical moth flights in the NE Research Station can be found online at the Extension Entomology Web site (Catangui 2003).

Yield. No significant differences in yields were detected among the Bt-corn, untreated non-Bt corn, and insecticide-treated non-Bt corn hybrids (Fig. 2A). Although corn borers were present on the field, their numbers did not appear to be economically significant in 2003. Attempts to control corn borers, either by planting Bt-corn hybrids, or by treating non-Bt corn hybrids with insecticides may not have been economically justifiable. In general, the yields were much lower across treatments due to moisture stress compared with normal years.

Stalk injury. In the untreated non-Bt hybrid, 25-30% of the stalks were infested with corn borer larvae by the time the stalks were dissected on October 2 (Figure 2B). These infestation levels did not significantly reduce yields.

None of the stalks in the Bt hybrids were infested with corn borers indicating that the Cry 1 Ab gene provided total protection against corn borer infestations throughout the growing season. The Bt-corn hybrids however did not have significantly higher yields than their untreated non-Bt counterparts.

The various insecticide treatments were able to protect the corn stalks from being infested by corn borer larvae. Like the Bt-corn hybrids, none of the insecticide treatments resulted in significantly higher yields indicating that the corn borer numbers on the field were not economically significant.

Summary. Despite providing excellent protection against European corn borer infestations, none of the Bt-corn hybrids or insecticide treatments resulted in significantly higher yields than the untreated non-Bt corn hybrids. The 2003 season underscores the fact that corn borers are not present in damaging numbers every single growing season in a location. Expenditure related to corn borer control either by deploying transgenic Bt-corn hybrids at planting, or by treating with insecticides may not have been necessary in 2003 at the NE Research Station. Scouting the field (and deciding not to treat) would have been the better corn borer control strategy during this "low" corn borer year.

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Fig. 1. European corn borer moth flight at the NE Research Station

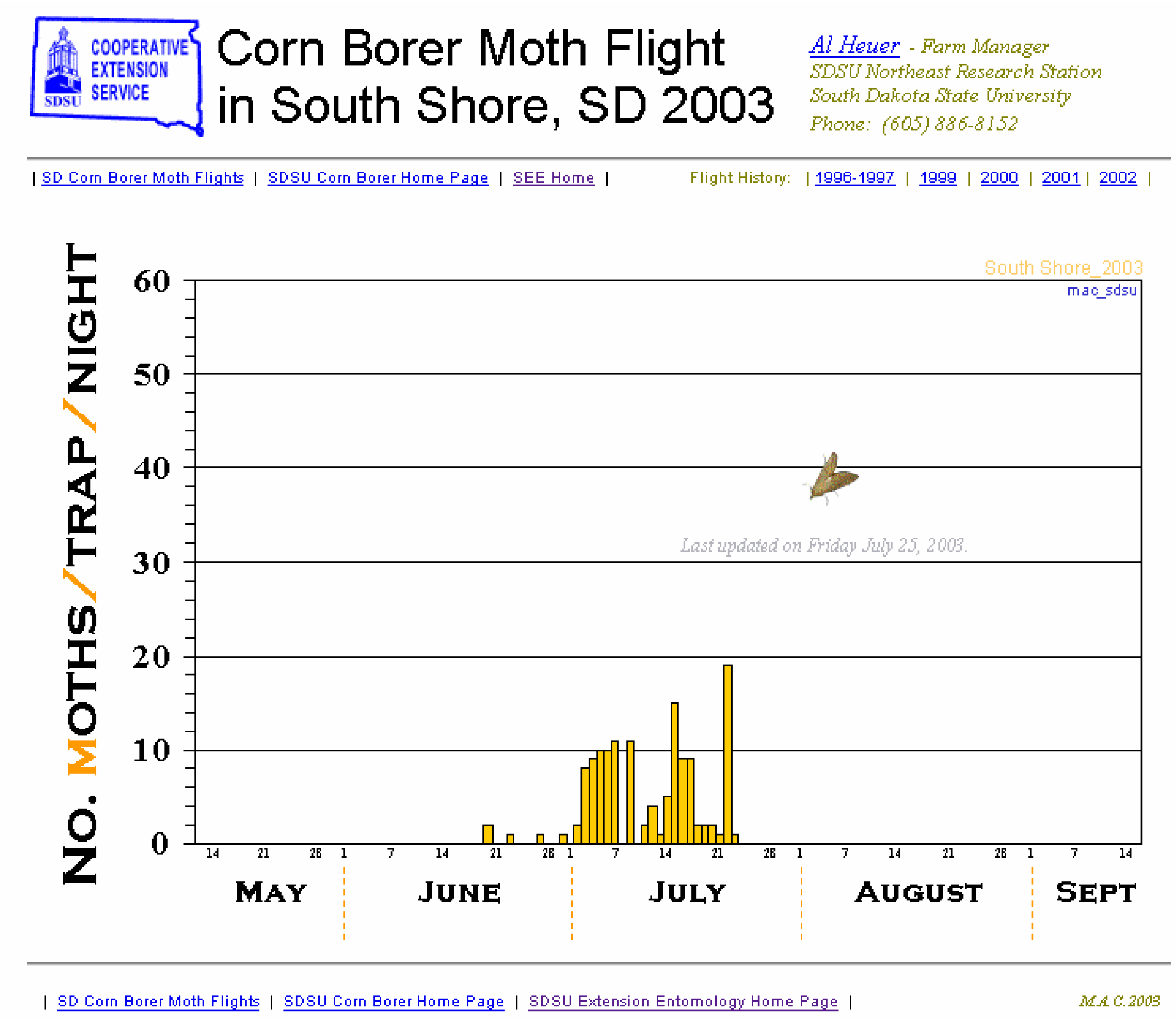
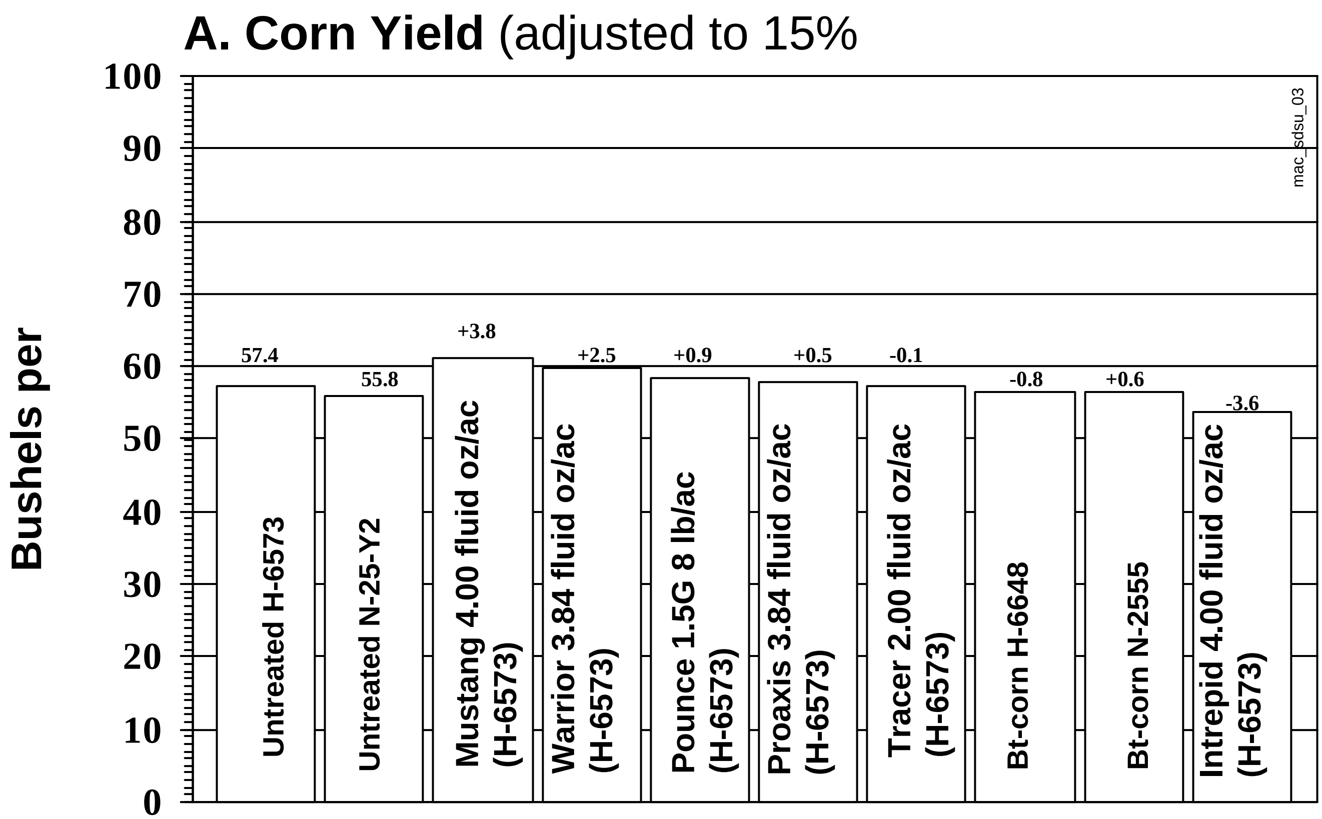
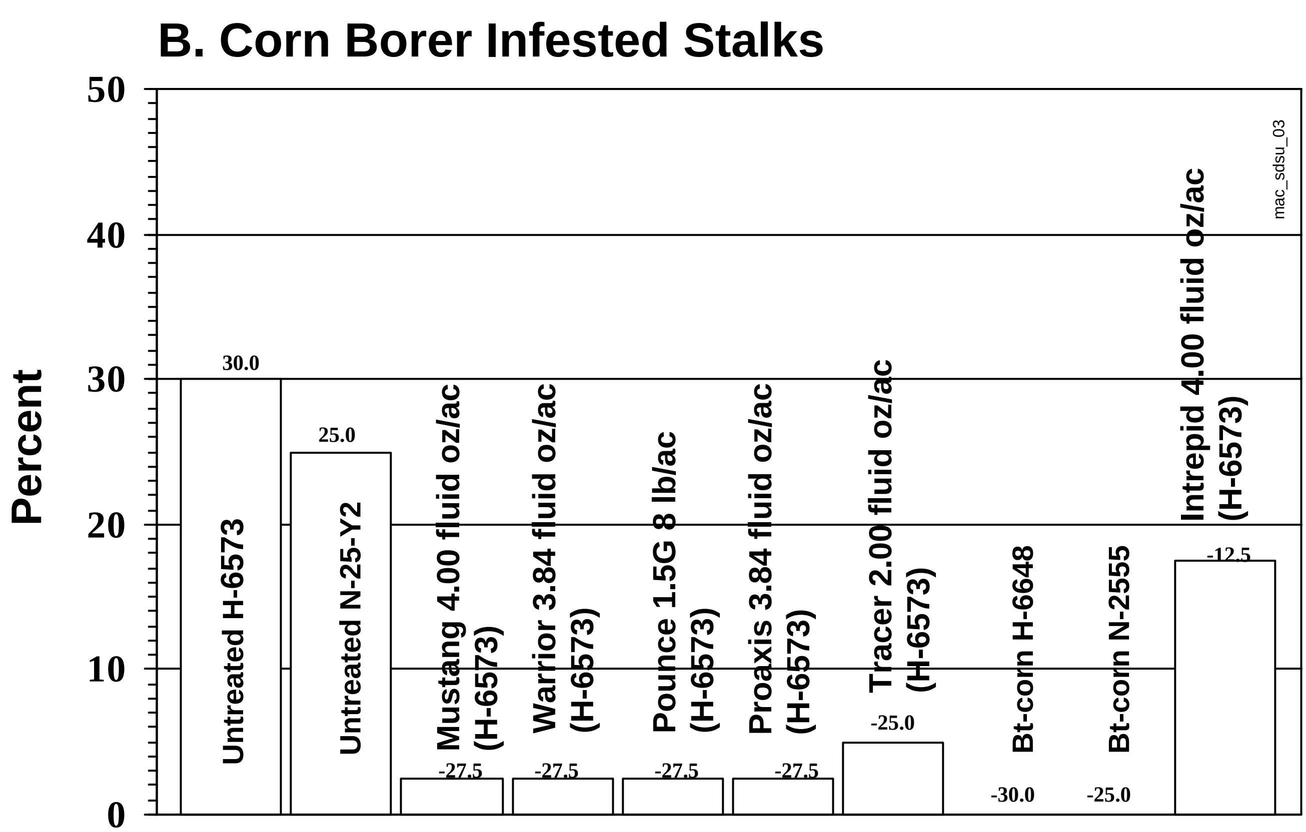


Fig. 2. Performances of Bt-corn and various insecticides against the univoltine ecotype European corn borer at the NE Research Station during the





Corn Breeding

Zeno W. Wicks, III *and* Dawn M. Gustafson
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Interest exists among both 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 seed. 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 because of profit realized from meat or dairy production. 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 in 2002-3. 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 South Dakota State University corn project once again evaluated three 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) at three locations.

In addition, the North Dakota State University corn breeder developed four open-pollinated populations adapted to the northern region. We felt the Northeast Research Station would provide a suitable climate for evaluation. Three replications of a Dekalb hybrid check and four open-pollinated populations developed by North Dakota were evaluated for yield, plant population, lodging, and overall agronomic health.

Preliminary yield data shows that the Dekalb hybrid was superior at the Northeast Research Station in terms of yield and lodging. Yields for the check hybrid ranged from

61.33 bushels/acre to 70.66 bushels/acre, while the open-pollinated populations ranged from 39.64 bushels/acre to 55.46 bushels/acre.

These results are not inconsistent from prior findings. In terms of economic feasibility, however, open-pollinated populations when compared to commercial hybrids under high-stress and low-yielding farming conditions may prove to be a profitable alternative.

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

Acknowledgements

This research was sponsored by the North Central Region Sustainable Agriculture Research and Education Program. We also appreciate the financial support provided by the SDSU Plant Science Department and the South Dakota Corn Utilization Council.

We would also like to thank Allen Heuer for establishing and maintaining the corn nursery and for his readiness to aid our project.

Fertilizer Influences on Soil Test and Corn Grain Yield, Watertown, SD 2003

Jim Gerwing, Ron Gelderman, Anthony Bly, and Allen Heuer

Introduction

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 less or no fertilizer is used when test levels are high. It is still a common practice, however, to apply fertilizer without a current soil test. Frequently all the major nutrients (N P K) and sometimes zinc are used. This experiment was initiated to demonstrate the effects of applying P, K and Zn regardless of soil test. The objective is to demonstrate soil testings' ability to predict crop response to fertilizer and fertilizer influence on soil tests. The intent is to continue the experiment on the same location at the NE Experiment Station for a number of years.

Materials and Methods

The site selected at the NE Experiment Station is a nearly level silty clay loam soil (Brookings) that is common to North East South Dakota. The experiment was initiated in 1996 with the same fertilizer nutrients applied to the same plots each year.

The check fertilizer treatment in this experiment received all fertilizer nutrients (130 lb/a N, 40 lb/a P_2O_5, 50 lb/a K_2O, 5 lb/a Zn). Each subsequent treatment received three of the four nutrients allowing a comparison of the "full" fertilizer program to a treatment lacking one individual nutrient (Table 1). Nutrient rates were the same each year except nitrogen. Fertilizer sources used were urea (46-0-0), super phosphate (0-46-0), potassium chloride (0-0-60) and zinc sulfate (35% Zn). Fertilizer was broadcast and incorporated by field cultivating prior to planting. The corn hybrid was DKC 44-46 and was planted on May 14. Plant height was measured on July 23, 2003. Six plants were selected randomly in each plot for height measurement. The site had been chisel plowed in the fall of 2002. Plot size was 15 feet by 60 feet. Each treatment was replicated four times. Corn was harvested with a small plot combine.

Results and Discussion

Soil test results from samples taken November 4, 2002, are listed in Table 2. The nitrate soil test was 19 lb/a 2 feet where no nitrogen had been applied since 1995. The residual nitrate level was 40 lb/a 2 feet where 60 lb/a N was applied in the spring of 2002. The 40 pounds of phosphorus and 50 pounds of potassium applied each year since 1996 raised the phosphorous soil test from 4 ppm in the check to 14 ppm and the potassium test from 128 ppm in the check to 169 ppm. Five pounds of zinc applied five times raised the zinc soil test from 0.78 to 7.50 ppm.

Yields were low due to drought stress. Early in the growing season treatment differences were seen in plant height. Plant height measurements show these differences (Table 1). Treatments without N, P, or K had significantly shorter plant height. However, yields were not significantly different. The treatment without N had the lowest yield. When orthogonal contrasts were applied to each treatment without a nutrient in the application, the treatment without N was significantly different from the other treatments (Table 1). Grain yield response to P was expected because the check plot soil test was in the low soil test category (4 ppm). The height data shows that a yield response to P was probably going to happen, but the lack of precipitation in July and August negated this effect. A yield response to K could have also occurred, but was less likely since the check treatment soil test K was in the high soil test category (128 ppm). Like P, the drought negated any yield increase from K application.

This site will be rotated to soybeans in 2004. Similar fertilizer treatments (N rate will change) will be applied to the same plots. Yield and soil tests from the past years of this study can be found in the 1996 to 2002 NE Farm Progress Reports or in the 1996 to 2002 SDSU Plant Science Department Soil/Water Science Research Annual Report, TB No. 99.

Table 1. Fertilizer Treatments and Corn Yield and Height, North East Research Farm, Watertown, 2002.

Fertilizer[1]					Grain	
N	P_2O_5	K_20	Zn	Height	Orthogonal Contrast	Yield
- - - - - - - - - - - - - lb/a - - - - - - - - - - - - -				bu/a	Pr>F	
130	40	50	5	79.7 a	No contrast	68
0	40	50	5	70.8 bc	**N contrast = 0.032**	61
130	0	50	5	69.0 c	P contrast = 0.783	66
130	40	0	5	73.4 b	K contrast = 0.465	64
130	40	50	0	79.6 a	Zn contrast = 0.141	69
Pr > F				0.01		0.137
CV%				2.4		6.6
LSD .05				2.8		ns

[1] P, K, Zn applied each year 1996-2002, N rate was 50, 95, 50, 75, 115, 50, 60, 130 lb/a for years 1996-2003

Table 2. Soil Tests for Fertilizer Experiment at NE Research Farm, Watertown, 2003.

Soil Test[1]	Fertilized[2]	Unfertilized
Nitrate-N, lb/a 2 feet	40	19
Phosphorus, ppm Olson	14	4
Potassium, ppm	169	128
Zinc, ppm	7.50	0.78
pH	6.5	---
Organic Matter, %	3.3	---
Salt, mmhos/cm	0.3	---

[1] Sampled 11/4/02
[2] each year since 1996

Weed Control - W.E.E.D. Project

L. Wrage, D. Deneke, D. Vos, B. Rook and S. Andersen

INTRODUCTION

Evaluation and extension demonstration plots provide weed control data for northeastern South Dakota. Field plots provide side-by-side comparisons and comparative performance data. Rates used are those best suited for the weed and soil type. Plots are evaluated for weed control and crop tolerance. Yields are harvested from replicated tests.

2003 Tests

Early-season precipitation was adequate for preemergence herbicides in corn and soybean. Dry conditions during mid season resulted in crop stress. Yield response for weed control were excellent.

Wide temperature fluctuations during early season may have resulted in atypical weed emergence patterns.

Additional plot area provided from Korth Farms was used for several tests. The area provided a uniform site with adequate yellow foxtail densities for evaluation.

2003 Evaluation/Demonstration Tests Reported

1. Corn Herbicide Demonstration
2. Herbicide Tolerant Corn Demonstration
3. Preemerge Program Comparisons in Corn
4. Postemerge Program Comparisons in Corn
5. Roundup Ready Corn Systems
6. Soybean Herbicide Demonstration
7. Herbicide Tolerant Soybean Demonstration
8. Late Lambsquarters Control in Soybean
9. Control of Volunteer Soybeans
10. Tillage Comparisons with Herbicide Programs
11. Oat Herbicide Tolerance
12. Weed Control in Canola
13. Flax Demonstration
14. Clearfield Sunflowers

Weeds represent typical problem species in the area. Lambsquarter, redroot pigweed, and wild mustard are primary broadleaf weeds at the station and in the area. Yellow foxtail has become the prodominant grassy weed in most blocks.

Lambsquarter density has increased. Kochia in some test blocks appears to have a significant population of ALS resistant biotypes.

Additional evaluation plots include initial tests with experimental herbicides, additives, and tests for other crops. Data collected for additional tests are reported in the W.E.E.D. Project Report.

1. Weed Control in Corn with Priority
2. Option Additives
3. Lumax and Camix Comparisons
4. Weed Control with KIH-485
5. Corn Response to Glyphosate Exposure
6. Assure II Control of Volunteer Spring Wheat
7. Weed Control in Express Sunflowers
8. Weed Control Programs in SU Tolerant Sunflowers and Canada Thistle Control
9. Express Response on Clearfield Sunflowers

The cooperation and assistance from station personnel is acknowledged. Extension educators identify needs, assist with tours, and utilize the data in producer programs.

NOTE: ***Data reported in this publication are results from field tests that include labeled 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 products available. Refer to the appropriate weed control fact sheet available from county extension offices for herbicide recommendations.***

Table 1. Corn Herbicide Demonstration

Demonstration
Variety: DeKalb DKC44-46
Planting Date: 5/1/03
SPPI/PRE: 5/1/03
EPOST: 6/3/03
POST: 6/13/03
Soil: Clay loam; 3.0% OM; 6.1 pH

Precipitation:

SPPI/PRE:	1st week	0.70 inches
	2nd week	1.76 inches
EPOST:	1st week	0.41 inches
	2nd week	0.00 inches
POST:	1st week	0.00 inches
	2nd week	0.56 inches

Yeft = Yellow foxtail
BDLF = Redroot pigweed and lambsquarter

COMMENTS: Demonstration comparison. Effective early-season precipitation. Yellow foxtail represents a greater challenge than green foxtail. Broadleaf control tended to be consistent for most treatments.

Treatment	***Rate/A***	***% Yeft 7/9/03***	***% BDLF 7/9/03***
Check	----	0	0
SHALLOW PREPLANT INCORPORATED			
Surpass	2.5 pt	93	30
PREEMERGENCE			
Harness	2.3 pt	95	20
Harness	1.5 pt	90	10
Dual II Magnum	2 pt	88	20
Outlook	21 oz	91	42
Degree	4.25 pt	84	58
Experimental	6.7 oz	82	84
Define SC	21 oz	79	65
Balance Pro	2.25 oz	72	95
Epic	13 oz	80	94
Balance Pro + Define SC	2.25 oz + 12 oz	84	95
Balance Pro + Atrazine	2.25 oz + .75 qt	81	98
Lumax	3 qt	83	99
Camix	2.4 qt	80	84
PREEMERGENCE & POSTEMERGENCE			
Dual II Magnum&Callisto + COC + 28% N	1.67 pt&3 oz + 1% + 2 qt	86	98
PREEMERGENCE			
Bicep Lite II Magnum	2 qt	81	88
G-Max Lite	3.5 pt	92	86
Harness Xtra	2.1 qt	94	92
Keystone LA	2.2 qt	95	93
Check	----	0	0

2003 Corn Herbicide Demonstration
Northeast Research Farm
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Treatment	*Rate/A*	*% Yeft 7/9/03*	*% BDLF 7/9/03*
PREEMERGENCE & POSTEMERGENCE			
Balance Pro&Option+MSO+28% N	2 oz&1.5 oz+1.5 pt+2 qt	98	98
Balance Pro&Buctril/Atrazine	2.25 oz&1 qt	79	99
PREEMERGENCE			
Balance Pro+Callisto	2.25 oz+6 oz	76	99
PREEMERGENCE & POSTEMERGENCE			
Balance Pro&Callisto+COC+28% N	2.25 oz&3 oz+1%+2 qt	79	97
Outlook&Distinct+NIS+28% N	21 oz&6 oz+.25%+2 qt	90	99
Outlook&Distinct+NIS+28% N	21 oz&4 oz+.25%+2 qt	93	97
Outlook&Distinct+atrazine+ NIS+28% N	21 oz&4 oz+1.5 pt+ .25%+2 qt	87	99
Outlook&Marksman+NIS+28% N	21 oz&2 pt+.125%+2 qt	89	98
Surpass&2,4-D amine	2.5 pt&1 pt	87	98
Surpass&Shotgun	2.5 pt&3 pt	90	99
Surpass&Aim EW+atrazine+ COC+28% N	2.5 pt&.5 oz+1 qt+ 1%+2 qt	89	98
Surpass&Aim EW+Hornet WDG+ NIS+28% N	2.5 pt&.5 oz+3 oz+ .25%+2 qt	92	99
Surpass&Hornet WDG+NIS+28% N	2.5 pt&3 oz+.25%+2 qt	90	98
Surpass&Hornet WDG+atrazine+ COC+AMS	2.5 pt&3 oz+1.33 pt+ 1%+2.5 lb	94	99
Surpass&Hornet WDG+Callisto+ COC+AMS	2.5 pt&3 oz+.75 oz+ 1%+2.5 lb	90	96
Surpass&Accent+atrazine+ COC+28% N	2.5 pt&.33 oz+1.5 pt+ 1%+2 qt	96	99
Surpass&Accent+atrazine+ COC+28% N	1.25 pt&.67 oz+1.5 pt+ 1%+2 qt	91	99
Surpass&Accent+atrazine+ COC+28% N	1.25 pt&.33 oz+1.5 pt+ 1%+2 qt	88	99
Dual II Magnum&Northstar+atrazine+ NIS+28% N	1.67 pt&5 oz+1.5 pt+ .25%+2 qt	86	99
Cinch&Steadfast+Marksman+ COC+28% N	1 pt&.75 oz+1 pt+ 1%+2 qt	91	99
Check	----	0	0

2003 Corn Herbicide Demonstration
Northeast Research Farm
Page 3

Treatment	Rate/A	% Yeft 7/9/03	% BDLF 7/9/03
EARLY POSTEMERGENCE			
Lumax + COC + 28% N	2.5 qt + 1% + 2 qt	85	99
Option + MSO + 28% N	1.5 oz + 1.5 pt + 2 qt	88	40
Option + atrazine + MSO + 28% N	1.5 oz + 1.5 pt + 1.5 pt + 2 qt	81	98
Option + Distinct + MSO + 28% N	1.5 oz + 4 oz + 1.5 pt + 2 qt	91	99
Option + Callisto + atrazine + MSO + 28% N	1.5 oz + 1.5 oz + 1.5 pt + 1.5 pt + 2 qt	86	99
Steadfast + COC + 28% N	.75 oz + 1% + 2 qt	89	65
Steadfast + Priority + COC + AMS	.75 oz + 1 oz + 1% + 2.5 lb	83	98
Steadfast + Marksman + COC + AMS	.75 oz + 1 pt + 1% + 2.5 lb	87	98
Steadfast + atrazine + Callisto + COC + AMS	.75 oz + 1.5 pt + 2 oz + 1% + 2.5 lb	89	99
Accent + COC + 28% N	.67 oz + 1% + 2 qt	84	60
Accent Gold + atrazine + COC + 28% N	3.5 oz + 1.5 pt + 1% + 2 qt	93	98
Celebrity Plus + atrazine + COC + 28% N	4.7 oz + 1.5 pt + 1% + 2 qt	95	99
Basis Gold + COC + 28% N	14 oz + 1% + 2 qt	89	99

Table 2. Herbicide Tolerant Corn Demonstration

Demonstration
Variety:
PIO 37H27 (Liberty Link)
PIO 38A23 (Clearfield)
DeKalb DKC44-46 (Roundup Ready)
PRE: 5/1/03
EPOST: 6/3/03
POST: 6/13/03
Soil: Clay loam; 3.0% OM; 6.1 pH

Precipitation:

PRE:	1st week	0.70 inches
	2nd week	1.76 inches
EPOST:	1st week	0.41 inches
	2nd week	0.00 inches
POST:	1st week	0.00 inches
	2nd week	0.56 inches

Fxtl = Yellow foxtail
Bdlf = Redroot pigweed and lambsquarter

COMMENTS: Comparison of Clearfield, Liberty Link and Roundup Ready weed control programs.

Treatment	***Rate/A***	***% Fxtl 7/9/03***	***% Bdlf 7/9/03***
CLEARFIELD Check	----	0	0
EARLY POSTEMERGENCE			
Lightning + NIS + 28% N	1.28 oz + .25% + 2 qt	94	25
Lightning + atrazine + NIS + 28% N	1.28 oz + 1.5 pt + .25% + 2 qt	91	98
Lightning + Marksman + NIS + 28% N	1.28 oz + 2 pt + .25% + 2 qt	89	99
PREEMERGENCE & POSTEMERGENCE			
Outlook + Lightning + Marksman + NIS + 28% N	12 oz + 1.28 oz + 2 pt + .25% + 2 qt	91	99
LIBERTY LINK Check	----	0	0
EARLY POSTEMERGENCE			
Liberty + atrazine + AMS	32 oz + 1 pt + 3 lb	89	98
POSTEMERGENCE			
Liberty + atrazine + AMS	32 oz + 1 pt + 3 lb	99	98
EARLY POSTEMERGENCE & POSTEMERGENCE			
Liberty + atrazine + AMS& Liberty + AMS	24 oz + 1 pt + 3 lb& 24 oz + 3 lb	97	99
PREEMERGENCE & POSTEMERGENCE			
Define&Liberty + atrazine + AMS	10 oz&32 oz + 1 pt + 3 lb	96	98
EARLY POSTEMERGENCE			
Define + Liberty + atrazine + AMS	4 oz + 32 oz + 1 pt + 3 lb	93	99
PREEMERGENCE & POSTEMERGENCE			
Balance Pro&Liberty + atrazine + AMS	1.5 oz&32 oz + 1 pt + 3 lb	99	98

Treatment	*Rate/A*	*% Fxtl 7/9/03*	*% Bdlf 7/9/03*
ROUNDUP READY Check	----	0	0
EARLY POSTEMERGENCE			
Roundup UltraMax+AMS	26 oz+2.5 lb	89	93
POSTEMERGENCE			
Roundup UltraMax+AMS	26 oz+2.5 lb	97	99
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup UltraMax+AMS&	26 oz+2.5 lb&		
Roundup UltraMax+AMS	26 oz+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Atrazine&Roundup UltraMax+AMS	1.5 qt&26 oz+2.5 lb	97	99
Harness&Roundup UltraMax+AMS	2.3 pt&26 oz+2.5 lb	99	99
Harness&Roundup UltraMax+AMS	1 pt&26 oz+2.5 lb	98	99
EARLY POSTEMERGENCE			
Harness+Roundup UltraMax+AMS	2.3 pt+26 oz+2.5 lb	98	99
PREEMERGENCE & POSTEMERGENCE			
Dual II Magnum&Touchdown+AMS	1.67 pt&1 qt+2.5 lb	99	97
Surpass&Glyphomax Plus+AMS	1.75 pt&1 qt+2.5 lb	99	99
Keystone LA&Warrant+AMS	1.3 qt&24 oz+2.5 lb	99	99
POSTEMERGENCE			
Glyphomax Plus+Curtail+AMS	1 qt+1 pt+2.5 lb	98	99
EARLY POSTEMERGENCE			
Prowl H_2O+Roundup Original+	33.8 oz+24 oz+		
NIS+AMS	.25%+2.5 lb	99	99
Outlook+Distinct+	12 oz+4 oz+		
Roundup UltraMax+AMS	16 oz+2.5 lb	98	99
PREEMERGENCE & EARLY POSTEMERGENCE & POSTEMERGENCE			
Outlook&Distinct&	12 oz&4 oz&		
Roundup Original+NIS+AMS	1 pt+.25%+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Outlook&Roundup UltraMax+AMS	12 oz&24 oz+2.5 lb	99	98
Outlook&Roundup Original+	12 oz&1 pt+		
Clarity+NIS+AMS	8 oz+.25%+2.5 lb	98	99

Treatment	*Rate/A*	*% Fxtl 7/9/03*	*% Bdlf 7/9/03*
POSTEMERGENCE			
Roundup UltraMax+atrazine+AMS	24 oz+1 pt+2.5 lb	99	99
Roundup UltraMax+Aim EW+	24 oz+.5 oz+		
atrazine+AMS	1 pt+2.5 lb	98	99
Roundup UltraMax+Resource+AMS	24 oz+4 oz+2.5 lb	99	99
Roundup UltraMax+Callisto+AMS	24 oz+3 oz+2.5 lb	99	99

Table 3. Preemerge Program Comparison in Corn

RCB; 4 reps
Variety: DeKalb DKC 44-46
Planting Date: 5/1/03
PRE: 5/1/03
POST: 6/19/03
Soil: Silty clay loam; 3.2% OM; 5.9 pH

Precipitation:

PRE:	1st week	0.70 inches
	2nd week	1.76 inches
POST:	1st week	0.56 inches
	2nd week	0.00 inches

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

Yeft = Yellow foxtail
KOCZ = Kochia

COMMENTS: Uniform site across treatments. Heavy foxtail pressure. Effective early precipitation. Harness Xtra tended to have highest ratings. Excellent kochia control. Yellow foxtail control was less than desired in several tests at this site.

Treatment	***Rate/A***	***% VCRR 7/9/03***	***% Yeft 7/9/03***	***% KOCZ 7/9/03***	***% Yeft 9/8/03***	***% KOCZ 9/8/03***	***Yield bu/A***
Check	----	0	0	0	0	0	12
PREEMERGENCE & POSTEMERGENCE							
Degree&Yukon +	4.25 pt&4 oz +						
NIS + AMS	.25% + 2 lb	0	71	98	71	98	59
Degree Xtra&Yukon +	3 qt&4 oz +						
NIS + AMS	.25% + 2 lb	0	80	98	70	98	66
Harness&Yukon +	2.5 pt&4 oz +						
NIS + AMS	.25% + 2 lb	0	82	98	75	98	72
Harness Xtra&Yukon +	2 qt&4 oz +						
NIS + AMS	.25% + 2 lb	0	82	98	84	98	75
Degree Xtra&Permit +	3 qt&.67 oz +						
NIS + AMS	.5% + 2 lb	0	80	98	78	97	64
Harness Xtra&Permit +	2 qt&.67 oz +						
NIS + AMS	.5% + 2 lb	0	85	98	81	95	73
PREEMERGENCE							
Fieldmaster	3 qt	0	77	98	65	94	54
Harness +	1.25 pt +						
Balance Pro + atrazine	1.875 oz + 1.5 pt	0	79	98	79	98	65
Define + Balance Pro	10 oz + 2.25 oz	0	68	98	68	97	44
LSD (.05)		0	4	0	5	2	7

Table 4. Postemerge Program Comparisons in Corn

RCB; 3 reps
Variety: DeKalb DKC 44-46
Planting Date: 5/16/03
POST: 6/19/03
POST1: 7/7/03
Soil: Clay loam; 3.2% OM; 6.3 pH

Precipitation:

POST:	1st week	0.56 inches
	2nd week	0.00 inches
POST1:	1st week	0.29 inches
	2nd week	1.07 inches

Yeft = Yellow foxtail

COMMENTS: Late data suggests antagonism response for some treatments. Very dry mid and late season resulted in low yield and test weight. Early post produced higher yields than later timing.

Treatment	***Rate/A***	***% Yeft 7/9/03***	***% Yeft 8/12/03***	***% Yeft 9/8/03***	***Yield bu/A***
Check	----	0	0	0	
POSTEMERGENCE					
Roundup UltraMax + Exp. + AMS	13 oz + .75 oz + 2.5 lb	97	92	88	89
POSTEMERGENCE1					
Roundup UltraMax + Exp. + AMS	13 oz + .75 oz + 2.5 lb	—	95	97	65
POSTEMERGENCE					
Roundup UltraMax + Exp. + Clarity + AMS	13 oz + .75 oz + 2 oz + 2.5 lb	95	90	88	91
Steadfast + Distinct + Dyne-Amic + AMS	.75 oz + 2 oz + .5% + 2.5 lb	92	88	88	77
Steadfast + Clarity + Dyne-Amic + AMS	.75 oz + 4 oz + .5% + 2.5 lb	93	89	88	78
Accent + Clarity + Dyne-Amic + AMS	.85 oz + 4 oz + .5% + 2.5 lb	89	85	77	72
Steadfast + Dyne-Amic + AMS	.75 oz + .5% + 2.5 lb	91	85	79	70
Option + Dyne-Amic + AMS	1.5 oz + .5% + 2.5 lb	81	75	70	60
Steadfast + Callisto + Dyne-Amic + AMS	.75 oz + 3 oz + .5% + 2.5 lb	89	87	83	81
Option + Clarity + Dyne-Amic + AMS	1.5 oz + 4 oz + .5% + 2.5 lb	81	71	72	74
Atrazine + Distinct + Dyne-Amic + AMS	1.5 pt + 2 oz + .5% + 2.5 lb	70	53	49	57
Clarity + atrazine	6 oz + 1.5 pt	50	44	35	42
Steadfast + Callisto + atrazine + Dyne-Amic + AMS	.75 oz + 3 oz + 1.5 pt + .5% + 2.5 lb	72	63	62	73
LSD (.05)		6	6	5	13

Table 5. Roundup Ready Corn Systems

RCB; 3 reps	Precipitation:		
Variety: DeKalb DKC 44-46	PRE:	1st week	0.60 inches
Planting Date: 5/16/03		2nd week	0.07 inches
PRE: 5/16/03	POST:	1st week	0.56 inches
POST: 6/19/03		2nd week	0.00 inches
POST1: 6/26/03	POST1:	1st week	0.00 inches
Soil: Clay loam; 3.2% OM; 6.3 pH		2nd week	0.64 inches

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

Yeft = Yellow foxtail

COMMENTS: Roundup Ready programs with rate comparisons. Heavy yellow foxtail. Treatments provided very good control. Crop response in check represents stunting weed competition. Uniform site. Treatment yields similar. Severe yield reduction in check.

Treatment	***Rate/A***	***% VCRR Competition 7/9/03***	***% Yeft 7/9/03***	***% Yeft 9/8/03***	***Yield bu/A***
Check	----	40	0	0	14
PREEMERGENCE & POSTEMERGENCE					
Degree Xtra&	1.5 qt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	98	96	92
Degree Xtra&	3 pt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	97	92	87
Harness Xtra&	1.05 qt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	96	90	85
Harness Xtra&	2.1 qt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	98	91	88
POSTEMERGENCE					
Degree Xtra +	1.5 qt +				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	7	96	93	85
PREEMERGENCE & POSTEMERGENCE					
Harness Xtra&	1.05 qt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	97	93	95
POSTEMERGENCE & POSTEMERGENCE1					
Roundup WeatherMax + AMS&	21 oz + 8.5 lb/100 gal&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	5	98	92	84
PREEMERGENCE & POSTEMERGENCE & POSTEMERGENCE1					
Atrazine&	1.5 qt&				
Roundup WeatherMax + AMS&	21 oz + 8.5 lb/100 gal&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	98	92	91
PREEMERGENCE & POSTEMERGENCE					
Harness&	2.3 pt&				
Roundup WeatherMax + AMS	21 oz + 8.5 lb/100 gal	0	98	95	91
LSD (.05)		4	1	5	10

Table 6. Soybean Herbicide Demonstration

Demonstration Precipitation:			
Variety: Asgrow AG1401	PPI/PRE:	1st week	0.42 inches
PPI/PRE: 5/29/03		2nd week	0.33 inches
EPOST: 6/26/03	EPOST:	1st week	0.00 inches
POST: 7/2/03		2nd week	0.64 inches
Soil: Clay loam; 3.2% OM; 6.3 pH	POST:	1st week	0.39 inches
		2nd week	0.60 inches

VCRR = Visual Crop Response Rating
(0 = no injury; 100 = complete kill)
Grft = Green foxtail
Colq = Common lambsquarter
Rrpw = Redroot pigweed
KOCZ = Kochia

COMMENTS: Demonstration comparison. Data provides clear differences in lambsquarter, redroot pigweed, and kochia control. Apparent high percentage ALS resistant kochia biotype. Several treatments exceeded 95% broadleaf control.

Treatment	***Rate/A***	***% VCRR 8/3/03***	***% Grft 8/3/03***	***% Colq 8/3/03***	***% Rrpw 8/3/03***	***% KOCZ 8/3/03***
Check	----	0	0	0	0	0
PREPLANT INCORPORATED						
Treflan	1.5 pt	0	86	97	98	—
Sonalan	2.67 pt	0	95	98	93	—
Prowl H_2O	2.17 pt	0	76	84	89	—
Treflan + Authority	1.5 pt + 5.3 oz	0	88	97	96	—
PREPLANT INCORPORATED & PREEMERGENCE						
Treflan&Authority	1.5 pt&5.3 oz	0	79	98	95	—
PREEMERGENCE & EARLY POSTEMERGENCE						
Prowl H_2O&Pursuit DG + Flexstar + MSO + 28% N	2.17 pt&.72 oz + 10 oz + 1 qt + 1 qt	5	82	99	99	—
Prowl H_2O&Aim EW + NIS	2.17 pt&.25 oz + .25%	0	45	99	98	—
PREEMERGENCE						
Gauntlet	7.9 oz	0	35	99	99	—
Command 3ME + Spartan	1.6 pt + .6 pt	0	30	99	94	—
Boundary	2.5 pt	0	40	97	91	—
Valor + FirstRate	3 oz + .6 oz	0	45	95	90	—
PREEMERGENCE & EARLY POSTEMERGENCE						
Valor&Poast Plus + COC	3 oz&1.5 pt + 1 qt	0	98	78	84	—
Authority&Assure II + COC	4 oz&7 oz + 1 qt	0	94	84	85	—
Authority&Assure II + COC	5.3 oz&7 oz + 1 qt	0	85	88	94	—
Gauntlet&Select + COC	7.9 oz&7 oz + 1 qt	0	90	76	68	---
PREEMERGENCE & EARLY POSTEMERGENCE						
Valor + FirstRate& Select + COC	3 oz + .6 oz& 7 oz + 1 qt	0	93	55	73	—

Treatment	Rate/A	% VCRR 8/3/03	% Grft 8/3/03	% Colq 8/3/03	% Rrpw 8/3/03	% KOCZ 8/3/03
EARLY POSTEMERGENCE & POSTEMERGENCE						
Poast Plus + COC&	1.5 pt + 1 qt&					
Ultra Blazer + NIS	1.5 pt + .25%	0	94	68	94	75
Poast Plus + COC&	1.5 pt + 1 qt&					
Phoenix + COC	.8 pt + 1 pt	0	95	48	97	88
Poast Plus + COC&	1.5 pt + 1 qt&					
Flexstar + MSO + 28% N	16 oz + 1 qt + 1 qt	0	97	76	95	89
Poast Plus + COC&	1.5 pt + 1 qt&					
FirstRate + MSO + 28% N	.3 oz + 1 qt + 1 qt	0	98	86	79	30
Poast Plus + COC&	1.5 pt + 1 qt&					
Harmony GT + NIS	.083 oz + .25%	0	98	93	95	20
EARLY POSTEMERGENCE						
FirstRate + Flexstar +	.3 oz + 10 oz +					
Select + MSO + 28% N	6 oz + 1 qt + 1 qt	0	96	93	94	95
Raptor + MSO + 28% N	5 oz + 1 qt + 1 qt	0	98	97	99	25
Pursuit DG + MSO + 28% N	1.44 oz + 1 qt + 1 qt	0	98	92	99	30
Raptor + Flexstar +	4 oz + 8 oz +					
MSO + 28% N	1 qt + 1 qt	0	97	98	98	98

Table 7. Herbicide Tolerant Soybean Demonstration

Demonstration Precipitation:
Variety: Asgrow AG1401
Planting Date: 5/29/03
PPI/PRE: 5/29/03
EPOST: 6/26/03
POST: 7/2/03
POST1: 7/7/03
Soil: Clay loam; 3.2% OM; 6.3 pH

PPI/PRE:	1st week	0.42 inches
	2nd week	0.33 inches
EPOST:	1st week	0.00 inches
	2nd week	0.64 inches
POST:	1st week	0.39 inches
	2nd week	0.60 inches
POST1:	1st week	0.29 inches
	2nd week	1.07 inches

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

Yeft = Yellow foxtail
Colq = Common lambsquarter
Rrpw = Redroot pigweed

COMMENTS: Comparisons of glyphosate programs in RR soybeans. Split programs with all products and rates provided excellent control. No significant crop response due to treatment. Possible antagonism with some tank-mixes at late post timing.

Treatment	Rate/A	% VCRR 8/3/03	% Yeft 8/3/03	% Colq 8/3/03	% Rrpw 8/3/03
Check	----	0	0	0	0
EARLY POSTEMERGENCE					
Roundup UltraMax+AMS	12.8 oz+2.5 lb	0	88	40	20
Roundup UltraMax+AMS	25.6 oz+2.5 lb	0	94	40	25
POSTEMERGENCE					
Roundup UltraMax+AMS	25.6 oz+2.5 lb	0	87	84	86
EARLY POSTEMERGENCE & POSTEMERGENCE1					
Roundup UltraMax+AMS&	12.8 oz+2.5 lb&				
Roundup UltraMax+AMS	12.8 oz+2.5 lb	0	95	96	98
Roundup UltraMax+AMS&	25.6 oz+2.5 lb&				
Roundup UltraMax+AMS	25.6 oz+2.5 lb	0	96	98	97
Touchdown 3L+AMS&	32 oz+2.5 lb&				
Touchdown 3L+AMS	32 oz+2.5 lb	0	95	98	98
Glyphomax Plus+AMS&	32 oz+2.5 lb&				
Glyphomax Plus+AMS	32 oz+2.5 lb	0	96	98	99
ClearOut 41+AMS&	32 oz+2.5 lb&				
ClearOut 41+AMS	32 oz+2.5 lb	0	95	97	99
Roundup WeatherMax+AMS&	21 oz+2.5 lb&				
Roundup WeatherMax+AMS	21 oz+2.5 lb	0	97	98	97
Roundup UltraMax+AMS&	25.6 oz+2.5 lb&				
Roundup UltraMax+AMS	51.2 oz+2.5 lb	0	98	99	98
Touchdown 3L+AMS&	32 oz+2.5 lb&				
Touchdown 3L+AMS	64 oz+2.5 lb	0	98	99	96

Treatment	% VCRR Rate/A	% Yeft 8/3/03	% Colq 8/3/03	% Rrpw 8/3/03	8/3/03
EARLY POSTEMERGENCE & POSTEMERGENCE1					
Glyphomax Plus+AMS&	32 oz+2.5 lb&				
Glyphomax Plus+AMS	64 oz+2.5 lb	0	96	99	98
ClearOut 41+AMS&	32 oz+2.5 lb&				
ClearOut 41+AMS	64 oz+2.5 lb	0	97	99	96
Roundup WeatherMax+AMS&	21 oz+2.5 lb&				
Roundup WeatherMax+AMS	42 oz+2.5 lb	0	98	97	99
PREPLANT INCORPORATED & POSTEMERGENCE					
Treflan&	24 oz&				
Roundup Ultramax+AMS	12.8 oz+2.5 lb	0	99	97	99
Prowl H_2O&Extreme+	2.17 pt&1.5 qt+				
NIS+AMS	.25%+2.5 lb	0	99	96	99
PREEMERGENCE & POSTEMERGENCE					
Python&	1 oz&				
GlyphoMax Plus+AMS	24 oz+2.5 lb	0	98	97	99
Authority&	4 oz&				
Roundup Ultramax+AMS	19.2 oz+2.5 lb	0	98	99	99
Axiom&	13 oz&				

Treatment	*Rate/A*	*% VCRR 8/3/03*	*% Yeft 8/3/03*	*% Colq 8/3/03*	*% Rrpw 8/3/03*
Roundup Ultramax + AMS	19.2 oz + 2.5 lb	0	98	99	99
Domain& Roundup Ultramax + AMS	12 oz& 19.2 oz + 2.5 lb	0	97	97	99
Valor + FirstRate& Roundup Ultramax + AMS	1.5 oz + .3 oz& 19.2 oz + 2.5 lb	0	96	98	99
Boundary& Touchdown 2L + AMS	1.5 pt& 24 oz + 2.5 lb	0	98	98	99
Valor& Roundup UltraMax + AMS	2 oz& 19.2 oz + 2.5 lb	0	97	99	99
EARLY POSTEMERGENCE					
Extreme + NIS + AMS	1.5 qt + .25% + 2.5 lb	0	98	99	97
POSTEMERGENCE					
Roundup Ultramax + Resource + AMS	12.8 oz + 4 oz + 2.5 lb	0	86	81	91
Roundup Ultramax + Flexstar + AMS	12.8 oz + 8 oz + 2.5 lb	0	85	98	95
Roundup Ultramax + Phoenix + AMS	12.8 oz + 10 oz + 2.5 lb	5	79	98	99
Roundup Ultramax + Aim EW + AMS	12.8 oz + .25 oz + 2.5 lb	5	75	90	94
Roundup Ultramax + Harmony GT XP + AMS	12.8 oz + .083 oz + 2.5 lb	0	82	94	93
POSTEMERGENCE					
Glyphomax Plus + FirstRate + AMS	24 oz + .3 oz + 2.5 lb	0	89	87	83
Roundup Ultramax + Supporrt + AMS	12.8 oz + .5 oz + 2.5 lb	0	84	90	74
POSTEMERGENCE1					
Roundup UltraMax + Flexstar + AMS	25.6 oz + 8 oz + 2.5 lb	5	98	99	98
Roundup UltraMax + Harmony GT XP + AMS	25.6 oz + .083 oz + 2.5 lb	5	98	99	99
Roundup UltraMax + Resource + AMS	25.6 oz + 4 oz + 2.5 lb	5	94	96	99
Roundup UltraMax + AMS	51.2 oz + 2.5 lb	0	98	99	99

Table 8. Late Lambsquarters Control in Soybeans

RCB; 2 reps
Variety: AG1401
Planting Date: 6/2/03
POST: 8/7/03
Soil: Clay loam; 3.6% OM; 6.3 pH

Precipitation:
POST: 1st week 0.46 inches
2nd week 0.05 inches

Colq = Common lambsquarters
Rrpw = Redroot pigweed

COMMENTS: Comparison of herbicides, additives and additive rates for late season salvage control of large lambsquarters. Early evaluation (1 wk) indication of early phyto response. At 3 weeks lambsquarter and pigweed were satisfactorily controlled with all treatments. Most additives did not increase initial control; some suggest possible antagonism.

Treatment	*% Colq* ***Rate/A***	*% Colq Kill* ***8/13/03***	*% Rrpw Kill* ***9/1/03***	*Kill* ***9/1/03***
Check	----	0	0	0
POSTEMERGENCE				
Roundup UltraMax	25.6 oz	78	99	99
Roundup UltraMax + Indicate	25.6 oz	70	97	99
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	75	99	99
Roundup UltraMax + AMS	25.6 oz + 10 lb	60	98	99
Roundup UltraMax + Preference	25.6 oz + 4 pt/100 gal	83	98	99
Roundup UltraMax + Preference	25.6 oz + 12 pt/100 gal	48	95	98
Roundup UltraMax + Land Oil	25.6 oz + 1 qt	83	95	97
Roundup UltraMax + MSO	25.6 oz + 1.5 pt	58	95	97
Check	----	0	0	0
Roundup UltraMax + AG Exp.	25.6 oz + 2.5 lb	73	98	99
Roundup UltraMax + Preference + AMS	25.6 oz + 8 pt/100 gal + 5 lb	50	99	99
Roundup UltraMax + AMS	19.2 oz + 2.5 lb	55	98	99
Extreme + AMS	3 pt + 2.5 lb	60	98	99
Roundup UltraMax + Harmony GT XP + AMS	19.2 oz + .083 oz + 2.5 lb	65	98	99
Roundup UltraMax + Harmony GT XP + AMS	19.2 oz + .166 oz + 2.5 lb	60	96	98
Roundup UltraMax + Harmony GT XP + COC + AMS	19.2 oz + .083 oz + 1 qt + 2.5 lb	63	96	98
Roundup UltraMax + Phoenix + AMS	19.2 oz + 10 oz + 2.5 lb	70	98	95
Roundup UltraMax + Phoenix + AMS	19.2 oz + 20 oz + 2.5 lb	83	96	99
Roundup UltraMax + Supporrt + AMS	19.2 oz + .5 oz + 2.5 lb	55	96	99
Roundup UltraMax + Aim EW + AMS	19.2 oz + .5 oz + 2.5 lb	65	97	99
Roundup UltraMax + Resource + AMS	19.2 + 4 oz + 2.5 lb	78	96	98

Treatment	***Rate/A***	***% Colq Kill 8/13/03***	***% Colq Kill 9/1/03***	***% Rrpw Kill 9/1/03***
POSTEMERGENCE				
Roundup UltraMax + AMS	12.8 oz + 2.5 lb	70	96	98
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	58	99	99
Roundup UltraMax + AMS	51.2 oz + 2.5 lb	75	98	99
Roundup UltraMax + AMS	102.4 oz + 2.5 lb	75	99	99
Roundup Original + NIS + AMS	1 qt + .25% + 2.5 lb	63	98	99
Roundup Weathermax + AMS	23.7 oz + 2.5 lb	60	97	99
Touchdown 3L + AMS	1 qt + 2.5 lb	63	96	99
ClearOut 41 Plus + AMS	1 qt + 2.5 lb	68	96	98
Glyphomax Plus + AMS	1 qt + 2.5 lb	53	99	99
Glyfos X-tra + AMS	1 qt + 2.5 lb	65	98	99
Warrant + AMS	23.7 oz + 2.5 lb	65	96	99
Exp + AMS	23.7 oz + 2.5 lb	58	97	97
Glyphosate Potassium + AMS	32 oz + 2.5 lb	73	97	97
LSD (.05)		20	2	1

Table 9. Control of Volunteer Soybeans

Demonstration
POST: 8/29/03
Soil: Silty clay loam; 3.2% OM; 6.3 pH

Precipitation:
POST: 1st week 0.00 inches
2nd week 0.53 inches

Vosb = Volunteer soybeans

COMMENTS: Fall test; cool conditions. Data represents evaluation of initial response to herbicides. Rates represent half and full rates. Some treatments with low early evaluation due to slower visual response may be satisfactory in spring applied situations.

Treatment	Rate/A	% Vosb Stunt 9/19/03	% Vosb Burn 9/19/03	% Vosb Kill 9/19/03
Check	----	0	0	0
POSTEMERGENCE				
Beacon + COC + 28% N	.375 oz + 1% + 1 qt	40	30	10
Beacon + COC + 28% N	.75 oz + 1% + 1 qt	65	65	20
Hornet WDG + COC + 28% N	1.5 oz + .25% + 1 qt	70	15	10
Hornet WDG + COC + 28% N	3 oz + .25% + 1 qt	75	30	25
Accent + COC + 28% N	.33 oz + 1% + 1 qt	15	0	0
Accent + COC + 28% N	.67 oz + 1% + 1 qt	25	0	0
Clarity	2 oz	30	45	10
Clarity	4 oz	40	55	15
Lightning + NIS + 28% N	.64 oz + .25% + 1 qt	5	10	0
Lightning + NIS + 28% N	1.28 oz + .25% + 1 qt	25	35	0
Liberty + AMS	16 oz + 3 lb	85	95	80
Liberty + AMS	32 oz + 3 lb	95	99	95
Distinct + NIS + 28% N	2 oz + .25% + 1 qt	75	80	50
Distinct + NIS + 28% N	4 oz + .25% + 1 qt	75	90	70
2,4-D amine	8 oz	10	5	0
2,4-D amine	16 oz	20	10	0
2,4-D ester	8 oz	60	60	20
2,4-D ester	16 oz	65	75	30
Northstar + NIS + 28% N	2.5 oz + .25% + 1 qt	75	85	45
Northstar + NIS + 28% N	5 oz + .25% + 1 qt	80	90	55
Atrazine + COC	1 qt + 1 qt	90	95	85
Atrazine + COC	2 qt + 1 qt	90	98	92
Marksman	2.5 pt	85	95	85
Marksman	5 pt	95	98	95
Callisto + COC + 28% N	1.5 oz + 1% + 2 qt	50	85	60
Callisto + COC + 28% N	3 oz + 1% + 2 qt	55	90	65

Table 10. Tillage Comparisons with Herbicide Programs

RCB; 4 reps
Variety: DeKalb DKC 44-46
Planting Date: 5/16/03
PRE: 5/16/03
EPOST: 6/9/03
POST: 6/19/03
Soil: Clay loam; 4.1% OM; 5.8 pH

Precipitation:

PRE:	1st week	0.60 inches
	2nd week	0.07 inches
EPOST:	1st week	0.02 inches
	2nd week	0.03 inches
POST:	1st week	0.56 inches
	2nd week	0.00 inches

Fxtl = Green foxtail
Bdlf = Redroot pigweed, lambsquarter

COMMENTS: Evaluation of tillage systems on weed control and yield. Uniform site. Moisture stress during season. Weed density and control ratings were generally similar across tillage and herbicide treatments. Weed density in checks were similar. No-till treatments produced highest yield; response attributed to moisture efficiency.

Treatment	*Rate/A*	*% Fxtl 7/2/03*	*% Bdlf 7/2/03*	*% Fxtl 9/8/03*	*% Bdlf 9/8/03*	*Foxtail Plants/ ft²*	*Yield bu/A*
Check - NO TILLAGE	----	0	0	0	0	24	42
PREEMERGENCE							
Harness + atrazine	2.3 pt + 1 qt	91	94	96	99	—	96
PREEMERGENCE & POSTEMERGENCE							
Harness&	2.3 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	96	95	98	98	—	89
POSTEMERGENCE							
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	94	90	98	98	—	88
EARLY POSTEMERGENCE & POSTEMERGENCE							
Roundup UltraMax + AMS&	25.6 oz + 2.5 lb&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	92	93	97	98	—	94
PREEMERGENCE & POSTEMERGENCE							
Harness&	1.25 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	97	87	98	97	—	81
Check - STRIP TILLAGE	----	0	0	0	0	26	32
PREEMERGENCE							
Harness + atrazine	2.3 pt + 1 qt	89	95	96	99	—	87
PREEMERGENCE & POSTEMERGENCE							
Harness&	2.3 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	95	92	99	98	—	85

Treatment	Rate/A	% Fxtl 7/2/03	Foxtail % Bdlf 7/2/03	% Fxtl 9/8/03	% Bdlf 9/8/03	Plants/ ft^2	Yield bu/A
POSTEMERGENCE							
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	94	93	98	99	—	80
EARLY POSTEMERGENCE & POSTEMERGENCE							
Roundup UltraMax + AMS&	25.6 oz + 2.5 lb&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	92	95	97	98	----	79
PREEMERGENCE & POSTEMERGENCE							
Harness&	1.25 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	94	94	98	97	—	79
Check - CONVENTIONAL	----	0	0	0	0	24	48
PREEMERGENCE							
Harness + atrazine	2.3 pt + 1 qt	80	94	94	95	—	78
PREEMERGENCE & POSTEMERGENCE							
Harness&	2.3 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	96	95	99	99	----	82
POSTEMERGENCE							
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	94	95	98	99	----	76
EARLY POSTEMERGENCE & POSTEMERGENCE							
Roundup UltraMax + AMS&	25.6 oz + 2.5 lb&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	95	95	98	99	----	83
PREEMERGENCE & POSTEMERGENCE							
Harness&	1.25 pt&						
Roundup UltraMax + AMS	25.6 oz + 2.5 lb	95	96	99	99	----	84
LSD (.05)		7	3	2	1		14

Table 11. Oat Herbicide Tolerance

RCB; 3 reps
Variety: Loyal
Planting Date: 5/12/03
POST: 6/3/03
POST1: 6/9/03
Soil: Clay loam; 3.0% OM; 6.1 pH

Precipitation:

POST:	1st week	0.41 inches
	2nd week	0.00 inches
POST1:	1st week	0.02 inches
	2nd week	0.03 inches

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

COMMENTS: Crop emergence was uniform. Below normal mid and late season precipitation. Comparisons included X and 2X rates of labeled oat herbicides and Callisto at X and 2X rates. X and 2X rates provided similar visual crop response. Yield data directly corresponds to visual crop response. All 2,4-D treatments reduced yield significantly. POST1 treatments did not affect visual crop response and yield to the degree of POST treatments.

Treatment	*Rate/A*	*% VCRR 7/9/03*	*Yield bu/A*	*Test Wt. lb/bu*
Check	----	0	125	37
POSTEMERGENCE				
Opti-Amine	1 pt	20	67	29
Opti-Amine	2 pt	20	59	29
Salvo	.8 pt	20	70	29
2,4-D ester	1 pt	18	78	31
MCPA amine	1 pt	0	122	37
MCPA amine	2 pt	0	116	36
MCPA ester	1 pt	0	107	36
Bronate Advanced	.8 pt	0	118	36
Bronate Advanced	1.6 pt	0	128	37
Clarity + MCPA amine	3 oz + .5 pt	0	120	36
Starane + LI-700	.67 pt + .25%	0	120	36
Starane + LI-700	1.33 pt + .25%	0	123	37
Aim EW + NIS	.5 oz + .25%	0	121	37
Aim EW + NIS	1 oz + .25%	0	126	37
Callisto + COC + 28% N	2 oz + 1% + 2 qt	0	124	37
Callisto + COC + 28% N	4 oz + 1% + 2 qt	0	121	36
Harmony GT + NSI	.3 oz + .25%	0	131	37
Stampede CM + COC	1 pt + 1 pt	0	126	36
Stampede CM + COC	2 pt + 1 pt	0	124	36
POSTEMERGENCE1				
MCPA amine	2 pt	0	124	36
Bronate Advanced	.8 pt	0	126	36
Opti-Amine	1 pt	8	110	32
LSD (.05)		1	15	3

Table 12. Weed Control in Canola

RCB; 3 reps
Variety: DKL 223, Invigor 2663
Planting Date: 4/28/03
PPI&PRE: 4/28/03
EPOST: 6/3/03
POST: 6/9/03
Soil: Clay loam; 4.1% OM; 5.8 pH

Precipitation:

PPI&PRE:	1st week	0.83 inches
	2nd week	1.33 inches
EPOST:	1st week	0.41 inches
	2nd week	0.00 inches
POST:	1st week	0.02 inches
	2nd week	0.03 inches

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

Grft = Green foxtail
Colq = Common lambsquarters

COMMENTS: Test demonstrates performance with Liberty Link, Roundup Ready, and standard herbicides. Foxtail and lambsquarter control was very good for most treatments. Experimental Authority did not have adequate tolerance; Outlook and Surpass were tolerant in this test. Yield data for checks indicate crop was very competitive.

Treatment	***Rate/A***	***% VCRR Std Red. 6/26/03***	***% Grft 6/26/03***	***% Colq 6/26/03***	***Yield lb/A***	***Test Wt. lb/bu***
ROUNDUP READY Check	----	0	0	0	1155	52
PREPLANT INCORPORATED						
Sonalan	2.5 pt	0	96	91	956	52
Treflan	2 pt	0	97	96	950	52
PREPLANT INCORPORATED & POSTEMERGENCE						
Treflan&Stinger	1.5 pt&.33 pt	0	93	94	1002	52
PREEMERGENCE						
Dual II Magnum	1.67 pt	0	87	84	877	52
Outlook	21 oz	0	96	88	1391	52
Surpass	3 pt	0	94	91	1271	52
Authority	5.33 oz	60	45	92	640	52
EARLY POSTEMERGENCE						
Roundup UltraMax + AMS	25.6 oz + 2 lb	0	92	96	1267	52
POSTEMERGENCE						
Roundup UltraMax + AMS	25.6 oz + 2 lb	0	92	95	1193	52
EARLY POSTEMERGENCE						
Assure II + COC	8 oz + 1%	0	97	0	993	51
Select + COC	6 oz + 1%	0	97	0	1078	52
LIBERTY LINK Check	----	0	0	0	993	52
EARLY POSTEMERGENCE						
Liberty + AMS	34 oz + 3 lb	0	89	94	1363	53
Liberty + AMS	68 oz + 3 lb	0	92	97	1291	53
LSD (.05)		4	6	5	272	1

Table 13. Flax Demonstration

RCB; 2 reps
Variety: Webster
Planting Date: 4/28/03
PPI: 4/28/03
POST: 6/3/03
Soil: Clay loam; 3.0% OM; 6.1 pH

Precipitation:

PPI:	1st week	1.08 inches
	2nd week	1.08 inches
POST:	1st week	0.41 inches
	2nd week	0.00 inches

Yeft = Yellow foxtail
BDLF = Lambsquarter, mustard

COMMENTS: Yellow foxtail primary limiting factor. Control is critical for maximum yield. Curtail M new label registration for flax.

Treatment	***Rate/A***	***% Yeft 7/24/03***	***% BDLF 7/24/03***	***Yield bu/A***
Check	----	0	0	15
PREPLANT INCORPORATED				
Treflan	1.5 pt	93	64	21
POSTEMERGENCE				
MCPA amine	1 pt	0	85	11
MCPA ester	1 pt	0	72	10
Buctril	1 pt	0	94	12
Poast + COC	1 pt + 1 qt	97	0	23
Poast + Buctril + COC	1 pt + 1 pt + 1 qt	86	90	19
Poast + Stinger + COC	1 pt + .33 pt + 1 qt	98	77	21
Curtail M	2.33 pt	0	86	12
Select + COC	8 oz + 1 qt	98	0	24
LSD (.05)		3	14	6

Table 14. Clearfield Sunflowers

RCB; 4 reps	Precipitation:		
Variety: 8N429CL	PRE:	1st week	0.41 inches
Planting Date: 6/3/03		2nd week	0.00 inches
PRE: 6/3/03	EPOST:	1st week	0.39 inches
EPOST: 7/2/03		2nd week	0.60 inches
POST: 7/7/03	POST:	1st week	0.29 inches
Soil: Clay loam; 4.1% OM; 5.8 pH		2nd week	1.07 inches

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

COMMENTS: Fair to good yellow foxtail control with Beyond. MSO slightly more crop response than NIS. Early application provided best tolerance. No increased treatment response apparent at late evaluation. Weed competition was a factor in crop stunting ratings with postemerge timing.

Treatment	***Rate/A***	***Sunflower % VCRR Chlorosis 7/9/03***	***Sunflower % VCRR Chlorosis 7/16/03***	***Sunflower % VCRR Chlorosis 7/24/03***	***% Yeft 7/24/03***	***Sunflower % VCRR Chlorosis 9/8/03***
Check	----	----	0	0	0	0
PREEMERGENCE						
Prowl + Spartan	38 oz + 4 oz	—	0	0	39	1
EARLY POSTEMERGENCE						
Beyond + NIS + 28% N	4 oz + .25% + 1%	6	1	1	85	0
Beyond + MSO + 28% N	4 oz + 1% + 1%	10	1	1	89	1
PREEMERGENCE & EARLY POSTEMERGENCE						
Prowl&Beyond + NIS + 28% N	38 oz&4 oz + .25% + 1%	3	1	0	86	0
POSTEMERGENCE						
Beyond + NIS + 28% N	4 oz + .25% + 1%	—	10	3	78	0
Beyond + MSO + 28% N	4 oz + 1% + 1%	—	14	4	85	1
PREEMERGENCE & POSTEMERGENCE						
Prowl&Beyond + NIS + 28% N	38 oz&4 oz + .25% + 1%	—	13	3	77	0
Outlook&Beyond + NIS + 28% N	10 oz&4 oz + .25% + 1%	—	9	1	81	0
LSD (.05)		3	3	4	6	4

Intensive Hard Red Spring Wheat Management Study

Robert G. Hall, Kevin K. Kirby, and Glenda Piechowski

INTRODUCTION

Some growers are changing to more intensive management in hopes of increasing the yield and quality of their hard red spring wheat. Two input factors they have increased are (1) seeding rate and (2) level of nitrogen fertility.

Purpose: Evaluate the response of hard red spring wheat to (1) high seeding rates and (2) to a level of nitrogen fertility equal to a common yield goal for the local area and an elevated yield goal of 100 bushels per acre.

MATERIALS & METHODS

This study was conducted at two locations (Table 1). The South Shore study was located on the Orrin Korth farm on Hwy-77 adjacent to the southern border of the NE Research Farm. The Warner study was located on the Allen and Inel Ryckman Farm, five miles east and a mile south of Warner, SD. Common N-yield goals (NYG) included 50 and 64 bu/ac at Warner and South Shore, respectively. A high 100 bu/ac yield goal was used at both sites. Varieties included Forge, Oxen, Walworth, and the experimental line SD3623. Seeding rates included a recommended 1X rate of 28 pure-live-seeds (PLS)/ft^2, an intermediate 1.5X rate (42 PLS), and a high 2X rate (56 PLS).

The common and high NYG levels were calculated using the soil test results and recommendations indicated in Table 1. A total of 250 of N (soil test N + applied N) is recommended for a 100 bu/ac NYG. Soil tests at South Shore and Warner indicated available nitrogen (N) levels of 161 and 65 lb/ac, respectively. At South Shore, no additional N was applied to attain the 64 bu/ac NYG while an additional 60 pounds of N was added to attain the 50 bu/ac NYG at Warner. The test results also indicated an additional 90 lb/ac of N was needed at South Shore and 185 lb/ac of N was needed at Warner to attain the 100 bu/ac NYG at both locations. Additional fertility needed to attain a given NYG was applied just before the planting. Nitrogen fertilizer was supplied as 35-18-0 and urea (46-0-0) and P was supplied as diammonium phosphate (18-46-0).

Plots were 5 feet wide by 20 feet long and were seeded with a small plot cone-drill. The experimental design at both locations was a stratified split-split plot design. The design factors included variety, seeding rate, and level of N-fertility as defined by yield goal. There were 54 total plots per location (4 varieties or experimental lines x 2 NYG levels x 3 seeding rates x 3 blocks = 72). Seeding was accomplished by the cone-drill in two stages. First, any additional fertilizer was applied; then plots were then seeded.

Fungicide treatments included Tilt, applied at 2.0 oz/ac at first leaf and again at flag leaf emergence; and Folicur, applied at 4.0 oz/ac at the initial flowering stage (Feekes, 10.51). Tilt was applied at Warner on May 14 and June 11; and at South Shore on May 19 and June11, at the first leaf and flag emergence stages, respectively. Folicur was applied during flowering at Warner on June 20 and South Shore on June 24. Weed control included Puma (.5 pt/ac) and Bronate (1 pt/ac) applied by label instructions.

Plots were harvested with a Wintersteiger Elite small plot combine. Prior to combining, two 4-foot sections of row were randomly selected within each plot. Plants within these two sections were pulled by hand and grouped into a composite sample. The samples were then used to determine what effects variety, seeding rate, and NYG level have on the density variables spikes (heads)/ft^2, seeds/spike, seeds/lb, and spikes/seed kernel. The first three density variables indicate if the treatments influence yield by affecting spikes/ft^2, seeds/spike, and seeds/lb (seed size). The last variable spikes/seed kernel was calculated to determine if treatments affected the number of spikes produced/seed kernel planted. The number of spikes and seeds (seed counter) in each sample were counted. Spikes/ft^2, spikes/seed kernel, seeds/spike and seeds/lb (seed size) was then calculated. Each sample and combined plot yield was added together to obtain the final plot yield. Significant treatment effects and interactions (.05 level of probability) were identified using mixed analysis procedures from the Statistical Analysis System. Temperature and rainfall data is listed for the nearest weather station in Table 2.

Table 1. Summary of materials & methods used at both test locations in 2003.

	Location					
Materials	South Shore			Warner		
Variety (maturity, days):	**Forge** (-1), **Oxen** (2), **Walworth** (2), **SD3623** (2)					
Seeding rate/ft^2:	**1X** (28 pure-live-seeds, PLS), **1.5X** (42PLS), **2X** (56PLS)					
Seeding date:	April 15			Apr 8		
Initial soil test levels :	***N*** *lb*	***P*** *ppm*	***K*** *ppm*	***N*** *lb*	***P*** *ppm*	***K*** *ppm*
	161	34	170	65	11	336
Common yield goal:	***64 bu/ac***			***50 bu/ac***		
Nutrient needs:	***N***	***P***	***K***	***N***	***P***	***K***
(1) Test recommendations.	0	0	0	60	17	0
(2) Nutrients applied.	0	0	0	60	33	0
(3) Total N requirements.	160	0	0	125		
High yield goal:	***100 bu/ac***			***100 bu/ac***		
Nutrient needs:	***N***	***P***	***K***	***N***	***P***	***K***
(1) Test recommendations.	90	0	0	185	35	0
(2) Nutrients applied.	90	0	0	185	76	0
(3) Total N requirements.	250			250		
Fungicides applied (fl oz/ac):						
(1) 2 oz Tilt, 1st leaf	May 14			May 19		
(2) 2 oz Tilt, flag leaf emergence	Jun 11			June 11		
(3) 4 oz Folicur, initial flowering	Jun 20			Jun 24		
Herbicides applied (pt/ac):						
Puma (0.5) & Bronate (1.0)	May 31			May 31		

Table 2. Temperature and rainfall levels for 2003 growing season starting April 1.

Reporting date	Location							
	South Shore – N.E. Research Farm				Aberdeen Airport			
	Avg. Temp. - ^oF.		Total Rainfall. – in.		Avg. Temp. - ^oF.		Total Rainfall – in.	
	Avg.	DFN*	Avg.	DFN*	Avg.	DFN*	Avg.	DFN*
April 27	44.4	+ 1.4	1.40	- 0.35	43	- 9	1.34	- 0.40
June 1	53.0	+ 2.8	5.04	+ 0.35	53	- 9	4.19	- 0.26
June 29	62.8	- 2.4	6.22	- 2.24	80	+ 9	10.76	+ 3.35
July 27	69.6	- 0.8	7.95	- 1.67	71	- 3	12.68	+ 2.74
Aug. 31	70.4	+ 2.4	9.56	- 4.78	72	0	14.33	+ 1.94

* Departure from normal – DFN. South Dakota Weekly Weather Crop Report, SDASS.

RESULTS & DISCUSSION

This study was conducted under conditions where four varieties, three seeding rates, and two N-yield goals were imposed. Fungicides were applied to limit plant disease.

In general, the growing season weather at South Shore was near average in temperature but below average in rainfall. In contrast, at Warner, the weather was below average in temperature and near average in rainfall for April to May. In June temperatures rose above average then cooled down below average in July. During both June and July rainfall totals were well above average. At Warner, this combination of a cool spring and below average temperatures in July along with above average rainfall in June and July closely approximated an ideal growing season for small grain compared the hotter and drier climate at South Shore. A grain yield average of 60 and 39 bu/ac and test weight average of 60 and 56 lb/bu at Warner and South Shore, respectively, is indicative of the better small growing season at Warner.

At South Shore (Tables 3a and 4a), there were significant main effects for variety (V), seeding rate (SR), and N-yield goal (NYG); and for the two-way effect for V x SR. Likewise, at Warner (Tables 3b and 4b), there were significant were main effects for V, SR, and NYG; and the two-way effects for V x SR and V x NYG.

Variety Performance Variables – Main effects:

Variety effect: At South Shore (Table 3a), variety did not affect yield and lodging, but did affect test weight, protein, or plant height. SD3623 exhibited the highest test weight. The protein content for Oxen and Walworth were high while SD3623 was low.

At Warner (Table 3b), only yield, plant height, and lodging were significantly affected by variety. Oxen produced the highest while Forge produced the lowest yield. SD3623 was the tallest variety while Walworth and Oxen were the shortest. SD3623 exhibited the most while Oxen exhibited the least lodging.

On average, the grain yield at South Shore where it was drier was about 20 bu less than at Warner. This lack of a variety effect on yield at South Shore was likely the result of limited growing season rainfall. This lack of moisture likely caused the yielding ability of the varieties to be reduced so variety yield differences were not detected.

<u>Seeding rate (SR) effect</u>: At South Shore (Table 3a), all the variety performance variables were affected by SR. Both the 1X and the 1.5X SR yielded more, was higher in test weight, and was taller than if seeded at the 2X rate. In contrast, The 2X SR produced higher protein values compared to the other rates. However, the 2X SR produced the most while the 1X rate produced the least lodging.

Table 3a. Main effect means for variety, seeding rate, and N-yield goal and their effect on HR spring wheat performance variables at South Shore, SD.

Treatment Effects	*Variety performance variables*				
	Yield bu/ac	*Test Wt. lb/bu*	Protein %	*Height inch*	*Lodging %*
Variety (V):					
Forge	37.3 a*	55.4 **b***	16.0 **ab**	31.6 **b**	2.2 a
Oxen	41.7 a	54.9 **b**	16.5 **a**	27.4 **d**	1.8 a
Walworth	37.8 a	55.4 **b**	16.8 **a**	30.2 **c**	1.9 a
SD3623	41.4 a	57.9 **a**	15.6 **b**	33.1 **a**	2.3 a
Seeding rate (SR):					
1X (28) - recommended	41.1 **a**	56.6 **a**	15.9 **b**	31.0 **a**	1.8 **b**
1.5X (42) - intermediate	42.0 **a**	56.3 **a**	16.1 **b**	31.4 **a**	2.0 **ab**
2X (56) - high	35.6 **b**	54.9 **b**	16.7 **a**	29.3 **b**	2.4 **a**
N-yield goal (NYG) :					
64 bu/ac - recommended	39.9 a	56.0 a	15.9 **b**	30.8 a	2.0 a
100 bu/ac - high	39.3 a	55.8 a	16.5 **a**	30.4 a	2.2 a
V x SR:					
Forge - 1X	-	57.0 **a**	-	-	-
1.5X	-	56.3 **a**	-	-	-
2X	-	53.2 **b**	-	-	-
Oxen - 1X	-	56.7 **k**	-	-	-
1.5X	-	55.1 **k**	-	-	-
2X	-	53.9 **l**	-	-	-
Walworth - 1X	-	55.2 r	-	-	-
1.5X	-	55.4 r	-	-	-
2X	-	55.7 r	-	-	-
SD3623 - 1X	-	58.4 **y**	-	-	-
1.5X	-	56.8 **y**	-	-	-
2X	-	55.2 **z**	-	-	-

*Values followed by the same letter do not differ significantly (.05 level).
**Values followed by different letters that are in bold type differ significantly (.05 level).

At Warner (Table 3b), protein and lodging were affected by SR, but not yield, test weight, or height. Protein values were highest for the 1X SR and lowest for the 2X rate. Lodging was highest at the 2X SR and lowest at the 1X rate.

Again, as with the variety effect, the response of yield to the seeding rate effect differed between the two locations. There was no effect of seeding rate on yield at Warner where rainfall was plentiful and temperatures were below average in late spring. This lack of yield response to seeding rate is not surprising since plentiful moisture likely cause seedling competition for moisture among the seeding rates to be minimal. In contrast, the effect of seeding rate on yield was significant at South Shore where seasonal moisture was well below average. In this case, where seedling competition for moisture was likely high, the effect of seeding rate was more evident and significant.

Table 3b. Main effect means for variety, seeding rate, and N-yield goal and their effect on HR spring wheat performance variables at Warner, SD.

	Variety performance variables				
Treatment Effects	*Yield bu/ac*	*Test Wt. lbs./bu.*	*Protein %*	*Height inch*	*Lodging %*
Variety (V):					
Forge	56.3 **c****	61.6 a*	15.6 a	35.8 **b**	2.9 **b**
Oxen	62.5 **a**	60.8 a	15.4 a	33.6 **c**	2.4 **c**
Walworth	59.4 **b**	61.2 a	15.9 a	33.8 **c**	3.1 **ab**
SD3623	60.6 **ab**	60.1 a	15.4 a	38.1 **a**	3.5 **a**
Seeding rate (SR):					
1X (28) - recommended	59.4 a	61.8 a	15.7 **a**	35.0 a	2.3 **c**
1.5X (42) - intermediate	60.3 a	61.6 a	15.6 **ab**	35.4 a	2.8 **b**
2X (56) - high	59.3 a	60.1 a	15.4 **b**	35.5 a	3.8 **a**
N-yield goal (NYG):					
50 bu/ac - recommended	59.3 a	61.4 a	15.2 **b**	35.3 a	2.8 **b**
100 bu/ac - high	60.1 a	60.4 a	15.9 **a**	35.3 a	3.1 **a**
V x SR:					
Forge - 1X	-	-	-	-	2.2 **c**
1.5X	-	-	-	-	2.8 **b**
2X	-	-	-	-	3.8 **a**
Oxen - 1X	-	-	-	-	1.8 **l**
1.5X	-	-	-	-	2.0 **l**
2X	-	-	-	-	3.3 **k**
Walworth - 1X	-	-	-	-	2.7 **z**
1.5X	-	-	-	-	3.2 **y**
2X	-	-	-	-	3.3 **y**
SD3623 - 1X	-	-	-	-	2.7 **s**
1.5X	-	-	-	-	3.3 **s**
2X	-	-	-	-	4.5 **r**
V x NYG:					
Forge - 50 bu/ac	-	-	-	35.0 **b**	
100 bu/ac	-	-	-	36.6 **a**	
Oxen - 50 bu/ac	-	-	-	33.6 k	
100 bu/ac	-	-	-	33.4 k	
Walworth - 50 bu/ac	-	-	-	34.2 r	
100 bu/ac	-	-	-	33.4 r	
SD3623 - 50 bu/ac	-	-	-	38.3 y	
100 bu/ac	-	-	-	37.8 y	

*Values followed by the same letter do not differ significantly (.05 level).
**Values followed by different letters that are in bold type differ significantly (.05 level).

N-yield goal (NYG) effect: At South Shore (Table 3a), protein content was the only variety performance variable affected by NYG. Increasing the yield goal from 64 to 100 lb/ac increased the protein content of the grain. At Warner (Table 3b) however, NYG affected both the protein content and the lodging percentage. Again, increasing NYG from 50 to 100 lb/ac increased the grain protein content; but it also increased lodging.

Variety Performance Variables – Two-way effects:

Variety x seeding rate (SR) effect: At South Shore (Table 3a), this interaction affected test weight. Both the 1X and 1.5X SR produced higher test weight grain than the 2X rate for the varieties Forge, Oxen, and SD3623; but not for the variety Walworth.

At Warner (Table 3b), the variety x SR effect was only significant for lodging. Across all varieties the 1X SR exhibited the least lodging and the 2X rate the most lodging.

Variety x N-yield goal (NYG) effect: This effect was not evident at South Shore; but did affect plant height at Warner (Table 3b). The effect was only significant for the variety Forge, where the 100 bu/ac NYG resulted in taller plants than did the 50 bu/ac NYG.

Yield Variables – Main effects:

At South Shore (Table 4a), the impact of the main effects of variety and seeding rate (SR) were only significant for the yield variables seeds/ft^2, spikes/ft^2, seeds/spike, and spikes/seed kernel. The variety Forge produced significantly fewer seeds/ft^2 than the other varieties. The varieties Oxen and Walworth produced more spikes/ft^2 and spikes/seed kernel than did Forge and SD3623. The experimental line SD3623 produced significantly more seeds/spike than the other varieties.

The effect of SR on seeds/ft^2 and spikes/ft^2 tended to be inversely related. The 1X SR produced more seeds/ft^2 than the 2X rate. In contrast, the 2X SR produced more spikes/ft^2 than the 1X rate. Seeds/spike and spikes/seed kernel responded to SR similarly. In both variables, the 1X SR produced more seeds and spikes than did the 2X rate. In addition, neither the effect of variety or SR affected seeds/lb or seed size. The effect of N-yield goal (NYG) was not significant for any yield density variable.

At Warner (Table 4b) the effect of variety was significant only for the yield variable seeds/spike. Seeds/spike was highest for Walworth and lowest for Forge and SD3623. In contrast, the effect of SR was significant for all of the yield variables except seeds/ft^2. The 1X SR produced more seeds/ft^2, more seeds/spike, and more spikes/seed kernel than the 1.5X and 2X rates. In addition, the 1X and the 1.5X SR produced fewer seeds/lb (larger seed size) than the 2X rate. Again, at Warner, the effect of NYG on the yield variables was not significant.

Variety effect: At South Shore, all the yield variables, but seeds/lb (seed size), were significantly affected by variety (Table 4a). Seeds/ft^2 was significantly higher for SD3623, Walworth, and Oxen than for Forge. Spikes/ft^2 and spikes/seed kernel were significantly higher for Walworth and Oxen than for SD3623 and Forge. In the case of spikes/seed kernel, it does not indicate Walworth and Oxen produced more tillers/seed kernel; but it does indicate they produced more spike bearing tillers/seed kernel. SD3623 produced significantly more seeds/spike that the other varieties. Walworth and Oxen produced significantly more spikes/seed kernel than SD3623 and Forge.

At Warner, seeds/spike was the only yield density significantly affected by variety (Table 4b). Seeds/spike was highest for Walworth and lowest for SD2623 and Forge.

<u>Seeding rate effect</u>: At South Shore, all the yield density variables but seeds/lb (seed size) was significantly affected by SR (Table 4a). Seeds/ft^2 was significantly higher for both the 1X and 1.5X SR than for the 2X rate. Spikes/ft^2 was significantly higher for the 2X SR and the lower for the 1X rate. The 1X SR produced the most and the 2X rate the fewest seeds/spike. Likewise, the 1X SR produced the most and the 2X rate the fewest spikes/seed kernel.

Table 4a. Main effect means for variety, seeding rate, and N-yield goal and their effect on yield variables of HR spring wheat at South Shore, SD.

	Yield variables				
Treatment Effects	Seeds/ft^2	Spikes/ft^2	Seeds/spike	Spikes/seed kernel	Seeds/lb
Variety (V):					
Forge	852 **b****	52.9 **b**	16.3 **b**	1.3 **b**	19,775 a*
Oxen	991 **a**	60.1 **a**	16.7 **b**	1.5 **a**	19,938 a
Walworth	1019 **a**	62.7 **a**	16.4 **b**	1.6 **a**	21,236 a
SD3623	1055 **a**	52.9 **b**	20.2 **a**	1.3 **b**	20,752 a
Seeding rate (SR):					
1X (28) - recommended	1057 **a**	54.0 **b**	19.8 **a**	1.9 **a**	20,272 a
1.5X (42) - intermediate	982 **a**	57.8 **ab**	17.2 **b**	1.4 **b**	19,819 a
2X (56) - high	899 **b**	59.7 **a**	15.2 **c**	1.1 **c**	21,185 a
N-yield goal (NYG):					
64 bu/ac - recommended	982 a	57.8 a	17.3 a	1.5 a	19,831 a
100 bu/ac - high	977 a	56.4 a	17.5 a	1.4 a	21,020 a
V x SR:					
Forge-1X	-	-	18.8 **a**	1.8 **a**	-
1.5X	-	-	16.4 **b**	1.2 **b**	-
2X	-	-	13.5 **c**	1.0 **c**	-
Oxen-1X	-	-	19.9 **k**	2.0 **k**	-
1.5X	-	-	17.1 **l**	1.4 **l**	-
2X	-	-	13.3 **m**	1.2 **m**	-
Walworth-1X	-	-	22.8 **r**	2.2 **r**	-
1.5X	-	-	20.1 **s**	1.6 **s**	-
2X	-	-	17.7 **t**	1.0 **t**	-
SD3623-1X	-	-	17.7 **y**	1.7 **x**	-
1.5X	-	-	15.2 **z**	1.6 **y**	-
2X	-	-	16.2 **yz**	1.0 **z**	-

*Values followed by the same letter do not differ significantly (.05 level).
**Values followed by different letters that are in bold type differ significantly (.05 level).

At Warner, all the yield density variables but seeds/ft^2 was significantly affected by SR (Table 4b). Both the 1.5X and 2X SR produced more spikes/ft^2 than the 1X rate. In contrast, the 1X SR produced more seeds/spike and spikes/seed kernel than the higher rates. In addition, both the 1X and 1.5X SR produced more seeds/lb than the 2X rate.

<u>N-yield goal effect</u>: At both locations (Tables 4a and 4b) the yield variables did not respond significantly to NYG.

Table 4b. Main effect means for variety, seeding rate, and N-yield goal and their effect on yield variables of HR spring wheat at Warner, SD.

	Yield variables				
Treatment Effects	Seeds/ft^2	Spikes/ft^2	Seeds/spike	Spikes/seed kernel	Seeds/lb.
Variety (V):					
Forge	1017 a*	52.3 a	19.7 **b****	1.3 a	14,232 a
Oxen	1183 a	56.3 a	21.6 **ab**	1.4 a	14,751 a
Walworth	1147 a	57.3 a	24.4 **a**	1.5 a	14,472 a
SD3623	1122 a	47.0 a	20.4 **b**	1.2 a	14,923 a
Seeding rate (SR):					
1X (28) - recommended	1117 a	48.4 **b**	23.6 **a**	1.7 **a**	14,121 **b**
1.5X (42) - intermediate	1091 a	53.4 **a**	20.9 **b**	1.3 **b**	14,422 **b**
2X (56) - high	1146 a	57.8 **a**	20.2 **b**	1.0 **b**	15,241 **a**
N-yield goal (NYG):					
50 bu/ac - recommended	1124 a	51.9 a	22.4 a	1.3 a	14,687 a
100 bu/ac - high	1112 a	54.6 a	20.7 a	1.4 a	14,503 a
V x SR:		-	-	-	-
Forge - 1X	1116 a	-	-	-	-
1.5X	903 a	-	-	-	-
2X	1033 a	-	-	-	-
Oxen - 1X	1225 k	-	-	-	-
1.5X	1161 k	-	-	-	-
2X	1165 k	-	-	-	-
Walworth - 1X	1131 r	-	-	-	-
1.5X	1151 r	-	-	-	-
2X	1159 r	-	-	-	-
SD3623 - 1X	995 **z**	-	-	-	-
1.5X	1147 **yz**	-	-	-	-
2X	1224 **y**	-	-	-	-
SR x NYG:					
1X - 50 bu/ac	-	45.0 **b**	-	1.6 **b**	-
100 bu/ac	-	52.0 **a**	-	1.9 **a**	-
1.5X - 50 bu/ac	-	50.8 k	-	1.2 k	-
100 bu/ac	-	56.0 k	-	1.3 k	-
2X - 50 bu/ac	-	59.8 r	-	1.1 r	-
100 bu/ac	-	55.9 r	-	1.0 r	-

*Values followed by the same letter do not differ significantly (.05 level).
**Values followed by different letters that are in bold type differ significantly (.05 level).

Yield Variables – Two-way effects:

Variety x seeding rate effect: At South Shore (Table 4a), this interaction only affected the variables seeds/spike and spikes/seed kernel. Across varieties, seeds/spike and spikes/seed kernel tended to be high at the 1X SR, intermediate at the 1.5X rate, and low at the 2X rate.

At Warner (Table 4b) the variety x SR interaction was only significant for the yield variable seeds/ft^2. In this case, however, this interaction was only significant for the variety SD3623. The 2X SR produced the most and the 1X SR the fewest seeds/ft^2.

Seed rate x N- yield goal (NYG) effect: This interaction was evident at Warner but not at South Shore. Spikes/ft^2 and spikes/seed kernel were the only yield variables affected

(Table 4b). This interaction was only significant at the 1X SR. The number of spikes/ft^2 and spikes/seed kernel were higher at the 100 bu/ac than at the 50 bu/ac NYG.

SUMMARY

Results indicate wheat growers near South Shore can use variety selection to increase test weight and grain protein; however, it did not increase grain yield. The use of lower seeding rates (1X or 1.5X) also produces higher yields than the higher 2X rate. High N-fertility yield goal produces more grain protein (< 1%) than a common yield goal; but it does not increase grain yield.

Results indicate growers near Warner can use variety selection to increase grain yield and decrease lodging. The use of low seeding rates also increases grain protein and reduces lodging. Again, high N-fertility yield goal produces more grain protein (< 1%) than a common yield goal; but it does not increase grain yield.

At both locations, the variety performance variable yield was affected by the effects of variety or seeding rate; but not by their interaction. Generally, the variety x seeding rate and/or variety x N-yield goal interactions were only significant for test weight, plant height, and lodging percentage; but not for grain yield.

The effect of variety, seeding rate, and N-yield goal on the yield variables was mixed. At South Shore, the variety effect was significant for all the yield variables except seeds/lb. In contrast, at Warner this effect was only significant for seeds/spike. At both locations, the seeding rate effect was significant for four of the five yield variables. In addition, at both locations, increasing the common N-yield goal to a higher level did not affect any of the yield variables.

At both locations, there were significant interactions that affected the yield variables. At South Shore, the variety x seeding rate interaction affected seeds/spike and spikes that developed from each seed kernel (spikes/seed kernel). Regardless of variety, with both variables, the 1X seeding rate produced more seeds/spike and spikes/seed kernel than the 2X rate. At Warner, the variety x seeding rate interaction only affected seeds/ft^2. However, this only affected one variety. Likewise, at Warner, there was a significant seeding rate x N-yield goal interaction that affected seeds/spike and spikes/seed kernel. In both cases, only the 1X seeding rate was significant. That is, the 1X seeding rate, in combination with the high N-yield goal produced more seeds/spike and spikes/seed kernel than the other seeding rate-yield goal combinations. This indicates when using the recommended 1X seeding rate there was an additional benefit from using higher N-fertility levels.

Managing Cultural Practices for High Yield Wheat in Northeast South Dakota in 2003.

J. Gerwing, A. Bly and R. Gelderman

Introduction

There are many cultural practices available to growers that under certain circumstances, increase wheat yield. Some individuals have recommended using many of these practices together to attain higher wheat yield. Often, the use of such practices wouldn't be recommended by standard agronomic principles. These individuals claim that the combined use of these practices will result in higher wheat yield. Due to this theory, a research project was conducted to determine the combined and individual effect of several cultural practices for increased wheat grain yield.

Materials and Methods

A research site was selected on the Northeast Research Farm near South Shore SD. The soil type is a nearly level silty clay loam soil (Brookings) that is common to North East South Dakota. Composite soil samples of the 0-6 and 6-24 inch depths were obtained during the Fall of 2002 and analyzed for nitrate-nitrogen, phosphorus (Olsen method), potassium, pH, organic matter, salts, zinc, sulfur, manganese, copper, chloride, calcium and magnesium. The five cultural practices chosen for evaluation were soil fertility with a sulfur comparison, split application of nitrogen, seeding rate, foliar fungicide, and fungicide seed treatment. The five cultural practices were employed to compare with standard recommended methods for successful wheat production. The soil fertility comparison was made between standard nutrient recommendations determined from soil test results for a 60 bu/a yield goal and nutrient applications for 100 bu/a yield goal. The split application of nitrogen was evaluated by splitting the N for the 100 bu/a yield goal into 3 timings, planting, tillering and boot growth stages. The standard seeding rate of 1.2 million Pure Live Seeds (PLS)/a was compared to 2.2 million PLS/a. Applying 4 oz/a Tilt at flag leaf and 4 oz/a Folicur at heading was the treatment used for disease control. The fungicide seed treatment used was Raxil XT (0.16 oz/100 lbs seed). The treatments used to test these cultural practices were determined so that comparisons of each practice with an appropriate check could be made as well as the combined effect of all the practices (Table 1). Treatments were randomized in a complete block design with four replications. The fertility comparison treatments were split in each block with filler plots to minimize any border effect from the high N rate applied for the 100 bu/a yield goal.

Ingot hard red spring wheat was no-till planted on April 8, 2003 into soybean residue. All plots were sprayed with a herbicide tank mix of Puma (7 oz/a), Buctril (1pt/a), and MCPA Ester (1.25 oz/a) on May 23, 2003. Weed control was excellent. The second and third nitrogen application splits were applied on May 23 and June 11, respectively. Tilt (4 oz/a) and Folicur (4 oz/a) were applied on June 11 and July 1, respectively. Plots measured 5 x 15 feet and were harvested with a small plot combine on July 31, 2003. Grain protein was determined with standard NIR technique. Grain yield and protein were adjusted to 13 percent grain moisture. Mean determination and separation was accomplished with SAS. Orthogonal contrasts for each cultural practice were performed to determine if the individual practice had an effect on the measured parameter.

Results and Discussion

Pre-plant soil test analysis showed that nitrate-nitrogen was limiting for both the 60 and 100 bu/a yield goals. Nitrogen was applied at a rate of 85 lbs/a and 185 lbs/a as urea for the recommended and maximum soil fertility treatments, respectively.

Phosphorus (P) was in the high (14 ppm) category and therefore no P was applied to the recommended plots, but 30 lbs/a P_2O_5 was applied with the seed as 0-46-0 to the maximum soil fertility treatments. Potassium (K) was also in the very high (187 ppm) category and none would have been recommended. However since there was only 10 lbs/a chloride (Cl^-) in the top two feet, 38 lbs/a Cl^- was applied to both the recommended and maximum soil fertility treatments. This Cl^- application resulted in 50 lbs/a potassium (K) applied to all plots. Soil pH was 6.3 and salts were 0.3 mmho/cm. Zinc was in the medium category (0.54 ppm). Since wheat has not been shown to respond to zinc application, none was applied to the recommended treatment plots. Zinc was applied to the maximum soil fertility plots at 0.5 lbs/a with the seed as zinc sulfate. The sulfur test showed 18 lbs/a in the top two feet. Sulfur was applied to the recommended soil fertility plots, but another recommended soil fertility treatment was added that had no sulfur application. Sulfur at 56 lbs/a was applied to the maximum soil fertility plots as gypsum (calcium sulfate). This gypsum application also resulted in 69 lbs/a calcium applied to the maximum soil fertility plots. The calcium soil test was considered very high (2798 ppm) and therefore none was applied to the recommended soil fertility plots. Manganese and copper were considered high (36.5 and 0.89 ppm, respectively) and therefore none was applied to the recommended soil fertility plots but 2 lbs/a and 0.5 lbs/a manganese and copper respectively were applied with the seed in the maximum soil fertility plots as the sulfate form. Magnesium was very high and none was applied to the recommended soil fertility plots or maximum soil fertility plots because individuals recommending practices for high yield wheat say that magnesium levels are already too high and calcium should be applied as gypsum to balance the high magnesium.

There was a significant treatment effect on grain yield, which ranged from 41.7 to 53.2 bu/a (Table 1). Twelve treatments make it hard to distinguish what is happening so orthogonal comparisons were used to separate meaningful treatment comparisons. Grain test weight was significantly higher for the recommended soil fertility treatment plots when compared to the maximum soil fertility treatment plots (Table 1). Grain protein tended to be higher for the maximum soil fertility treatments plots when compared to the recommended soil fertility plots because of the extra nitrogen that was applied (Table 1).

Orthogonal contrasts for soil fertility treatment showed that grain test weight was significantly higher with the recommended treatments, grain protein was higher for the maximum treatments and grain yield was not different (Table 2). Seeding rate and foliar fungicide application significantly influenced grain test weight, protein and yield (Table 2). However, the differences between the seeding rate and fungicide treatments for grain test weight and protein are really insignificant when considering any price dividends that could be received. Increasing the seeding rate from 1.2 to 2.2 million seeds/a decreased the grain yield 4 bu/a. Applying foliar fungicide increased yield 4.8 bu/a. Split N application did not significantly influence any of the dependent variables. Sulfur application significantly decreased grain test weight, had no effect on protein and significantly increased grain yield (Table 2). The sulfur application seemed to decrease grain test weight only because we see that as yield increases, grain test weight decreases.

Acknowledgement

This study partially funded by the SD Wheat Commission and the SD Ag. Experiment Station.

Table 1. Cultural practice treatment influence on grain test weight, protein and yield for the high yield wheat experiment at northeast farm in 2003.

Treatment	Soil Fertility Level[1]	Seeding Rate[2]	Fungicide[3]	Seed Treatment[4]	Split N application[5]	Grain @ 13 % moisture Test Weight	Protein	Yield
						lbs/bu	%	bu/a
1	Recommended	1.2	Yes	No	No	61.4 bc	11.8 e	53.1 a
2	Recommended	1.2	No	No	No	61.1 cde	12.5 cd	49.1 bcd
3	Recommended	2.2	Yes	No	No	61.2 cd	12.7 ab	53.6 a
4	Recommended	2.2	No	No	No	61.2 cd	12.6 abc	46.1 d
5	Maximum	1.2	No	No	No	60.9 de	12.5 bcd	50.1 abc
6	Maximum	1.2	Yes	No	No	60.9 de	12.7 ab	53.2 a
7	Maximum	2.2	No	No	No	60.2 f	12.7 ab	47.1 cd
8	Maximum	2.2	Yes	Yes	Yes	61.0 de	12.6 abcd	52.4 ab
9	Maximum	2.2	Yes	Yes	No	60.7 e	12.6 cd	51.9 ab
10	Maximum	2.2	Yes	No	No	60.8 de	12.6 abcd	51.5 ab
11	Recommended, No S[6]	1.2	No	No	No	62.3 a	12.8 a	46.8 cd
12	True check[7]	1.2	No	No	No	61.8 b	12.5 d	41.7 e
LSD $_{(.05)}$						0.1	0.1	3.6
Pr > F						0.001	0.001	0.001

[1] Either recommended based on soil test and 60 bu/a yield goal or maximum based on 100 bu/a yield goal plus micro-nutrients.
Recommended nutrient rate (lbs/a) : N=85, P_2O_5=0, K_2O=50, Cl=38, S=25
Maximum nutrient rate (lbs/a): N=185, P_2O_5=30, K_2O=50, Cl=38, S=56, Ca=69, Mn=2, Zn=0.5, Cu=0.5

[2] Seeding rate either 1.2 or 2.2 million Pure Live Seeds/a

[3] Fungicides applied as Tilt (4oz/a) at flag leaf and Folicur (4 oz/a) applied at heading.

[4] Raxol seed treatment applied to seed.

[5] Nitrogen rate split evenly between planting, tillering and boot growth stages.

[6] Received all recommended nutrients except sulfur.

[7] no nutrients applied.

Table 2. Orthogonal comparisons of cultural practices for the high yield wheat experiment at northeast farm in 2003.

Cultural Practice	Grain at 13 % moisture		
	Test Weight	Protein	Yield
	lbs/bu	%	bu/a
Soil Fertility Level[1]			
Recommended	61.2	12.4	50.5
Maximum	60.8	12.7	50.7
Contrast Significant at 0.05 level	yes	yes	No
Seeding Rate[2]			
1.2	61.1	12.4	51.4
2.2	61.2	12.8	48.4
Contrast Significant at 0.05 level	yes	yes	yes
Fungicide[3]			
no	60.8	12.7	48.1
yes	61.1	12.5	52.9
Contrast Significant at 0.05 level	yes	yes	yes
Seed Treatment[4]			
no	60.8	12.7	51.5
yes	60.7	12.6	52.0
Contrast Significant at 0.05 level	no	no	no
Split N application[5]			
no	60.7	12.6	52.0
yes	61.0	12.7	52.5
Contrast Significant at 0.05 level	no	no	no
Sulfur application[6]			
no	62.3	12.8	46.8
yes	61.1	12.5	49.1
Contrast Significant at 0.05 level	yes	no	yes

[1] Either recommended based on soil test and 60 bu/a yield goal or maximum based on 100 bu/a yield goal.
Recommended nutrient rate (lbs/a) : N=85, P_2O_5=0, K_2O=50, Cl=38
Maximum nutrient rate (lbs/a): N=185, P_2O_5=30, K_2O=50, Cl=38, S=56, Ca=69, Mn=2, Zn=0.5, Cu=0.5

[2] Seeding rate either 1.2 or 2.2 million Pure Live Seeds/a

[3] Fungicides applied as Tilt (4oz/a) at flag leaf and Folicur (4 oz/a) applied at heading.

[4] Raxol seed treatment applied to seed.

[5] Nitrogen rate evenly split between planting, tillering and boot growth stages.

[6] sulfur application comparison between recommended treatments only.

2003 Spring Wheat Fungicide Trials

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Introduction:

Fusarium head blight (scab or FHB) has been a recurring problem in winter and spring wheat, durum, and barley grown in South Dakota since the severe epidemic of 1993. Scab outbreaks have been periodic and localized since that time. Scab management requires a multi-faceted approach including cultural methods and variety selection. Fungicides have provided no better than FHB suppression. Pending the release of highly resistant crop varieties, fungicides have been relied on as a stopgap, providing the best available protection from disease to reduce losses. Fungicide applications late in crop development, approaching flowering, have been shown to provide the best control of scab. At the same time, they often provide improved control of leaf disease over application at flag leaf emergence.

Additionally, several fungi cause foliar diseases on wheat, including leaf rust (*Puccinia recondita*), tan spot (*Pyrenophora tritici-repentis*) and the Septoria complex (*S. tritici*, *S. avenae*, and *S. nodorum*). These foliar diseases are present every year and fungicides are more efficacious at their control. In the process, losses to grain yield and test weight are minimized. Timing of fungicide applications varies, as does the period at which the diseases attack, and as such all fungicide applications should not be expected to provide maximum suppression of all diseases.

Materials and Methods:

Hard red spring wheat was planted in several South Dakota locations in the northeastern quarter of the state; the Northeast Research Station, (NE Farm), on-station in Brookings, SD(Brookings), and in a cooperator's field near Groton, SD (Groton).

The trial was conducted on two red hard spring wheat cultivars, Oxen and Ingot. Trials were planted in a factorial randomized complete block design where factor A was wheat varieties and factor B was the fungicide treatment and were replicated four times. Fungicide treatments (Table 1) were applied at various growth stages from three to five leaf stage to initiation of flowering. Most fungicides were applied with Induce, a non-ionic surfactant (NIS). Brookings plots were misted for five out of every twenty minutes for fifteen days following anthesis to enhance the environment for FHB development.

At about the soft dough stage of crop development, plots were evaluated for leaf diseases, FHB incidence, FHB head severity, and FHB field severity, Fusarium damaged kernels (FDK), deoxynivelanol (DON), grain yield, test weight, and protein. Various ratings were used for leaf disease. Whole plot ratings evaluated the relative amount of green tissue remaining on a 0-9 scale where completely green tissue was rated as a zero and fully necrotic plants were rated a nine. Ideally, leaf area assessments are used to estimate the percentage of the flag leaf that is necrotic due to total leaf diseases and leaf rust alone. Hot and dry weather can dictate if flag leaf rating is possible at soft dough, about 18 days after anthesis. Specific information on dates of planting and treatment dates is listed in Table 1. Fungicide treatments are listed in Table 2. Due to the volume of data generated, only leaf rust infection on the flag leaf, yield, and test weight are reported here.

Two studies were conducted. Study one looked at several times of application as well as products. Study two compared a limited number of fungicides all applied at Feekes 10.3 (50% heading).

Table 1: Dates of planting, fungicide applications, plot rating, and harvest for wheat fungicide trials in northeastern South Dakota in 2003.

Activity	Crop stage		Date/Location (2003)		
	Descriptive	Feekes growth stage			
			Brookings	NE Farm	Groton
Planting			5/16	4/22	4/10
Fungicide applications	Jointing	2	6/10	6/5	6/3
	Flag leaf emergence	8	6/13	6/9	6/12
	50% heading	10.3	6/30	6/26	6/26
	Anthesis	10.51	7/2	6/27	7/3
Rating	Soft dough	11.2	7/28	7/18	7/23
Harvest	Mature	11.4	8/21	7/31	8/18

Results and Discussion:

No scab developed at the NE Farm. Scab was favored by an artificial environment at Brookings. At Groton, about 5% scab developed naturally. Those results will not be reported at this time.

Leaf rust was late arriving at most of the study locations. In study one (Table 2), most products gave good rust control if applied late in crop development (after flag leaf emergence). JAU 6476 was inferior for rust control at all locations, with the differences being most notable at Brookings and Groton. In study two (Table 3), only Quilt at the high rate and Quilt without surfactant did not significantly reduce rust severity at Brookings. At the NE Farm, all products but Headline decreased rust. At Groton, where the rust pressure was heaviest, only Folicur successfully reduced rust.

Grain yields were quite high in 2003. All products increased yield in study one at Brookings, but at Groton, JAU 6476 did not provide a yield response. This is likely due to its poor performance against leaf diseases, especially leaf rust. In study two, all products significantly increased yield at Brookings and Groton. There were no significant differences among the treatments at the relatively dry NE Farm site.

Grain test weight was increased by all treatments in study one. In study two, only Folicur did not significantly increase test weigh at NE Farm, while at Groton, all products increased test weight.

Fungicide treatments in study one that were applied early in crop development (jointing) without being followed by a later treatment, typically did not have adequate residual protection long enough into the season to significantly reduce leaf rust severity at soft dough or increase yield at maturity. When early treatments are made, they must be followed with a second application later in the season to increase the duration of residual protection if the season continues to favor disease development. Late season applications work well if the producer plans to only apply fungicide once.

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Table 2: Responses from Study one of leaf rust disease, yield, and test weight of grain on two spring wheat cultivars and several fungicide treatments applied at various crop stages at three northeastern South Dakota locations

Fungicide[1]	**Rate**	**Crop Stage**[2]	**Leaf Rust** (% of flag leaf)			**Yield** (bu/A)			**Test Weight** (lb/bu)		
			Brookings	NE Farm	Groton	Brookings	NE Farm	Groton	Brookings	NE Farm	Groton
Untreated	n/a	n/a	3.6	4.1	4.5	36.0	44.4	40.9	48.2	58.9	54.0
Folicur + NIS	4.0 fl oz/A	10.51	0.1	0.3	3.23	43.1	44.8	46.4	51.1	59.3	56.6
	0.125 %										
JAU 6476	5.7 fl oz/A	10.51	2.7	1.2	4.6	44.7	45.5	44.0	51.2	59.3	56.9
+ NIS	0.125 %										
JAU 6476	5.0 fl oz/A	10.51	3.0	1.2	4.8	45.1	46.1	43.7	51.2	59.0	57.0
+ NIS	0.125 %										
Folicur +	4.0 fl oz/A	10.51	0.1	0.1	2.8	46.6	46.1	48.1	51.8	59.2	56.9
JAU 6476	3.6										
+ NIS	0.125 %										
Exp -V1	6.0 fl oz/A	10.51	0.4	0.3	4.8	46.3	46.0	42.7	52.1	59.0	57.2
+ NIS	0.125 %										
Exp -V1	8.0 fl oz/A	10.51	0.1	0.3	2.2	44.5	46.1	46.2	52.9	59.4	57.0
+ NIS	0.125 %										
Folicur EW	6.84 fl oz/A	10.51	0.1	0.7	2.4	44.3	44.8	41.8	50.5	59.2	57.2
+ NIS	0.125 %										
JAU 6476	5.0 fl oz/A	10.51	3.1	1.2	5.3	43.9	46.0	43.0	50.7	59.0	56.7
+ NIS	0.125 %										
Folicur +	3.18 fl oz/A	10.51	0.7	0.9	2.2	44.7	45.4	46.4	51.0	58.9	58.1
JAU 6476	2.85 fl oz/A										
+ NIS	0.125 %										
Folicur +	2.0 fl oz/A	2	3.2	0.7	5.0	46.6	46.4	46.8	52.5	59.2	57.2
NIS	0.125 %										
JAU 6476	5.0 fl oz/A	10.51									
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	2	3.2	1.0	4.3	46.0	48.0	44.8	51.7	59.3	57.8
+ NIS	0.125 %										
JAU 6476	5.0 fl oz/A	10.51									
+ NIS	0.125 %										
Folicur	2.0 fl oz/A	2	3.1	0.8	4.7	46.3	46.8	45.9	50.6	59.5	57.3
+ NIS	0.125 %										
JAU 6476	5.0 fl oz/A	10.51									
+ NIS	0.125 %										
JAU 6476	5.7 fl oz/A	10.3	3.8	2.2	7.7	44.1	45.5	47.2	51.0	59.2	57.0
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	2	4.9	1.9	5.1	42.9	45.1	41.8	49.0	59.2	55.3
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	8	4.8	1.1	5.8	43.3	46.3	45.3	50.6	59.4	55.0
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	2	4.6	1.7	6.2	45.6	46.1	44.3	49.9	59.1	55.7
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	8									
+ NIS	0.125 %										
Stratego	10.0 fl oz/A	2	4.0	1.9	6.9	43.9	45.5	42.5	49.4	58.8	55.2
+ NIS	0.125 %										
Stratego	10.0 fl oz/A	8	3.3	1.4	5.2	46.7	46.5	44.5	51.8	59.7	55.0
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	2	0.3	0.2	1.9	46.8	47.8	46.6	51.8	59.3	57,7
+ NIS	0.125 %										
Folicur	4.0 fl oz/A	10.51									
+ NIS	0.125 %										
Stratego	10.0 fl oz/A	2	0.3	0.3	2.5	49.5	47.7	46.1	52.9	59.2	57.3
+ NIS	0.125 %										
Folicur	4.0 fl oz/A	10.51									
+ NIS	0.125 %										
Exp V-2	0.15 fl oz/A	10.51	3.0	1.1	4.6	39.8	45.6	43.6	49.5	59.6	56.0
+ NIS	0.125 %										
Folicur	0.113 # ai/A	10.51	0.5	0.4	3.1	43.4	45.9	41.3	52.6	59.3	57.2
+ NIS	0.125 %										
Stratego	5.0 fl oz/A	8	4.1	1.1	5.5	44.5	47.0	44.5	50.9	59.3	55.7
+ NIS	0.125 %										
Stratego	10.0 fl oz/A	8	4.1	1.4	5.9	46.1	47.3	41.9	52.0	59.6	56.2
+ NIS	0.125 %										
LSD $_{(P=0.05)}$			1.1	0.9	1.9	3.0	1.2	3.3	1.7	0.5	0.9

[1] – Crop stage refers to Feekes growth stage (see Table 1 for descriptive crop stages)

Table 2: Responses from Study two of leaf rust disease, yield, and test weight of grain on two spring wheat cultivars and several fungicide treatments applied at 50% heading at three northeastern South Dakota locations.

Fungicide	Rate	Crop Stage[1]	Leaf Rust (% of flag leaf)			Yield (bu/A)			Test Weight (lb/bu)		
			Brookings	NE Farm	Groton	Brookings	NE Farm	Groton	Brookings	NE Farm	Groton
Untreated	n/a	n/a	2.9	2.9	3.8	34.0	45.4	43.1	55.2	59.0	54.3
Tilt + NIS	4.0 fl oz/A 0.125 %	10.3	1.45	0.3	6.7	39.9	46.4	48.3	58.2	59.4	57.7
Folicur + NIS	5.7 fl oz/A 0.125 %	10.3	0.6	0.1	1.0	39.0	45.4	53.1	58.8	59.3	58.4
Quilt + NIS	10.3 fl oz/A 0.125 %	10.3	1.5	0.5	6.2	38.2	45.6	51.1	59.4	59.5	58.1
Quilt + NIS	13.7 fl oz/A 0.125 %	10.3	3.5	0.1	5.4	36.8	45.8	53.8	56.9	59.7	58.8
Quilt	13.7 fl oz/A	10.3	2.4	0.5	3.6	35.2	45.8	55.8	56.2	59.2	58.3
Stratego + NIS	10.0 fl oz/A 0.125 %	10.3	1.3	0.2	3.4	42.1	44.4	52.8	59.2	60.0	58.6
Quadris + NIS	6.84 fl oz/A 0.125 %	10.3	0.8	0.3	2.9	41	45.1	53.8	59.2	59.6	58.1
Headline + NIS	5.0 fl oz/A 0.125 %	10.3	0.7	1.4	2.0	42.4	45.4	50.1	59.5	59.7	58.1
Untreated	n/a	n/a	2.3	2.8	3.7	34.9	45.0	40.4	56.5	58.8	54.9
	LSD $_{(P=0.05)}$		0.9	1.54	2.1	0.9	NS	5.1	NS	0.5	1.1

[1] – Crop stage refers to Feekes growth stage (see Table 1 for descriptive crop stages)