RESULTS OF AGRONOMIC AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA - 2003

The Annual Report of the Investigations at and Administration of the Southern Agricultural Research Center, Huntley, Montana

http://www.sarc.montana.edu/annualreport/2003/

PROJECT TITLE: Dryland and Irrigated Spring Wheat Performance Trials near Molt, Ryegate, Hysham and Fromberg, Montana. (Exps. 039994, 039995, 039996 and 039997).

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OBJECTIVES: To provide growers in south central Montana with a reliable, unbiased, up-to-date source of information that will permit valid comparisons among improved spring wheat varieties. This information should help spring wheat producers in south central Montana select varieties best suited to their particular area and growing conditions.

METHODS: The 2003 off-station spring wheat trials were established under dryland conditions near Molt and Ryegate, and under irrigated conditions near Fromberg and Hysham, Montana (Figure 1). The spring wheat trials each possessed 20 entries (19 commercial cultivars, 1 experimental line).

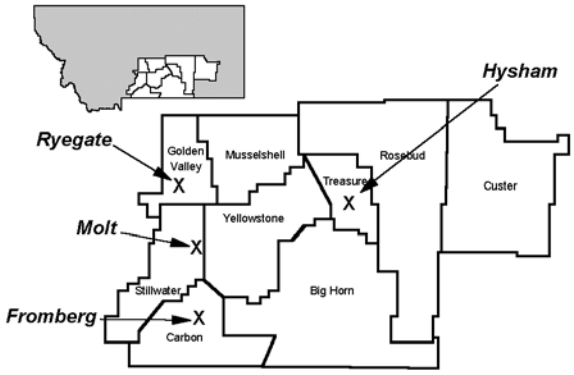

Figure 1. 2003 off-station spring wheat trial locations in south central Montana.

All studies were planted using a randomized complete block design with three replications. Dryland test plots consisted of a 15-foot, 4-row plot with 12-inch row

spacing. Irrigated test plots consisted of a 15-foot, 7-row plot with 6-inch row spacing. All rows of each test plot were trimmed 36 inches and harvested using an experimental-plot combine. Recorded grain yields were adjusted to 13% grain moisture content, and are reported in bushels per acre based on a 60 pound standard bushel weight. Test weight (pounds per bushel) and percent grain moisture content were obtained for each plot using a Dickey-john™ GAC 2100 grain analyzer. Grain protein (%) was determined for each entry bulked across replications. Reported grain protein values are adjusted to a 12% grain moisture content. Plant height was measured in inches from the soil surface to the top of the head, excluding the awns if present. Lodging severity was recorded on a 0 to 9 scale at Hysham representing no lodging to all stems lying flat on the ground, respectively.

RESULTS:

Surface soil moisture conditions in the spring of 2003 were more favorable for spring wheat germination and emergence compared to the previous year. Uniform stands eventually developed at all four testing sites. The dryland trials produced higher yields compared to the previous year, but still experienced substantial drought stress and feeding damage from grasshoppers. Heat stress was a concern during the later portions of the grain fill period, particularly among later maturing entries at the Hysham location.

The trial in Molt produced an average yield of 15.4 bu/ac, up nearly 111 percent from the previous year. Grain yields ranged from 17.8 bu/ac for 'Conan' and 'Westbred 926' to 11.6 bu/ac for 'Newana' (Table 1). Fourteen entries had yields from 14.4 to 17.7 bu/ac, which was equal to the highest yield. Average test weight was 58.2 pounds per bushel. None of the entries produced test weights greater than or equal to 60 pounds per bushel. Two-year average yield for spring wheat varieties tested during 2002 and 2003 in Molt averaged 11.3 bu/ac. Conan produced the highest yield of 12.6 bu/ac. Thirteen entries produced yields equal with that of Conan. Grain protein levels averaged 18.1 percent and varied from 12.9 percent for 'MTHW9420' to 19.8 percent for 'Hi-Line'.

The Ryegate trial suffered from drought and substantial grasshopper damage, resulting in the lowest yield and poorest test weight averaged among the four locations. Average yield was 11.3 bu/ac and ranged from 14.9 bu/ac for 'Fortuna' and 'Westbred 936' to 11.2 bu/ac for 'Lew' (Table 2). Six entries produced equal yields with that of the highest yielding entry. Average test weight was 48.9 lb/bu. None of the entries produced test weights greater than or equal to 60 pounds per bushel. Grain protein averaged 18.8 percent and ranged from 16.9 to 19.8 percent.

Substantial lodging was observed for some spring wheat entries grown at the Hysham site in 2003 (Table 3), yet average spring wheat yield under irrigated conditions at Hysham was 103.3 bu/ac. The highest yielding spring wheat cultivar was 'Hank', averaging 129.3 bu/ac. 'Choteau', 'MT9918', MTHW9420, Westbred 936 and 'Westbred Express' produced yields from 114.7 to 120.4 bu/ac, which was equal with that of the highest yield. Average test weight was 62.3 lb/bu, with all of the entries having test weights greater than 60 lb/bu. Two-year average yield for spring wheat varieties tested during 2002 and 2003 averaged 98.5 bu/ac. Westbred Express produced the highest two-year average yield of 122.2 bu/ac. Only Westbred 936 produced yields equal with that of Westbred Express from 2002 to 2003. Grain protein levels averaged 15.9 percent and varied from 14.2 percent for MTHW9420 to 17.3 percent for 'Ernest'.

The irrigated off-station spring wheat trial grown at Fromberg during 2003 had a 50% yield improvement compared to the previous year. The average yield in 2003 was 88.4 bu/ac and ranged from 100.1 bu/ac for 'McNeal' to 74.0 bu/ac for 'Explorer' (Table 4). 'Amidon', Hank, Lew, MT9918, 'Rambo', 'Scholar' and Westbred Express produced yields equal with that of the highest yielding entry. Average test weight was 62.7 lb/bu, with all 20 entries having test weights

greater than 60 lb/bu. Two year average yield for spring wheat varieties tested during 2002 and 2003 in Fromberg averaged 73.4 bu/ac. McNeal had the highest yield of 82.8 bu/ac. Six entries produced yields equal with that of McNeal during the two-year trial. Three-year average yield for spring wheat varieties tested during 2001 to 2003 was 70.3 bu/ac, with McNeal producing the highest average seed yield at 79.4 bu/ac. Nine entries produced yields from 70.8 to 79.3 bu/ac, which was equal with the highest yield. No lodging was observed among entries tested at Fromberg in 2003. Grain protein levels averaged 16.5 percent and varied from 15.2 percent for Newana to 18.2 percent for Westbred 936.

SUMMARY:

Higher spring wheat yields were observed under dryland conditions at the Molt in 2003 compared to the previous year. This improvement was largely due to more favorable soil moisture conditions at planting and during early growth periods before jointing occurred. Lingering effects of the prolonged drought were still evident during grain fill. The Ryegate trial also suffered from drought conditions, as well as grasshopper damage, which further reduced yields and grain quality at that site. While discerning yield differences among entries is difficult under such stressful conditions, it appears the spring wheat cultivars Conan, Hank, Outlook and Westbred 926 have been the most consistent producers at these two dryland locations the past two years.

Substantial difference in yield, and ranking of the top yield entries, was evident between the two irrigated sites, Hysham and Fromberg. Amidon, Choteau, Conan, 'Ernest', 'Hi-Line', McNeal, MT9918, Rambo, 'Reeder', Westbred 926 and Westbred 936 produced high yields at one or the other of the two irrigated sites, but only Hank and Westbred Express produced yields in the top yield group at both locations. Based on three-year averages analyzed for Fromberg harvested in 2003, McNeal has been the highest yielding spring wheat cultivar grown in south central Montana since 2001 (Table 3).

FUTURE PLANS:

Off-station spring wheat variety performance trials will continue in 2004 at the Molt, Ryegate, Hysham and Fromberg locations.

Table 1. Performance of 20 hard red and hard white spring wheat cultivars and experimental lines tested under dryland conditions near Molt, Montana during 2003. Cultivars listed alphabetically. (Exp. 039994).

Cultivar	1/ Grain Yield 2003	1/ Grain Yield 2002-2003	Test Weight	Grain Moisture	2/ Grain Protein	Plant Height
	----- bushels/acre -----		lb/bu	%	%	inches
Amidon	**15.6***	**11.5***	59.6	8.2	18.0	24.2
Choteau	**15.5***	**11.4***	59.6	8.1	19.1	19.3
Conan	**17.8****	**12.6****	59.3	8.4	19.0	21.4
Ernest	**14.7***	**11.0***	59.5	8.1	19.6	24.6
Explorer	**14.5***	**11.0***	58.3	8.1	13.7	20.3
Fortuna	13.3	10.3	58.9	8.3	17.7	24.0
Hank	**17.8***	**12.6***	57.3	8.1	13.4	21.5
Hi-Line	**17.1***	**12.1***	58.2	8.0	19.8	21.6
Lew	11.2	9.2	54.3	8.2	19.2	21.9
McNeal	**17.7***	**12.5***	56.2	7.8	19.6	22.7
MT9918	**17.5***		58.4	8.3	18.9	24.0
MTHW9420	12.9	10.1	58.5	8.2	12.9	21.3
Newana	11.6	9.5	57.6	8.1	17.8	20.0
Outlook	**14.4***	**11.0***	57.4	8.0	19.2	22.6
Rambo	**16.3***	**11.7***	59.0	8.4	19.3	21.7
Reeder	**16.8***	**12.1***	59.5	8.1	18.7	21.2
Scholar	**16.5***	**11.9***	60.2	8.6	18.9	25.2
Westbred 926	**17.8***	**12.6***	58.4	8.1	19.2	22.8
Westbred 936	12.7	9.9	56.3	8.1	18.9	20.3
Westbred Express	**17.3***	**12.2***	57.3	8.1	18.2	20.3
Average	15.4	11.3	58.2	8.2	18.1	22.0
LSD (p=0.05)	3.9	2.0	2.5	0.2	-.-	2.0
CV %	15.1	15.0	2.6	1.6	-.-	5.5

1/ Yields are based on 60 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to 12 percent grain moisture content.
** Indicates highest yielding cultivar within a column.
* Indicates cultivars yielding equal to highest yielding cultivar within a column based on Fisher's protected LSD (p=0.05).

Molt Dryland Spring Wheat (Exp. 039994)

Planted:	April 14, 2003
Harvested:	August 1, 2003
Fertility:	11-52-00, 120 lb/a in-furrow, at planting
Herbicide:	Harmony Extra, 0.3 oz/a; Bronate, 1 pt/a; R-11, 1 pt/a; May 14, 2003
Insecticide:	none applied
Previous Crop:	summer fallow
Precipitation:	n/a

Table 2. Performance of 20 hard red and hard white spring wheat cultivars and experimental lines tested under irrigation near Ryegate, Montana during 2003. Cultivars listed alphabetically. (Exp. 039995).

Cultivar	1/ Grain Yield	Test Weight	Grain Moisture	2/ Grain Protein	Plant Height
	bu/ac	lb/bu	%	%	inches
Amidon	9.9	51.4	7.2	17.9	28.0
Choteau	9.8	48.8	6.9	19.0	23.4
Conan	**12.4***	50.6	7.3	18.8	23.4
Ernest	8.8	48.6	6.8	19.7	27.9
Explorer	11.7	48.6	7.0	19.5	25.9
Fortuna	**14.9****	50.3	7.5	16.9	30.2
Hank	**13.4***	48.2	7.2	19.7	24.8
Hi-Line	11.5	44.7	6.6	19.8	24.3
Lew	8.9	48.6	7.1	19.7	27.7
McNeal	11.2	47.2	6.8	19.3	21.9
MT9918	8.9	48.8	7.1	18.6	27.0
MTHW9420	**12.9***	47.8	7.1	17.6	25.1
Newana	7.6	49.6	7.1	17.8	23.8
Outlook	**12.4***	48.5	6.6	19.1	23.2
Rambo	8.4	50.3	7.1	19.2	21.5
Reeder	10.7	49.8	7.0	18.5	23.6
Scholar	11.1	51.3	7.0	18.9	28.3
Westbred 926	**14.7***	48.9	7.0	19.0	26.4
Westbred 936	**14.9****	47.7	7.4	19.0	23.7
Westbred Express	11.9	48.5	6.9	18.3	22.3
Average	11.3	48.9	7.0	18.8	25.1
LSD (p=0.05)	2.5	-.-	-.-	-.-	3.6
CV %	13.3	-.-	-.-	-.-	8.7

1/ Yields are based on 60 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to 12 percent grain moisture content.
** Indicates highest yielding cultivar within a column.
* Indicates cultivars yielding equal to highest yielding cultivar within a column based on Fisher's protected LSD (p=0.05).

Ryegate Dryland Spring Wheat (Exp. 039995)

Planted:	May 5, 2003
Harvested:	August 14, 2003
Fertility:	11-52-00, 120 lb/a in-furrow, at planting
Herbicide:	none applied
Insecticide:	none applied
Previous Crop:	chemical fallow
Precipitation:	n/a

Table 3. Performance of 20 hard red and hard white spring wheat cultivars and experimental lines tested under irrigation near Hysham, Montana during 2003. Cultivars listed alphabetically. (Exp. 039996).

Cultivar	Grain Yield 1/ 2003	Grain Yield 1/ 2002-2003	Test Weight	Grain Moisture 2/	Grain Protein	Plant Height	Lodging 3/
	----- bushels/acre ----		lb/bu	%	%	inches	0-9
Amidon	85.1	94.6	61.5	9.7	16.5	42.8	7.7
Choteau	**116.1***	107.2	63.4	10.0	16.1	41.4	0.7
Conan	97.7	93.3	61.7	12.9	15.6	40.3	0.3
Ernest	100.7	105.6	63.0	10.0	17.3	45.6	3.0
Explorer	105.8	86.4	62.4	9.9	15.5	40.2	1.3
Fortuna	75.3	80.9	61.9	9.8	16.6	39.5	8.7
Hank	**123.9****	111.6	62.0	10.0	16.0	40.2	0.0
Hi-Line	96.7	92.4	61.0	9.8	15.9	37.7	1.3
Lew	80.7	74.3	63.0	10.2	16.4	43.9	6.7
McNeal	107.2	105.7	62.9	10.3	16.3	43.6	0.7
MT9918	**120.4***		63.2	10.0	14.9	47.0	1.0
MTHW9420	**114.7***	97.1	62.1	9.8	14.2	41.8	2.3
Newana	99.1	86.4	61.4	10.3	14.5	39.8	1.7
Outlook	104.3	107.0	61.7	10.2	15.3	43.4	1.0
Rambo	105.9	95.4	62.4	11.5	14.7	38.8	1.0
Reeder	105.2	104.7	63.5	10.4	17.0	44.6	0.7
Scholar	84.0	87.2	61.9	10.2	17.2	39.0	7.0
Westbred 926	106.1	105.6	61.8	9.8	16.1	40.7	0.7
Westbred 936	**119.4***	**114.6***	62.0	9.8	16.3	36.8	0.0
Westbred Express	**118.6***	**122.2****	63.1	9.7	15.6	37.1	1.0
Average	103.3	98.5	62.3	10.2	15.9	41.2	2.3
LSD (p=0.05)	12.7	10.2	1.1	0.4	-.-	3.1	1.9
CV %	7.5	9.0	1.1	2.6	-.-	4.6	49.3

1/ Yields are based on 60 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to 12 percent grain moisture content.
3/ Lodging severity scores of 0 to 9 represent no lodging to all stems flat on the ground, respectively.
** Indicates highest yielding cultivar within a column.
* Indicates cultivars yielding equal to highest yielding cultivar within a column based on Fisher's protected LSD (p=0.05).

Hysham Irrigated Spring Wheat (Exp. 039996)

Planted:	April 8, 2003
Harvested:	August 5, 2003
Fertility:	11-52-00, 120 lb/a in-furrow, at planting
Herbicide:	
Insecticide:	none applied
Previous Crop:	sugar beets
Irrigation:	flood
Precipitation:	n/a

Table 4. Performance of 20 hard red and hard white spring wheat cultivars and experimental lines tested under irrigation near Fromberg, Montana during 2003. Cultivars listed alphabetically. (Exp. 039997).

Cultivar	1/ Grain Yield 2003	2002-2003	2001-2003	Test Weight	2/ Grain Moisture	Grain Protein	Plant Height
	bushels/acre			lb/bu	%	%	inches
Amidon	**96.8***	**78.8***	**75.3***	62.4	10.4	16.9	38.7
Choteau	90.0	**78.3***	**70.8***	60.3	9.2	16.7	32.5
Conan	75.0	67.3	63.5	63.0	10.4	16.0	31.4
Ernest	90.4	73.7	**71.0***	63.3	9.6	17.4	39.7
Explorer	74.0	62.0	64.7	62.8	9.0	16.0	30.3
Fortuna	79.0	65.2	62.9	63.4	9.3	16.7	39.0
Hank	**92.2***	**79.1***		62.4	9.2	16.6	29.5
Hi-Line	84.7	73.4	**75.9***	63.5	8.9	16.0	32.1
Lew	**94.9***	74.5	**71.4***	63.5	9.4	15.5	42.4
McNeal	**100.1****	**82.8****	**79.4****	62.8	8.9	17.0	34.7
MT9918	**92.5***			62.5	9.6	16.3	35.7
MTHW9420	80.0	61.0	65.5	61.8	9.3	16.7	30.9
Newana	88.3	72.9	65.7	63.9	9.1	15.2	33.9
Outlook	82.5	72.7	**71.5***	61.8	8.9	16.2	37.2
Rambo	**97.8***	**82.5***	**73.5***	63.6	10.2	15.4	32.6
Reeder	87.3	76.9	**76.7***	63.5	9.9	17.1	34.7
Scholar	**98.2***	**78.4***	**79.3***	61.4	10.1	16.4	38.1
Westbred 926	80.2	66.3	65.2	62.3	9.3	16.7	29.0
Westbred 936	87.3	72.3	64.7	62.6	9.2	18.2	28.7
Westbred Express	**97.3***	77.3	69.2	62.8	8.9	16.1	29.6
Average	88.4	73.4	70.3	62.7	9.4	16.5	34.0
LSD (p=0.05)	7.9	5.0	9.4	ns	0.4	-.-	1.9
CV%	5.4	5.9	14.3	2.1	2.8	-.-	3.3

1/ Yields are based on 60 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to 12 percent grain moisture content.
** Indicates highest yielding cultivar within a column.
* Indicates cultivars yielding equal to highest yielding cultivar within a column based on Fisher's protected LSD (p=0.05).
ns Indicates no significant difference between cultivars within a column based on Fisher's protected LSD (p=0.05).

Fromberg Irrigated Spring Wheat (Exp. 039997)

Planted:	April 14, 2003
Harvested:	August 1, 2003
Fertility:	11-52-00, 120 lb/a in-furrow, at planting
Herbicide:	Harmony Extra, 0.3 oz/a; Bronate, 1 pt/a; Stinger, 10 oz/a; R-11, 1 pt/a, May 14, 2003
Insecticide:	none applied
Previous Crop:	malt barley
Irrigation:	flood
Precipitation:	n/a