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

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PROJECT TITLE: Dryland and Irrigated Spring Barley Performance Trials near Molt, Ryegate, Fromberg and Hysham, Montana. (Exps. 033691, 033692, 033794 and 033795).

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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 barley varieties. This information should help spring barley producers in south central Montana select varieties best suited to their particular area and growing conditions.

METHODS: Off-station spring barley trials were conducted under dryland conditions near Molt and Ryegate, and under flood irrigation near Fromberg and Hysham, Montana (Fig. 1). Sixteen spring barley entries (10 commercial cultivars, 6 experimental lines) were planted at Molt and Ryegate, while 24 entries (19 commercial cultivars, 5 experimental lines) were planted at Fromberg and Hysham. The dryland sites were oriented towards feed-type barley cultivars whereas malt-types dominated the entries tested on the irrigated sites.

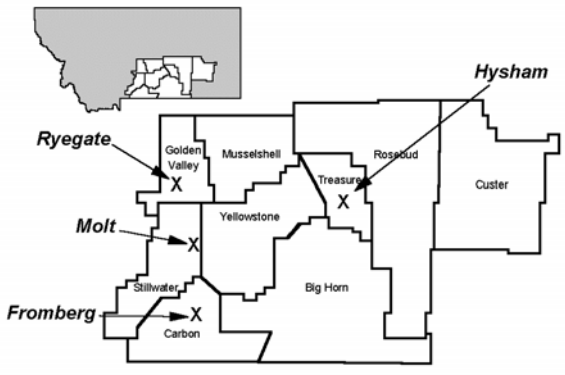

Figure 1. 2003 off-station spring barley trial locations in south central Montana.

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 48 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 and is reported on a 100% dry matter basis. Plant height was measured in inches from the soil surface to the top of the head, excluding the awns if present. Lodging was observed at the irrigated locations. Lodging severity was recorded on a 0 to 9 scale representing no lodging to all stems lying flat on the ground, respectively. Percent plump and thin kernels were determined by measuring the amount of a ~100 gram sub-sample retained above a 6-64" slotted screen and passing through a 5½-64" slotted screen, respectively, following 30 oscillations on a Strand™ sizer shaker.

RESULTS:

Surface soil moisture conditions in the spring of 2003 were more favorable for spring barley 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 drought stress was still evident during grain fill. The dryland trials, especially Ryegate, also experienced feeding damage from grasshoppers (Fig. 2). Heat stress was a concern during the later portions of the grain fill period, particularly among later maturing entries at the Hysham location.

The spring barley trial at Molt produced an average yield of 14.8 bu/ac. Grain yields ranged from 19.9 bu/ac for 'MT970116' to 5.3 bu/ac for 'Haybet' (Table 1). Eleven entries had yields from 13.7 to 18.5 bu/ac, which was statistically equal to the highest yield. Average test weight was 48.6 pounds per bushel. Grain protein content averaged 10.6 percent and ranged from 9.8 to 11.4 percent. Two-year average yield for barley varieties tested during 2002 and 2003 in Molt averaged 15.8 bu/ac. There was no significant difference in yield between entries tested for the past two years.

The Ryegate trial suffered extensive grasshopper damage, resulting in the lowest barley yield among the four locations. Average yield was 7.0 bu/ac and ranged from 12.7 bu/ac for 'MT970148' to 1.1 bu/ac for 'Harrington' (Table 2). Five entries produced equal yields with that of the highest yielding entry. There was not enough sample to measure test weight for most of the entries evaluated in Ryegate. Grain protein averaged 15.9 percent and ranged from 14.3 to 17.6 percent.

The irrigated off-station spring barley trial grown at Fromberg during 2003 had a 100% yield improvement compared to the study grown the previous year near Bridger (Table 3). The average yield was 121.1 bu/ac and ranged from 138.9 bu/ac for 'Stander' to 86.8 bu/ac for 'Robust'. Six commercial entries ('Baronesse', 'Excel', 'Gallatin', 'Lacey', Legacy', 'Moravian 37') had yields from 127.5 to 135.9 bu/ac, which was statistically equal to the highest yield. 'MT981091' was the highest yielding experimental line tested at this site in 2003, averaging 138.1 bu/ac. Average test weight across all entries tested at Fromberg for 2003 was 52.2 lb/bu. Grain protein averaged 12.3 percent and ranged from 11.6 to 14 percent. Mean percent plump and thin kernels were 89.7 and 4.5 percent, respectively. Two-year average yield for spring barley varieties tested during 2002 and 2003 in Fromberg/Bridger locations averaged 88.7 bu/ac with Baronesse producing the highest average seed yield at 107.5 bu/ac. Only Gallatin had yield equal with that of the highest yielding entry fro the past two seasons. Three-year average yield for spring barley varieties tested during 2001 to 2003 averaged 88.5 bu/ac with Baronesse producing the highest yield at 102.8

bu/ac. Gallatin, 'Harrington', Moravian 37 and Stander produced yields from 93.1 to 100.3 bu/ac, which was equal with the highest yield. Baronesse had consistent high yields during the past three years of the study.

Substantial lodging was observed among most barley entries grown at the Hysham site in 2003, resulting in reduced yields. The average spring barley yields under irrigated condition in Hysham was 96.6 bu/ac, with 'CDC Stratus' producing the highest yield at 123.4 bu/ac (Table 4). Four commercial entries ('AC Metcalfe', 'Garnett', 'Lacey' and 'Merit') produced yields from 98.3 to 110.0 bu/ac, which was equal to the highest yield. 'MT960101' was the highest yielding experimental line tested at this site in 2003, averaging 122.7 bu/ac. Average test weight across all entries tested at Hysham for 2003 was 53.5 lb/bu. Grain protein averaged 14 percent and ranged from 13 to 16.1 percent. Mean percent plump and thin kernels were 86 and 7 percent, respectively. Two-year average yield for barley varieties tested during 2002 and 2003 in Hysham averaged 96.9 bu/ac, with CDC Stratus producing the highest yield at 114.4 bu/ac. Seven entries produced yields equal with that of the highest yielding entry.

SUMMARY:

Higher spring barley 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 barley cultivars Baronesse, 'Conlon' and 'Haxby' 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. AC Metcalfe, Baronesse, Excel, Garnett, Legacy, Merit, Moravian 37, Stander and CDC Stratus produced high yields at one or the other of the two irrigated sites during 2003, but only Lacey spring barley produced yields in the top yield group among the commercial cultivars tested at both locations (Tables 3 and 4). Based on three-year averages analyzed for Fromberg harvested in 2003, Baronesse, Gallatin, Garnett and Moravian 37 have been the highest yielding spring barley cultivars grown in the irrigated trials since 2001 (Table 3).

FUTURE PLANS:

Off-station spring barley variety evaluations will continue in 2004 at the Molt, Ryegate, Fromberg and Hysham locations.

Table 1. Performance of 16 spring barley cultivars and experimental lines tested under dryland conditions near Molt, Montana during 2003. Cultivars listed alphabetically. (Exp. 033691).

Cultivar	Grain Yield 1/ 2003	Grain Yield 1/ 2002-2003	Test Weight	Grain Moisture	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height
	-------- bu/ac ------		lb/bu	%	%	%	%	inches
Baronesse	**18.5***	16.7	48.6	8.3	10.5	12.4	53.6	17.6
Conlon	**17.6***	16.3	50.7	8.1	10.3	75.7	6.5	21.3
Eslick (MT960228)	**14.5***		50.5	8.8	9.9	4.7	68.5	19.6
Gallatin	12.2	14.1	48.4	8.5	10.5	9.2	56.6	20.0
Harrington	**16.3***	15.2	45.8	8.0	11.1	19.3	44.4	18.5
Haxby	**16.0***	17.8	50.7	8.5	9.9	3.1	80.1	20.8
Haybet	5.3		45.6	8.7	10.7	0.6	92.8	22.8
Hays	6.4		45.8	8.2	10.8	3.9	75.4	19.9
MT960099	**18.1***		47.6	8.4	11.4	6.0	83.1	16.0
MT960101	10.3		48.2	8.6	11.3	1.9	79.8	17.8
MT970116	**19.9****	14.9	50.7	8.3	9.8	27.6	25.4	22.1
MT970148	**14.0***		47.9	8.7	10.0	12.1	54.9	17.2
MT970155	**18.2***		49.3	8.4	10.7	20.5	40.3	17.5
MT970229	**13.7***		50.7	8.7	11.1	22.6	30.9	18.2
Valier	**17.8***	15.3	50.1	8.7	10.8	5.9	59.1	19.3
Xena	**18.0***		46.3	8.1	11.3	7.3	59.5	19.5
Average	14.8	15.8	48.6	8.4	10.6	14.6	56.9	19.3
LSD (p=0.05)	6.7	ns	-.-	-.-	-.-	5.9	7.7	1.6
CV %	27.2	24.2	-.-	-.-	-.-	24.1	8.1	4.9

1/ Yields are based on a 48 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to a 100 percent dry matter basis.
** 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 Barley (Exp. 033691)

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 16 spring barley cultivars and experimental lines tested under dryland conditions near Ryegate, Montana during 2003. Cultivars listed alphabetically. (Exp. 033692).

Cultivar	1/ Grain Yield	Test Weight	Grain Moisture	2/ Grain Protein	Plump Kernels	Thin Kernels	Plant Height
	bu/ac	lb/bu	%	%	%	%	inches
Baronesse	**11.0***	-.-	8.0	15.0	0.7	95.4	21.8
Conlon	**10.9***	-.-	7.8	14.3	3.7	77.3	28.0
Eslick (MT960228)	3.8	-.-	7.5	17.0	1.9	96.7	24.6
Gallatin	6.3	-.-	7.4	15.0	0.7	96.3	23.3
Harrington	1.1	-.-	7.3	15.0	5.4	83.5	21.1
Haxby	**9.4***	37.5	7.6	14.3	0.8	96.4	25.7
Haybet	2.0	-.-	7.6	16.1	0.8	96.8	22.8
Hays	2.3	-.-	7.6	17.4	0.2	97.4	21.0
MT960099	**12.6***	38.6	8.1	15.9	0.7	98.4	19.8
MT960101	4.1	-.-	7.5	17.5	0.6	98.3	22.4
MT970116	4.0	-.-	7.7	15.5	0.0	97.9	26.6
MT970148	**12.7****	-.-	7.8	17.6	0.4	95.4	22.4
MT970155	**9.0***	-.-	7.6	16.5	0.8	92.5	19.9
MT970229	**12.6***	39.0	8.1	16.5	0.7	94.8	22.3
Valier	3.6	37.5	8.2	14.5	0.6	95.9	22.0
Xena	6.9	-.-	7.5	16.6	0.5	96.0	22.4
Average	7.0	-.-	7.7	15.9	1.2	94.3	22.9
LSD (p=0.05)	5.4	-.-	-.-	-.-	-.-	-.-	2.9
CV %	46.2	-.-	-.-	-.-	-.-	-.-	7.6

1/ Yields are based on a 48 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to a 100 percent dry matter basis.
** 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 Barley (Exp. 033692)

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 24 spring barley cultivars and experimental lines tested under irrigated conditions near Fromberg, Montana during 2003. Cultivars listed alphabetically. (Exp. 033794).

Cultivar	Grain Yield 1/ 2003	Grain Yield 1/ 2002-2003	Grain Yield 1/ 2001-2003	Test Weight	Grain Moisture	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height	Lodging 3/
	----------	bushels/acre	----------	lb/bu	%	%	%	%	inches	0-9
AC Metcalfe	110.5	87.0		52.3	9.3	12.3	90.0	5.9	37.3	2.7
Baronesse	**135.6***	**107.5****	**102.8****	51.2	9.1	12.1	82.9	6.1	31.2	5.7
Busch Agr 1202	126.0	95.5	84.0	50.2	9.2	11.9	86.6	6.6	32.6	4.0
CDC Kendall	106.9	82.5		53.2	9.2	12.9	93.6	3.8	35.8	1.3
CDC Stratus	125.2	87.3		49.9	8.9	11.6	85.1	5.1	31.7	8.0
Conlon	91.6	78.1		53.3	9.3	13.2	89.9	4.6	30.7	1.3
Drummond	123.7	90.5		51.3	8.7	11.9	88.8	3.6	36.1	4.3
Excel	**134.8***	92.2		52.8	9.1	12.0	94.5	1.7	36.0	1.3
Foster	115.6	80.7	76.9	52.3	9.0	12.1	97.4	1.0	35.2	1.7
Gallatin	**132.9***	**98.7***	**100.3***	52.1	9.2	11.8	83.9	8.8	34.0	7.3
Garnett	115.0	90.8	**93.1***	51.1	9.3	12.6	91.3	3.8	36.3	5.7
Harrington	111.2	90.9	89.5	51.0	9.2	11.7	86.1	5.4	35.3	6.3
Lacey	**135.9***			53.7	9.0	12.3	96.1	1.3	35.5	0.3
Legacy	**127.5***	92.0	81.6	52.5	9.2	12.7	94.2	2.0	37.8	4.3
Merit	109.5	81.5	79.6	51.1	9.2	12.1	87.1	6.0	37.9	2.7
Moravian 37	**126.7***	96.8	**94.0***	52.4	9.1	11.9	92.4	3.7	32.0	8.0
Morex	100.2	74.9	78.7	52.3	9.2	14.0	96.2	1.1	37.6	0.7
MT960101	**129.0***	90.7		52.9	10.1	12.0	86.3	6.2	32.9	1.3
MT970116	**132.0***	98.3		53.9	9.5	12.3	93.4	2.9	35.0	0.3
MT981091	**138.1***			51.6	9.3	12.0	84.1	10.1	30.5	4.0
MT981210	**132.0***			54.1	9.3	12.1	92.5	4.9	36.0	5.3
MT981238	121.3			52.7	9.2	12.3	86.1	10.0	34.3	6.3
Robust	86.8	61.3		54.0	9.4	12.9	80.9	1.0	39.2	0.7
Stander	**138.9****	97.8	**93.2***	51.7	9.3	11.8	93.7	2.4	36.9	0.3
Average	121.1	88.7	88.5	52.2	9.2	12.3	89.7	4.5	34.9	3.5
LSD (p=0.05)	12.8	9.1	12.5	1.1	0.5	-.-	9.7	2.7	2.4	3.4
CV %	6.4	8.9	14.9	1.3	3.1	-.-	6.6	36.8	4.1	59.0

1/ Yields are based on 48 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to a 100 percent dry matter basis.
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).

Fromberg Irrigated Spring Barley (Exp. 033794)

Planted:	April14, 2003
Harvested:	August 11, 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

Table 4. Performance of 24 spring barley cultivars and experimental lines tested under irrigated conditions near Hysham, Montana during 2003. Cultivars listed alphabetically. (Exp. 033795).

Cultivar	Grain Yield 1/ 2003	Grain Yield 1/ 2002-2003	Test Weight	Grain Moisture	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height	Lodging 3/
	--------- bu/ac ---------		lb/bu	%	%	%	%	inches	0-9
AC Metcalfe	**99.7***	**105.0***	54.1	10.0	14.0	84.7	7.8	47.9	5.3
Baronesse	88.5	**100.3***	52.7	9.8	16.1	78.5	13.1	42.1	7.0
Busch Agr 1202	94.7	**108.4***	52.2	9.8	15.1	87.5	6.3	43.3	6.7
CDC Kendall	90.3	97.3	52.6	9.9	15.1	85.3	7.9	46.2	5.7
CDC Stratus	**123.4****	**114.4****	49.1	9.6	13.0	44.8	31.5	39.4	9.0
Conlon	62.0	85.8	54.9	10.0	13.8	95.4	2.1	45.7	8.0
Drummond	83.8	89.1	53.9	10.1	13.4	94.2	1.9	51.7	2.7
Excel	96.9	95.2	53.8	9.7	12.8	89.7	3.7	48.3	7.0
Foster	96.7	93.0	53.4	10.0	12.6	96.9	1.2	50.9	2.3
Gallatin	95.9	96.2	53.9	10.1	14.6	77.8	11.9	45.4	6.0
Garnett	**104.3***	**104.6***	54.0	9.8	14.3	92.4	3.0	44.4	4.7
Harrington	97.5	93.7	52.0	9.8	15.3	79.4	10.8	43.8	6.7
Lacey	**98.3***		54.7	10.0	12.7	96.9	0.9	49.2	2.3
Legacy	96.9	**102.7***	53.5	9.7	13.1	92.1	2.2	50.1	5.0
Merit	**110.0***	**109.8***	52.1	9.7	14.3	81.0	10.1	43.9	6.0
Moravian 37	79.1	82.0	50.8	9.6	15.6	73.9	14.5	42.6	6.7
Morex	97.6	95.3	51.4	9.5	13.6	79.7	7.9	53.8	7.7
MT960101	**122.7***	**104.9***	55.3	10.3	13.4	87.8	5.4	44.5	3.3
MT970116	92.7	97.9	54.3	9.8	13.6	83.7	8.9	48.2	7.3
MT981091	**108.9***		54.8	9.9	13.6	92.5	4.4	41.7	5.0
MT981210	**112.9***		55.3	9.9	14.1	92.9	2.8	46.9	5.7
MT981238	**111.2***		55.1	10.3	14.5	91.7	3.2	47.5	3.0
Robust	67.4	77.2	54.3	10.0	14.5	92.3	3.2	51.1	5.0
Stander	86.0	84.7	54.5	10.1	13.1	92.8	2.9	48.4	2.3
Average	96.6	96.9	53.5	9.9	14.0	86.0	7.0	46.5	5.4
LSD (p=0.05)	25.5	16.3	1.5	0.3	-.-	8.2	5.4	4.2	3.0
CV %	16.1	14.6	1.7	2.0	-.-	5.8	47.4	5.4	33.1

1/ Yields are based on a 48 pound standard bushel weight and adjusted to 13.0 percent moisture content.
2/ Grain protein values adjusted to a 100 percent dry matter basis.
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 Barley (Exp. 033795)

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