RESULTS OF AGRONOMIC AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA - 2004

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PROJECT TITLE: Dryland and Irrigated Spring Barley Performance Trials near Molt, Ryegate, Fromberg and Hysham, Montana. (Exps. 043691, 043692, 043794 and 043795).

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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 (13 commercial cultivars, 3 experimental lines) were planted at Molt and Ryegate, while 24 entries (20 commercial cultivars, 4 experimental lines) were planted at Fromberg and Hysham. Both feed and malt type cultivars were grown at all locations, but the dryland sites were more oriented towards feed and hay type barley cultivars whereas malt types dominated the barley entries tested on the irrigated sites. The Ryegate trial was no-till planted on chemical fallow.

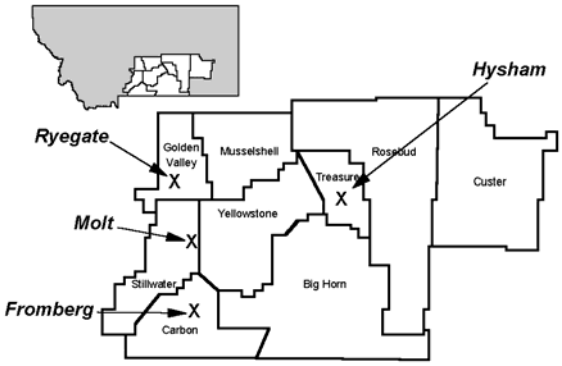

Figure 1. 2004 off-station spring barley trial locations in south central Montana.

All studies were planted using a randomized complete block design with three replications. Dryland test plots established on conventional summer fallow consisted of a 15-foot, 4-row plot with 12-inch row spacing. Dryland test plots no-till planted into chemical fallow consisted of a 15-foot, 4-row plot with 14-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 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:

The 2004 spring barley trial at Molt produced an average yield of 45.7 bu/ac (Table 1), more than three times the average yield produced by spring barley tested at this location in 2003. Grain yields ranged from 53.3 bu/ac for 'Haxby' and 'Tradition', to 32.0 bu/ac for 'Haybet'. No differences in yield were detected between the 16 spring barleys tested at Molt in 2004. Average test weight was 47.7 pounds per bushel. Grain protein content averaged 13.5 percent and ranged from 12.1 to 15.3 percent. Two-year average yield for barley varieties tested during 2003 and 2004 in Molt averaged 29.9 bu/ac, with Haxby producing the highest yield at 34.6 bu/ac. Three-year average yield for barley varieties tested during 2002, 2003 and 2004 in Molt averaged 26.2 bu/ac. There was no significant difference in yield between entries tested for the past three years at this location.

The Ryegate trial suffered from hail and extensive grasshopper damage, and was not harvested in 2004.

The 2004 Fromberg irrigated spring barley trial was planted under marginal surface soil moisture conditions. Spring rains did not occur and initial irrigation was delayed to divert water for emerging sugar beet crops in the area. Post-irrigation stands and subsequent tillering of the spring barley at Fromberg did not improve enough to offset the early season moisture stress. Damage to spring barley entries was less evident than injury levels experienced by spring wheat entries planted at the same location. The average spring barley yield at Fromberg in 2004 was 98.1 bu/ac and ranged from 109.7 bu/ac for 'Merit' to 82.2 bu/ac for 'Conlon'. No statistical differences in grain yield where detected between spring barleys tested during 2004. Average test weight across all entries tested at Fromberg for 2004 was 52.0 lb/bu. Grain protein averaged 12.6 percent and ranged from 10.8 to 13.8 percent. Mean percent plump and thin kernels were 94.8 and 1.7 percent, respectively. Two-year average yield for spring barley varieties tested during 2003 and 2004 at Fromberg averaged 108.8 bu/ac with 'Stander' producing the highest average seed yield at 123.9 bu/ac. Three-year average yield for spring barley varieties tested during 2002 to 2004 averaged 91.7 bu/ac with Baronesse producing the highest yield at 105.1 bu/ac. 'Moravian 37', 'MT970116' and Stander produced yields from 97.9 to 101.5 bu/ac, which was equal with the highest three-year yield.

Like Fromberg, the 2004 Hysham irrigated spring barley trial was planted under drier-than-normal seedbed conditions, and initial stands were not uniform. Spring barley stands at Hysham recovered substantially with timely rains in April. Lodging was observed among most barley entries grown at the Hysham site in

2004, but lodging was most evident for 'CDC Kendall', 'Legacy' and 'Morex'. Conlon experienced severe bird damage at Hysham and was not harvested. The average spring barley yields under irrigated condition at Hysham was 129.0 bu/ac, with Baronesse producing the highest yield at 151.6 bu/ac (Table 3). Nine commercial entries ('AC Metcalfe', 'Busch Agr 1202', 'CDC Copeland', 'Lacey', 'Legacy', 'Merit', 'Moravian 37', 'Stander' and Tradition) produced yields from 134.9 to 148.3 bu/ac, which were statistically equal to the yield of Baronesse. 'MT910189' was the highest yielding experimental line tested at this site in 2004, averaging 139.5 bu/ac. Average test weight across all entries tested at Hysham for 2004 was 52.7 lb/bu. Grain protein averaged 10.7 percent and ranged from 9.2 to 12.4 percent. Mean percent plump and thin kernels were 96.1 and 1.4 percent, respectively. Two-year average yield for barley varieties tested during 2003 and 2004 in Hysham averaged 111.5 bu/ac, with Merit producing the highest yield at 126.9 bu/ac. Seven commercial entries (Baronesse, Busch Agr 1202, 'Excel', 'Harrington', Lacey, Legacy and Stander) produced two-year yields equal with that of the highest yielding entry. Three-year average yield for barley varieties tested from 2002 to 2004 in Hysham averaged 105.8 bu/ac, with Merit producing the highest yield at 121.1 bu/ac. Three entries (Baronesse, Busch Agr 1202 and Legacy) produced three-year yields equal with that of Merit.

SUMMARY:

Higher spring barley yields were observed under dryland conditions at the Molt in 2004 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 and hail damage, which precluded the harvesting of spring barleys planted at that site. Discerning yield differences among entries is difficult under such stressful conditions.

Substantial difference in yield, and ranking of the top yield entries, was evident between the two irrigated sites, Hysham and Fromberg. Averaged across both locations, CDC Copeland was the highest yielding barley grown under irrigation in 2004 (Table 4). AC Metcalfe, Baronesse, Legacy, Merit, Moravian 37 and Stander produced irrigated yields equal to those of CDC Copeland in 2004.

FUTURE PLANS:

Off-station spring barley variety evaluations will continue in 2005 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 2004. Cultivars listed alphabetically. (Exp. 043691).

Cultivar	Grain Yield 1/ 2004	Grain Yield 1/ 2003-2004	Grain Yield 1/ 2002-2004	Test Weight	Grain Moisture	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height
	bushels/acre			lb/bu	%	%	%	%	inches
AC Metcalfe	35.0			45.7	11.9	15.3	15.1	29.5	20.4
Baronesse	50.4	**34.5***	27.9	47.2	12.1	14.0	19.9	26.0	20.0
CDC Copeland	52.5			45.1	12.0	13.7	27.9	18.7	24.5
Conlon	47.5	**32.5***	26.7	48.6	11.0	14.0	61.6	3.6	22.3
Eslick	45.2	**29.8***		46.9	11.7	12.7	20.2	31.7	19.5
Gallatin	45.6	**28.9***	24.6	44.3	11.9	12.1	28.6	21.5	22.2
Harrington	43.1	**29.7***	24.5	47.1	12.0	13.2	21.2	24.1	20.0
Haxby	53.3	**34.6****	29.6	52.3	11.9	13.4	39.3	19.1	21.9
Haybet	32.0	18.7		45.7	12.0	15.0	4.5	40.4	21.8
Hays	43.3	24.9		44.6	11.9	12.6	10.3	36.3	19.5
Lacey	38.6			48.2	11.3	13.5	39.4	19.3	20.7
MT910189	50.8			48.9	12.1	13.2	37.6	16.9	22.7
MT970116	40.0	**29.9***	23.3	49.9	12.0	13.5	37.1	14.5	21.4
MT970229	50.3	**32.0***		49.3	12.0	14.3	32.2	15.5	20.9
Tradition	53.3			49.1	11.3	13.1	43.6	13.4	25.1
Valier	50.1	**34.0***	26.9	50.1	12.4	12.6	28.5	22.3	21.9
Average	45.7	29.9	26.2	47.7	11.8	13.5	29.2	22.0	21.6
PLSD (p=0.05)	ns	7.0	ns	3.1	0.6	-.-	14.6	9.2	ns
CV%	18.4	19.9	18.5	3.9	2.9	-.-	30.1	25.0	9.6

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).
ns Indicates no significant difference between cultivars within a column based on Fisher's protected LSD (p=0.05).

Molt Dryland Spring Barley (Exp. 043691)	
Planted	April 6, 2004
Harvested	August 5, 2004
Fertility	11-52-00, 100 lbs/a at planting
Insecticide:	none applied
Previous Crop:	summer fallow
Precipitation:	n/a

Table 2. Performance of 24 spring barley cultivars and experimental lines tested under irrigated conditions near Fromberg, Montana during 2004. Cultivars listed alphabetically. (Exp. 043794).

Cultivar	Grain Yield 1/ 2004	Grain Yield 1/ 2003-2004	Grain Yield 1/ 2002-2004	Test Weight	Grain Moisture	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height
	bushels/acre			lb/bu	%	%	%	%	inches
AC Metcalfe	104.9	107.7	93.0	53.0	12.3	12.3	93.8	2.3	31.7
Baronesse	100.4	**118.0***	**105.1****	51.8	12.3	12.4	89.0	4.6	25.8
Busch Agr 1202	89.6	107.8	93.6	50.9	12.5	12.7	92.1	2.9	28.7
CDC Copeland	106.7			51.8	12.9	10.8	94.7	2.2	33.8
CDC Kendall	90.8	98.9	85.2	52.3	12.6	12.9	96.1	1.3	28.7
Conlon	82.2	86.9	79.5	52.2	11.7	12.1	97.9	0.6	26.7
Drummond	97.6	110.7	92.9	51.3	11.8	13.4	95.7	1.1	31.7
Excel	100.4	**117.6***	94.9	51.3	12.8	12.4	95.0	1.1	32.3
Foster	101.2	108.4	87.5	50.4	12.8	12.9	97.1	0.8	32.4
Gallatin	91.8	112.4	96.4	52.2	13.0	12.1	94.3	2.0	28.2
Harrington	95.2	103.2	92.3	52.2	12.2	12.1	92.3	2.5	28.6
Haxby	102.9			54.2	11.7	12.4	95.5	1.5	27.1
Lacey	94.0	**115.0***		51.5	12.2	13.1	94.9	1.1	30.8
Legacy	99.2	113.3	94.4	51.0	12.7	13.1	96.3	0.8	34.2
Merit	109.7	109.6	90.9	51.7	12.5	12.6	93.9	2.2	32.5
Moravian 37	101.0	**113.9***	**98.2***	52.4	11.9	12.5	94.5	2.1	26.6
Morex	97.0	98.6	82.2	50.9	11.2	13.8	94.9	1.4	33.3
MT910189	104.0			53.0	12.3	11.8	94.0	2.4	27.8
MT970116	97.3	**114.6***	**97.9***	53.6	12.3	12.3	96.4	1.3	30.7
MT981210	99.2	**115.6***		53.3	11.8	12.6	94.6	2.1	27.7
MT981238	95.2	108.3		53.5	13.2	13.0	95.2	1.5	28.4
Robust	96.5	91.7	73.0	52.1	12.2	13.1	94.8	1.4	34.9
Stander	108.9	**123.9****	**101.5***	51.3	14.3	13.0	96.7	0.9	31.5
Tradition	89.7			51.0	12.1	13.5	96.3	0.8	30.1
Average	98.1	108.8	91.7	52.0	12.4	12.6	94.8	1.7	30.2
PLSD (p=0.05)	ns	10.2	8.0	0.6	1.0	-.-	2.3	1.1	2.8
CV%	10.2	8.1	9.3	0.8	5.1	-.-	1.5	38.7	5.6

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.
** 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 Barley (Exp. 043794)

Planted	March 12, 2004
Harvested	August 16, 2004
Fertility	11-52-00, 100 lbs/a at planting
Herbicide	Bronate Advanced @ 32 oz/a; Harmony Extra @ 0.5 oz/a; R-11 @ 16 oz/a; AMS @ 3 lb/a, April 30, 2004
Previous Crop:	sugar beets
Precipitation:	n/a

Table 3. Performance of 23 spring barley cultivars and experimental lines tested under irrigated conditions near Hysham, Montana during 2004. Cultivars listed alphabetically. (Exp. 043795).

Cultivar	Grain Yield 1/ 2004	Grain Yield 1/ 2003-2004	Grain Yield 1/ 2002-2004	Test Weight	Grain Moisture 2/	Grain Protein 2/	Plump Kernels	Thin Kernels	Plant Height	Lodging 3/
	bu/ac			lb/bu	%	%	%	%	inches	0-9
AC Metcalfe	**138.2***			53.8	10.5	10.7	96.2	1.5	40.6	0.0
Baronesse	**151.6****	**120.1***	**117.4***	53.3	10.6	9.5	94.0	2.3	38.1	2.0
Busch Agr 1202	**137.6***	**116.2***	**118.2***	51.9	10.4	10.6	98.2	0.7	40.3	1.0
CDC Copeland	**148.3***			53.1	10.4	10.0	98.1	0.8	45.0	0.7
CDC Kendall	124.9			53.0	10.2	12.4	96.3	1.6	41.6	2.7
Drummond	114.3	99.1	97.5	51.1	10.1	10.8	95.8	1.1	42.5	1.3
Excel	129.0	**113.0***	106.5	51.4	10.3	10.0	93.2	2.1	42.5	1.7
Foster	124.7	110.7	103.6	50.7	10.0	11.5	97.5	0.9	43.3	0.0
Gallatin	123.7	109.8	105.3	53.9	11.1	10.1	96.0	1.6	39.8	0.0
Harrington	131.6	**114.5***	106.3	52.9	10.5	9.7	96.1	1.7	39.8	0.7
Haxby	95.3			54.8	10.6	10.6	97.8	0.9	42.0	0.3
Lacey	**136.8***	**117.5***		52.3	10.1	11.1	96.9	0.8	43.1	0.3
Legacy	**138.3***	**117.6***	**114.6***	50.9	10.1	11.1	92.1	2.4	44.3	3.7
Merit	**143.8***	**126.9****	**121.1****	52.2	10.8	9.2	94.9	1.9	42.6	0.0
Moravian 37	**136.1***	107.6	100.0	53.6	10.5	10.5	97.2	1.1	34.0	1.0
Morex	100.8	99.2	97.2	50.2	10.0	10.7	92.5	2.4	45.9	3.3
MT910189	**139.5***			54.0	10.7	10.3	97.5	1.1	37.0	1.0
MT970116	113.1	102.9	103.0	54.8	10.7	10.1	98.2	0.7	43.8	0.3
MT981210	126.7	**119.8***		54.1	10.7	11.4	97.7	0.8	41.7	0.7
MT981238	129.0	**120.1***		54.8	11.0	11.9	95.9	1.5	42.4	0.7
Robust	105.5	86.4	86.6	52.8	10.4	11.0	96.3	0.7	46.7	1.3
Stander	**143.3***	**114.6***	104.2	52.0	10.4	11.3	94.5	2.2	43.6	0.7
Tradition	**134.9***			51.5	9.9	11.0	97.2	0.6	42.9	1.0
Average	129.0	111.5	105.8	52.7	10.4	10.7	96.1	1.4	41.9	1.1
PLSD (p=0.05)	17.5	14.8	12.1	0.4	0.3	-.-	2.0	1.0	2.6	1.2
CV%	8.3	11.5	12.2	0.5	1.8	-.-	1.3	43.2	3.8	71.2

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. 043795)

Planted	March 18, 2004
Harvested	August 2, 2004
Fertility	11-52-00, 100 lbs/a at planting; 30-9-0, 25 lbs/a, June 3, 2004
Previous Crop:	sugar beets
Irrigation:	flood

Table 4. Grain yield[1/] of 29 spring barley cultivars tested at three locations in south central Montana during 2004. Varieties listed by declining three-location average yield.

Cultivar	Fromberg Irrigated	Hysham Irrigated	Irrigated Average	Molt Dryland	Ryegate Dryland	Three Location Average
	---------- bushels/acre ----------					
AC Metcalfe	104.9	**138.2***	**121.6***	35.0	-.-	**92.7***
Baronesse	100.4	**151.6****	**126.0***	50.4	-.-	**100.8***
Busch Agr 1202	89.6	**137.6***	113.6	-.-	-.-	-.-
CDC Copeland	106.7	**148.3***	**127.5****	52.5	-.-	**102.5****
CDC Kendall	90.8	124.9	107.8	-.-	-.-	-.-
Conlon	82.2	-.-	-.-	47.5	-.-	-.-
Drummond	97.6	114.3	105.9	-.-	-.-	-.-
Eslick	-.-	-.-	-.-	45.2	-.-	-.-
Excel	100.4	129.0	114.7	-.-	-.-	-.-
Foster	101.2	124.7	112.9	-.-	-.-	-.-
Gallatin	91.8	123.7	107.7	45.6	-.-	87.0
Harrington	95.2	131.6	113.4	43.1	-.-	89.9
Haxby	102.9	95.3	99.1	53.3	-.-	83.8
Haybet	-.-	-.-	-.-	32.0	-.-	-.-
Hays	-.-	-.-	-.-	43.3	-.-	-.-
Lacey	94.0	**136.8***	115.4	38.6	-.-	89.8
Legacy	99.2	**138.3***	**118.7***	-.-	-.-	-.-
Merit	109.7	**143.8***	**126.8***	-.-	-.-	-.-
Moravian 37	101.0	**136.1***	**118.6***	-.-	-.-	-.-
Morex	97.0	100.8	98.9	-.-	-.-	-.-
MT910189	104.0	**139.5***	**121.7***	50.8	-.-	**98.1***
MT970116	97.3	113.1	105.2	40.0	-.-	83.5
MT970229	-.-	-.-	-.-	50.3	-.-	-.-
MT981210	99.2	126.7	112.9	-.-	-.-	-.-
MT981238	95.2	129.0	112.1	-.-	-.-	-.-
Robust	96.5	105.5	101.0	-.-	-.-	-.-
Stander	108.9	**143.3***	**126.1***	-.-	-.-	-.-
Tradition	89.7	**134.9***	112.3	53.3	-.-	**92.6***
Valier	-.-	-.-	-.-	50.1	-.-	-.-
Average	98.1	129.0	113.9	45.7	-.-	92.1
PLSD (p=0.05)	ns	17.5	11.7	ns	-.-	10.4
CV%	10.2	8.3	8.9	18.4	-.-	12.0

1/ Yields are based on 48 pound standard bushel weight and adjusted to 13.0 percent 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).