

## RESULTS OF AGRONOMIC AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA - 2007

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

<http://www.sarc.montana.edu/annualreport/2007/>

- PROJECT TITLE:** Off-Station Spring Barley Variety Performance Trials in South Central Montana. (Exps. 073691, 073692, 073794 and 073795). This research is partially supported by the Montana Wheat and Barley Committee.
- PROJECT LEADERS:** Kenneth D. Kephart, Agronomist, SARC, Huntley  
Geraldine B. Opena, Research Associate, SARC, Huntley  
Tom Blake, Barley Breeder, PSPP, Bozeman  
Stan Bates, Barley Research Associate, PSPP, Bozeman
- PROJECT PERSONNEL:** Tom A. Fischer, Research Specialist and Farm Foreman, SARC, Huntley  
Tanya Daniels, Carbon County Extension, Red Lodge  
Paul Dixon, Yellowstone County Extension, Billings  
Travis Standley, Stillwater County Extension, Columbus  
Byron Hould, Rosebud/Treasure County Extension, Forsyth
- COOPERATORS:** Greg Lackman, Farmer Cooperator, Hysham  
Bill Linger, Farmer Cooperator, Molt  
Ervin Schlemmer, Farmer Cooperator, Fromberg  
Tony Zinne, Farmer Cooperator, Ryegate
- 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:** The 2007 off-station spring barley trials were conducted under dryland conditions near Molt and Broadview, and under flood irrigation near Fromberg and Hysham, Montana (Fig. 1). Twenty spring barley entries comprised of 17 commercial cultivars and 3 experimental lines, representing both feed and malt type cultivars, were grown at all locations.

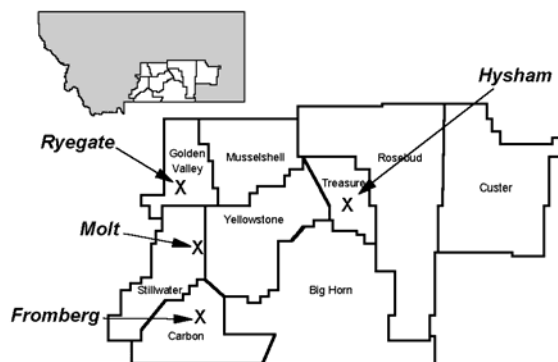


Figure 1. 2007 off-station spring barley trial locations in south central Montana.

All studies were planted using a randomized complete block design with three replications. All entries were seeded at approximately 0.6 million seeds per acre

(~14 seed per foot<sup>2</sup>) under dryland conditions and 1.1 million seeds per acre (~24 seed per foot<sup>2</sup>) under irrigation. Actual seeding rates were calculated from the thousand kernel weight determined for the seed lot of each cultivar (Table 1), and varied from 44 to 74 pounds per acre for the dryland sites and from 75 to 126 pounds per acre under irrigation. Seeding rates were not adjusted for germination. Dryland test plots established on conventional summer fallow 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 (lb/bu, pounds per bushel) and grain moisture content (% , percent) were obtained for each plot using a Dickey-john™ GAC 2100 grain analyzer. Grain protein (% , percent) was estimated using near infrared spectroscopy 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, where observed, 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.

Table 1. Adjusted seeding rates used to establish 20 spring barley cultivars tested at four off-station sites in south central Montana during 2007.

Cultivar	Thousand Kernel Weight	Seeds per Pound	1/ Dryland Seeding Rate		2/ Irrigated Seeding Rate	
			per plot	per acre	per plot	per acre
	grams	#	grams	pounds	grams	pounds
AC Metcalfe	42.4	10,705	36.4	58	74.0	118
Boulder	45.0	10,088	38.6	62	78.5	126
Calgary	42.1	10,787	36.1	58	73.4	117
Conrad	33.8	13,429	29.0	46	59.0	94
Craft	53.1	8,544	45.6	73	92.7	148
Drummond	37.7	12,040	32.4	52	65.8	105
Eslick	34.5	13,148	29.6	47	60.2	96
Harrington	42.7	10,633	36.6	59	74.5	119
Haxby	44.4	10,224	38.1	61	77.4	124
Hays	33.6	13,520	28.8	46	58.6	94
Hockett	50.7	8,962	43.5	70	88.3	141
Legacy	28.7	15,826	24.6	39	50.0	80
Merit	39.3	11,550	33.7	54	68.5	110
Moravian 37	46.2	9,834	39.6	63	80.5	129
Moravian 69	40.8	11,123	35.0	56	71.2	114
Stellar	39.6	11,477	33.9	54	69.0	110
Tradition	39.8	11,414	34.1	55	69.4	111
Xena	40.6	11,196	34.8	56	70.7	113
Coors 100	44.7	10,161	38.3	61	77.9	125
MT960101	35.0	12,957	30.1	48	61.1	98

1/ Equivalent to 0.6 million seeds per acre (14 seeds per foot<sup>2</sup>) on a mass basis.

2/ Equivalent to 1.1 million seeds per acre (24 seeds per foot<sup>2</sup>) on a mass basis.

## **RESULTS:**

The 2007 spring barley test sites were unusually dry over-winter, with very little rain or snow accumulating during November, December and January. Spring rains produced average precipitation levels during most of the spring growth period. All five of the test locations planted in the spring of 2007 possessed adequate soil moisture to facilitate germination and emergence. Spring barley stands appeared fairly uniform at all sites before the middle of May.

The region remained marginally dry for spring barley production until late May, when 6 to 8 inches of precipitation occurred at most test sites over a 14 day interval lasting into the first week of June. Hot, dry weather resumed in mid-June and continued throughout July. Accumulated heat units at Huntley were 15

percent above normal from May 1 to the middle of July in 2007. The trial at Hysham was severely damaged by hail in June and was not harvested in 2007. Post-heading heat and moisture stress dampened the performance of spring barley cultivars tested under dryland conditions near Molt. The wet conditions in May prevented a pre-emergence application of Roundup™ herbicide at the Broadview locations which resulted in a heavy infestation of volunteer 'Tiber' winter wheat. The spring barley trial at the Broadview location also was not harvested for yield in 2007.

The 2007 spring barley trial at Molt produced an average yield of 18.2 bu/a (Table 2), nearly 7 bu/a more than this location produced in 2006. Grain yields ranged from 28.5 bu/a for 'Calgary' to 2.5 bu/a for 'Hays'. Seven commercial entries ('Boulder', 'Conrad', 'Craft', 'Eslick', 'Harrington', 'Merit', and 'Moravian 37') produced yields that ranged from 26.9 to 22.5 bu/a, statistically equal to that of the highest yielding entry. Average test weight was 49.8 pounds per bushel. Grain protein content averaged 10.7 percent and ranged from 8.7 to 13.5 percent. Plump kernels averaged 76.2 percent, and were surprisingly high for the malt type cultivars tested at this site. Two-year average yield for barley varieties tested during 2005 and 2006 at Molt averaged 14.7 bu/a. Three-year average yield for barley varieties tested during 2005, 2006 and 2007 in Molt averaged 23.2 bu/a. The malt cultivar Conrad has been the highest yielding entry at this location for past three years.

The average spring barley yield at Fromberg in 2007 was 105.7 bu/a and ranged from 134.7 bu/a for Moravian 37 to 56.9 bu/a for Craft (Table 3). Eight other commercial entries (Boulder, Calgary, Conrad, Eslick, Harrington, 'Moravian 69' Tradition and Xena) produced yields that ranged from 105.1 to 129.8 bu/a, statistically equal to that of the highest yielding entry. Average test weight across all entries tested at Fromberg for 2007 was 51.0 lb/bu. Grain protein averaged 10.1 percent and ranged from 9.1 to 11.2 percent. Mean percent plump and thin kernels were 85.0 and 7.2 percent, respectively. Lodging was much more severe at the Fromberg in 2007 than had been observed in prior years. Some entries, notably Craft, lodged completely flat which limited yield. Two-year average yield for spring barley varieties tested during 2006 and 2007 at Fromberg averaged 111.1 bu/a. Three-year average yield for spring barley varieties tested during 2005 to 2007 averaged 109.9 bu/a.

**SUMMARY:**

Averaged across both the Molt and Fromberg locations for the past two and three years, Boulder has been the highest yielding barley grown under both dryland and irrigation conditions averaging 74.5 and 71.5 bu/a, respectively (Table 6). Conran, Eslick, Harrington, 'Haxby', 'Legacy', Merit and 'Xena' have produced yields equal to those of Boulder for the past three years in these environments.

**FUTURE PLANS:**

Off-station spring barley variety evaluations will continue in 2007.

Table 2. Performance of 20 spring barley cultivars and experimental lines tested under dryland conditions near Molt, Montana during 2007. Cultivars listed alphabetically. (Exp. 073691).

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein		Plump Kernels	Thin Kernels	Plant Height
	2007	2006-2007	2005-2007			%	%			
	-----	bushels/acre	-----	lb/bu	%	%	%	%	inches	
AC Metcalfe	17.2	10.9	10.3	51.9	9.1	10.3	88.0	3.4	20.7	
Boulder	<b>23.8*</b>	21.0	<b>19.4*</b>	50.6	8.4	11.4	80.8	5.4	19.5	
Calgary	<b>28.5**</b>	18.5		52.3	9.7	8.7	61.5	12.1	15.5	
Conrad	<b>26.1*</b>	20.3	<b>20.0**</b>	51.1	9.2	9.6	86.6	3.4	20.3	
Craft	<b>22.9*</b>	18.5	<b>15.8*</b>	51.8	9.0	9.7	88.4	2.7	23.0	
Drummond	6.7	8.7	9.0	42.1	7.7	12.4	52.2	19.7	18.9	
Eslick	<b>24.5*</b>	21.5	<b>19.6*</b>	53.1	9.6	8.7	79.5	4.6	19.4	
Harrington	<b>26.9*</b>	19.5	<b>18.1*</b>	51.5	8.9	9.9	86.4	3.6	20.2	
Haxby	19.7	19.5	<b>16.4*</b>	53.6	9.5	9.3	77.9	5.9	20.0	
Hays	2.5	2.2	2.7	47.8	8.7	13.5	70.4	13.0	17.4	
Hockett (MT910189)	18.5	14.6	<b>14.1*</b>	51.7	9.4	8.7	87.9	2.8	18.9	
Legacy	11.2	13.2	12.4	47.5	8.6	11.6	65.9	11.7	18.8	
Merit	<b>25.6*</b>	17.7	<b>16.6*</b>	50.0	9.2	11.2	86.3	4.0	19.5	
Moravian 37	<b>22.5*</b>	16.2		50.9	8.8	9.9	84.1	3.3	17.1	
Moravian 69	17.5	13.6		49.0	8.9	10.6	74.6	8.4	15.3	
Stellar	3.3	7.7		43.4	7.4	11.9	66.6	14.5	17.4	
Tradition	6.6	8.7	8.9	44.4	7.9	13.1	37.8	27.4	19.0	
Xena	14.3	13.8	<b>14.0*</b>	51.3	8.9	12.8	76.0	5.4	17.9	
Coors 100	<b>27.8*</b>			51.1	8.7	10.2	83.6	5.3	15.3	
MT960101	17.7	14.2	<b>14.2*</b>	50.5	9.2	11.4	88.7	3.6	17.5	
Average	18.2	14.7	14.1	49.8	8.8	10.7	76.2	8.0	18.6	
PLSD (p=0.05)	7.2	ns	6.5	--	0.6	--	11.7	5.0	2.0	
CV%	24.0	65.5	47.6	--	4.4	--	9.3	37.7	6.6	

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

2/ Grain protein values determined from bulked samples and 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. 073691)

Planted:	April 30, 2007
Harvested:	July 31, 2007
Fertility:	11-52-00, 100 lbs/a in-furrow at planting
Herbicide:	Bronate, 16 oz/a + Clarity, 3 oz/a + Harmony Extra 0.5 oz/a + R-11 4 oz/a + AMS 1.5 lb/a, June 19, 2007
Insecticide:	none applied
Previous Crop:	summer fallow
Precipitation:	n/a

Table 3. Performance of 20 spring barley cultivars and experimental lines tested under irrigated conditions near Fromberg, Montana during 2007. Cultivars listed alphabetically. (Exp. 073794).

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein		Plump Kernels	Thin Kernels	Plant Height	Lodging
	2007	2006-2007	2005-2007			- % -	- % -				
	bushels/acre			- lb/bu -	- % -	- % -	- % -	- % -	- inches -	0-9	
AC Metcalfe	<b>105.9*</b>	105.3	106.3	51.6	11.2	9.8	86.5	6.8	37.4	3.0	
Boulder	<b>129.8*</b>	127.9	123.5	52.4	11.2	10.3	86.6	7.9	35.2	3.3	
Calgary	<b>119.0*</b>	123.7	124.3	52.9	11.1	10.4	86.5	6.9	30.6	3.0	
Conrad	<b>112.6*</b>	120.1	116.1	52.5	11.7	9.1	94.1	2.4	32.2	3.0	
Craft	58.9	93.4	100.9	51.1	10.5	11.2	84.5	7.8	39.0	8.7	
Drummond	88.4	105.8	105.0	50.3	10.5	10.0	88.7	4.4	34.6	4.0	
Eslick	<b>129.7*</b>	119.0	116.9	51.3	11.1	10.0	83.0	8.5	35.2	6.3	
Harrington	<b>106.6*</b>	109.5	107.2	51.6	11.1	9.6	89.0	5.0	37.3	4.0	
Haxby	89.7	104.1	108.3	52.8	11.4	9.9	84.6	8.1	37.0	5.3	
Hays	64.7	76.4	83.0	48.0	10.9	9.8	64.4	18.4	36.8	5.7	
Hockett (MT910189)	<b>103.1*</b>	108.1	105.3	51.9	10.4	10.0	86.4	6.5	35.7	6.0	
Legacy	102.0	109.4	110.3	49.6	10.3	10.1	84.2	6.1	37.9	4.3	
Merit	95.2	102.8	105.0	48.4	10.9	11.2	81.7	8.8	32.5	5.7	
Moravian 37	<b>134.7**</b>	131.1		52.0	11.5	10.0	93.1	3.0	31.2	2.0	
Moravian 69	<b>129.6*</b>	132.2		49.7	11.3	9.5	83.2	7.5	30.8	2.0	
Stellar	90.5	96.3		49.4	10.5	10.2	89.9	4.2	33.8	4.3	
Tradition	<b>105.1*</b>	114.7	109.3	50.8	10.5	9.8	93.5	2.0	36.5	4.3	
Xena	<b>128.0*</b>	117.8	121.3	50.2	11.2	10.3	73.6	14.0	37.2	5.7	
Coors 100	<b>110.9*</b>			51.6	11.2	10.7	83.5	8.4	24.0	3.0	
MT960101	<b>109.6*</b>	112.6	116.5	52.2	11.4	9.6	83.1	7.3	35.7	4.0	
Average	105.7	111.1	109.9	51.0	11.0	10.1	85.0	7.2	34.5	4.4	
PLSD (p=0.05)	32.3	ns	ns	2.1	0.6	ns	10.2	5.8	4.1	4.3	
CV%	18.5	22.2	20.0	2.5	3.5	9.9	7.3	49.1	7.2	58.7	

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

2/ Grain protein values determined from bulked samples and 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. 073794)

Planted:	March 26, 2007
Harvested:	August 7, 2007
Fertility:	n/a
Herbicide:	n/a
Previous Crop:	sugar beets
Irrigation:	flood

Table 5. Grain yield<sup>1/</sup> of 20 spring barley cultivars tested at two locations in south central Montana during 2007. Cultivars listed alphabetically.

Cultivar	Molt Dryland	Fromberg Irrigated	Two Location Average
	----- bushels per acre -----		
Moravian 37	<b>22.5*</b>	<b>134.7**</b>	78.6
Eslick	<b>24.5*</b>	<b>129.7*</b>	77.1
Boulder	<b>23.8*</b>	<b>129.8*</b>	76.8
Calgary	<b>28.5**</b>	<b>119.0*</b>	73.7
Moravian 69	17.5	<b>129.6*</b>	73.5
Xena	14.3	<b>128.0*</b>	71.2
Conrad	<b>26.1*</b>	<b>112.6*</b>	69.4
Coors 100	<b>27.8*</b>	<b>110.9*</b>	69.3
Harrington	<b>26.9*</b>	<b>106.6*</b>	66.8
MT960101	17.7	<b>109.6*</b>	63.6
AC Metcalfe	17.2	<b>105.9*</b>	61.5
Hockett (MT910189)	18.5	<b>103.1*</b>	60.8
Merit	<b>25.6*</b>	95.2	60.4
Legacy	11.2	102.0	56.6
Tradition	6.6	<b>105.1*</b>	55.8
Haxby	19.7	89.7	54.7
Drummond	6.7	88.4	47.5
Stellar	3.3	90.5	46.9
Craft	<b>22.9*</b>	58.9	40.9
Hays	2.5	64.7	33.6
Average	18.2	105.7	61.9
PLSD (p=0.05)	7.2	32.3	ns
CV%	24.0	18.5	37.3

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).

Table 6. Performance of 20 spring barley cultivars and experimental lines tested under dryland and irrigated conditions at two locations in south central Montana during 2007. Cultivars listed alphabetically.

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein			Plump Kernels	Thin Kernels	Plant Height
	2007	2006-2007	2005-2007			Grain Protein	Plump Kernels	Thin Kernels			
	bushels/acre			lb/bu	%	%	%	%	%	inches	
AC Metcalfe	61.5	58.1	58.3	51.7	10.1	9.9	87.2	5.1	29.1		
Boulder	76.8	<b>74.5**</b>	<b>71.5**</b>	52.0	9.8	10.6	83.7	6.7	27.3		
Calgary	73.7	<b>71.1*</b>		52.8	10.4	10.0	74.0	9.5	23.1		
Conrad	69.4	<b>70.2*</b>	<b>68.0*</b>	52.2	10.5	9.2	90.3	2.9	26.2		
Craft	40.9	55.9	58.4	51.3	9.7	10.9	86.4	5.3	31.0		
Drummond	47.5	57.2	57.0	48.2	9.1	10.6	70.4	12.1	26.7		
Eslick	77.1	<b>70.2*</b>	<b>68.3*</b>	51.8	10.4	9.7	81.3	6.5	27.3		
Harrington	66.8	<b>64.5*</b>	<b>62.7*</b>	51.6	10.0	9.7	87.7	4.3	28.7		
Haxby	54.7	<b>61.8*</b>	<b>62.4*</b>	53.0	10.5	9.8	81.3	7.0	28.5		
Hays	33.6	39.3	42.8	48.0	9.8	10.8	67.4	15.7	27.1		
Hockett (MT910189)	60.8	<b>61.3*</b>	59.7	51.8	9.9	9.7	87.2	4.7	27.3		
Legacy	56.6	<b>61.3*</b>	<b>61.3*</b>	49.1	9.4	10.5	75.0	8.9	28.3		
Merit	60.4	<b>60.2*</b>	<b>60.8*</b>	48.8	10.1	11.2	84.0	6.4	26.0		
Moravian 37	78.6	<b>73.6*</b>		51.7	10.2	10.0	88.6	3.2	24.2		
Moravian 69	73.5	<b>72.9*</b>		49.5	10.1	9.8	78.9	8.0	23.1		
Stellar	46.9	52.0		47.9	9.0	10.7	78.2	9.4	25.6		
Tradition	55.8	<b>61.7*</b>	59.1	49.2	9.2	10.6	65.7	14.7	27.8		
Xena	71.2	<b>65.8*</b>	<b>67.6*</b>	50.5	10.1	10.9	74.8	9.7	27.5		
Coors 100	69.3			51.5	9.9	10.6	83.6	6.9	19.7		
MT960101	63.6	<b>63.4*</b>	<b>65.4*</b>	51.8	10.3	10.1	85.9	5.4	26.6		
Average	61.9	62.9	61.5	50.7	9.9	10.2	80.6	7.6	26.6		
PLSD (p=0.05)	ns	15.9	11.0	3.4	0.8	ns	ns	ns	3.8		
CV%	37.3	30.8	26.9	4.6	6.9	15.3	24.1	131.2	11.9		
Location-Years	2	4	6	2	2	2	2	2	2		

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

2/ Grain protein values determined from bulked samples and 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).