

## RESULTS OF AGRONOMIC AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA - 2016

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

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

**PROJECT TITLE:** Off-Station Spring Barley Variety Performance Trials in South Central Montana. This research is partially supported by the Montana Wheat and Barley Committee.

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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:** The 2016 off-station spring barley trials were conducted under dryland conditions at Huntley and Broadview, and under irrigation near Fromberg and Hysham Montana (Fig. 1). Twenty-five spring barley entries comprised of 20 commercial cultivars and 5 experimental lines, representing both feed and malt types, were grown at all locations.

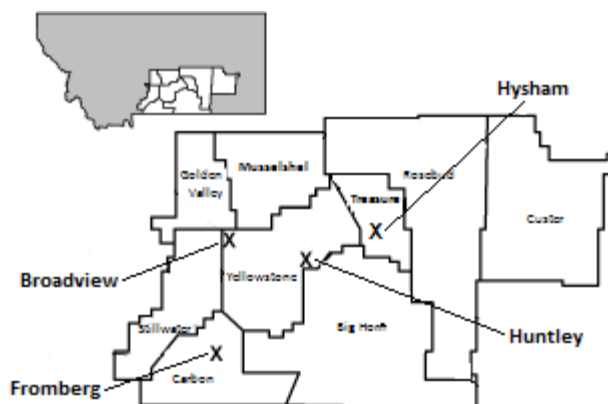


Figure 1. 2016 off-station spring barley trial locations in south central Montana.

All studies were planted using a partially-balanced lattice 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 1.0 million seeds per acre (~24 seed per foot<sup>2</sup>) under irrigation.

Dryland test plots consisted of a 16-foot, 4-row plot with 12-inch row spacing, while irrigated plots were 16-foot, 7-row with 7-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 12% moisture 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 (0) to all stems lying flat on the ground (9). 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 2016 spring barley test sites had below average rain or snow accumulation during winter months except in October. Precipitation during spring months, March through May, provided adequate soil moisture for spring barley planting and emergence. Below-average precipitation in June and July resulted in late season drought stress at all test sites. Moreover, temperature was above-average through-out the spring barley growing season except in May and July. Late season drought stress coupled with above average temperature in 2016 growing season resulted in accelerated barley growth and caused early maturity.

The dryland spring barley yield at Huntley averaged 89 bu/a in 2016 (Table 1). Yield ranged from 52 bu/a for 'Conlon' to 125 bu/a for 'Moravian 153'. Cultivars 'Moravian 69' also produced yield that was statistically equal to the yield highest yielding cultivar. Test weight averaged 51.6 lb/bu and ranged from 44.9 for 'Stepford' to 54.1 for 'Haxby'. All entries except Stepford produced test weight values more than 48 lb/bu. Grain protein content averaged 14.8 percent and ranged from 12.8 percent to 17.1 percent. Most spring barley cultivars produced high proportion of plump kernels, averaging 91.3 percent of the harvested grain. Proportion of plump kernels ranged from 78.1 percent to 96.4 percent. The measured level of thin kernels averaged only 3.0 percent. Two- and three-years (2014- 2016) average yield for barley cultivars tested at Huntley was 87 and 81 bu/a respectively.

Dryland spring barley yield at Broadview averaged only 16 bu/a (Table 2), less than half than last year at this site. The lower yield was mainly attributed to poor stand establishment due to dry conditions at planting and to drought during grain filling period. Cultivars 'CDC Copeland', 'Champion' and Moravian 153 produced the highest of 20 bu/a at Broadview in 2016. Test weight was good and averaged 51 lb/bu. All entries produced test weight more than 48 lb/bu except feed cultivar 'Lavina' and Stepford. Grain protein content averaged 9.3 percent. The percentage of plump kernels was 86 percent in the harvested grain. Percentage of thin kernels averaged 1.3 percent. Champion was the top yielding cultivar over the past 2-yrs. Two- and three-year average yield for barley cultivars tested during 2014 to 2016 at Broadview was 31 and 35 bu/a respectively.

Spring barley lodging was moderately high at Fromberg in 2016 for most of the entries, averaging a lodging score of 6.0 out of 9. (Table 3). Lodging score varied from 3.3 for Moravian 153 to 8.0 for 'Craft,' and MT090182'. Spring barley yield was good and averaged 117 bu/a under irrigation. Yield was highest at Fromberg among all locations tested in 2016. Yield ranged from 78 bu/a for Conlon to 148 bu/a for Moravian 153. Three other commercial spring barley cultivars produced

yield statistically equal to the highest yielding entry. The test weight averaged 50.6 lb/bu and ranged from 42.9 lb/bu to 53.8 lb/bu. Average grain protein content was 12.7 percent and ranged from 11.0 percent to 14.8 percent. The percentage of plump kernels averaged 91 percent in the harvested grain. Percentage of thin kernels averaged only 1.5 percent. Two- and three-years averaged yield for barley cultivars tested during 2014 to 2016 was 123 and 121 bu/a respectively.

Spring barley yield under irrigation at Hysham in 2016 averaging 113 bu/a (Table 3). Lodging was relatively moderate for barley cultivars at Hysham in 2016 with an average lodging score of 3.2 out of 9. 'AC Metcalf' and 'Eslick' had the highest lodging score of 7 among the commercial entries. Yield ranged from 81 bu/a for Conlon to 147 bu/a for 'Moravian 69'. Average test weight was 51.7 lb/bu. All entries produced test weight heavier than 48 lb/bu. Grain protein averaged 12.4 percent and ranged from 11 to 14.4 percent. Barley quality was also good at Hysham where mean percent plump and thin kernels were 93 and 0.9 percent, respectively. Two- and three-years averaged yield for barley cultivars tested during 2014 to 2016 at Hysham was 118 and 112 bu/a respectively.

### **SUMMARY:**

Below-average precipitation in the spring caused early season drought stress that resulted in earliest spring barley harvest in south eastern Montana. Moravian 153 was the top yielding commercial cultivar under irrigated condition in 2016 (Table 7). Averaged across all locations cultivar Moravian 153 also had the highest grain yield in 2016 (Table 6). Averaged across all locations over the past two- and three-years (2014-2016) averaged yield was 89 and 87 bu/a respectively (Table 6). Moravian 69 was the top yielding commercial cultivar under irrigated condition over the past two- and three-years (Table 6). Averaged across locations grain protein content was 12.2 percent. Overall test weight averaged 51.6 lb/bu. Averaged over locations the percentage of plump kernels averaged 91 percent in the harvest grain (Table 6), and was higher, 93 percent, under irrigation (Table 7).

Table 1. Performance of 25 spring barley cultivars and experimental lines tested under dryland conditions near Huntley, Montana during 2016. Cultivars listed alphabetically. (Exp. 163690).

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain		Plump Kernels	Thin Kernels	Plant Height	Heading date	
	2016	2015-16	2014-16			Protein	Moisture				Julian	Calendar
	- bushels/acre -			- lb/bu -	- % -	- % -	- % -	- % -	- inches			
<u>Commercial</u>												
AC Metcalfe	85.8	83.8	78.7	53.2	12.4	15.2	92.2	2.6	39.7	158.0	Jun-7	
CDC Copeland	105.0			52.7	12.2	15.0	95.8	1.5	38.1	161.0	Jun-10	
Champion	100.4	98.0	87.8	53.7	12.4	14.8	90.8	3.2	38.5	157.0	Jun-6	
Conlon	52.1			51.6	12.5	16.4	96.4	1.3	39.5	152.7	Jun-1	
Conrad	97.5	91.5	83.7	52.2	13.5	14.9	94.8	1.3	36.8	162.0	Jun-11	
Craft	78.0	84.8	80.2	52.7	11.8	16.1	92.9	2.4	40.1	159.0	Jun-8	
Eslick	110.4	96.8	87.6	53.1	12.0	14.2	86.6	4.1	34.9	164.0	Jun-13	
Genesis	65.2			51.4	13.0	14.1	91.3	3.3	41.7	156.3	Jun-5	
Harrington	88.8	80.9	76.9	51.9	11.9	16.0	90.5	2.7	39.2	159.7	Jun-8	
Haxby	76.4	81.5	78.1	54.1	12.0	16.2	88.8	3.3	40.2	157.7	Jun-6	
Hockett	76.2	81.8	79.2	51.8	12.4	15.5	92.5	2.9	39.6	157.7	Jun-6	
Lavina	75.4			49.7	12.2	17.1	78.1	8.3	42.7	156.0	Jun-5	
Moravian 115	98.1	80.2	74.8	49.5	12.6	15.3	88.7	3.2	27.6	164.3	Jun-13	
Moravian 150	108.3			51.7	12.8	14.7	93.2	2.0	30.1	161.3	Jun-10	
Moravian 153	<b>124.7**</b>			52.2	13.5	13.9	93.6	2.2	30.4	162.7	Jun-11	
Moravian 69	<b>122.7*</b>	96.4	84.2	51.9	12.4	13.4	93.7	1.8	30.6	164.3	Jun-13	
Pinnacle	82.7			51.4	11.7	13.2	95.4	2.0	38.0	157.7	Jun-6	
Rawson	76.2			49.8	13.8	14.5	95.5	2.1	42.3	155.0	Jun-4	
Stepford	48.7			44.9	11.5	15.5	78.8	9.1	45.2	155.3	Jun-4	
Stockford	76.8			49.2	13.4	14.9	92.8	2.4	45.7	157.0	Jun-6	
<u>Experimental</u>												
MT090182	93.9			51.8	13.7	12.8	93.4	1.8	37.6	161.0	Jun-10	
MT090190	95.1	87.0		52.6	13.1	13.6	91.2	2.6	38.1	159.7	Jun-8	
MT100120	91.4	88.5		52.3	14.0	13.2	93.0	2.4	38.0	159.0	Jun-8	
MT100126	89.9	84.5		51.6	12.8	13.5	91.6	2.6	36.6	161.0	Jun-10	
MT124555	96.0			53.6	13.1	15.5	92.0	3.0	37.6	161.0	Jun-10	
Average	88.6	87.4	81.1	51.6	12.7	14.8	91.3	3.0	37.9	159.2		
PLSD (p=0.05)	8.2	ns	ns	1.4	ns	1.0	3.1	1.4	1.7	2.8		
CV%	5.3	5.7	6.6	1.7	7.6	4.2	2.0	26.2	2.8	1.1		

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 12% moisture 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).

Huntley Dryland Spring Barley (Exp. 163690)

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Planted: March 9, 2016  
Harvested: July 14, 2016  
Fertility: n/a  
Herbicide: n/a  
Previous Crop: chemical fallow  
Precipitation: 11.68 inches

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Table 2. Performance of 25 spring barley cultivars and experimental lines tested under dryland conditions near Broadview, Montana during 2016. Cultivars listed alphabetically. (Exp. 163692).

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein			
	2016	2015-16	2014-16			Plump Kernels	Thin Kernel	Plant Height	
	----- bushels/acre -----			- lb/bu -	- % -	- % -	- % -	- % -	- inches -
<u>Commercial</u>									
AC Metcalfe	17.3*	31.2	34.3	52.3	10.7	8.9	86.9	0.7	16.8
CDC Copeland	19.5*			51.1	10.4	8.7	91.2	1.1	15.7
Champion	19.8	37.1**	41.3	52.2	10.7	8.8	76.2	1.4	17.2
Conlon	15.9			51.1	9.9	9.7	95.7	1.1	17.7
Conrad	13.8	27.9	34.4	50.0	10.6	9.9	87.9	1.5	17.5
Craft	16.5*	33.1*	36.3	51.6	10.2	9.8	90.8	1.1	18.4
Eslick	17.3*			51.2	10.5	8.5	58.2	3.6	13.4
Genesis	17.5*			50.6	10.2	9.3	84.8	1.1	18.4
Harrington	14.8	30.2	32.6	51.6	10.6	8.9	89.1	1.1	17.5
Haxby	15.7	32.0*	39.5	54.4	11.0	9.1	91.1	1.0	18.0
Hockett	15.9	31.9	36.6	53.0	10.9	8.8	92.9	0.7	17.1
Lavina	13.2	29.6		46.0	10.5	9.4	64.8	4.9	16.4
Moravian 115	18.1*	31.0	35.1	50.8	10.5	9.2	94.1	1.1	13.5
Moravian 150	17.1*	29.7		50.6	10.6	9.2	88.7	1.1	15.5
Moravian 153	20.1**	33.4*		48.9	9.8	8.7	75.4	1.5	16.8
Moravian 69	18.2*	31.8	31.2	49.7	10.2	9.0	81.7	1.1	15.2
Pinnacle	15.1			52.1	10.3	9.8	92.8	1.1	16.5
Rawson	14.6			50.6	10.5	10.6	93.4	1.1	17.7
Stepford	14.5			46.8	9.7	10.8	90.0	0.4	17.1
Stockford	14.4	26.7		49.8	10.6	9.0	92.0	0.7	18.0
<u>Experimental</u>									
MT090182	16.8*			51.0	10.4	9.1	81.9	1.5	18.5
MT090190	16.9*			52.4	10.6	9.2	87.7	1.5	17.7
MT100120	15.1	27.8	31.7	51.7	10.5	9.4	87.6	1.1	17.8
MT100126	12.2	27.8	34.8	52.1	10.8	9.2	87.7	1.1	18.0
MT124555	17.1*			52.5	10.7	8.8	92.1	1.1	18.0
Average	88.6	87.4	81.1	51.6	12.7	14.8	91.3	3.0	37.9
PLSD (p=0.05)	4.1	5.1	ns	1.8	0.3	0.6	4.5	0.9	2.8
CV%	15.2	13.3	14.2	2.2	1.8	4.0	3.2	41.4	10.2

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 12% moisture 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).

Broadview Dryland Spring Barley (Exp. 163692)

Planted: April 4, 2016  
 Harvested: August 8, 2016  
 Fertility: n/a  
 Herbicide: n/a  
 Previous Crop: summer fallow  
 Precipitation: n/a

Table 3. Performance of 25 spring barley cultivars and experimental lines tested under irrigated conditions near Fromberg, Montana during 2016. Cultivars listed alphabetically. (Exp. 163794).

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein			Plump Kernels	Thin Kernels	Plant Height	3/ Lodging
	2016	2015-16	2014-16			- % -	- % -	- % -				
	-----	bushels/acre	-----	- lb/bu	- % -	- % -	- % -	- % -	-	0-9		
<u>Commercial</u>												
AC Metcalfe	115.2	<b>121.0*</b>	115.2	51.9	11.1	12.8	93.3	1.0	41.5	6.0		
CDC Copeland	122.1			51.0	10.9	13.0	91.1	1.8	41.6	6.7		
Champion	130.9	<b>130.0*</b>	125.5	52.4	11.0	12.6	95.2	0.7	42.8	6.3		
Conlon	79.7			53.8	11.1	13.6	99.0	0.0	40.4	5.7		
Conrad	120.6	<b>126.2*</b>	118.8	51.5	11.3	13.6	91.5	1.7	39.2	4.7		
Craft	101.4	113.0	115.4	50.8	11.1	14.8	86.7	2.1	43.2	8.0		
Eslick	<b>141.5*</b>			52.9	11.3	11.9	90.5	1.7	38.8	5.0		
Genesis	107.0			52.4	11.5	12.8	98.3	0.0	41.3	6.3		
Harrington	104.7	<b>120.5*</b>	115.0	47.7	11.0	13.0	83.6	2.5	39.6	7.3		
Haxby	114.8	113.7	111.6	53.4	11.1	12.5	95.3	0.7	40.9	6.7		
Hockett	113.3	<b>120.2*</b>	120.8	51.8	11.3	12.6	92.1	1.4	37.8	5.7		
Lavina	93.0	100.3		45.1	11.0	13.8	64.1	7.8	43.2	7.3		
Moravian 115	106.9	111.3	118.1	46.8	11.0	12.2	86.8	1.6	34.1	4.0		
Moravian 150	<b>136.2*</b>	<b>136.3*</b>		50.4	11.1	12.6	95.5	0.7	34.5	3.7		
Moravian 153	<b>148.5**</b>	<b>141.0**</b>		49.6	11.0	11.0	90.0	1.1	34.9	3.3		
Moravian 69	<b>142.1*</b>	<b>138.5*</b>	138.0	49.5	11.1	12.0	88.9	1.1	34.6	4.3		
Pinnacle	128.1			51.5	11.1	11.7	98.3	0.0	41.6	4.0		
Rawson	101.6			50.9	11.0	12.8	97.9	0.3	43.7	6.0		
Stepford	94.9			42.9	10.5	14.5	81.5	2.5	43.8	7.7		
Stockford	120.2	109.3		49.0	11.6	12.5	92.8	1.1	45.4	7.0		
<u>Experimental</u>												
MT090182	112.3			50.6	11.5	12.4	86.0	2.7	42.8	8.0		
MT090190	123.3			52.0	11.8	11.7	91.5	1.4	42.1	7.3		
MT100120	124.9	<b>133.4*</b>	126.0	51.6	11.7	11.8	92.7	1.0	40.8	7.0		
MT100126	124.4	<b>129.0*</b>	129.9	53.5	11.8	11.3	97.1	0.3	41.6	5.7		
MT124555	112.1			51.9	11.5	13.4	87.5	2.7	42.1	7.3		
Average	116.8	122.9	121.3	50.6	11.2	12.7	90.7	1.5	40.5	6.0		
PLSD (p=0.05)	15.8	21.6	ns	2.2	0.5	1.2	9.4	2.6	2.4	2.4		
CV%	8.2	9.1	9.8	2.6	2.7	5.5	6.3	102.7	3.7	24.0		

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

2/ Grain protein values adjusted to 12% moisture 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).

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

Fromberg Irrigated Spring Barley (Exp. 163794)

Planted:	March 11, 2016
Harvested:	July 27, 2016
Fertility:	100 lb N/a preplant; 120 lb N/a top dress in May, 2016
Herbicide:	n/a
Previous Crop:	Sugar beet
Irrigation:	overhead sprinkler

Table 4. Performance of 22 spring barley cultivars and experimental lines tested under irrigated conditions near Hysham, Montana during 2016. Cultivars listed alphabetically. (Exp. 163795).

1/ Cultivar	2/ Grain Yield			Test Weight	Grain Moisture	3/ Grain Protein	Plump Kernels	Thin Kernels	Plant Height	4/ Lodging
	2016	2015-16	2014-16							
	----- bushels/acre -----			- lb/bu	- % -	- % -	- % -	- % -	-	0-9
<u>Commercial</u>										
AC Metcalfe	102.1	105.4	104.9	51.3	9.7	14.4	83.1	2.1	41.6	7.0
CDC Copeland	100.1			51.2	9.8	13.3	89.5	1.7	41.5	4.7
Champion	123.8	<b>125.4*</b>	<b>120.0*</b>	52.4	10.0	12.5	89.8	1.7	42.9	3.7
Conlon	80.6			52.7	9.9	13.3	98.6	0.0	42.7	2.3
Conrad	118.6	122.0	115.6	52.5	10.1	13.7	96.9	0.0	38.3	2.7
Craft	101.7	96.5	101.2	50.4	9.8	13.2	95.9	0.7	43.4	1.7
Eslick	108.7			52.3	10.1	13.0	86.1	1.4	39.9	7.0
Genesis	97.9			50.5	9.5	12.1	96.4	0.4	42.9	3.3
Harrington	113.0	117.9	112.8	50.1	10.5	13.1	92.0	0.7	42.0	3.0
Haxby	84.1	91.4	96.3	52.6	9.9	13.3	90.6	1.7	43.7	5.7
Hockett	110.8	112.8	108.6	51.1	9.9	13.2	84.3	2.1	41.2	5.7
Moravian 115	<b>135.4*</b>	<b>129.4*</b>	<b>130.0*</b>	51.0	9.9	12.0	97.2	0.0	30.8	2.7
Moravian 150	<b>143.2*</b>	<b>136.5*</b>		51.9	10.1	11.4	97.0	0.3	33.2	2.0
Moravian 153	<b>142.3*</b>	<b>141.7**</b>		50.6	10.1	11.5	87.9	1.8	32.4	3.7
Moravian 69	<b>147.4**</b>	<b>135.7*</b>	<b>134.8**</b>	51.4	10.1	11.0	92.6	1.1	32.4	4.0
Pinnacle	112.2			51.2	9.8	11.3	97.2	0.7	42.3	1.0
Rawson	91.4			51.2	9.8	12.6	97.2	0.0	44.4	3.0
<u>Experimental</u>										
MT090182	116.9			52.6	10.1	11.7	94.3	0.7	41.1	1.7
MT090190	118.4			52.5	10.1	11.9	93.1	1.0	40.2	1.7
MT100120	116.9	108.6	102.3	52.7	10.2	11.4	95.0	0.7	41.7	1.3
MT100126	111.4	105.9	108.8	53.2	10.1	11.4	96.7	0.3	42.0	0.0
MT124555	113.8			52.9	10.0	12.4	95.3	1.0	39.4	1.7
Average	113.2	117.6	112.3	51.7	10.0	12.4	93.0	0.9	40.0	3.2
PLSD (p=0.05)	22.4	18.2	16.6	1.6	0.4	1.0	6.1	1.2	2.3	2.7
CV%	12.0	10.1	11.1	1.9	2.3	5.1	3.9	83.5	3.5	51.4

1/ Cultivars Lavina, Stopford and Stockford were grazed/damaged by deer and were excluded from data analysis.

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

3/ Grain protein values adjusted to 12 percent moisture basis.

4/ 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).

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

Hysham Irrigated Spring Barley (Exp. 163795)

Planted:	March 7, 2016
Harvested:	July 26, 2016
Fertility:	60 lb N/a preplant, 140 lb N/a top dress in spring
Previous Crop:	n/a
Irrigation:	flood
Precipitation:	n/a

Table 5. Grain yield<sup>1/</sup> of 25 spring barley cultivars tested at four locations in south central Montana during 2016. Varieties listed by declining four-location average yield.

Cultivar	Dryland			Irrigated			Four
	Huntley	Broadview	Ave.	Fromberg	Hysham	Ave.	Location
	----- bushels/acre -----						
Moravian 153	<b>124.7**</b>	<b>20.1**</b>	72.4	<b>148.5**</b>	<b>142.3*</b>	<b>145.4**</b>	<b>108.9**</b>
Moravian 69	<b>122.7*</b>	<b>18.2*</b>	70.1	<b>142.1*</b>	<b>147.4**</b>	<b>144.8*</b>	<b>107.5*</b>
Moravian 150	108.3	<b>17.1*</b>	63.2	<b>136.2*</b>	<b>143.2*</b>	<b>139.7*</b>	<b>101.4*</b>
Eslick	110.4	<b>17.3*</b>	64.2	<b>141.5*</b>	108.7	125.1	94.7
Champion	100.4	<b>19.8</b>	60.1	130.9	123.8	127.3	93.7
Moravian 115	98.1	<b>18.1*</b>	58.4	106.9	<b>135.4*</b>	121.2	89.8
MT090190	95.1	<b>16.9*</b>	55.2	123.3	118.4	120.9	88.1
Conrad	97.5	13.8	55.6	120.6	118.6	119.6	87.6
MT100120	91.4	15.1	53.2	124.9	116.9	120.9	87.1
CDC Copeland	105.0	<b>19.5*</b>	62.2	122.1	100.1	111.1	86.7
MT090182	93.9	<b>16.8*</b>	55.9	112.3	116.9	114.6	85.3
MT124555	96.0	<b>17.1*</b>	57.0	112.1	113.8	113.0	85.0
Pinnacle	82.7	15.1	48.8	128.1	112.2	120.1	84.5
MT100126	89.9	12.2	50.6	124.4	111.4	117.9	84.3
Harrington	88.8	14.8	51.4	104.7	113.0	108.8	80.1
AC Metcalfe	85.8	<b>17.3*</b>	51.6	115.2	102.1	108.6	80.1
Hockett	76.2	15.9	46.2	113.3	110.8	112.1	79.1
Craft	78.0	<b>16.5*</b>	47.7	101.4	101.7	101.5	74.6
Haxby	76.4	15.7	46.1	114.8	84.1	99.4	72.8
Genesis	65.2	<b>17.5*</b>	41.4	107.0	97.9	102.5	71.9
Rawson	76.2	14.6	44.8	101.6	91.4	96.5	70.6
Conlon	52.1	15.9	34.3	79.7	80.6	80.2	57.2
Lavina	75.4	13.2	43.7	93.0			
Stepford	48.7	14.5	32.3	94.9			
Stockford	76.8	14.4	45.2	120.2			
Average	88.6	<b>88.6</b>	52.5	116.8	113.2	116.0	85.0
PLSD (p=0.05)	8.2	4.1	ns	15.8	22.4	10.8	14.1
CV%	5.3	15.2	7.6	8.2	12.0	10.2	10.5

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 25 spring barley cultivars and experimental lines tested under dryland and irrigated conditions at five locations in south central Montana during 2016. Cultivars listed alphabetically.

Cultivar	1/ Grain Yield			Test Weight	Grain Moistur e	2/ Grain Protein		Plump Kernels	Thin Kernels	Plant Height
	2016	2015- 16	2014-16			- % -	- % -			
	----- bushels/acre -----			- lb/bu -	- % -	- % -	- % -	- % -	- inches	
<u>Commercial</u>										
AC Metcalfe	80.1	85.3	83.3	52.2	10.9	12.8	88.8	1.6	34.9	
CDC Copeland	86.7			51.5	10.8	12.5	91.9	1.5	34.2	
Champion	93.7	<b>97.6*</b>	<b>93.7*</b>	52.7	11.0	12.2	87.9	1.8	35.3	
Conlon	57.2			52.3	10.9	13.3	97.4	0.7	35.1	
Conrad	87.6	<b>91.9*</b>	88.2	51.5	11.4	13.0	92.8	1.1	33.0	
Craft	74.6	81.8	83.3	51.4	10.7	13.5	91.6	1.6	36.3	
Eslick	94.7			52.4	11.0	11.8	80.3	2.7	31.7	
Genesis	71.9			51.2	11.1	12.0	92.7	1.2	36.1	
Harrington	80.1	87.4	84.3	50.3	11.0	12.7	88.7	1.8	34.6	
Haxby	72.8	79.6	81.4	53.6	11.0	12.8	91.5	1.6	35.7	
Hockett	79.1	86.7	86.3	51.9	11.1	12.5	90.4	1.8	33.9	
Lavina										
Moravian 115	89.8	88.0	<b>89.5*</b>	49.5	11.0	12.2	91.8	1.4	26.5	
Moravian 150	<b>101.4*</b>			51.2	11.1	12.0	93.6	1.0	28.3	
Moravian 153	<b>108.9**</b>			50.3	11.1	11.4	86.8	1.6	28.6	
Moravian 69	<b>107.5*</b>	<b>100.6*</b>	<b>97.0**</b>	50.6	11.0	11.4	89.2	1.3	28.2	
Pinnacle	84.5			51.6	10.7	11.5	96.0	0.9	34.6	
Rawson	70.6			50.6	11.3	12.6	96.0	0.9	37.0	
Stepford										
Stockford										
<u>Experimental</u>										
MT090182	85.3			51.5	11.4	11.6	88.9	1.7	35.0	
MT090190	88.1			52.4	11.4	11.6	90.8	1.6	34.5	
MT100120	87.1	89.6		52.1	11.6	11.5	92.1	1.3	34.6	
MT100126	84.3	86.8		52.6	11.4	11.3	93.3	1.1	34.5	
MT124555	85.0			52.7	11.3	12.5	91.9	1.9	34.3	
Average	85.0	88.7	87.4	51.6	11.1	12.2	91.1	1.5	33.5	
PLSD (p=0.05)	14.1	9.7	8.3	1.4	ns	0.9	6.6	0.9	2.4	
CV%	10.5	9.6	10.8	1.9	5.0	5.3	3.7	51.9	4.2	
Location Years	4	8	12	4	4	4	4	4	4	

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

2/ Grain protein values adjusted to 12% moisture 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).

Table 7. Performance of 22 spring barley cultivars and experimental lines tested under irrigated conditions at two locations in south central Montana during 2016. Cultivars listed alphabetically.

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain Protein		Plump Kernels	Thin Kernels	Plant Height	3/ Lodging
	2016	2015-16	2014-16			- % -	- % -				
	----- bushels/acre -----			- lb/bu	- % -	- % -	- % -	- % -	-	0-9	
<u>Commercial</u>											
AC Metcalfe	108.6	113.2	110.0	51.6	10.4	13.5	88.2	1.5	41.5	6.5	
CDC Copeland	111.1			51.1	10.4	13.1	90.3	1.8	41.5	5.7	
Champion	127.3	<b>127.7*</b>	122.8	52.4	10.4	12.6	92.5	1.2	42.8	5.0	
Conlon	80.2			53.3	10.5	13.5	98.8	0.0	41.5	4.0	
Conrad	119.6	124.1	117.2	52.0	10.7	13.7	94.2	0.9	38.8	3.7	
Craft	101.5	104.8	108.3	50.6	10.5	14.0	91.3	1.4	43.3	4.8	
Eslick	125.1			52.6	10.7	12.2	88.3	1.5	39.4	6.0	
Genesis	102.5			51.5	10.5	12.3	97.4	0.2	42.1	4.8	
Harrington	108.8	119.2	113.9	48.9	10.7	13.0	87.8	1.6	40.8	5.2	
Haxby	99.4	102.5	103.9	53.0	10.5	13.0	93.0	1.2	42.3	6.2	
Hockett	112.1	116.5	114.7	51.5	10.6	12.8	88.2	1.7	39.5	5.7	
Moravian 115	121.2	120.4	<b>124.0*</b>	48.9	10.4	12.2	92.0	0.8	32.5	3.3	
Moravian 150	<b>139.7*</b>	<b>136.4*</b>		51.2	10.6	11.9	96.2	0.5	33.9	2.8	
Moravian 153	<b>145.4**</b>	<b>141.4**</b>		50.1	10.5	11.4	89.0	1.5	33.7	3.5	
Moravian 69	<b>144.8*</b>	<b>137.1*</b>	<b>136.4**</b>	50.5	10.6	11.5	90.8	1.1	33.5	4.2	
Pinnacle	120.1			51.4	10.4	11.5	97.7	0.4	41.9	2.5	
Rawson	96.5			51.1	10.5	12.6	97.6	0.2	44.0	4.5	
<u>Experimental</u>											
MT090182	114.6			51.6	10.8	12.2	90.2	1.7	41.9	4.8	
MT090190	120.9			52.2	11.0	11.8	92.3	1.2	41.1	4.5	
MT100120	120.9	121.0	114.1	52.2	10.9	11.6	93.8	0.9	41.3	4.2	
MT100126	117.9	117.4	119.4	53.3	10.9	11.3	96.9	0.3	41.8	2.8	
MT124555	113.0			52.4	10.7	12.9	91.4	1.9	40.7	4.5	
Average	116.0	121.7	116.8	51.5	10.6	12.5	92.6	1.1	40.0	4.0	
PLSD (p=0.05)	10.8	14.3	11.9	2.0	ns	1.2	ns	ns	2.8	ns	
CV%	10.2	9.6	10.4	2.2	2.7	6.0	4.7	85.2	3.5	34.1	
Location Years	2	4	6	2	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 adjusted to 12% moisture 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).

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

Table 8. Performance of 25 spring barley cultivars and experimental lines tested under dryland conditions at two locations in south central Montana during 2016. Cultivars listed alphabetically.

Cultivar	1/ Grain Yield			Test Weight	Grain Moisture	2/ Grain	Plump Kernels	Thin Kernel	Plant Height
	2016	2015-16	2014-16			Protein			
	----- bushels/acre -----			- lb/bu -	- % -	- % -	- % -	- % -	- inches -
<u>Commercial</u>									
AC Metcalfe	51.6	57.5	56.5	52.7	11.5	12.1	89.5	1.7	28.3
CDC Copeland	62.2			51.9	11.3	11.9	93.5	1.3	26.9
Champion	60.1	67.5	64.5	53.0	11.5	11.8	83.3	2.4	27.8
Conlon	34.3			51.4	11.2	13.1	95.9	1.3	28.6
Conrad	55.6	59.7	59.1	51.1	12.1	12.4	91.4	1.4	27.1
Craft	47.7	58.9	58.2	52.2	11.0	13.0	91.8	1.8	29.2
Eslick	64.2			52.2	11.3	11.4	72.3	3.9	24.1
Genesis	41.4			51.0	11.6	11.7	88.0	2.3	30.0
Harrington	51.4	55.6	54.8	51.8	11.3	12.5	89.6	2.0	28.3
Haxby	46.1	56.8	58.8	54.3	11.5	12.7	90.1	2.0	29.1
Hockett	46.2	56.8	57.9	52.4	11.6	12.1	92.5	1.9	28.3
Lavina	43.7			47.8	11.4	13.2	71.5	6.6	29.5
Moravian 115	58.4	55.6	54.9	50.2	11.5	12.2	91.6	2.1	20.5
Moravian 150	63.2			51.2	11.7	12.0	91.0	1.5	22.8
Moravian 153	72.4			50.6	11.7	11.3	84.7	1.8	23.6
Moravian 69	70.1	64.1	57.7	50.8	11.3	11.2	87.7	1.5	22.9
Pinnacle	48.8			51.8	11.0	11.5	94.3	1.4	27.3
Rawson	44.8			50.2	12.2	12.5	94.4	1.6	30.0
Stepford	32.3			45.8	10.6	13.1	84.6	4.7	31.1
Stockford	45.2			49.5	12.0	12.0	92.3	1.7	31.8
<u>Experimental</u>									
MT090182	55.9			51.4	12.1	10.9	87.7	1.7	28.1
MT090190	55.2			52.5	11.8	11.4	89.3	2.1	27.9
MT100120	53.2	58.2		52.0	12.3	11.3	90.3	1.8	27.9
MT100126	50.6	56.1		51.8	11.8	11.4	89.6	1.9	27.3
MT124555	57.0			53.1	11.9	12.2	92.3	1.9	27.8
Average	52.5	58.8	58	51.3	11.6	12	88.8	2.2	27.5
PLSD (p=0.05)	ns	ns	ns	2.1	ns	ns	11.5	2.4	5.5
CV%	7.6	7.6	8.7	2.0	6.0	4.3	2.7	33.7	5.2
Location Years	2	4	6	2	2	2	2	2	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 12% moisture 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).