

Title: Off-station spring barley cultivar evaluations for the Western Golden Triangle area of Montana

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Cooperators: Bradley Farms, north of Cut Bank, MT
Brian Aklestad, north of Devon, MT
Aaron Killion, east of Brady, MT
Inbody Farms, northeast of Choteau, MT

Objectives: There are diverse cropping environments within the area served by Western Triangle Agricultural Research Center. Each off station location has its own unique environment and soils. Producers in the various locations are interested in variety performance in the local area. To this end the objective is to evaluate spring barley varieties under the local conditions with respect to yield, test weight, plant height, plump seed, thin seed and seed protein. The environmental conditions at the off station nurseries can vary greatly from those at WTARC. The research center strives to provide growers of the western triangle area unbiased information of various spring barley varieties.

Methods: Off station barley nurseries consist of 16 entries replicated three times, seeded with a four row plot seeder on one foot spacing. The irrigated off station nursery consisted of 25 entries for the 2016 cropping season. All plots were planted on no-till chemical fallow. Plots were trimmed, measured for length, and then harvested with a Hege 140 plot combine. Spring barley seed plot weights were collected, then the samples were cleaned prior to collecting data.

Results: Data are presented for all off station barley locations in Tables 1 thru 10, Table 11 shows soil test results for each location.

At the research center, this years' overall crop year temperatures were slightly higher than the 30 year average at the research center, being 1.2 degrees warmer than normal. With November being 0.9 degrees warmer than the 30 year average. December and January average temperatures were very close to the long term average. February was exceptionally warmer, with the temperature being 11.4 degrees warmer than the 30 year average. March and April were also warmer by 4.6 and 2.4 degrees above the 30 year average. May temperatures were cooler than the average by 1.6 degrees. June was also above average by 1.9 degrees. With July and August being slightly cooler than normal by 2.1 and 2.7 degrees.

Precipitation at the research center was surprising with 5.18 inches more moisture than the 30 year average. We received above average moisture the fall of 2015, resulting in good soil moisture at planting. September was 1.82 inches above the 30 year average. October through December were 0.5 inches of precipitation above normal. January was ahead of the average with

2.1 inches more than the normal precipitation. February was exceedingly dry reporting no moisture for the month. With March close behind only receiving 0.2 of inch. April brought some much needed moisture with about an inch above the 30 year average, while May was only slightly above the 30 year average. June precipitation was 2.3 inches below normal. July received 1.4 inches over the 30 year average for precipitation.

Yields for the irrigated off station spring barley nursery, averaged 104.4 bu/ac, with an average kernel plumpness of 95.7%, a mean seed protein of 9.6%, and an average test weight of 50.3 lb/bu (Table 1). Four year means for the irrigated off station nursery are tabulated in (Table 2).

Grain yields averaged 75.2 bu/acre at the Knees, 56.6 bu/ac north of Devon, 71.4 bu/ac at the Choteau site, and 75.1 bu/ac at the site north of Cut Bank. Kernel plumpness averaged 88.3 % and test weight averaged 48.6 lbs/bu at the Devon site while kernel plumpness averaged 70.8% and test weight averaged 42.5 lbs/bu at the Knees. Choteau kernel plumpness was 80.7 % and test weight averaged 46.7 lbs/bu. The nursery at Cut Bank averaged 49.6 lb/bu, 95.5% plumps, with 14.2 % seed protein (Tables 3 thru 10).

Top yielding varieties at the Knees were Conrad, Hays, and Hockett, yields were 98.0, 95.6, and 85.0 bu/ac. Whereas the top yielding barleys north of Devon were Champion, Conrad, and Hays they yielded 64.3, 61.7, and 59.9 bu/ac. Yielding highest at the Choteau site were Champion, the Montana State University experimental entry MT124555, and Hays with yields of 83.0, 77.8 and 77.7 bu/ac. High yielding varieties at Cut Bank were Champion, 99.4 bu/ac, Moravian 115, 91.8 bu/ac and the Montana State University experimental entry MT124555, 86.0 bu/ac (Tables 3 thru 10).

No insect incidence (wheat stem sawfly or wireworms) were noticed in any of the barley varieties, on or off station. Insignificant amount of adult of orange wheat blossom midge were found at the off station locations.

Summary: The data from the off station plots is supported by the local producers and advisory committee as well as the seed industry. It is planned to continue the off station variety plots at the same locations as the environmental conditions at each location is unique to the western triangle area. No insect incidence or damage was noticed in any of the varieties.

These data should be used for comparative purposes rather than using absolute numbers. Statistics are used to indicate that treatment or variety differences are really different and are not different due to chance or error. The least significant difference (LSD) and coefficient of variability (CV) values are useful in comparing treatment or variety differences. The LSD value represents the smallest difference between two treatments at a given probably level. The LSD at $p=0.05$ or 5 % probability level is usually the statistic reported, and it means that the odds are 19 to 1 that treatment differences by the amount of the LSD are truly different. The CV value measures the variability of the experiment or variety trial, and a CV greater than 15 % indicates a high degree of variability and less accuracy.

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Table 1. 2016 Irrigated off station barley variety trial, Conrad, MT.

Variety	Yield bu/ac ¹	Test Wt lb/bu ¹	Height inch	Plump %	Thin %	Protein %	Lodging %
Rawson	124.4	51.7	25.7	97.2	0.9	8.85	10.0
Eslick	121.4	51.5	28.7	93.4	1.1	9.27	43.3
Moravian 115	121.1	49.4	23.7	97.5	0.9	9.21	16.7
Conrad	117.6	51.4	31.0	97.5	0.8	9.67	20.0
Champion	116.5	51.7	30.0	96.4	0.8	9.38	30.0
MT090190	115.2	52.3	35.0	98.0	0.5	8.73	6.7
MT100120	113.5	51.8	35.0	97.8	0.6	8.71	3.3
Merit	113.4	49.8	32.7	96.7	1.0	9.41	13.3
Harrington	112.9	51.2	31.0	96.9	1.1	9.96	35.0
MT100126	111.6	52.6	34.7	98.1	0.4	9.19	3.3
MT090182	110.7	51.8	33.7	95.5	0.5	8.68	5.0
Hays	110.2	48.3	32.7	90.5	4.5	9.83	36.7
Stockford	109.5	50.7	33.7	96.1	1.4	9.83	6.7
Hockett	106.8	52.0	30.3	97.9	0.7	9.41	60.0
Genesis	98.9	48.9	31.3	98.5	0.4	9.27	10.0
Metcalfe	97.8	50.8	33.3	96.0	1.7	9.78	33.3
Haxby	97.7	51.5	30.0	97.5	0.6	9.57	20.0
Lavina	94.0	47.5	34.0	89.3	4.6	9.82	30.0
MT124555	93.7	49.9	30.7	96.2	1.1	10.22	23.3
Pinnacle	93.6	50.9	32.7	95.0	0.7	9.28	3.3
Copeland	92.4	51.0	30.3	98.2	0.6	9.10	46.7
Haybet	91.7	46.8	34.3	83.6	4.5	12.34	86.7
Craft	87.3	51.3	33.0	96.9	1.0	9.62	50.0
Conlon	86.0	50.7	28.7	99.1	0.4	11.21	30.0
Stepford	72.1	42.5	33.7	93.8	2.2	10.16	56.7
Mean	104.4	50.3	31.7	95.7	1.3	9.6	27.2
LSD (.05)	17.9	1.4	2.3	4.2	0.8	0.96	28.9
C.V. (s/mean)*100	10.5	1.6	4.4	2.7	38.5	6.05	64.8
P-Value	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Planted on May 2, 2016 into chemical fallow barley stubble. Harvested on September 2, 2016. Fertilizer, actual (lbs/a): 11-22-0 place with seed at planting, 53-0-20 broadcast while seeding. Fertilizer rates are based on achieving malt grade barley.

Growing season precipitation: 6.62 inches. Irrigation = 12.3 inches

Pre-plant sprayed with RT3 at 32 oz/ac on 5/1/2016. The plot was sprayed with Bison @ 4 pts/ac and 16.4 oz/ac of Axial XL on 6/3/16.

¹ Yield and test weight are adjusted to 13% seed moisture.

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 2. 4-year Means, Irrigated off station barley varieties, Conrad, MT, 2012, 2014-2016.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant height
Champion	120.4	52.2	95.7	1.5	11.2	32.9
Conrad	115.2	51.3	96.6	1.3	10.6	30.7
Haxby	111.3	52.9	96.1	1.5	10.9	31.5
Metcalfe	108.2	50.9	95.5	1.8	11.1	32.9
Harrington	107.8	50.1	96.4	2.6	11.1	32.1
Hockett	101.5	52.0	96.3	1.2	10.7	30.7
Mean	110.7	51.6	96.1	1.6	10.9	31.8

Location: MSU Western Triangle Ag. Research Center, Conrad, MT.

Table 3. Off-station spring barley variety trial located in the Choteau area. Teton County.
Western Triangle Ag. Research Center, 2016.

Variety	Yield ¹ bu/ac	Test Wt ¹ lb/bu	Plump %	Thin %	Plant Height inch	Protein %
Champion	83.0	49.1	90.0	2.9	25.3	13.1
MT124555	77.8	48.6	92.2	1.8	27.0	12.8
Hays	77.7	45.3	71.6	9.7	23.7	14.7
Lavina	77.5	45.2	70.0	8.9	25.7	14.2
Haxby	73.5	48.9	88.7	3.1	26.0	13.6
Moraviana 115	73.2	45.1	88.3	2.6	19.7	14.7
MT090182	71.6	47.8	84.6	3.7	24.7	12.6
Metcalf	71.6	47.3	86.9	3.3	25.0	14.3
Harrington	70.3	45.9	84.2	3.4	24.7	14.2
Hockett	70.1	47.4	80.4	7.4	26.7	13.3
MT090190	69.6	47.1	86.7	3.7	27.0	12.2
Merit	69.0	45.6	76.7	6.1	25.0	15.3
MT100126	68.9	47.6	84.8	4.0	28.7	12.8
Conrad	66.3	45.7	82.9	5.1	24.3	15.1
MT100120	65.0	47.0	87.1	3.8	27.7	12.2
Haybet	57.8	44.0	35.7	19.4	28.0	15.3
Average	71.4	46.7	80.7	5.6	25.6	13.8
LSD (.05) =	7.9	1.7	6.9	4.1	3.0	0.8
C.V. =	6.7	2.2	5.1	44.6	7.1	3.5
P-Value (0.05)	0.0002	<0.0000	<0.0000	<0.0000	0.0005	<0.0000

Cooperator and Location: Inbody Farms, Teton County.

Planted: May 4, 2016 on chem-fallow. Harvested: August 24, 2016.

Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting. 17-0-20 was applied as a broadcast while seeding.

Herbicide: Pre-plant sprayed with RT3 at 32 oz/ac on 5/1/2016. Plots were sprayed on 6/2/16 with Vendetta at 2 pts/ac and Axial XL at 16.4 oz/ac.

¹ Yield and test weight are adjusted to 13% seed moisture

Conducted by MSU Western Triangle Ag. Research Center.

Table 4. Five-year means, Barley varieties, Choteau area, Teton County 2012-2016.

Variety Or ID	5-Year Mean					
	Yield bu/ac	Test weight lbs/bu	Plump %	Thins %	Height inch	Protein %
Champion	72.3	50.9	79.0	6.8	27.1	13.7
Haxby	66.8	51.3	85.2	7.8	25.8	14.2
Metcalf	64.7	49.0	84.7	6.6	25.9	15.0
Harrington	61.0	47.9	62.7	11.4	25.0	15.4
Hockett	64.7	49.4	80.2	10.5	26.3	14.9
Conrad	62.0	48.9	81.3	8.7	24.9	15.6
Mean	65.3	49.6	78.9	8.6	25.8	14.8

Conducted by MSU Western Triangle Ag. Research Center.

Table 5. Off-station spring barley variety trial located in the Cut Bank area. Glacier County.
Western Triangle Ag. Research Center, 2016.

Variety	Yield ¹ bu/ac	Test Wt ¹ lb/bu	Plump %	Thin %	Plant Height inch	Protein %
Champion	99.4	50.8	94.8	2.5	25.0	14.4
Moravian115	91.8	50.2	98.1	0.6	20.3	13.5
MT124555	86.0	50.1	97.5	1.0	26.3	13.8
MT090190	82.1	49.1	95.9	1.7	27.7	13.9
Hockett	81.8	50.8	97.8	0.9	27.3	13.7
MT100120	79.8	49.4	95.9	2.0	28.7	12.9
MT100126	79.7	50.2	96.4	1.5	26.7	13.2
Metcalf	75.9	51.0	97.6	0.8	27.0	14.9
Harrington	75.2	50.6	96.3	1.5	26.7	14.5
Conrad	73.4	50.0	98.3	0.6	23.3	15.7
Haxby	73.4	50.5	97.2	1.2	26.3	14.8
MT090182	73.0	48.9	96.2	1.4	27.3	12.8
Lavina	69.6	47.9	89.3	3.6	25.7	15.1
Merit	69.6	48.9	97.4	0.9	25.3	14.0
Hays	51.7	48.7	93.4	2.4	25.0	14.9
Haybet	39.1	46.3	85.3	4.4	30.7	16.8
Average	75.1	49.6	95.5	1.7	26.2	14.2
LSD (.05) =	14.5	1.3	2.3	1.3	2.8	0.9
C.V. =	11.6	1.6	1.5	45.8	6.5	3.9
P-Value (0.05)	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Cooperator and Location: Bradley Farms, Glacier County.

Planted: 5/5/2016 on chemical fallow barley stubble. Harvested: 9/16/2016.

Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting. 0-0-20 was applied as a broadcast while seeding.

Herbicide: Pre-plant sprayed with RT3 at 32 oz/ac on 5/2/2016.

¹ Yield and test weight are adjusted to 13% seed moisture

Conducted by MSU Western Triangle Ag. Research Center.

Table 6. Three-year means, Barley varieties, Cut Bank area, Glacier County 2013, 2015-2016.

Variety Or ID	3-Year Mean					
	Yield bu/ac	Test weight lbs/bu	Plump %	Thins %	Height inch	Protein %
Champion	71.0	51.4	93.5	2.8	26.1	13.7
Hockett	67.8	51.3	96.8	1.3	26.9	13.7
Harrington	62.2	50.1	94.6	2.1	26.8	14.1
Haxby	61.4	51.5	95.8	1.6	26.8	13.8
Conrad	60.8	51.4	95.8	1.7	24.8	14.9
Metcalfe	59.9	50.7	95.4	1.7	26.6	14.1
Mean	63.9	51.1	95.3	1.9	26.3	14.0

Conducted by MSU Western Triangle Ag. Research Center.

Table 7. Off-station spring barley variety trial located in the Devon, Toole County. Western Triangle Ag. Research Center, 2016.

Variety	Yield ¹ bu/ac	Test Wt ¹ lb/bu	Plump %	Thin %	Plant Height inch	Protein %
Champion	64.3	49.9	90.9	2.7	21.3	11.0
Conrad	61.7	48.9	94.6	1.4	21.0	10.9
Hays	59.9	46.6	74.9	9.9	19.3	10.5
MT090182	59.5	49.3	93.4	1.5	23.0	9.6
MT100120	59.4	49.6	95.1	2.7	22.7	9.7
Moravian115	58.8	47.2	90.3	3.0	16.3	11.0
Hockett	58.5	48.5	89.0	5.0	22.7	10.2
MT124555	58.2	50.6	95.0	1.7	20.7	10.7
Merit	57.9	47.3	90.3	2.6	20.0	10.0
Lavina	56.6	48.1	84.8	2.5	21.3	9.3
Metcalfe	54.7	48.4	88.4	3.4	21.7	10.7
MT090190	53.0	48.9	95.2	1.6	21.3	9.7
MT100126	52.9	48.6	91.4	2.6	23.0	10.4
Harrington	52.2	48.5	82.1	6.0	20.7	10.7
Haxby	51.8	49.9	84.7	4.0	22.7	10.8
Haybet	45.9	47.0	72.6	7.1	25.0	10.7
Average	56.6	48.6	88.3	3.7	21.4	10.4
LSD (.05)	8.2	2.2	11.4	4.6	1.8	ns
C.V. (%)	8.7	2.7	7.8	61.3	5.1	6.7
P-Value (0.05)	0.0134	0.0322	0.0043	0.0049	<0.0000	0.0761

Cooperator and Location: Brian Aklestad Farms, Toole County.

Planted: 4/18/2016 on chemical fallow winter wheat stubble. Harvested: 8/7/2016.

Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting. 27-0-20 was applied as a broadcast while seeding.

Herbicide: Pre-plant sprayed with RT3 at 32 oz/ac on 4/18/2016. Plots were sprayed on 5/1/16 with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac.

¹ Yield and test weight are adjusted to 13% seed moisture

Conducted by MSU Western Triangle Ag. Research Center.

Table 8. Four-year means, Barley varieties, Devon area, Toole County 2012, 2014-2016.

Variety Or ID	4-Year Mean					
	Yield bu/ac	Test weight lbs/bu	Plump %	Thins %	Height inch	Protein %
Champion	60.1	50.7	84.0	6.4	21.3	12.0
Conrad	56.0	49.2	91.0	4.2	21.1	12.7
Haxby	51.2	49.8	81.4	8.3	22.0	12.1
Hockett	50.5	49.2	87.0	5.2	21.9	12.3
Harrington	48.8	47.8	81.0	8.9	21.2	13.1
Metcalfe	47.3	48.2	88.1	4.8	22.0	12.7
Mean	52.3	49.1	85.4	6.3	21.6	12.5

Conducted by MSU Western Triangle Ag. Research Center.

Table 9. Off-station spring barley variety trial located in the Knees area. Western Chouteau County. Western Triangle Ag. Research Center. 2016.

Variety	Yield bu/ac ¹	Test Wt lb/bu ¹	Plump %	Thin %	Plant Height inch	Protein %
Conrad	98.0	45.6	84.9	6.2	22.3	13.8
Hays	95.6	44.0	77.8	9.0	27.3	13.8
Hockett	85.0	46.5	79.4	9.8	28.3	12.8
Harrington	82.9	44.7	76.7	10.8	29.3	13.5
Metcalfe	81.1	43.9	79.8	9.0	29.0	14.6
Lavina	80.5	42.3	63.3	15.7	28.7	13.7
Merit	79.4	42.5	72.4	14.2	29.3	14.6
Moravian115	78.2	42.0	81.5	9.4	30.7	13.5
MT124555	77.5	44.3	82.7	8.4	30.0	12.6
MT100120	68.5	40.6	63.6	19.9	29.3	12.5
Champion	67.8	41.0	53.5	26.2	31.0	13.2
MT090182	64.2	40.0	62.5	20.1	29.7	12.2
MT090190	63.3	39.4	70.7	15.4	28.7	11.9
Haxby	63.0	43.5	69.8	17.2	30.0	13.4
Haybet	60.9	41.9	49.4	19.3	26.7	14.6
MT100126	57.0	38.2	64.2	19.2	31.3	12.9
Average	75.2	42.5	70.8	14.4	28.9	13.3
LSD (.05)	20.6	1.7	9.0	6.0	4.3	0.8
C.V.	16.6	2.5	7.6	25.0	9.0	3.6
P-Value (0.05)	0.0070	<0.0000	<0.0000	<0.0000	0.0476	<0.0000

Cooperator and Location: Aaron Killion, western Chouteau County.

Planted: 4/22/2016 on chemical fallow winter wheat stubble. Harvested: August 22, 2016.

Fertilizer, actual lbs/a: 11-22.5-0 with seed at planting. 8-0-20 was applied as a broadcast while seeding.

Herbicide: Sprayed with RT3 at 32 oz/a 4/22/2016. Plots were sprayed on 6/2/16 with Vendetta at 2 pt/ac and Axial XL at 16.4 oz/ac.

¹ Yield and test weight are adjusted to 13% seed moisture

Conducted by MSU Western Triangle Ag. Research Center.

Table 10. Five-year means, barley varieties, Knees area, Chouteau county 2012-2016.

Variety Or ID	5-Year Mean					
	Yield bu/ac	Test weight lbs/bu	Plumps %	Thins %	Height inch	Protein %
Harrington	70.7	47.2	86.5	5.3	26.1	12.9
Hockett	69.5	48.8	87.1	5.1	26.3	12.3
Conrad	69.2	47.7	87.8	4.0	23.7	13.0
Metcalfe	68.8	47.1	87.8	4.4	26.4	13.2
Champion	67.8	47.6	79.9	8.7	26.6	12.4
Haxby	67.8	49.1	83.0	6.6	26.0	12.4
Mean	69.0	47.9	85.3	5.7	25.8	12.7

Conducted by MSU Western Triangle Ag. Research Center.

Table 11. Soil test values for off-station and on-station plots, 2016.

Location	N (lbs/ac) ¹	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	39.6	17	385	7.5	2.7	0.39
Devon	12.1	14	221	7.2	0.8	0.15
Knees	21.1	28	482	6.9	2.4	0.55
Choteau	44.5	7	412	8.1	2.3	0.82
WTARC	15.6	20	318	7.8	2.4	0.56

¹Nitrogen soil samples were to a depth of four feet in one foot increments. All other soil tests were for zero to six inches in depth.

WTARC- Western Triangle Ag. Research Center