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

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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. All plots were planted on no-till chemical fallow. Plots were trimmed, measured for length, and then harvested with a Hege 140 or a Wintersteiger Classic plot combine. Spring barley seed was not cleaned prior to collecting yield data.

Results: Results are tabulated in Tables 1 thru 10. The irrigated off-station spring barley nursery data are presented in Tables 1 and 2. Table 3 is for the Choteau location, with multi-year data presented in Table 4. Tables 7 and 8 are for the Devon location, with Table 9 and 10 representing the 'Knees' location. The Cut Bank data are presented in Tables 5 and 6. Table 11 is the soil test results from each location.

Overall, the crop year temperatures where much warmer than 31 year average at the research center, July was 4.9 degrees warmer than the average. But the overall average temperature for the year from September to August was 1 degree cooler than the 31 year average. The winter temperature was well below average, with the exception of November being about 7 degrees warmer than usual. December and January were 10 and 6 degrees colder than the 31 year average while May thru August were warmer than the 31 year average. July was 5 degrees warmer than the normal. Precipitation was generally above the average from September to April, then below normal from May to August. Overall, precipitation was average for the year.

The spring barley plots were seeded into soil that had good soil moisture storage from the summer, fall and winter of 2016-17. Overall, considering the lack of moisture and heat this past summer, the barley did quite well.

Yields for the irrigated off station spring barley nursery, averaged 110.1 bu/ac, with Odyssey, Oreana, and MT124073 being the top yielders at 130.3, 124.6, and 122.1 bu/ac. There was an average kernel plumpness of 94.2%, a mean protein of 9.0%, and an average test weight of 51.3 lb/bu (Table 1). Five year means for the irrigated off station nursery are tabulated in (Table 2).

Grain yields averaged 74.1 bu/acre at the Knees, 60.0 bu/ac north of Devon, 81.8 bu/ac at the Choteau site, and 73.7 bu/ac at the site north of Cut Bank. Kernel plumpness averaged 79.6 % and test weight averaged 47.1 lbs/bu at the Devon site while kernel plumpness averaged 69.9% and test weight averaged 46.0 lbs/bu at the Knees. Choteau kernel plumpness was 67.0 % and test weight averaged 45.0 lbs/bu. The nursery at Cut Bank averaged 48.2 lb/bu, 80.8% plumps, with 10.5 % seed protein (Tables 3 thru 10).

Top yielding varieties at the Knees were Oreana, Champion, and Haxby, yields were 85.6, 81.2, and 79.7 bu/ac. Whereas the top yielding barleys north of Devon were Oreana, Champion, and Lavina they yielded 77.5, 75.5, and 69.8 bu/ac. Yielding highest at the Choteau site were Oreana, Champion, and Bill Coors 100 with yields of 94.4, 91.0 and 87.2 bu/ac. High yielding varieties at Cut Bank were Montana State University experimental entry MT124128, 90.5 bu/ac, Champion, 83.6 bu/ac and Oreana, 82.8 bu/ac (Tables 3 thru 10). This being the first year Oreana was in the off station barley nurseries, it was the top yielding variety at three locations and the third yielding barley at one location.

The hot dry weather this past summer gave the barley varieties the opportunity to show what they can do with respect to malt quality barley when conditions are not ideal. In general, the Montana State University experimental entries, MT124128 and MT 090190 held their plumps well and did not have as high a seed protein as other entries in the off station dryland plots during our hotter and drier than usual summer.

No insect incidence (wheat stem sawfly or wireworms) was noticed in any of the barley varieties, on or off station. Insignificant amount of adult wheat 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.

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 probability 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. 2017 Irrigated off station barley variety trial, Conrad, MT.

Variety	Yield (bu/ac[1])	Test Wt (lb/bu[1])	Height (inch)	Head Date	Plump (%)	Thin (%)	Protein (%)	Lodging (%)
Odyssey	130.3	50.8	24.0	187.7	98.3	0.5	8.8	23.3
Oreana	124.6	51.8	23.0	187.3	94.4	1.6	8.8	7.0
MT124073	122.1	52.3	30.7	187.7	96.8	0.8	9.0	10.0
MT124027	122.0	51.8	27.7	187.7	97.2	0.6	8.9	23.3
Genie	120.3	52.3	23.7	187.7	98.7	0.6	9.2	13.3
Eslick	118.8	52.3	27.0	187.3	93.3	1.8	8.9	43.3
Merit 57	118.0	50.0	28.0	187.7	92.8	1.6	8.7	13.3
Claymore	116.9	51.4	28.7	187.0	93.5	1.3	8.3	10.0
Haxby	116.8	53.4	27.3	184.0	97.8	0.6	9.9	16.7
Champion	115.9	52.8	27.7	186.3	95.7	1.3	8.9	8.3
Conrad	115.6	51.1	25.3	187.7	97.7	0.8	9.1	13.3
Balster	111.0	49.6	26.0	187.7	95.2	1.8	8.6	10.0
MT090190	109.9	51.9	28.3	185.0	97.9	0.7	9.2	13.3
Copeland	107.0	51.6	30.0	187.7	97.3	1.2	9.0	20.0
Growler	106.9	50.1	26.0	187.7	94.6	1.5	8.8	7.0
Bill Coors 100	106.5	50.2	22.7	188.0	97.8	0.8	9.4	11.7
Synergy	106.2	49.6	28.3	187.0	97.5	0.8	8.8	28.3
Hockett	105.7	51.1	25.0	187.0	95.0	1.5	9.0	73.3
Lavina	105.3	47.8	30.7	187.3	86.6	3.1	8.9	16.7
Metcalfe	102.1	51.5	27.7	186.7	93.5	2.0	8.9	33.3
09WA9-265.12	101.8	61.0	29.3	186.7	83.1	4.7	9.2	36.7
Moravian165	100.3	50.6	28.7	187.0	97.5	0.7	9.5	26.7
Hays	98.9	48.8	28.0	187.3	91.7	2.5	8.9	16.7
MT124128	97.0	52.1	24.3	179.7	98.0	0.6	9.5	5.0
Haybet	72.6	47.5	31.3	185.7	73.0	5.3	9.9	73.3
Mean	110.1	51.3	27.2	186.7	94.2	1.5	9.0	22.2
LSD (.05)	12.1	0.9	2.5	2.2	3.0	1.0	0.9	18.8
C.V. (s/mean)*100	6.7	1.1	5.5	0.7	1.9	38.5	6.3	51.7
P-Value	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Planted on 06/2/2017 into chemical fallow barley stubble. Harvested on 09/2/ 2017.
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 5/1/2017. The plot was sprayed with Bison @ 4 pts/ac and 16.4 oz/ac of Axial XL on 6/3/17.
[1] Yield and test weight are adjusted to 13% seed moisture.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 2. 5-year Means, Irrigated off station barley varieties, Conrad, MT, 2012, 2014-2017.

Variety	Yield (bu/ac)	Test Wt (lb/bu)	Plump (%)	Thin (%)	Protein (%)	Plant height (inch)	Heading date
Champion	107.8	52.4	96.3	0.9	9.5	29.3	180.9
Haxby	105.9	52.2	96.6	1.2	10.1	29.4	108.1
Metcalfe	104.9	51.2	96.6	1.3	10.3	31.1	179.2
Hockett	101.1	51.7	96.6	1.3	10.6	28.1	180.7
Mean	104.9	51.8	96.5	1.2	10.1	29.5	180.2

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, 2017.

Variety	Yield[1] (bu/ac)	Test Wt[1] (lb/bu)	Plump (%)	Thin (%)	Plant Height (inch)	Lodging (%)	Protein (%)
Oreana	94.4	46.3	61.6	9.9	22.0	1.7	13.8
Champion	91.0	48.3	64.6	7.6	26.0	10.0	13.7
Bill Coors 100	87.2	43.9	74.1	7.9	21.0	4.0	14.5
MT124128	84.3	48.7	84.4	5.0	24.0	16.7	12.1
Genie	83.7	46.2	71.8	8.7	22.3	7.3	13.1
Odyssey	83.7	42.0	76.4	5.9	22.0	5.7	13.5
Haxby	83.3	48.2	54.7	11.1	25.3	13.3	13.7
Copeland	81.6	45.0	70.6	8.1	25.7	2.3	13.7
Lavina	81.2	39.9	23.0	32.3	26.7	11.7	14.8
MT090190	81.1	47.5	86.2	3.9	25.3	1.3	12.5
Hockett	80.9	45.6	72.0	9.2	23.0	15.0	13.0
Moravian165	80.7	46.0	78.0	6.3	26.0	15.0	13.7
Balster	75.5	42.8	63.4	14.5	24.0	5.7	14.3
Synergy	74.7	44.9	73.2	7.7	23.7	15.0	12.7
Metcalfe	74.5	45.2	62.4	10.8	24.3	10.0	13.9
Growler	70.4	39.9	55.4	14.0	23.7	0.7	15.9
Average	81.8	45.0	67.0	10.2	24.1	8.5	13.7
LSD (.05) =	10.4	2.5	18.0	6.5	2.3	8.9	1.4
C.V. =	7.6	2.4	16.1	38.2	5.7	63.0	6.3
P-Value (0.05)	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Cooperator and Location: Inbody Farms, Teton County.
Planted: 06/6/2017 on chem-fallow. Harvested: 08/29/2017.
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 and 1 oz/ac Sharpen on 5/6/2017.
[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 2013-2017.

Variety Or ID	6-Year Mean					
	Yield (bu/ac)	Test weight (lbs/bu)	Plump (%)	Thins (%)	Height (inch)	Protein (%)
Champion	80.1	50.5	76.6	6.8	27.3	13.8
Haxby	73.9	50.9	81.2	7.8	26.6	14.1
Hockett	71.9	49.0	81.9	9.4	26.6	14.4
Metcalfe	70.8	48.5	80.6	7.5	26.0	14.8
Mean	74.2	49.7	80.1	7.9	26.6	14.3

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, 2017.

Variety	Yield[1] (bu/ac)	Test Wt[1] (lb/bu)	Plump (%)	Thin (%)	Plant Height (inch)	Protein (%)
MT124128	90.5	50.8	95.6	1.4	23.3	9.7
Champion	83.6	50.7	72.7	4.4	25.7	10.6
Oreana	82.8	49.4	80.4	4.1	21.7	10.2
Balster	79.3	46.6	83.1	4.7	24.0	10.3
Genie	76.6	48.9	83.2	3.7	22.3	10.5
Hockett	75.8	48.9	83.8	3.8	23.0	10.5
Metcalfe	75.4	48.6	79.8	4.5	24.7	11.3
Copeland	74.6	48.0	85.6	3.7	26.3	11.9
Lavina	74.1	44.7	49.8	13.9	25.7	11.5
Odyssey	72.3	46.8	90.0	1.9	22.3	9.9
Synergy	71.3	47.2	85.4	3.4	24.7	10.7
Bill Coors 100	69.9	47.2	92.7	1.9	20.7	10.5
Moraviana165	68.7	46.9	78.7	5.1	25.0	10.8
Haxby	67.2	51.5	70.7	5.7	22.7	9.6
MT090190	63.9	49.7	86.6	2.1	26.3	10.2
Growler	53.6	44.6	74.8	6.4	23.3	10.6
Average	73.7	48.2	80.8	4.4	23.9	10.5
LSD (.05) =	21.1	0.9	8.5	2.2	1.8	1.0
C.V. =	17.1	1.1	6.3	30.2	4.4	6.0
P-Value (0.05)	0.2203	<0.0000	<0.0000	<0.0000	<0.0000	0.0375

Cooperator and Location: Bradley Farms, Glacier County.
Planted: 5/8/2017 on chemical fallow barley stubble. Harvested: 8/6/2017.
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 and 1 oz/ac Sharpen on 5/8/2017.
[1] Yield and test weight are adjusted to 13% seed moisture
Conducted by MSU Western Triangle Ag. Research Center.

Table 6. Four-year means, Barley varieties, Cut Bank area, Glacier County 2013, 2015-2017.

Variety Or ID	4-Year Mean					
	Yield (bu/ac)	Test weight (lbs/bu)	Plump (%)	Thins (%)	Height (inch)	Protein (%)
Champion	74.1	51.2	88.3	3.2	26.0	12.9
Haxby	62.9	51.5	89.6	2.6	25.8	12.7
Hockett	69.8	50.7	93.5	1.9	25.9	12.9
Metcalfe	63.8	50.2	91.5	2.4	26.1	13.4
Mean	67.6	50.9	90.7	2.5	25.9	13.0

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, 2017.

Variety	Yield[1] (bu/ac)	Test Wt[1] (lb/bu)	Plump (%)	Thin (%)	Plant Height (inch)	Protein (%)
Oreana	77.5	49.5	86.9	3.9	18.3	11.9
Champion	75.5	50.2	83.1	5.6	20.3	12.3
Lavina	69.8	45.7	68.6	10.3	20.3	12.3
Odyssey	68.6	48.5	95.4	1.4	18.3	11.0
Genie	62.4	47.7	78.2	6.9	19.0	12.4
MT124128	62.1	49.4	89.6	2.7	19.0	11.0
Copeland	58.0	46.3	87.5	3.3	22.3	13.3
Hockett	57.4	45.7	71.9	8.6	20.3	12.5
Bill Coors 100	56.7	47.7	91.4	2.5	17.7	13.5
MT090190	56.2	47.9	82.6	5.3	21.7	11.2
Haxby	54.8	47.9	55.1	14.9	19.3	13.1
Growler	54.6	44.1	75.8	7.3	20.0	12.1
Balster	54.1	44.5	68.8	11.4	19.0	12.4
Moravian165	53.7	46.4	79.4	6.2	20.3	13.3
Synergy	49.6	44.9	78.4	6.2	21.3	12.7
Metcalfe	41.5	46.2	75.8	7.5	21.0	13.4
Average	60.0	47.1	79.6	6.4	19.9	12.4
LSD (.05)	14.8	3.3	13.8	5.3	2.7	
C.V. (%)	12.0	3.4	8.5	40.8	6.6	4.2
P-Value (0.05)	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Cooperator and Location: Brian Aklestad Farms, Toole County.
Planted: 5/4/2017 on chemical fallow winter wheat stubble. Harvested: 8/22/2017.
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 and 1 oz/ac Sharpen on 5/4/2017.
[1] Yield and test weight are adjusted to 13% seed moisture
Conducted by MSU Western Triangle Ag. Research Center.

Table 8. Five-year means, Barley varieties, Devon area, Toole County 2012, 2014-2017.

Variety Or ID	5-Year Mean					
	Yield (bu/ac)	Test weight (lbs/bu)	Plump (%)	Thins (%)	Height (inch)	Protein (%)
Champion	63.2	50.2	83.8	6.3	21.1	12.1
Haxby	51.9	49.2	76.1	9.6	21.5	12.3
Hockett	51.9	48.2	84.0	5.9	21.6	12.3
Metcalfe	46.1	47.4	85.6	5.3	21.8	12.9
Mean	53.3	48.7	82.4	6.8	21.5	12.4

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. 2017.

Variety	Yield (bu/ac[1])	Test Wt (lb/bu[1])	Plump (%)	Thin (%)	Plant Height (inch)	Lodging (%)	Protein (%)
Oreana	85.6	46.8	68.0	8.7	25.0	0	14.0
Champion	81.2	48.7	64.7	8.2	26.3	1.3	13.5
Haxby	79.7	49.5	58.7	9.2	28.0	3.0	13.8
Genie	78.4	47.7	75.4	7.3	26.0	0	13.0
Hockett	76.7	47.7	83.6	4.7	26.7	1.3	13.3
Balster	75.9	43.7	71.7	9.8	25.3	0	14.2
Synergy	75.9	45.1	72.7	7.0	27.7	0.7	14.0
Metcalfe	73.6	46.0	71.6	6.9	27.7	1.3	14.3
Bill Coors 100	72.5	44.4	74.6	7.2	24.3	0	14.7
MT090190	72.4	48.6	85.6	3.1	28.0	0	12.4
Copeland	72.2	45.7	77.4	6.2	27.3	0.3	14.2
Morivian165	69.6	46.0	71.0	8.1	27.3	2.7	14.3
Odyssey	69.1	43.7	75.4	7.3	23.7	0.7	13.7
Growler	68.6	41.3	62.1	13.0	26.3	0	15.7
MT124128	67.8	49.4	80.5	3.8	24.3	3.0	12.3
Lavina	66.3	41.7	26.0	28.7	27.0	2.0	14.1
Average	74.1	46.0	69.9	8.7	26.3	1.0	13.8
LSD (.05)	7.7	1.4	13.3	4.5	1.6	2.0	0.7
C.V.	6.2	1.8	11.4	30.8	3.6	120.1	2.9
P-Value (0.05)	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000	0.0161	<0.0000

Cooperator and Location: Aaron Killion, western Chouteau County.
Planted: 5/6/2017 on chemical fallow winter wheat stubble. Harvested: 08/17/2017.
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/ac and 1 oz/ac Sharpen on 5/6/17.
[1] Yield and test weight are adjusted to 13% seed moisture
Conducted by MSU Western Triangle Ag. Research Center.

Table 10. Six-year means, barley varieties, Knees area, Chouteau county 2012-2017.

Variety Or ID	6-Year Mean					
	Yield (bu/ac)	Test weight (lbs/bu)	Plumps (%)	Thins (%)	Height (inch)	Protein (%)
Champion	71.6	47.1	77.6	9.3	25.7	13.1
Hockett	71.7	48.4	87.6	4.7	25.8	12.9
Haxby	70.0	48.5	80.1	6.9	25.8	13.1
Metcalfe	69.9	46.4	84.5	5.1	25.7	13.9
Mean	70.8	47.6	82.5	6.5	25.8	13.2

Conducted by MSU Western Triangle Ag. Research Center.

Table 11. Soil test values for off-station and on-station plots, 2017.

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	12.0	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 Fall	15.5	20	318	7.8	2.6	0.56
WTARC Spring	15.9	30	528	7.4	2.6	0.36
Sweetgrass Hills	3.5	27	336	6.7	2.5	0.23

[1]Nitrogen 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