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

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Personnel: John H. Miller, Research Associate and Julie Prewett, Research Assistant WTARC, Conrad, MT, and Jamie Sherman and Liz Elmore, MSU PSPP Dept., Bozeman, MT.

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. All plots were planted on no-till chemical fallow. Plots were trimmed, measured for length, then harvested with a Hege 140 plot combine. Spring barley seed was cleaned prior to collecting data.

Results: Data are presented for all off station barley location in Tables 1 thru 9, Table 10 shows soil test results for each location.

Overall, the crop year temperatures where close to the 29 year average at the research center with the exception of 2.5 inches less moisture than the 29 year average. The winter temperature was close to average, with the exception of November being 8 degrees cooler than usual, March being 7 degrees warmer than the normal. Also June was 4.6 degrees warmer compared to the 29 year average.

Soil temperatures at the station under chemical fallow stubble stayed under 40 degrees at a depth of eight inches until mid-April. May was cool with slightly above average precipitation. Early in June we received 0.95 inches, then it warmed up and remained dry for about 30 days, during that time the barley was running out of water as it was heading. July had normal amounts of rain.

Yields for the irrigated off station spring barley nursery, averaged 124.7 bu/ac, with an average kernel plumpness of 89.6%, a mean protein of 11.9%, and an average test weight of 51.1 lb/bu (Table 1). Three year means from the irrigated off station nursery are tabulated in (Table 2).

Grain yields averaged 50.0 bu/ac. at the Knees, 36.8 bu/ac north of Devon, and 82.6 bu/ac at the Choteau site. Kernel plumpness averaged 79.4 % and test weight averaged 50.7 lbs/bu at the Devon site while kernel plumpness averaged 83.2% and test weight averaged 45.2 lbs/bu at the Knees. Choteau kernel plumpness was 87.1 % and test weight averaged 52.0 lbs/bu (Tables 3, 6 and 8). The nursery at Cut Bank averaged 60.7 bu/ac, 50.3 lb/bu, 93.5% plumps, with 11.1 % seed protein (Table 5).

Top yielding varieties at the Knees were Champion, Harrington and Metcalfe, yields were 58.3, 57.6, and 56.7 bu/ac. Whereas the top yielding barleys north of Devon Champion, Lavina and Merit they yielded 47.6, 46.4 and 43.8 bu/ac. Yielding highest at the Choteau site were Lavina, Haxby and the Montana State University experimental variety MT100126, with yields of 95.7, 92.4 and 90.7 bu/ac. High yielding varieties at Cut Bank were Hockett, 70.2 bu/ac, Champion, 68.2 bu/ac and Haxby, 67.8 bu/ac. There is no long term data table for the Cut Bank location as it has suffered severe hail damage for the last two out of five years.

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 are 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. 2015 Irrigated off station spring barley variety trial, Conrad, MT.

Variety	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Plump %	Thin %	Heading Date Julian	Protein %
Champion	155.7	52.5	36.7	91.9	3.2	171.0	15.3
Haxby	142.1	53.7	31.7	92.4	3.4	172.0	14.2
MT100120	141.5	53.8	36.3	96.5	1.4	175.0	14.9
MT124027	132.8	52.2	32.3	95.6	1.2	174.0	16.1
Merit	127.9	50.7	32.7	92.1	3.2	174.0	14.7
Conrad	126.7	51.4	33.0	92.7	2.9	175.7	12.9
Craft	124.9	53.6	35.3	96.6	1.8	172.0	14.4
Moravian 115	124.2	49.4	28.7	94.4	2.2	177.7	14.6
MT124728	123.5	51.9	30.0	95.1	2.0	175.0	15.7
Metcalfe	122.9	51.6	35.7	93.5	2.7	174.0	14.3
MT100126	119.9	55.0	36.7	95.2	2.0	174.0	15.5
Stockford	119.8	47.8	35.7	88.6	3.8	173.0	13.6
Harrington	119.5	49.3	34.7	97.0	6.8	173.7	14.2
Hockett	112.1	53.4	32.7	93.0	1.7	173.0	15.4
Lavina	110.5	49.8	33.2	70.7	13.3	173.0	15.7
Haybet	91.8	46.3	37.0	58.6	20.0	172.3	15.1
Mean	124.7	51.1	33.8	89.6	4.5	173.7	11.9
LSD (.05)	25.5	2.5	4.2	4.9	2.5	2.4	
C.V. (s/mean)*100	12.3	2.9	7.4	3.3	33.3	0.8	
P-Value	0.0103	<0.0000	0.0070	<0.0000	<0.0000	0.0006	

Planted April 22, 2015 on fallow. Harvest August 19, 2015
Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting, 60-0-20 broadcast while seeding.
Fertilizer rates are based on achieving malt grade barley.
Growing season precipitation: 5.59 inches. Irrigation = 9.9 inches
Preplant sprayed with RT3 at 32 oz/ac on 4/22/15.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 2. 3-year Means, Irrigated off station spring barley varieties, Conrad, MT, 2013-2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Height inches	Head date Julian
Champion	121.7	52.4	95.4	1.7	11.8	33.8	178.4
Haxby	115.8	53.3	95.7	1.8	11.4	32.0	178.3
Conrad	114.4	51.2	96.3	1.5	11.0	30.6	180.7
Metcalfe	111.6	50.9	95.3	1.8	11.6	32.8	179.9
Craft	111.5	50.3	97.7	1.0	11.6	30.8	179.3
Harrington	106.1	49.7	96.2	3.1	11.4	32.5	179.7
Hockett	99.7	52.0	95.8	1.3	11.2	30.8	179.1
Mean	111.5	51.4	96.1	1.7	11.4	31.9	179.3

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

Table 3. Off-station spring barley variety trial located in the Choteau area. Western Triangle Ag. Research Center, 2015.

Variety	Spike	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Height inches
Lavina	2	95.7	48.8	68.0	21.6	15.5	25.7
Haxby	2	92.4	54.4	84.6	11.3	14.3	25.7
MT100126	2	90.7	54.2	90.9	5.9	13.5	26.7
Champion	2	88.9	54.0	93.6	4.5	14.3	27.0
Stockford	2	83.6	50.6	95.5	4.0	14.0	26.3
MT124728	2	82.8	51.4	81.7	13.3	15.6	25.7
Haybet	2	82.5	48.5	62.6	25.9	15.8	24.3
Moravian 115	2	81.9	51.1	91.4	6.7	14.3	24.0
MT100120	2	80.3	53.5	91.2	6.3	13.4	27.7
Hockett	2	79.9	53.0	93.2	4.7	15.4	26.3
MT124027	2	78.7	52.1	90.1	7.1	15.1	25.3
Metcalfe	2	77.8	52.2	92.7	6.2	15.5	25.0
Merit	2	77.3	50.1	83.0	11.3	15.9	24.3
Craft	2	77.2	54.7	96.5	2.7	15.3	29.3
Harrington	2	76.1	50.7	86.3	10.6	15.9	24.0
Conrad	2	75.4	51.9	91.6	6.4	16.7	25.3
Average		82.6	52.0	87.1	9.3	15.0	25.6
LSD (.05)		ns	0.9	6.3	4.5	0.7	1.9
C.V.		9.8	1.0	4.3	29.1	2.8	4.6
P-Value (0.05)		0.0918	<0.0000	<0.0000	<0.0000	<0.0000	<0.0000

Planted April 24, 2015 on chemical fallow. Harvest August 11, 2015.
Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting. Fertilizer rates are based on achieving malt grade barley.
Growing season Precipitation: Rain gauge tipped over when ditches were pulled up to the road surface.
Herbicide: None
Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 4. 4-year means, off station spring barley varieties, Choteau, MT, 2012-2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Height inches
Champion	69.6	51.4	76.2	7.8	13.7	27.6
Haxby	65.2	51.9	84.3	9.0	14.2	25.8
Craft	64.3	52.5	83.7	4.4	14.3	28.9
Hockett	63.4	49.9	80.2	11.3	14.9	26.2
Metcalfe	63.0	49.4	84.2	7.5	15.0	26.1
Conrad	61.0	49.7	80.9	9.6	15.6	25.0
Harrington	58.7	48.4	75.3	13.4	15.4	25.1
Mean	63.6	50.4	78.1	9.0	14.7	26.4

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

Table 5. Off-station spring barley variety trial located north of Cut Bank, MT. Glacier county. Western Triangle Ag. Research Center, 2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thins %	Plant Height inches	Protein %
Hockett	70.2	52.0	96.8	1.3	22.0	10.5
Champion	68.2	52.1	95.0	1.9	21.3	10.8
Haxby	67.8	53.1	96.1	1.2	21.3	10.5
Lavina	63.4	48.1	87.0	4.0	21.7	10.8
Moravian 115	62.3	48.0	95.8	1.2	16.7	11.3
Stockford	61.8	48.6	96.2	1.2	21.0	11.2
MT100126	61.1	51.8	96.9	1.0	22.3	10.4
Conrad	61.0	54.6	96.5	1.5	19.7	11.5
Metcalfe	60.1	50.5	94.7	1.9	21.0	11.5
Harrington	60.0	49.8	94.6	2.0	19.3	11.1
MT100120	60.0	50.9	95.0	1.9	22.0	10.2
MT124027	59.8	49.8	95.0	2.0	20.3	10.6
MT124728	57.5	48.9	92.3	3.0	19.3	11.7
Merit	55.7	47.5	92.2	2.7	19.3	11.8
Craft	52.3	51.4	95.4	2.1	24.0	11.2
Haybet	49.2	47.9	77.4	5.9	23.0	12.3
Mean	60.7	50.3	93.5	2.2	20.9	11.1
LSD (.05)	9.0	3.6	3.0	1.3	2.5	
C.V. 1 (%) (S/mean)*100	8.9	4.2	1.9	34.7	7.2	
P-Value	0.0043	0.0068	0.0000	<0.0000	0.0004	

Cooperator and Location: Bradley Farms, northern Glacier county.
Planted April 30, 2015 on chem-fallow. Harvested August 24, 2015.
Fertilizer, actual lbs/ac: 11-22.5-0 with seed at planting.
Sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/4/2015.
Precipitation from 4/30/2015 until harvest was: 4.2 inches.
Conducted by MSU Western Triangle Ag. Research Center.

Table 6. Off-station spring barley variety trial located north of Devon, MT. Toole county. Western Triangle Ag. Research Center, 2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plant Height inches	Plump %	Thin %	Protein %
Champion	47.6	51.8	18.0	77.6	15.7	15.2
Lavina	46.4	48.4	20.3	59.9	25.5	16.2
Merit	43.8	50.0	19.7	76.1	16.7	16.4
MT124728	42.1	50.7	20.3	78.2	15.4	16.1
MT100120	39.6	52.3	18.0	88.7	7.4	13.9
Conrad	38.9	50.7	18.3	88.9	9.3	16.7
MT100126	38.6	51.5	18.7	87.2	10.3	14.8
Haxby	38.4	51.5	19.3	74.9	20.0	15.7
Stockford	36.5	48.9	20.0	91.6	5.6	15.2
MT124027	36.2	50.4	18.0	81.2	13.0	16.0
Haybet	33.4	47.1	18.0	27.8	40.1	17.8
Craft	32.9	53.0	19.7	91.2	5.3	16.5
Moravian	30.6	50.9	19.3	90.2	6.3	16.9
Metcalfe	30.4	51.1	20.3	92.1	8.2	16.7
Hockett	26.9	52.3	19.0	89.2	6.7	17.6
Harrington	26.0	50.2	18.0	74.9	18.4	18.2
Mean	36.8	50.7	19.1	79.4	14.0	16.2
LSD (0.05)	10.6	1.2	ns	16.0	9.8	1.4
C.V. (s/mean)*100	17.2	1.4	7.2	12.1	42.1	5.2
P-Value	0.0039	<0.0000	0.2212	<0.0000	<0.0000	<0.0000

Cooperator and Location: Brian Aklestad farm, north east of Devon.
Planted April 27, 2015 on chemical fallow. Harvest August 12, 2015.
Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting, 30-0-20 broadcast while seeding. Fertilizer rates are based on achieving malt grade barley.
Growing season precipitation: 1.25 inches. Rain gauge was cracked at some point during growing season.
Herbicide: The plot area was pre-plant sprayed with 32 oz/ac RT3 on 4/27/2015. The plots were sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/11/2015.
Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 7. 5-year means, off station spring barley varieties, Devon, MT, 2011-2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Height inches
Champion	57.5	51.2	82.8	6.5	10.9	22.3
Conrad	57.0	49.1	89.4	4.6	11.9	21.9
Hockett	54.4	49.3	83.8	6.2	11.6	22.8
Harrington	52.3	48.0	86.5	7.4	12.0	21.8
Craft	51.9	49.6	89.6	3.1	11.7	25.0
Haxby	49.8	50.8	83.2	8.2	11.2	22.8
Metcalfe	49.4	48.6	87.0	4.9	11.7	23.2
Mean	53.2	49.5	86.0	5.9	11.6	22.8

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

Table 8. Off-station spring barley variety trial located in the Knees area. Western Chouteau County. Western Triangle Ag. Research Center. 2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Plant Height inches	Protein %
Champion	58.3	45.9	81.0	9.0	23.0	13.6
Harrington	57.6	45.4	85.1	7.2	21.0	14.7
Metcalfe	56.7	46.4	89.1	4.0	21.7	14.3
MT124728	56.2	48.0	89.5	3.1	20.3	14.6
Merit	56.1	45.1	87.4	5.5	19.3	14.5
MT124027	56.0	46.1	87.4	4.9	21.3	13.4
Moravin	55.8	44.6	91.2	4.0	13.3	13.7
Hockett	52.3	48.9	91.7	3.9	22.7	13.6
Haxby	52.3	48.9	88.9	4.1	21.0	13.5
Craft	52.2	47.9	88.8	5.3	22.7	13.8
MT100120	48.9	43.9	81.6	8.6	21.7	12.7
Lavina	44.0	40.4	62.9	19.5	20.7	13.8
Conrad	43.2	45.0	85.8	6.6	20.7	15.4
Haybet	41.3	42.5	60.9	14.4	23.3	15.2
MT100126	41.0	44.0	79.0	11.0	22.7	12.3
Stockford	36.1	40.3	81.3	9.2	22.3	13.7
Means	50.0	45.2	83.2	7.5	21.1	14.1
LSD (.05)	11.7	1.8	5.3	3.8	3.4	
C.V.	14.0	2.4	3.9	30.2	9.6	
P-Value (0.05)	0.0019	<0.0000	<0.0000	<0.0000	0.0006	

Cooperator and Location: Aaron Killion, western Chouteau County.
Planted April 23, 2015 on chemical fallow winter wheat stubble. Harvest August 31, 2015.
Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting, 0-0-20 broadcast while seeding.
Fertilizer rates are based on achieving malt grade barley.
Growing season precipitation: 4.0 inches.
Herbicide: The plot area was pre-plant sprayed with 32 oz/ac RT3 on 4/23/15.
Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 9. 5-year means, off station spring barley varieties, Knees area, MT, 2013-2015.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Height inches
Haxby	69.2	51.1	82.5	4.9	12.4	12.4
Harrington	67.9	48.6	87.2	4.2	12.8	25.5
Champion	67.8	50.1	84.3	5.1	12.4	25.7
Craft	65.9	50.2	87.5	4.2	13.1	27.7
Metcalfe	65.6	48.7	87.1	3.9	13.2	26.1
Hockett	65.6	50.1	87.2	4.8	12.4	25.9
Conrad	62.6	49.0	85.6	5.3	12.9	25.4
Mean	66.4	49.7	85.9	4.7	12.7	25.8

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

Table 10. Soil test values for off-station and on-station plots, 2015.

Location	N (lbs/ac)[1]	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	8.3	21	355	7.7	2.1	0.61
Devon	11.4	11	388	7.2	1.1	0.33
Knees	23.3	11	652	8.1	2.8	0.69
Choteau	67.6	10	664	8.1	2.9	0.59
WTARC	15.1	17	375	7.8	2.4	0.47

[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