Title: Spring barley variety evaluation with a special reference to insect infestations in the Western Triangle Region

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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 winter wheat 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 plot combine. Spring barley seed was cleaned prior to collecting data. The insect monitoring activity was initiated in all the entries. The plant samples were collected randomly and brought to the laboratory. The stems were cut and noticed for the diapausing stages of the larvae of the wheat stem sawfly. Orange wheat blossom midge pheromone traps were also installed at each off station plot.

Results: Table 1 and 2 are data from the off station irrigated barley trial. Tables 3 thru 8 are for off station barley nurseries. The Cut Bank nursery was lost to hail. Soil test values are presented in Table 9.

Overall, the crop year was a little over 3 degrees cooler than the 28 year average at the research center with a little over an inch more moisture than the 28 year average. The winter, with the exception of January was cooler than usual. February was quite cold when compared to the 28 year average. The spring was quite cool with April being slightly cooler and wetter than the 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 and dry. Early in June we received 0.9 inches, then it warmed up and remained dry for about 10 days. At that time the winter wheat was running out of water as it was beginning to head. About that time we started

getting significant rain for a five day span. The cool temps associated with the rain speeded up the barley heading.

Just as things were getting mature or close to mature the rain in August came at a very poor time. To further exacerbate the harvest situation we received snow on September 10^{th} and 11^{th}.

The irrigated off station barley was harvested after the wet period in August. There was sprout and mold damage in the irrigated off station nursery. Yields for the irrigated off station spring barley nursery, averaged 111.0 bu/ac, with an average kernel plumpness of 98.1%, a mean protein of 10.4%, and an average test weight of 50.3 lb/bu (Table 1). Two year means from the irrigated off station nursery are tabulated in Table 2.

Grain yields averaged 73.4 bu/ac at the Knees, 57.8 bu/ac north of Devon, and 78.2 bu/ac at the Choteau site. Kernel plumpness averaged 90.9% and test weight averaged 46.4 lbs/bu at the Devon site while kernel plumpness averaged 88.4% and test weight averaged 46.9 lbs/bu at the Knees. Choteau kernel plumpness was 66.1% and test weight averaged 49.2 lbs/bu. Top yielding varieties at the Knees were Haxby, Champion, and the Montana State University experimental line MT100120, yields were 84.0, 80.7, and 79.2 bu/ac. Whereas the top yielding barleys north of Devon were Tradition, and the Montana State University experimental lines MT100120 and MT090180, the yielded 64.9, 63.7, and 62.6 respectively. Yielding highest at the Choteau site were Champion, Craft, and MT100120, with yields of 91.5, 86.2, and 82.4. The Cut Bank site was not harvested due to severe hail damage.

None of the off station sites did well with respect to having malting quality spring barley.

No insect incidence (wheat stem sawfly or wireworms) was noticed in any of the spring wheat varieties. This is because of the high number of parasitoids of the wheat stem sawfly are present Devon area. None of the traps got any adults of orange wheat blossom midge 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.

Funding Summary: Office of Special Projects will provide expenditure information. No other grants support this project.

MWBC FY2015 Grant Submission Plans: A similar project will be proposed for FY 2015. The continuation of on and off-station variety trials help to elucidate researchers and farmers which varieties are better suited for that particular region in Montana.

Table 1. 2014 Irrigated off station spring barley variety trial, Conrad, MT.

Variety	Yield bu/ac	Test Wt lb/bu	Height in.	Plump %	Thin %	Heading Date	Protein %
MT100120	125.9	51.9	31.7	99.2	0.2	187.0	9.5
Geraldine	121.0	51.8	34.7	98.0	1.6	183.7	11.6
Champion	119.9	50.8	32.0	98.0	0.8	186.0	10.8
Conrad	118.8	49.7	32.0	98.6	0.5	185.0	10.8
MT090180	117.7	50.9	32.0	99.4	0.1	185.0	9.2
Metcalfe	117.1	49.0	32.0	96.5	1.2	185.3	10.9
Eslick	117.0	49.4	28.7	97.7	0.6	185.0	9.7
Craft	116.9	51.6	33.0	98.5	0.5	186.3	10.9
MT100126	114.1	51.2	31.7	98.4	0.2	186.3	9.3
Harrington	110.0	47.9	30.7	96.4	1.0	185.3	10.8
Gallatin	118.2	51.8	33.7	98.0	0.6	185.7	10.8
Haxby	105.7	51.0	31.7	98.0	0.6	184.0	10.2
Hockett	100.4	50.3	28.7	98.4	0.6	185.0	9.6
MT090190	100.3	48.9	30.6	99.0	0.3	184.0	11.1
Cowboy	94.8	50.8	38.7	98.3	0.5	185.3	11.1
Tradition	88.7	48.6	35.3	97.5	0.5	185.3	10.4
Mean	111.0	50.3	32.3	98.1	0.6	185.3	10.4
LSD (.05)	14.6	0.6	3.4	0.9	0.4	ns	
C.V. (s/mean)*100	7.9	0.7	6.3	0.6	37.5	0.8	
P-Value	0.0003	<0.0001	0.0003	<0.0001	<0.0001	0.4140	

Planted May 1, 2014 on chemical fallow barley stubble. Harvest September 6, 2014.
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 ppt: 8.35 inches. Irrigation = 4.0 inches
Preplant sprayed with RT3 at 20 oz/ac on 5/1/2014. Sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/10/2014.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 2. 2-year means, irrigated off station spring barley varieties, WTARC. 2012 and 2014.

	2-Year means						
Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.	Head date Julian
Eslick	114.2	51.2	96.0	1.4	10.4	30.7	184.7
Geraldine	110.6	52.5	96.0	1.9	10.1	33.5	184.0
Conrad	108.3	51.2	98.1	0.8	10.0	29.4	183.2
Metcalfe	106.0	50.6	96.2	1.4	9.3	31.4	182.8
Champion	104.7	52.4	97.2	1.0	10.1	32.4	182.2
Haxby	102.6	53.1	97.3	1.0	9.1	32.2	181.5
Harrington	99.5	49.9	95.9	1.3	10.0	31.4	182.7
Gallation	98.8	52.8	96.6	1.2	10.1	31.7	181.9
Hockett	93.5	51.3	97.2	1.1	10.2	29.9	182.2
Tradition	92.6	49.5	96.9	0.6	10.1	35.2	181.5
Cowboy	91.5	52.2	98.4	0.6	10.7	38.9	183.5
Mean	102.0	51.5	96.9	1.1	10.0	32.4	182.7

All barleys are 2 row with the exception of Tradition.
Conducted by 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. 2014.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Plant Ht (in)
Champion	91.5	51.7	74.6	5.9	11.0	29.3
Craft	86.2	51.8	80.4	6.3	11.3	32.3
MT100120	82.4	52.0	83.3	5.7	11.0	31.3
Tradition	81.5	49.0	76.3	5.6	11.5	35.3
Haxby	80.2	50.9	59.5	16.6	12.4	30.3
Gallatin	80.0	49.1	61.6	15.6	13.8	30.0
Hockett	79.3	47.7	63.5	16.9	12.8	28.3
Geraldine	77.7	48.1	53.7	22.7	13.5	30.0
Metcalfe	76.7	47.1	66.7	13.0	12.7	30.3
MT100126	76.5	50.3	74.1	9.6	11.5	31.7
Conrad	75.3	47.9	67.9	14.0	12.2	28.7
MT090180	74.5	49.3	70.6	12.2	11.5	31.0
Harrington	73.6	46.3	63.6	15.5	12.6	29.0
Eslick	73.0	47.5	27.3	38.0	13.8	27.3
Cowboy	72.3	48.6	75.3	9.1	13.4	36.3
MT090190	70.8	50.0	62.5	15.3	15.2	27.0
Average	78.2	49.2	66.1	13.9	12.5	30.5
LSD (.05)	7.5	2.4	17.4	12.0		2.1
C.V.	4.7	2.9	15.7	52.0		4.1
P-Value (0.05)	0.0003	0.0002	0.0002	0.0009		<0.0001

Cooperator and location: Inbody Farms, northeast of Choteau.

Planted May 6, 2014 on chemical fallow. Harvest August 13, 2014.

Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting, 15-0-20 broadcast while seeding. Fertilizer rates are based on achieving malt grade barley.

Herbicide: None
Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 4. 3-year means, dry land spring barley varieties, Choteau. 2012 - 2014.

Variety	3-Year means					
	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Champion	63.1	50.5	70.4	8.9	13.5	27.8
Eslick	60.8	47.7	61.1	22.2	15.6	24.7
Geraldine	60.6	48.7	66.7	16.3	15.21	25.8
Metcalfe	58.1	48.5	81.3	7.9	14.8	26.4
Hockett	57.9	48.9	81.3	10.4	14.8	25.6
Tradition	57.3	48.3	71.2	8.1	14.4	30.2
Conrad	56.2	48.9	77.3	10.6	15.2	24.9
Haxby	56.1	51.1	78.7	11.2	14.1	26.3
Gallation	55.4	49.2	80.7	10.6	15.4	26.7
Harrington	52.9	47.6	47.7	14.3	15.2	25.4
Cowboy	51.4	48.9	78.1	6.8	15.1	31.3
Mean	57.2	48.9	72.2	11.6	14.8	26.8

All barleys are 2 row with the exception of Tradition.
Cooperator and location: Inbody Farms, northeast of Choteau.

Fertilizer, actual (lbs/ac): 11-22-0 place with seed at planting, 15-0-20 broadcast while seeding. Fertilizer rates are based on achieving malt grade barley.

Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 5. 2014 spring barley variety trial, Devon, MT.

Variety	Yield bu/ac	Test Wt lb/bu	Height in.	Plump %	Thin %	Protein %
Tradition	64.9	45.8	22.3	93.1	1.4	12.4
MT100120	63.7	48.2	23.0	95.7	1.1	11.2
MT090180	62.6	47.3	22.7	94.1	1.4	11.3
Conrad	62.3	46.0	20.0	93.0	2.1	12.9
Champion	61.5	48.5	20.0	94.4	1.4	11.6
Harrington	60.7	44.1	21.0	88.3	3.5	12.6
Hockett	59.6	46.5	21.0	90.9	2.9	11.5
Craft	58.0	47.0	24.7	92.8	2.0	12.6
Haxby	57.3	47.6	22.3	91.2	2.2	12.0
MT090190	56.0	47.2	20.3	94.9	1.4	13.6
Geraldine	55.2	46.0	22.7	89.4	3.1	12.0
MT100126	54.6	46.8	23.0	91.6	2.4	11.3
Eslick	54.3	44.6	20.0	75.9	7.1	12.1
Gallatin	53.0	45.2	22.3	83.9	5.6	12.3
Cowboy	51.6	46.8	27.7	94.3	1.9	13.3
Metcalfe	49.9	44.5	20.0	90.5	2.2	12.6
Mean	57.8	46.4	22.1	90.9	2.6	12.2
LSD (0.05)	6.4	1.3	2.4	6.7	2.2	
C.V. (s/mean)*100	6.6	1.7	6.6	4.4	51.3	
P-Value	0.0004	<0.0001	<0.0001	0.0002	0.0002	

Cooperator and Location: Brian Aklestad farm, north east of Devon.

Planted May 21, 2014 on chemical fallow. Harvest September 7, 2014.

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 ppt: 3.8 inches.

Herbicide: The plot area was pre-plant sprayed with 20 oz/ac RT3 on 5/21/2014. The plots were sprayed with Huskie at 11 oz/ac and Axial XL at 16.4 oz/ac on 6/16/2014.

Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 6. Three-year means, Barley varieties, Devon area, Eastern Toole County. 2011-2010, and 2014.

Variety	3-Year Mean					
	Yield bu/ac	Test weight	Plump %	Thin %	Protein %	Plant Height
Haxby	61.6	50.6	86.5	10.8	10.1	26.3
Tradition	60.2	48.2	86.1	4.2	10.6	23.1
Gallatin	58.9	48.5	89.4	6.1	10.7	24.1
Champion	58.6	51.3	84.8	4.0	10.0	23.4
Hockett	58.4	48.6	83.8	4.7	10.5	23.1
Metcalfe	58.0	48.0	79.9	5.3	10.1	24.1
Geraldine	56.5	48.6	87.0	7.3	10.4	25.2
Harrington	55.0	47.5	74.1	3.4	10.4	23.2
Conrad	54.6	48.7	83.2	4.1	10.3	24.0
Eslick	52.5	50.3	76.2	8.1	9.9	21.5
Cowboy	46.7	49.6	92.6	3.0	11.3	31.2
Mean	56.4	49.1	84.0	5.5	10.4	24.5

All barleys are 2 row with the exception of Tradition.

Cooperator and location: Brian Aklestad, northeast of Devon.

Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 7. Off-station spring barley variety trial located in the Knees area. Western Chouteau County. 2014.

Variety	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Plant Height (in)	Protein %
Haxby	84.0	49.0	88.0	2.4	29.7	13.5
Champion	80.7	48.9	93.2	1.8	26.7	13.0
MT100120	79.2	48.5	94.0	1.5	31.3	12.9
Hockett	78.1	47.4	89.4	3.4	29.0	13.6
MT100126	77.6	47.6	92.9	2.0	31.3	12.0
Eslick	76.9	45.7	70.7	9.4	24.3	14.1
Craft	76.1	47.2	91.7	2.5	32.0	14.2
Tradition	75.6	44.2	76.6	6.3	30.3	13.8
MT090180	74.5	47.7	93.7	1.6	29.3	12.7
Conrad	73.4	47.5	93.6	2.4	26.3	13.9
Geraldine	73.0	47.3	91.8	3.4	30.0	14.3
Harrington	70.4	44.5	86.2	3.6	28.3	14.0
Gallatin	69.8	47.4	85.4	4.6	30.7	13.4
Metcalfe	69.7	44.5	85.5	4.1	29.0	14.5
MT090190	63.6	46.3	91.0	2.5	25.0	15.8
Cowboy	51.9	46.2	89.8	3.8	35.0	15.2
Average	73.4	46.9	88.4	3.5	29.3	13.8
LSD (.05) =	11.9	1.5	13.2	5.0	2.7	
C.V. =	9.7	2.0	8.9	70.3	5.5	
P-Value (0.05)	0.0021	<0.0001	0.0460	0.0428	<0.0001	

Cooperator and Location: Aaron Killion, western Chouteau County.

Planted May 21, 2014 on chemical fallow. Harvest September 6, 2014.

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 ppt: 3.8 inches.

Herbicide: The plot area was pre-plant sprayed with 20 oz/ac RT3 on 5/21/2014. Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 8. 5-year means, dryland spring barley varieties, Knees, MT, 2010 - 2014.

Variety	5-Year Means					
	Yield bu/ac	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Harrington	72.8	49.6	83.3	3.9	12.3	29.1
Champion	71.2	51.3	85.8	3.7	12.3	25.8
Gallatin	71.2	50.8	86.7	3.7	12.4	27.2
Haxby	71.0	51.8	88.9	10.4	12.8	28.3
Geraldine	70.9	50.0	87.1	4.9	12.6	25.4
Eslick	68.9	50.0	75.2	9.8	12.6	24.3
Metcalfe	68.5	49.5	87.0	4.7	12.8	26.1
Conrad	67.9	50.1	87.6	4.7	12.4	26.7
Tradition	66.2	48.9	79.5	5.2	12.5	26.1
Hockett	64.8	50.0	76.4	4.6	12.5	26.7
Cowboy	59.7	50.0	87.4	4.4	13.4	30.7
Mean	68.5	50.2	84.1	5.4	12.6	26.9

Cooperator and Location: Aaron Killion, western Chouteau County.

Conducted by MSU Western Triangle Ag Research Center, Conrad, MT.

Table 9. Soil test values for off-station and on-station plots, WTARC, 2014.

Location	N (lbs/a)[1]	Olsen-P (ppm)	K (ppm)	pH	OM (%)	EC (mmhos/cm)
Cut Bank	54.6	18	394	7.9	2.4	0.44
Devon	11.9	18	408	6.6	1.0	0.18
Choteau	26.5	11	550	8.0	2.7	0.62
WTARC	17.6	18	346	7.5	2.7	0.38

[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