On-Farm Cereal Variety and Advanced Breeding Line Testing across Montana for Environment Specific Cultivar Recommendations:

Spring Barley Off-Station Variety Performance, Havre, MT

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Objectives:

Commercially available spring barley varieties and advanced breeding lines were evaluated for agronomic performance and fit at on-farm locations across the state of Montana. Sites chosen for the research considered the environment, growing conditions and soil types, and represent the major land areas for producers in those regions served by Northern Agricultural Research Center (NARC). In 2009, three off-station spring barley variety trials were dropped from the NARC off-station testing program due to extensive feeding by deer and antelope, which made results meaningless. In northcentral Montana, barley production makes up 22 percent of the state's production. Because farmers base production decisions on variety performance data generated under local conditions, collaboration in the standardized off-station spring barley variety trial was reestablished in 2022.

Methods:

The uniform off-station barley variety performance trial was seeded into chemical fallow ground during 2024. The trial consisted of 25 entries focusing on seed production of three different end use markets including malt, feed or forage. The trial was seeded in replicated, 3-row, 22-foot plots on a 12-inch row spacing, utilizing a self-propelled cone seeder with Atom Jet paired row openers. All rows of each plot were trimmed to a harvest length of approximately 17 feet with a three-point rototiller. Plant height was measured from the soil surface to the top of the head, excluding awns. If observed, crop lodging and percent sawfly cutting was visually estimated for each plot immediately prior to harvest. A 'Wintersteiger' small plot combine, funded in part by Montana Wheat and Barley Committee, was used to harvest each 3-row plot. Prior to measuring plot weight for yield determination, seed was either cleaned or weighed in-dirt as per protocols. Protein, test weight and moisture content were determined on a clean sample using a Foss Infratec 1241 near infrared analyzer. Plump seed was determined by calculating the percent of barley that remained on top of a 6/64" x 3/4" inch slotted-hole sieve after mechanically shaking for 30 strokes.

Results:

This report contains both single-year and long-term data summaries limited to the most recent ten years. It should be noted that the 2024 data table in this report represents varietal performance for a

single crop year at a single location, therefore cannot be considered representative of performance expected when differing conditions due to location, year and management are imposed. By itself, 2024 data shall not constitute in any form a recommendation for or against any variety or breeding line included.

The 2024 Havre off-station dryland spring barley trial data was analyzed by barley type or end use. Spring barley seed yields for the **malt and feed** entries at Havre averaged 98 bu/ac (Table 1). The feed barley breeding line 'MT18M10106' was the highest yielding entry at 116 bu/ac. 'LCS Odyssey' was the only entry to produce seed yields statistically equal to that of MT18M10106. Test weights averaged over 58.4 lb/bu, with Haxby being the heaviest at nearly 57 lb/bu.

Seed yields for the **forage barley** entries averaged 98 bu/ac and breeding line 'MT20_F108_13' was the highest yielding entry at over 107 bu/ac (Table 2). 'Hays', 'Lavina' and one other breeding line produced seed yields statistically equal to that of MT20_F108_13.

Seed yield, test weight, protein, plump kernels, heading date, maturity date and plant height, as appropriate, for the 2024 Havre off-station dryland spring barley trial are summarized according to end use in Tables 1 and 2.

Comparable averages are calculated using a standard check variety when not all entries are present in a specific trial for all years. Variety means are adjusted by multiplying the actual check mean by the ratio of the individual variety mean compared to the check mean for the same years as tested. All varieties are then directly comparable to each other when in the same nursery. A minimum of three years of data is necessary to be included in the comparable average calculation. Because the barley trial was initiated near Havre in crop year 2022, comparable averages for a limited number of entries are available for the first time this year. Multi-year yield and test weight data are available in Table 3 while plump kernel and protein data are available in Table 4.

Summary:
Spring barley near Havre had great stand uniformity and received above average precipitation in May resulting in increased tillering, biomass, and seed production. Below normal temperatures during June limited environmental stresses during seed fill which contributed to high test weights and high plump kernel percentages.

Producers have been asking for information on spring barley varieties in northcentral Montana for several years. Because named varieties were dropped from the intrastate trial grown at the research center, and consistent data could not be obtained from small plot on-farm trials due to deer and antelope grazing, it was decided that the best option would be to grow the off-station trial at Northern Agricultural Research Center, behind the protection of a permanent deer fence. With budget and other resources allowing, it is planned to continue growing the standardized off station spring barley variety trial on-station to better serve producers in northcentral Montana with public and private variety information.

Recognition:
This research would not have been possible without the assistance of the following seasonal employees: Callie Bebee, David Bischoff, Clara Haslem, Brady Kueffler, Cleta Lamb, and Teresa Miller.

TABLE 1. MALT & FEED - Dryland Fallow Spring Barley Evaluation Nursery Grown On-Station at Havre. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 24-2702-SB)

ID	TYPE	1/ YIELD bu/ac	TEST WT lb/bu	2/ PROTEIN %	PLUMP %	3/ HEAD date	3/ MATURE date	PLNT HT inches
Haxby	Feed	106.0	**56.8**	11.9	88.1	173	**201**	**28.7**
MT Boy Howdy	Feed	104.9	55.0	**11.1**	94.2	174	205	**27.6**
AC Metcalfe	Malt/Feed	83.3	55.0	13.7	91.1	174	**202**	**27.9**
Hockett	Malt/Feed	99.8	56.0	12.5	**97.4**	174	204	**28.0**
MT18M10106	Malt/Feed	**115.9**	55.6	**11.2**	**97.0**	175	206	**29.0**
MT18M11004	Malt/Feed	94.9	55.4	12.8	81.4	174	204	27.0
AAC Synergy	Malt	96.1	53.7	12.1	90.2	174	204	**27.6**
ABI Eagle	Malt	86.0	52.3	13.3	65.7	177	205	25.5
ABI Voyager	Malt	92.8	53.1	13.3	92.2	176	204	**29.3**
Buzz	Malt	94.9	55.4	**11.4**	**97.7**	174	205	26.6
LCS Genie	Malt	99.3	54.6	13.6	78.0	178	**203**	23.7
LCS Odyssey	Malt	**106.9**	52.9	12.0	87.4	179	205	23.7
Merit 57	Malt	98.9	52.7	12.2	78.8	178	205	26.3
MT Endurance	Malt	89.4	53.6	**11.8**	**97.9**	173	205	27.4
MT19_M022_10	Malt	96.4	51.7	12.3	86.4	179	206	24.9
MT19_M034_16	Malt	97.8	54.0	**11.3**	91.1	177	204	26.1
MT19_M095_04	Malt	103.1	**56.6**	**11.4**	**97.1**	**172**	205	25.7
EXPERIMENTAL MEANS		98.0	54.4	12.2	88.9	175.4	204.3	26.8
LSD (0.05)		9.8	0.7	0.7	3.6	1.3	1.9	1.8
C.V.%		6.0	0.8	3.3	2.4	0.5	0.5	4.1
P-VALUE (Varieties)		<.0001	<.0001	<.0001	<.0001	<.0001	0.0	<.0001

1/ Volumetric yields are based on plot weights adjusted to uniform 13 percent grain moisture and 48 lbs/bu as the standar test weight for barley.

2/ Protein values are adjusted to 13 percent grain moisture.

3/ No. of Days from January 1 (174 = June 23, 195= July 14).

Bold indicates the highest or lowest value within a column (whichever is most desirable for the specific characteristic).

Bold indicates values equal to the underlined value within a column based on Fisher's protected LSD (P=0.05).

Management Information (24-2702-SB)

Seeding Date:	April 22, 2024
Harvest Date:	August 2, 2024
Fertility:	46-9-5-5
System:	No-Till
Herbicide:	Vendetta (24 oz/ac)
Insecticide:	none
Previous Crop:	Chemical Fallow - Oilseeds
Precipitation:	7.60"

TABLE 2. FORAGE - Seed Components Only. Dryland Fallow Spring Barley Evaluation Nursery Grown On-Station at Havre. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 24-2702-SB)

ID	TYPE	1/ YIELD bu/ac	TEST WT lb/bu	2/ PROTEIN %	3/ HEAD date	3/ MATURE date	PLNT HT inches
Haybet	Forage	85.8	**53.1**	**14.1**	**174**	**200**	**34.2**
Haymaker	Forage	96.3	**53.6**	**14.3**	**174**	**200**	31.2
Hays	Forage	**101.1**	**53.2**	12.6	177	**201**	27.7
Lavina	Forage	**100.3**	51.4	13.3	**173**	202	28.9
MT Cowgirl	Forage	93.8	52.4	13.4	**174**	**201**	31.5
MT16F01601	Forage	94.6	51.9	12.9	**173**	203	31.1
MT17F02410	Forage	**100.8**	52.7	13.0	175	**199**	26.7
MT20_F108_13	Forage	**107.4**	**53.4**	**13.5**	176	202	28.0
EXPERIMENTAL MEANS		97.5	52.7	13.4	174.5	201.1	29.9
LSD (0.05)		7.9	0.9	0.9	2.1	3.0	2.4
C.V.%		4.6	1.0	3.7	0.7	0.9	4.6
P-VALUE (Varieties)		0.0021	0.0010	0.0088	0.0073	0.3326	0.0002

1/ Volumetric yields are based on plot weights adjusted to uniform 13 percent grain moisture and 48 lbs/bu as the standard test weight for barley.

2/ Protein values are adjusted to 13 percent grain moisture.

3/ No. of Days from January 1 (174 = June 23, 201 = July 20).

Bold indicates the highest or lowest value within a column (whichever is most desirable for the specific characteristic).
Bold indicates values equal to the underlined value within a column based on Fisher's protected LSD (P=0.05).
NS for non-significant replaces the LSD when the probability value (P-Value) exceeds 0.05.

Management Information (24-2702-SB)

Seeding Date:	April 22, 2024
Harvest Date:	August 2, 2024
Fertility:	46-9-5-5
System:	No-Till
Herbicide:	Vendetta (24 oz/ac)
Insecticide:	none
Previous Crop:	Chemical Fallow - Oilseeds
Precipitation:	7.60"

TABLE 3. Three-Year Yield and Test Weight Summary on Selected Entries from Dryland Fallow Barley Variety Nurseries Grown at Havre. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 2702-SB)

			[1/] YIELD (Bushels Per Acre)								TEST WEIGHT (Pounds Per Bushel)							
2/ VARIETY		[3/] No. of YEARS TESTED	2022	2023	2024	2025	2026	[3/] AVE. for YEARS TESTED	[4/] % of CHECK YIELD	[5/] **3-YR COMP. AVE. YIELD**	2022	2023	2024	2025	2026	[3/] AVE. for YEARS TESTED	[4/] % of CHECK TEST WT	[5/] **3-YR COMP. AVE. TEST WT**
Lavina	Forage	3	73.1	63.6	100.3			79.0	124.6	**90.4**	45.6	47.8	51.4			48.3	98.5	**50.5**
Haxby	Feed	3	78.6	54.3	106.0			79.6	109.8	**79.6**	52.2	52.4	56.8			53.8	105.1	**53.8**
MT Boy Howdy	Feed	3	75.3	57.4	104.9			79.2	109.2	**79.2**	50.0	50.3	55.0			51.8	101.1	**51.8**
Buzz	Malt	3	67.8	55.8	94.9			72.8	100.4	**72.8**	50.6	50.5	55.4			52.2	101.9	**52.2**
Hockett	Malt/Feed	3	63.4	54.4	99.8			72.5	100.0	**72.5**	49.0	48.6	56.0			51.2	100.0	**51.2**
MT Endurance	Malt	3	64.5	54.8	89.4			69.6	96.0	**69.6**	46.6	46.6	53.6			48.9	95.6	**48.9**
MEANS (For Entries Listed)			70.5	56.7	99.2			75.5	106.7	77.4	49.0	49.4	54.7					51.4
April-July Precip. (in.)			5.5	6.4	7.6			6.5										
Total Annual Precip. (in.)			8.2	12.0	14.9			11.7										
Soil PAW (in.) to SD @ Planting			8.1	6.6	6.4			7.1										
Total Plant Available Water (in.)			14	13	14			14										
Soil NO3 (lbs.) to SD at Planting			133	175	58			122										
SD (Sampling Depth in Inches)			48	48	48			48										
Fertilizer Applied		(# N)	46	46	46			46										
		(# P2O5)	9	9	9			9										
		(# K2O)	5	5	5			5										
		(# S)	5	5	5			5										

Check Variety is Hockett.

1/ See MCES Bulletin 1094 or the Plant Sciences & Plant Pathology website at http://plantsciences.montana.edu/ for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making cultivar selecton decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending.

3/ Only the most recent 5 years are shown, but summary calculations include all years noted.

4/ Percent of Hockett yield or test weight for the same data years as those in which a given entry was tested.

5/ 3-Yr Comparable Average = (x/y) * z where x = average yield or test weight of a given entry for years tested, y = average yield or test weight for Hockett for the same years, and z = 3-Yr average yield or test weight for the check variety Hockett.

TABLE 4. Three-Year Plump Kernel and Protein Summary on Selected Entries from Dryland Fallow Barley Variety Nurseries Grown at Havre. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 2702-SB)

			1/ PLUMP (%)								1/ PROTEIN % (Values Adjusted to 13% Grain Moisture)							
2/ VARIETY		3/ No. of YEARS TESTED	2022	2023	2024	2025	2026	3/ AVE. for YEARS TESTED	4/ % of CHECK PLUMP	5/ **3-YR COMP. AVE. PLUMP**	2022	2023	2024	2025	2026	3/ AVE. for YEARS TESTED	4/ % of CHECK PROTEIN	5/ **3-YR COMP. AVE. PROTEIN**
Buzz	Malt	3	79.4	70.6	97.7			82.6	122.3	**82.6**	12.3	13.7	11.4			12.5	91.5	**12.5**
MT Boy Howdy	Feed	3	79.9	71.9	94.2			82.0	121.5	**82.0**	12.5	13.6	11.1			12.4	90.9	**12.4**
MT Endurance	Malt	3	77.7	62.2	97.9			79.3	117.5	**79.3**	13.2	13.5	11.8			12.9	94.2	**12.9**
Hockett	Malt/Feed	3	63.2	41.9	97.4			67.5	100.0	**67.5**	13.7	14.7	12.5			13.6	100.0	**13.6**
Haxby	Feed	3	59.0	41.1	88.1			62.7	92.9	**62.7**	14.3	15.2	11.9			13.8	101.1	**13.8**
Lavina	Forage	3	13.3	54.1	52.4			40.0	63.2	**42.7**	14.3	14.8	13.3			14.1	103.6	**14.1**
MEANS (For Entries Listed)			62.1	57.0	88.0					69.5	13.4	14.3	12.0					13.2
April-July Precip. (in.)			5.5	6.4	7.6			6.5										
Total Annual Precip. (in.)			8.2	12.0	14.9			11.7										
Soil PAW (in.) to SD @ Planting			8	7	6			7										
Total Plant Available Water (in.)			14	13	14			14										
Soil NO3 (lbs.) to SD at Planting			133	175	58			122										
SD (Sampling Depth in Inches)			48	48	48			48										
Fertilizer Applied		(# N)	46	46	46			46										
		(# P2O5)	9	9	9			9										
		(# K2O)	5	5	5			5										
		(# S)	5	5	5			5										

Check Variety is Hockett.

1/ See MCES Bulletin 1094 or the Plant Sciences & Plant Pathology website at http://plantsciences.montana.edu/ for evaluation of other important variety performance characteristics to include protein, quality, disease resistance, etc. before making cultivar selecton decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending.

3/ Only the most recent 5 years are shown, but summary calculations include all years noted.

4/ Percent of Hockett plump or protein for the same data years as those in which a given entry was tested.

5/ 3-Yr Comparable Average = (x/y) * z where x = average plump or protein of a given entry for years tested, y = average plump or protein for Hockett for the same years, and z = 3-Yr average plump or protein for the check variety Hockett.