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

Winter Wheat Off-Station Variety Performance, Turner, MT

Principal Investigator:
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Project Personnel:
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Cooperator:
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Objectives:
Commercially available winter wheat 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. The Blaine County location near Turner entered its thirteenth year of winter wheat testing in crop year 2024.

Methods:
The uniform off-station winter wheat variety performance trial was seeded into chemical fallow ground during 2024. The trial consisted of 25 entries seeded in replicated, three-row, 22-foot plots on a 12-inch row spacing, utilizing a self-propelled cone seeder with Atom Jet paired row openers. All plots 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, and percent sawfly cutting was visually estimated for each plot immediately prior to harvest. A 'Wintersteiger' small plot combine, funded in part by the Montana Wheat and Barley Committee, was used to harvest each three-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. Falling number was determined using a Perten FN1700 according to the FGIS Directive 9180.38. Other variables specific to each individual trial are listed with the current year data tables.

Please note that research trial seed yield results recorded under wheat stem sawfly pressure are likely much higher than a producer should expect. Small plot variety trials are managed to assess maximum yield potential and are harvested in such a way that all stems and heads are picked up by the combine, regardless of lodging or cutting due to wheat stem sawfly. Pickup guards coupled with an extremely slow ground speed and an exceptionally low cutting height help researchers collect all heads in order to assess seed yield potential. If you are a producer in a wheat stem sawfly environment, although hollow stemmed varieties may be high yielding in research trials in your area, we strongly recommend against growing those hollow stemmed varieties. Please be aware that if you seed hollow stemmed varieties with wheat stem

sawfly present, you are only creating a breeding ground for future generations of sawfly in your area and not helping combat the pest population.

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.

Winter wheat seed yields at Turner averaged just nearly 50 bu/ac (Table 1). 'AAC Coldfront' was the top yielding entry producing over 54 bu/ac. 'Bobcat', 'Bridger CLP', 'Fortress', 'Keldin', 'Loma', 'MT Warcat', and 'Yellowstone' along with 7 additional MSU breeding lines produced yields between 50 and 54 bu/ac, equal to the highest yielding entry. Test weights of all winter wheat entries for this site averaged just under 59 lb/bu. Wheat stem sawfly cutting in the winter wheat trial at Turner averaged six percent of the stems cut and lodged with eight entries averaging one percent cut. Yield, test weight, protein, falling number, plant height and sawfly cutting data for the 2024 Turner dryland winter wheat trial are summarized in Table 1.

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. Nine-year comparable averages (2015-2024) for winter wheat seed yield and test weight at Turner are summarized in Table 2, while nine-year comparable averages for protein content and wheat stem sawfly cutting are summarized in Table 3. Based on the comparable average calculations, MT WarCat, Bobcat, AAC Wildfire, and Loma are the highest yielding varieties at Turner, while MT WarCat, Bobcat and Warhorse showed the least amount of wheat stem sawfly cutting.

Summary:

Due to late fall seeding, the winter wheat stand was very not fully emerged going into winter. Spring moisture and favorable growing conditions contributed to a uniform stand establishment. The quantity and timeliness of precipitation throughout the growing season in the Turner area was very good, which was reflected in higher-than-average seed yields at the site.

This work has been strongly supported by producers in the Turner-Hogeland area, and by the Northern Agricultural Research Center Advisory Board. With budget and other resources allowing, it is planned to continue the off-station winter wheat variety and breeding line testing in this area. The Blaine County location near Turner hosted it's eleventh year of winter wheat testing in crop year 2024.

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. Dryland Fallow Winter Wheat Cultivar Evaluation Nursery Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 24-3851-WW)

ID	1/ YIELD bu/ac	TEST WT lb/bu	2/ PROTEIN %	3/ FN seconds	PLNT HT inches	4/ SAWFLY %
AAC Coldfront	**54.4**	59.2	13.3	433	**28.4**	25.0
AAC Wildfire	48.8	57.1	13.9	425	24.9	13.3
Bobcat	**54.1**	58.4	13.6	428	23.6	**1.0**
Brawl CL Plus	48.0	**60.1**	13.1	410	25.3	**5.3**
Bridger CLP	**53.1**	**59.7**	13.8	464	23.7	**5.3**
Flathead	49.1	59.4	13.4	434	25.6	**2.3**
Fortress	**53.2**	58.6	12.6	432	24.8	**1.0**
FourOsix	44.9	58.5	13.9	439	**27.7**	11.7
Keldin	**50.1**	58.6	13.7	463	26.9	13.3
Loma	**53.1**	58.6	13.9	403	25.5	**5.0**
MT WarCat	**50.4**	58.8	13.8	427	24.2	**3.7**
Northern	48.1	58.8	**14.4**	447	24.9	10.0
StandClear CLP	44.1	59.1	13.6	443	26.8	**1.0**
SY Monument	42.9	57.3	13.2	437	22.7	**5.0**
Warhorse	42.3	56.9	**14.6**	**472**	25.8	**1.0**
Yellowstone	**51.5**	58.5	13.8	452	**27.8**	8.3
MT2019	**51.8**	58.9	13.6	**489**	23.6	8.3
MT2270	**50.6**	59.4	13.2	424	25.2	8.3
MTAX22120	47.5	58.5	12.7	431	23.6	6.7
MTCL2010	**53.3**	59.5	14.0	450	24.8	**1.0**
MTCS20151	**52.5**	58.3	13.9	377	26.9	**1.0**
MTCS20156	**51.2**	58.9	14.1	437	26.7	**1.0**
MTS1908	**51.8**	58.5	13.2	451	**27.7**	**1.0**
MTS2110	46.7	58.2	13.7	443	**29.0**	8.3
MTV2164	**53.1**	58.8	13.1	441	**28.2**	6.7
EXPERIMENTAL MEANS	49.9	58.7	13.6	438.1	25.8	6.2
LSD (0.05)	4.8	0.5	0.5	17.4	1.9	4.7
C.V.%	5.9	0.5	2.2	2.4	4.4	46.7
P-VALUE (Varieties)	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

1/ Volumetric yields are based on plot weights adjusted to uniform 13 percent grain moisture and 60 lbs/bu as the standard test weight for wheat.

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

3/ FN is the falling number value reported in seconds adjusted to 14 percent flour moisture.

4/ Sawfly rating is reported as the percentage of cut stems.

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 (24-3851-WW)

Seeding Date:	October 10, 2023
Harvest Date:	August 31, 2024
Fertility:	66-13-7-7 side banded
System:	No Till
Herbicide:	OpenSky 16 oz
Insecticide:	none
Previous Crop:	Chemical Fallow - Durum
Precipitation:	6.22" April 1 to Harvest Maturity

TABLE 2. Nine-Year Yield and Test Weight Summary on Selected Entries from Dryland Fallow Spring Wheat Variety Nurseries Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2015-2024. (Exp# 3851-WW)

		[1/] YIELD (Bushels Per Acre)								TEST WEIGHT (Pounds Per Bushel)							
[2/] VARIETY	[3/] No. of YEARS TESTED	2020	2021	3/ 2022	2023	2024	[4/] AVE. for YEARS TESTED	[5/] % of CHECK YIELD	**[5/] 9-YR COMP. AVE. YIELD**	2020	2021	3/ 2022	2023	2024	[4/] AVE. for YEARS TESTED	[5/] % of CHECK TEST WT	**[6/] 9-YR COMP. AVE. TEST WT**
MT WARCAT (+)	4	66.9	22.5		49.8	50.4	47.4	123.7	**53.5**	60.4	58.9		60.4	58.8	59.6	100.8	**59.6**
BOBCAT (+)(sawfly res)	7	55.7	15.8		44.5	54.1	43.0	106.3	**45.9**	60.5	55.0		61.2	58.4	59.2	100.4	**59.4**
AAC WILDFIRE (P+)	5	59.7	20.1		50.6	48.8	47.5	104.3	**45.0**	59.5	56.7		59.9	57.1	58.3	98.4	**58.2**
LOMA (+)	9	58.0	20.4		45.9	53.1	44.9	104.0	**44.9**	60.3	59.0		60.9	58.6	59.6	100.8	**59.6**
YELLOWSTONE (+)	9	51.2	16.5		33.9	51.5	43.2	100.0	**43.2**	60.3	58.6		59.4	58.5	59.1	100.0	**59.1**
NORTHERN (+)	9	56.9	15.7		39.0	48.1	42.4	98.2	**42.4**	60.2	57.2		60.7	58.8	59.5	100.6	**59.5**
STANDCLEAR CLP (P+,CL)	6	57.9	24.0		37.1	44.1	42.4	96.4	**41.7**	61.9	59.6		61.1	59.1	60.7	101.8	**60.2**
FOUROSIX (+)	7	51.0	17.6		28.4	44.9	36.7	90.7	**39.2**	60.1	57.9		59.9	58.5	59.1	100.2	**59.2**
KELDIN (P+)	8	56.3	15.7		21.6	50.1	38.8	89.1	**38.5**	60.0	57.6		60.1	58.6	59.3	100.4	**59.4**
FLATHEAD (+)	6	43.4	18.7		33.0	49.1	37.4	85.0	**36.7**	60.9	59.4		61.3	59.4	60.3	101.3	**59.9**
WARHORSE (+)(sawfly tol)	9	49.7	14.1		23.8	42.3	36.1	83.5	**36.1**	60.2	57.0		59.5	56.9	59.1	100.0	**59.1**
SY MONUMENT (P+)	7	51.9	14.2		25.6	42.9	33.7	83.3	**36.0**	60.0	57.4		60.2	57.3	58.6	99.3	**58.7**
BRAWL CLP (+,CL)	7	33.9	16.3		13.8	48.0	28.2	69.6	**30.1**	61.8	60.7		61.8	60.1	60.7	102.8	**60.8**
MEANS (For Entries Listed)		53.3	17.8		34.4	48.3			**41.0**	60.5	58.1		60.5	58.5			**59.4**
[7/] Growing Season Precipitation (in.)		5.93	3.73	n/a	6.00	6.22	5.48										
Soil PAW (in.) to SD @ Planting		9.36	6.10	n/a	n/a	4.18	6.47										
Total Plant Available Water (in.)		15.30	9.80	n/a	n/a	9.94	12.22										
Soil NO3 (lbs.) to SD at Planting		231	106	n/a	n/a	123	96										
SD (Sampling Depth in Inches)		45	42	n/a	n/a	36	43										
Fertilizer Applied	(# N)	125	125	125	89	66	108										
	(# P_2O_5)	20	20	20	14	13	19										
	(# K_2O)	10	10	10	7	7	9										
	(# S)	10	10	10	7	7	6										

Check variety is Yellowstone.

1/ See MCES Bulletin 1098 or the Plant Sciences & Plant Pathology website at http://plantsciences.montana.edu/ for evaluation of other important variety performance characteristics to include protein, quality, winter hardiness, disease resistance, etc. before making cultivar selecton decisions.

2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending, CL = Clearfield Tolerant, HW = Hard White.

3/ No harvest in 2022 due to drought related stand establishment.

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

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

6/ 9-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 Yellowstone for the same years, and z = 9-Yr average yield or test weight for the check variety Yellowstone.

7/ April 1 to 14 days prior to harvest.

TABLE 3. Nine-Year Protein and Sawfly Summary on Selected Entries from Dryland Fallow Spring Wheat Variety Nurseries Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2015-2024. (Exp# 3851-WW)

		[1/] PROTEIN % (Adjusted to 13% grain moisture)								SAWFLY RATING (% of cut and lodged stems)							
[2/] VARIETY	[3/] No. of YEARS TESTED	2020	2021	3/ 2022	2023	2024	[4/] AVE. for YEARS TESTED	[5/] % of CHECK PROTEIN	[6/] **9-YR COMP. AVE. PROTEIN**	2020	2021	3/ 2022	2023	2024	[4/] AVE. for YEARS TESTED	[5/] % of CHECK SAWFLY	[6/] **9-YR COMP. AVE. SAWFLY**
MT WARCAT (+)	4	13.9	15.2		15.0	13.8	14.5	99.2	**13.8**	0.0	0.0		2.3	3.7	1.5	8.0	**0.7**
BOBCAT (+)(sawfly res)	7	14.0	16.3		14.9	13.6	14.6	100.6	**14.0**	4.5	0.7		2.3	1.0	1.4	12.7	**1.1**
WARHORSE (+)(sawfly tol)	9	14.5	16.3		16.2	14.6	14.7	105.6	**14.7**	5.0	1.0		2.3	1.0	1.2	13.3	**1.2**
LOMA (+)	9	14.3	15.4		15.6	13.9	14.4	103.3	**14.4**	4.5	1.0		7.0	5.0	2.0	23.3	**2.0**
STANDCLEAR CLP (P+,CL)	6	13.6	13.9		14.9	13.6	14.3	97.8	**13.6**	9.4	0.7		10.0	1.0	3.6	27.7	**2.4**
FLATHEAD (+)	6	14.3	15.0		14.9	13.4	14.8	100.9	**14.1**	4.7	2.3		21.7	2.3	5.3	41.6	**3.6**
BRAWL CLP (+,CL)	7	14.5	15.3		15.6	13.1	14.7	101.2	**14.1**	11.1	3.7		13.3	5.3	4.9	44.2	**3.8**
SY MONUMENT (P+)	7	13.0	14.2		14.3	13.2	13.6	93.6	**13.0**	8.5	5.3		21.7	5.0	5.9	53.3	**4.6**
NORTHERN (+)	9	14.1	15.8		15.3	14.4	14.4	103.6	**14.4**	15.4	8.3		28.3	10.0	7.0	80.6	**7.0**
FOUROSIX (+)	7	13.9	15.4		14.8	13.9	14.6	100.5	**14.0**	13.0	13.3		25.0	11.7	9.2	82.7	**7.1**
KELDIN (P+)	8	14.1	14.9		15.4	13.7	13.9	99.3	**13.8**	10.1	20.0		18.3	13.3	8.1	83.2	**7.2**
YELLOWSTONE (+)	9	14.0	15.5		15.1	13.8	13.9	100.0	**13.9**	17.1	20.0		30.0	8.3	8.6	100.0	**8.6**
AAC WILDFIRE (P+)	5	13.7	15.2		14.8	13.9	14.3	98.5	**13.7**	12.8	26.7		26.7	13.3	16.0	104.7	**9.1**
MEANS (For Entries Listed)		14.0	15.3		15.1	13.8			**14.0**	8.9	7.9		16.1	6.2			**4.5**
[7/] Growing Season Precipitation (in.)		5.93	3.73	n/a	6.00	6.22	5.48										
Soil PAW (in.) to SD @ Planting		9.36	6.10	n/a	n/a	4.18	6.47										
Total Plant Available Water (in.)		15.30	9.80	n/a	n/a	9.94	12.22										
Soil NO3 (lbs.) to SD at Planting		231	106	n/a	n/a	123	96										
SD (Sampling Depth in Inches)		45	42	n/a	n/a	36	43										
Fertilizer Applied	(# N)	125	125	125	89	66	108										
	(# P_2O_5)	20	20	20	14	13	19										
	(# K_2O)	10	10	10	7	7	9										
	(# S)	10	10	10	7	7	6										

Check variety is Yellowstone.

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2/ P = Private Variety, + = Protected Variety, ++ = PVP Title 5 Pending, CL = Clearfield Line, HW = Hard White.

3/ No harvest in 2014 due to hail or in 2022 due to drought related stand establishment.

4/ Only the most recent 5 years shown, but summary calculations include all years noted. No harvest in 2014 due to hail and in 2022 due to drought related poor stand.

5/ Percent of Yellowstone sawfly rating for the same data years as those in which a given entry was tested.

6/ 9-Yr Comparable Average = (x/y) * z where x = average sawfly rating of a given entry for years tested, y = rating for Yellowstone for the same years, and z = 9-Yr average sawfly rating for the check variety Yellowstone.

7/ April 1 to 14 days prior to harvest.