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

Spring Wheat Off-Station Variety Performance, Turner, MT

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Objectives:
Commercially available spring wheat varieties and advanced breeding lines were evaluated for agronomic performance and fit at on-farm locations across 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 forty-first year of spring wheat testing in crop year 2024.

Methods:
The uniform off-station spring 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 exceptionally slow ground speed and a low cutting height, help researchers collect all heads 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.

Spring wheat seed yields at Turner averaged just under 43 bu/ac (Table 1) and Montana State University breeding line 'MT 21473' was the top yielding entry producing over 51 bu/ac. 'MT Dutton' and 'MT UBet' produced yields statically the same as the highest yielding line. Test weights of all spring wheat entries for this site averaged just over 59 lb/bu. Wheat stem sawfly cutting in the spring wheat trial at Turner averaged over 10 percent. Yield, test weight, protein, falling number, plant height and sawfly cutting data for the 2024 Turner dryland spring 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. At least three years of data is needed to be included in the comparable average calculation. Ten-year comparable averages (2015-2024) for spring wheat seed yield and test weight at Turner are summarized in Table 2, while ten-year comparable averages for protein content and wheat stem sawfly cutting are summarized in Table 3. Based on the comparable average calculations, 'MT Carlson', MT Dutton, MT UBet and 'Vida' are the highest yielding varieties at Turner.

Summary:

Upon establishment, spring wheat at the Turner site had good stand uniformity. The quantity and timeliness of precipitation throughout the growing season in the Turner area was very good, which was reflected in the increased 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 spring wheat variety and breeding line testing in this area. The Blaine County location near Turner has been a long-term site for various cereal and variety testing trials since 1984, marking 2024 as the Cederberg Family's forty-first year of collaboration.

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 Spring Wheat Cultivar Evaluation Nursery Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2024. (Exp# 24-9951-SW)

ID	1/ YIELD bu/ac	TEST WT lb/bu	2/ PROTEIN %	3/ FN seconds	PLNT HT inches	4/ SAWFLY %
AP SMITH	34.0	**59.8**	**15.6**	435	28.1	23.3
DAGMAR	42.5	59.6	15.0	442	28.6	**2.3**
LANNING	41.4	58.8	15.1	410	**30.4**	18.3
LCS ASCENT	43.6	**60.2**	14.4	453	28.6	8.3
MT CARLSON	43.2	58.8	14.2	375	29.4	**5.0**
MT DUTTON	**46.6**	57.9	15.3	426	29.3	20.0
MT SIDNEY	40.1	**59.8**	14.9	432	28.9	13.3
MT UBET	**47.4**	58.8	15.1	453	29.9	23.3
REEDER	37.9	59.4	15.3	421	29.3	16.7
ROCKER	44.4	**59.9**	14.2	453	29.6	10.0
SY LONGMIRE	41.5	**60.0**	14.8	**491**	**30.3**	**6.7**
SY ROCKFORD	40.0	58.5	14.4	449	**31.5**	23.3
VIDA	43.0	59.6	14.4	403	28.0	**6.7**
WB 9668	38.2	59.5	**16.1**	**472**	25.9	**5.0**
WB 9879CLP	42.7	58.6	**15.3**	437	29.3	**2.3**
WB GUNNISON	40.6	59.0	14.4	441	29.2	13.3
MT 2049	45.4	59.1	14.1	444	29.0	11.7
MT 2063	42.2	59.5	13.9	406	27.1	**6.7**
MT 21074	44.5	**60.1**	14.9	396	29.8	10.0
MT 21104	41.6	59.4	13.9	394	29.1	8.3
MT 21174	42.9	59.1	14.3	437	30.0	**2.3**
MT 21186	44.3	58.2	14.3	426	29.7	**1.0**
MT 21220	45.5	58.9	14.4	437	29.9	8.3
MT 21473	**51.5**	58.4	14.4	422	**30.8**	8.3
MT 21484	43.1	**59.8**	14.9	423	**30.2**	**6.7**
EXPERIMENTAL MEANS	42.7	59.2	14.7	431.1	29.3	10.5
LSD (0.05)	5.2	0.6	0.9	23.3	1.3	5.7
C.V.%	7.3	0.6	3.6	3.3	2.8	33.4
P-VALUE (Varieties)	<.0001	<.0001	0.0002	<.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 (24-9951-SW)	
Seeding Date:	April 26, 2024
Harvest Date:	August 31, 2024
Fertility:	35-7-4-4 side banded
System:	No Till
Herbicide:	OpenSky 16 oz
Insecticide:	none
Previous Crop:	Chemical Fallow - Winter Wheat
Precipitation:	5.82" seeding to harvest maturity*

* Precip from Mesonet website

TABLE 2. Ten-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# 9951-SW)

		[1/] YIELD (Bushels Per Acre)								TEST WEIGHT (Pounds Per Bushel)							
[2/] VARIETY	[3/] No. of YEARS TESTED	2020	2021	2022	2023	2024	[3/] AVE. for YEARS TESTED	[4/] % of CHECK YIELD	[5/] **10-YR COMP. AVE. YIELD**	2020	2021	2022	2023	2024	[3/] AVE. for YEARS TESTED	[4/] % of CHECK TEST WT	[5/] **10-YR COMP. AVE. TEST WT**
MT CARLSON (+)	4		18.3	45.9	36.0	43.2	35.8	103.4	**41.4**		54.9	59.3	60.6	58.8	58.4	98.3	**58.1**
MT DUTTON (+)	4		20.2	39.3	36.9	46.6	35.7	103.1	**41.2**		55.2	58.7	60.3	57.9	58.0	97.7	**57.7**
MT UBET (+)	3			40.0	33.5	47.4	40.3	102.2	**40.9**			59.8	61.0	58.8	59.9	99.8	**59.0**
VIDA (+)	10	56.8	20.4	39.8	35.4	43.0	40.0	100.0	**40.0**	58.7	57.7	59.2	61.1	59.6	59.1	100.0	**59.1**
LANNING (+)	10	54.8	18.8	40.1	37.7	41.4	39.5	98.7	**39.5**	58.7	56.6	59.1	60.7	58.8	58.7	99.4	**58.7**
DAGMAR (+)	7	53.6	21.1	38.3	35.6	42.5	40.4	96.4	**38.6**	59.3	58.5	59.4	61.4	59.6	59.6	100.8	**59.6**
NS PRESSER CLP (P+)	8	46.1	23.8	36.1	36.1		36.6	93.4	**37.4**	56.6	58.2	59.5	61.2		57.7	98.4	**58.2**
REEDER (+)	10	54.4	17.9	37.6	32.8	37.9	36.9	92.2	**36.9**	58.3	57.0	59.4	61.4	59.4	59.2	100.2	**59.2**
MT SIDNEY (+)	6	51.7	17.8	37.1	32.1	40.1	38.4	90.7	**36.3**	59.8	58.3	60.4	61.7	59.8	59.7	101.3	**59.9**
DUCLAIR (+)(sawfly tol)	9	49.7	15.8	34.2	36.5		35.6	89.6	**35.9**	58.0	53.7	58.7	59.9		57.9	98.0	**57.9**
WB9879CLP (P+)	10	50.1	18.8	33.6	31.7	42.7	35.7	89.2	**35.7**	58.8	57.1	59.2	60.0	58.6	59.0	99.9	**59.0**
WB GUNNISON (P+)(sawfly tol)	9	50.7	15.3	37.0		40.6	35.7	88.1	**35.3**	59.2	56.7	60.4		59.0	59.5	101.1	**59.7**
CORBIN (P+)	9	48.3	17.1	32.2	29.3		34.1	85.8	**34.4**	59.1	57.6	60.2	61.3		59.7	101.1	**59.8**
SY INGMAR (P+)	7	51.6	17.7	33.6	30.0		33.7	85.6	**34.3**	59.8	58.5	60.5	61.7		60.4	102.2	**60.4**
SY SOREN (P+)	9	53.3	15.8	33.3	29.9		33.5	84.4	**33.8**	59.2	56.6	60.5	61.3		59.5	100.8	**59.6**
BRENNAN (P+)	9	46.4	13.8	32.2	31.5		32.6	82.3	**32.9**	60.8	56.3	60.6	62.0		60.6	102.6	**60.6**
MEANS (For Entries Listed)		51.3	18.2	36.9	33.7	42.5			**37.1**	58.9	56.9	59.7	61.1	59.0			**59.2**

[6/] Growing Season Precipitation (in.)		5.93	3.48	5.22	4.64	5.82	4.64
Soil PAW (in.) to SD @ Planting		n/a	n/a	n/a	3.70	n/a	5.59
Total Plant Available Water (in.)		n/a	n/a	n/a	8.30	n/a	10.77
Soil NO3 (lbs.) to SD at Planting		n/a	n/a	n/a	47	n/a	60
SD (Sampling Depth in Inches)		n/a	n/a	n/a	34	n/a	37
Fertilizer Applied	(# N)	100	100	46	46	35	91
	(# P_2O_5)	20	20	9	9	7	18
	(# K_2O)	10	10	5	5	4	9
	(# S)	10	10	5	5	4	7

Check variety is Vida.

1/ See MCES Bulletin 1093 or the Plant Sciences & Plant Pathology website at http://plantsciences.montana.edu/crops/index.html 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 shown, but summary calculations include all years noted.

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

5/ 10-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 Vida for the same years, and z = 10-Yr average yield or test weight for the check variety Vida.

6/ Seeding to 14 days prior to harvest maturity.

TABLE 3. Ten-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# 9951-SW)

		[1/] PROTEIN % (Adjusted to 13% grain moisture)								SAWFLY RATING (% of cut and lodged stems)							
[2/] VARIETY	[3/] No. of YEARS TESTED	2020	2021	2022	2023	2024	[3/] AVE. for YEARS TESTED	[4/] % of CHECK PROTEIN	[5/] **10-YR COMP. AVE. PROTEIN**	2020	2021	2022	2023	2024	[3/] AVE. for YEARS TESTED	[4/] % of CHECK SAWFLY	[5/] **10-YR COMP. AVE. SAWFLY**
WB9879CLP (P+)	10	16.0	16.2	15.4	16.0	15.3	15.9	106.0	**15.9**	0.0	1.0	1.0	7.0	2.3	1.2	36.5	**1.2**
DUCLAIR (+)(sawfly tol)	9	15.7	16.4	15.6	15.7		15.5	102.9	**15.4**	0.3	1.0	3.7	11.7		2.0	69.7	**2.2**
DAGMAR (+)	7	16.0	16.2	15.6	15.7	15.0	15.8	104.8	**15.7**	0.0	1.7	5.3	16.7	2.3	3.9	86.3	**2.8**
VIDA (+)	10	14.6	15.3	15.2	15.2	14.4	15.0	100.0	**15.0**	0.3	0.7	8.3	15.0	6.7	3.2	100.0	**3.2**
WB GUNNISON (P+)(sawfly tol)	9	15.0	15.5	14.6		14.4	14.8	98.6	**14.8**	0.0	0.7	3.7		13.3	2.1	111.6	**3.6**
CORBIN (P+)	9	15.7	16.4	14.9	15.1		15.5	103.0	**15.4**	0.0	2.3	3.7	20.0		3.1	111.8	**3.6**
MT CARLSON (+)	4		15.8	15.0	14.8	14.2	14.9	99.4	**14.9**		3.7	3.7	23.3	5.0	8.9	116.3	**3.7**
SY SOREN (P+)	9	16.1	17.3	16.2	16.0		16.3	108.1	**16.2**	0.7	6.7	5.0	16.7		3.5	125.0	**4.0**
BRENNAN (P+)	9	16.0	16.8	16.4	15.9		16.2	107.5	**16.1**	1.0	11.7	3.7	16.7		3.9	136.8	**4.4**
MT SIDNEY (+)	6	15.5	16.5	15.9	16.1	14.9	15.7	105.0	**15.7**	0.0	2.0	8.3	23.3	13.3	7.9	150.5	**4.8**
NS PRESSER CLP (P+)	8	16.7	14.9	15.3	14.4		15.5	102.0	**15.3**	1.0	5.0	5.3	23.3		4.9	153.9	**4.9**
SY INGMAR (P+)	7	16.0	16.3	16.1	16.4		16.4	107.8	**16.2**	0.3	5.0	11.7	26.7		6.3	173.7	**5.6**
MT UBET (+)	3			14.6	15.1	15.1	15.0	99.8	**15.0**			6.7	25.0	23.3	18.3	183.3	**5.9**
MT DUTTON (+)	4		16.7	15.5	15.9	15.3	15.8	105.4	**15.8**		2.3	5.0	30.0	20.0	14.3	186.9	**6.0**
REEDER (+)	10	15.8	16.1	15.5	15.1	15.3	15.6	104.1	**15.6**	1.0	3.7	11.7	23.3	16.7	6.0	187.5	**6.0**
LANNING (+)	10	15.9	15.9	16.1	15.3	15.1	15.8	105.1	**15.8**	0.3	10.0	10.0	26.7	18.3	6.8	211.5	**6.8**
MEANS (For Entries Listed)		15.8	16.1	15.5	15.5	14.9			**15.6**	0.4	3.8	6.0	20.4	12.1			**4.3**

[6/] Growing Season Precipitation (in.)		5.93	3.48	5.22	4.64	5.82	4.64
Soil PAW (in.) to SD @ Planting		n/a	n/a	n/a	3.70	n/a	5.59
Total Plant Available Water (in.)		n/a	n/a	n/a	8.30	n/a	10.77
Soil NO3 (lbs.) to SD at Planting		n/a	n/a	n/a	47	n/a	60
SD (Sampling Depth in Inches)		n/a	n/a	n/a	34	n/a	37
Fertilizer Applied	(# N)	100	100	46	46	35	91
	(# P_2O_5)	20	20	9	9	7	18
	(# K_2O)	10	10	5	5	4	9
	(# S)	10	10	5	5	4	7

Check variety is Vida.

1/ See MCES Bulletin 1093 or the Plant Sciences & Plant Pathology website at http://plantsciences.montana.edu/crops/index.html 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 shown, but summary calculations include all years noted.

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

5/ 10-Yr Comparable Average = (x/y) * z where x = average protein or sawfly rating of a given entry for years tested, y = average protein or sawfly rating for Vida for the same years, and z = 10-Yr average protein or sawfly rating for the check variety Vida.

6/ Seeding to 14 days prior to harvest maturity.