



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



Spring Wheat Off-Station Variety Performance, Loring, MT

Principal Investigator:

Peggy Lamb, Research Scientist, Northern Ag Research Center, Havre

Project Personnel:

Jason Cook, Breeder/Geneticist, Spring Wheat, Bozeman
Hwa-Young Heo, Research Associate, Spring Wheat, Bozeman
Eleri Haney, Research Associate, Havre
Tracy Runner, Research Assistant II, Havre
Christina Murphy, Phillips County Extension

Cooperator:

Pete Lumsden, Landowner, Loring

Objectives:

Commercially available spring 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 Phillips County location near Loring completed its 28th year of spring cereal variety testing collaborations in 2023.

Methods:

The uniform off-station spring wheat variety performance trial was seeded into minimally tilled chemical fallow ground during 2023. 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 2023 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, 2023 data shall not constitute in any form a recommendation for or against any variety or breeding line included.

Spring wheat seed yields near Loring averaged just over 50 bu/ac (Table 1). 'MT Carlson', released by Montana State University in 2023, was the highest yielding entry producing nearly 59 bu/ac. 'MT Dutton', also a 2023 release from MSU along with two breeding lines produced seed yields statistically equal to that of 'MT Carlson'. Test weights of all spring wheat entries for this site averaged just over 58 lb/bu. After years of minimal wheat stem sawfly infestation, cutting in the spring wheat trial at Loring increased to just under 20 percent across the trial. Yield, test weight, protein, falling number, plant height and sawfly cutting data for the 2023 Loring 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. A minimum of three years of data is necessary to be included in the comparable average calculation. Nine-year comparable averages (2014-2023) for spring wheat seed yield and test weight at Loring 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 Carlson, MT Dutton, 'Vida' and 'Lanning' are the highest yielding varieties near Loring.

Summary:

Following snow cover that persisted into early April, the Loring site continued to receive timely rain events throughout the growing season. This precipitation coupled minimal grasshopper damage and a lack of extreme temperatures during flowering and head fill contributed to the highest spring wheat trial seed yields near Loring since 2019.

This work has been strongly supported by producers in the Loring-White Water area, and by the Northern Agricultural Research Center Advisory Board. With budget and other resources allowing, it is planned to continue off-station winter wheat variety and breeding line investigations in this area. The Phillips County location near Loring has been used for various spring cereal variety trials since 1996.

Recognition:

This research would not have been possible without the assistance of the following seasonal employees: Clara Haslem, Brady Kueffler, Cleta Lamb, Teresa Miller, and Nevaeh Phillips.

TABLE 1. Dryland Fallow Spring Wheat Cultivar Evaluation Nursery Grown Off-Station at the Flansaa-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2023. (Exp# 23-9955-SW)

ID	ORIGIN or PEDIGREE	1/ YIELD bu/ac	TEST WT lb/bu	2/ PROTEIN %	3/ FN seconds	PLNT HT inches	4/ SAWFLY %
Brennan	AGRIPR 10	48.5	59.4	14.8	466	26.7	30.0
SY Soren	AGRIPR 14	44.5	58.5	15.2	488	26.7	30.0
SY Ingmar	AGRIPR141	43.1	58.2	15.4	478	27.2	18.3
Rocker	BZ 917-277	49.1	59.6	14.5	458	26.2	10.0
Corbin	BZ 996434	45.4	59.5	14.6	434	29.0	25.0
Reeder	ND 695	45.8	58.1	14.9	418	29.8	31.7
SY Longmire	SYN 182	43.2	58.5	15.3	486	27.0	25.0
Vida	PI 642366	51.1	58.6	14.1	413	28.1	16.7
Duclair	PI 660981	51.0	56.8	15.5	424	30.1	8.3
Lanning	PI 676978	50.4	56.7	14.8	399	30.0	21.7
NS Presser CLP	PI 679964	47.0	57.5	14.2	408	29.0	21.7
Dagmar	PI 690450	53.5	59.1	15.2	463	29.0	16.7
WB9879CLP	WB9879CLP	47.6	57.6	15.2	441	27.4	2.3
MT Sidney	MT 1716	52.0	58.2	14.8	435	30.8	30.0
MT Dutton	MT 1809	55.4	57.3	14.4	440	30.4	21.7
MT Carlson	MT 1939	58.9	58.3	14.0	419	29.0	18.3
MT 2030	LANNING/MT 1338	55.2	58.7	14.0	425	28.9	25.0
MT 2049	LANNING/MT 1415	52.6	58.8	14.3	433	30.4	40.0
MT 2050	MT 1542/MT 1415	55.5	59.0	14.1	422	30.0	21.7
MT 2063	MT 1572/MT1133//CHOTEAL	52.9	57.9	14.4	420	28.1	13.3
MT 21016	MT 1542/LANNING	52.2	57.6	15.1	418	29.3	23.3
MT 21037	MT 1570//MT1274/12F5 827	54.0	57.4	15.0	433	29.1	8.3
MT 21074	MT 1525/MT 1348	49.3	59.9	14.9	417	26.7	6.7
MT 21104	MT 1451/MT 1866	52.5	56.7	14.9	412	28.2	13.3
MT 21105	MT 1570/VIDA	55.4	59.0	14.6	421	29.8	18.3
EXPERIMENTAL MEANS		50.6	58.3	14.7	434.8	28.7	19.9
LSD (0.05)		4.5	1.0	0.4	17.7	1.8	13.0
C.V.%		5.5	1.0	1.5	2.5	3.9	39.7
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).

Management Information (23-9955-SW)

Seeding Date: May 3, 2023
Harvest Date: August 15, 2023
Fertility: 46-9-5-5 side banded
System: Minimum Till
Herbicide: none
Insecticide: none
Previous Crop: Chemical Fallow - Spring Wheat
Precipitation: 5.39" seeding 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 Flansaa-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2014-2023. (Exp# 9955-SW)

^{2/} VARIETY or SELECTION	^{3/} No. of YEARS TESTED	^{1/} YIELD (Bushels Per Acre)					^{3/} AVE. for YEARS					TEST WEIGHT (Pounds Per Bushel)					
		2019	2020	2021	2022	2023	41.1	112.5	52.9	2019	2020	2021	2022	2023	58.2	99.4	59.0
MT 1939 MT CARLSON (++)	3			36.9	27.5	58.9	41.1	112.5	52.9			57.3	58.9	58.3	58.2	99.4	59.0
MT 1809 MT DUTTON (++)	3			34.8	21.0	55.4	37.1	101.5	47.7			57.0	57.1	57.3	57.1	97.6	58.0
PI642366 VIDA (+)	9	65.8	53.4	35.1	23.4	51.1	47.0	100.0	47.7	59.3	61.0	58.9	58.1	58.6	59.4	100.0	59.4
PI676978 LANNING (+)	8	56.6	49.0	36.3	20.3	50.4	44.3	96.2	45.2	58.7	61.1	56.6	57.9	56.7	59.0	98.9	58.7
PI 690450 DAGMAR (++)	6	55.4	45.2	32.9	25.0	53.5	41.3	92.7	43.6	59.3	61.4	59.2	59.0	59.1	60.0	100.7	59.8
MT 1716 MT SIDNEY (++)	5	57.7	42.6	33.8	24.3	52.0	42.1	92.0	43.2	59.7	61.7	59.5	58.8	58.2	59.6	100.7	59.8
PI679964 NS PRESSER CLP (+)	7	63.4	43.7	32.1	23.3	47.0	41.6	91.9	43.2	58.4	59.1	58.0	57.3	57.5	58.5	98.1	58.2
WA 8166 ALUM (+)	5	56.6	45.1	31.0			44.0	90.7	42.6	60.4	61.5	60.6			61.5	102.3	60.7
ND 695 REEDER (+)	9	53.1	44.7	30.1	25.2	45.8	41.9	89.2	41.9	59.3	61.1	58.5	58.9	58.1	59.6	100.4	59.6
IMICHT-79 WB9879CLP (P+)	9	50.8	43.4	33.7	21.4	47.6	40.0	85.1	40.0	58.7	60.4	57.9	58.6	57.6	58.8	99.0	58.8
PI660981 DUCLAIR (+)(sawfly tol)	9	53.6	35.2	30.0	20.3	51.0	39.7	84.4	39.7	58.2	59.3	57.0	57.8	56.8	58.0	97.6	58.0
AGRIPR141 SY INGMAR (P+)	6	55.1	43.1	28.5	23.2	43.1	37.6	84.4	39.6	60.5	62.3	58.4	59.1	58.2	60.2	101.0	60.0
BZ996434 CORBIN (P+)(sawfly tol)	9	52.7	39.7	31.3	23.1	45.4	39.7	84.4	39.6	59.2	61.6	59.3	58.9	59.5	59.9	100.8	59.9
O1S0263-28 SY SOREN (P+)	8	56.0	38.5	31.4	21.9	44.5	38.7	84.1	39.5	59.8	61.9	58.4	58.2	58.5	60.0	100.5	59.7
BZ902413 WB GUNNISON (P+)(sf tol)	8	49.0	39.0	28.9	22.0		38.4	82.5	38.8	60.6	61.6	59.2	60.0		60.4	101.6	60.3
PI633974 CHOTEAU (+)(sawfly tol)	8	49.2	41.3	32.4	21.7		38.3	82.4	38.7	58.8	60.5	58.1	58.2		58.8	98.9	58.7
PI671855 EGAN (+)	7	44.1	40.2	32.5			40.3	80.9	38.0	58.1	58.8	57.6			58.4	97.8	58.1
O150042-10 BRENNAN (P+)	9	44.2	33.0	28.9	22.8	48.5	36.1	76.9	36.1	60.1	61.2	59.4	59.6	59.4	60.2	101.4	60.2
MEANS (For Entries Listed)		54.0	42.3	32.3	22.9	49.6			42.1	59.3	60.9	58.4	58.5	58.1			59.3
^{6/} Growing Season Precipitation (in.)		8.78	n/a	5.79	2.62	5.39	6.33										
Soil PAW (in.) to SD @ Planting		6.21	8.90	8.63	7.37	2.94	6.86										
Total Plant Available Water (in.)		15.00	n/a	14.40	10.00	8.30	12.89										
Soil NO3 (lbs.) to SD at Planting		n/a	23	36	62	87	48										
SD (Sampling Depth in Inches)		33	48	48	44	42	42										
Fertilizer Applied																	
	(# N)	100	100	100	46	46	92										
	(# P ₂ O ₅)	20	20	20	9	9	18										
	(# K ₂ O)	10	10	10	5	5	9										
	(# S)	10	10	10	5	5	6										

Check variety is Vida.

1/ See MCES Bulletin 1093 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 selection 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. No harvest in 2017 due to hail.

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

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

6/ Seeding 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 Flansaas-Lumsden Farm, Loring. Northern Agricultural Research Center. Havre, Montana. 2014-2023. (Exp# 9955-SW)

2/ VARIETY or SELECTION	3/ No. of YEARS TESTED	1/ PROTEIN % (Adjusted to 13% Grain Moisture)					SAWFLY RATING (% of Cut and Lodged Stems)										
		2019	2020	2021	2022	2023	3/ AVE. for YEARS	4/ % of CHECK	5/ 9-YR COMP. AVE.	3/ AVE. for YEARS	4/ % of CHECK	5/ 9-YR COMP. AVE.					
							TESTED	PROTEIN	PROTEIN	TESTED	SAWFLY	SAWFLY					
WA 8166 ALUM (+)	5	13.7	14.4	15.8			14.8	106.2	14.9	0.0	0.7	0.7	0.3	7.0	0.2		
PI679964 NS PRESSER CLP (P+)	7	12.6	16.0	15.1	14.4	14.2	14.5	103.2	14.5	0.0	1.0	0.7	11.7	21.7	5.1	14.9	0.4
IMICHT-79 WB9879CLP (P+)	9	14.8	16.2	16.3	14.6	15.2	15.5	110.3	15.5	0.0	0.7	0.0	0.7	2.3	0.4	16.4	0.4
BZ902413 WB GUNNISON (P+)(sawfly)	8	14.2	14.8	15.4	13.8		14.4	102.5	14.4	0.0	0.3	0.3	1.0		0.3	26.1	0.7
PI660981 DUCLAIR (+)(sawfly tol)	9	13.7	15.6	16.2	15.0	15.5	15.2	107.8	15.2	0.0	0.3	0.3	0.7	8.3	1.1	41.1	1.1
PI633974 CHOTEAU (+)(sawfly tol)	8	14.5	15.4	16.0	14.4		15.2	107.8	15.2	0.0	1.0	0.7	2.3		0.6	65.2	1.8
PI 690450 DAGMAR (++)	6	13.8	15.7	16.1	15.0	15.2	15.4	109.6	15.4	0.0	0.7	0.3	1.0	16.7	3.1	77.8	2.1
MT 1939 MT CARLSON (++)	3			15.5	14.2	14.0	14.6	102.2	14.4			0.7	1.0	18.3	6.7	88.2	2.4
PI642366 VIDA (+)	9	12.6	14.0	15.0	13.7	14.1	14.1	100.0	14.1	0.0	1.0	0.7	5.3	16.7	2.7	100.0	2.7
BZ996434 CORBIN (P+)	9	13.8	15.7	16.2	14.5	14.6	15.0	106.5	15.0	0.0	0.0	0.0	1.0	25.0	3.0	109.6	3.0
MT 1809 MT DUTTON (++)	3			16.5	14.7	14.4	15.2	106.5	15.0			2.3	6.7	21.7	10.2	135.3	3.7
AGRIPR141 SY INGMAR (P+)	6	14.0	16.0	16.6	15.0	15.4	15.6	111.3	15.7	0.0	0.7	0.0	13.3	18.3	5.4	136.1	3.7
PI676978 LANNING (+) (++)	8	13.9	15.1	16.1	14.9	14.8	15.0	107.0	15.1	0.0	1.0	2.0	11.7	21.7	4.8	161.1	4.4
MT 1716 MT SIDNEY (++)	5	13.8	15.9	15.9	14.3	14.8	14.9	105.9	14.9	0.0	1.0	0.3	8.7	30.0	8.0	170.2	4.6
01S0263-28 SY SOREN (P+)	8	14.8	16.2	16.6	15.0	15.2	15.8	112.7	15.9	0.0	1.0	1.0	8.3	30.0	5.1	170.8	4.6
01S0042-10 BRENNAN (P+)	9	15.2	17.0	16.4	14.9	14.8	15.7	111.8	15.7	0.0	1.0	0.7	8.3	30.0	4.6	171.2	4.6
PI671855 EGAN (+)	7	16.1	16.7	17.5			16.8	119.2	16.8	0.0	1.0	0.7			0.6	185.9	5.0
ND 695 REEDER (+)	9	14.0	14.9	16.3	14.5	14.9	15.0	106.9	15.0	0.0	1.0	0.7	10.0	31.7	5.3	195.9	5.3
MEANS (For Entries Listed)		14.1	15.6	16.1	14.6	14.8			15.1	0.0	0.8	0.7	5.7	20.9			5.6
6/ Growing Season Precipitation (in.)		8.78	n/a	5.79	2.62	5.39	6.33										
Soil PAW (in.) to SD @ Planting		6.21	8.90	8.63	7.37	2.94	6.86										
Total Plant Available Water (in.)		15.00	n/a	14.40	10.00	8.30	12.89										
Soil NO3 (lbs.) to SD at Planting		n/a	23	36	62	87	48										
SD (Sampling Depth in Inches)		33	48	48	44	42	42										
Fertilizer Applied	(# N)	100	100	100	46	46	92										
	(# P ₂ O ₅)	20	20	20	9	9	18										
	(# K ₂ O)	10	10	10	5	5	9										
	(# S)	10	10	10	5	5	6										

Check variety is Vida.

1/ See MCES Bulletin 1093 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 selection 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. No harvest in 2017 due to hail.

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

5/ 9-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 = 9-Yr average protein or sawfly rating for the check variety Vida.

6/ Seeding to 14 days prior to harvest.