Title: Northcentral Montana Off-Station Winter Wheat Variety Performance Evaluations

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Objectives:

Diverse cropping environments exist within the five-county area most closely served by Northern Agricultural Research Center. Winter wheat, spring wheat, barley, and durum production together in the five counties (Blaine, Chouteau, Hill, Liberty, and Phillips), represents nearly 29 percent of the 2017-2021 statewide cereal production totals (43 percent for winter wheat, 28 percent for spring wheat, 22 percent for barley and 5 percent for durum). Producers are keenly interested in variety performance data generated under local conditions. It is our objective, within budget and other resource limitations, to evaluate small grain variety performance, over time, under conditions representative of specific areas of northern Montana, yet differing from that of the Research Center. Growers are provided reliable, unbiased, up-to-date information to make comparisons among improved winter wheat varieties. This report provides producers in northcentral Montana the information necessary to select varieties best suited for their specific area and growing conditions.

Methods:

Standard off-station winter wheat variety performance trials were conducted on chemical fallow during 2022 in two northern Montana counties.

Dryland Winter Wheat Trials:

1. Cederberg Farm, Blaine County S13-T36N-R25E
2. McKeever Farms, Chouteau County S20-T27N-R10E

Both winter wheat trials consisted of 25 entries and were 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, 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 3-row plot. Seed was cleaned prior to measuring plot weight for yield determination. Protein, test weight and moisture content were determined 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:

Seeding in the fall after a drought that began early in 2021 resulted in minimal to no winter wheat emergence at both Turner and Loma. High winds throughout the winter and spring caused soil erosion of bare fields surrounding the trial at Turner. Blowing soil in the early spring at Turner filled the winter wheat furrows and blasted any of the seedlings that were able to emerge, leaving no surviving winter wheat plants. At the time of spring wheat seeding, the winter wheat trial at Turner was abandoned and spring wheat was seeded through the area. By late-April, emergence of winter wheat at the Loma location was still extremely spotty, with large areas containing no plants at all. At the time of spring wheat seeding, we were also considering abandoning the Loma winter wheat trial. Adequate precipitation during the first week of May resulted in germination and emergence of the entire winter wheat trial area and the collaborators adjacent winter wheat crop.

There is no 2022 crop year data to report for the Turner site, however, long-term comparable averages have been included. 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. Eight-year comparable averages for seed yield and test weight at Turner are summarized in Table 1, while eight-year comparable averages for protein content and sawfly cutting are summarized in Table 2. Based on the comparable average calculations, 'Bobcat', 'Loma', and 'Yellowstone' are the highest yielding varieties at Turner, and of those three, Bobcat displays the least amount of sawfly cutting.

At the Loma winter wheat site, yields averaged just over 35 bu/ac (Table 3). Bobcat was the highest yielding entry at 41.5 bu/ac. Yellowstone, 'StandClear CLP' and 'MT WarCat' along with breeding line 'MTCL19151' all produced seed yields statistically equal to Bobcat. Test weights of all entries were low, averaging just under 57 lb/bu. Wheat stem sawfly cutting was severe in the winter wheat entries lacking tolerance and/or solid stems, averaging 53 percent cut and lodged. However, entries with more solidness and/or tolerance to sawfly averaged only 8 percent cut. There were six entries exhibiting less than 10 percent cutting, including Bobcat at one percent cut. Plant height, yield, test weight, protein, falling number and sawfly cutting data for the 2022 Loma dryland winter wheat trial are summarized in Table 3. Ten-year comparable averages for seed yield and test weight at Loma are summarized in Table 4, while ten-year comparable averages for protein content and sawfly cutting are summarized in Table 5. Based on the comparable average calculations, Bobcat is the highest yielding variety at the Loma site and has the least amount of wheat stem sawfly cutting over the years.

Summary:

Stands were not established in the fall of 2021 at Turner or at Loma due to drought and excessively dry seeding conditions. Overall, the growing season started out cooler and drier than average, with many fall-seeded crops not emerging until adequate moisture was received in early May. Meaningful rain events were minimal from March through May, resulting in reduced seed yields and low test weights as northcentral Montana remained in a severe to extreme drought throughout 2022.

This work has been strongly supported by producers near each of the off-station locations, and by the Northern Agricultural Research Center Advisory Council. With budget and other resources allowing, it is planned to continue off-station cereal variety investigations in the five-county area. The Blaine County location near Turner is entering its thirteenth year of winter wheat testing, while the Chouteau County location, between Big Sandy and Loma, has been used for various trials since 1998.

Recognition:

This research would not have been possible without the assistance of the following seasonal employees:
Tracy Gorecki, Cleta Lamb, Kyla McNamara, Teresa Miller and Emily Tripp.

TABLE 1. Eight-Year Yield and Test Weight Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2013-2022. (Exp# 3851-WW).

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ YIELD (Bushels Per Acre) 2018	2019	2020	2021	2022 3/	AVE. for YEARS TESTED 3/	% of CHECK YIELD 4/	**8-YR COMP. AVE. YIELD 5/**	TEST WEIGHT (Pounds Per Bushel) 2018	2019	2020	2021	2022 3/	AVE. for YEARS TESTED 3/	% of CHECK TEST WT 4/	**8-YR COMP. AVE. TEST WT 5/**
MTS1588	BOBCAT (++)(saw fly res)	5	34.5	73.4	55.7	15.8		40.5	102.4	**46.9**	62.0	59.8	60.5	55.0		59.0	99.9	**59.4**
MTS1224	LOMA (++)	7	35.4	70.9	58.0	20.4		43.6	100.7	**46.1**	61.8	58.9	60.3	59.0		59.6	100.6	**59.8**
MT00159	YELLOWSTONE (+)	9	36.1	74.7	51.2	16.5		45.8	100.0	**45.8**	61.4	59.3	60.3	58.6		59.5	100.0	**59.4**
MTCS1601	STANDCLEAR CLP (P+,CL)	4	35.5	55.9	57.9	24.0		43.4	97.1	**44.5**	62.1	60.3	61.9	59.6		60.9	101.8	**60.4**
SECAN, 2015	AAC WILDFIRE (+)	3		58.3	59.7	20.1		46.0	97.0	**44.4**		58.1	59.5	56.7		58.1	97.8	**58.1**
MT0978	NORTHERN (+)	8	38.3	65.4	56.9	15.7		43.7	95.4	**43.7**	61.8	59.7	60.2	57.2		59.7	100.4	**59.6**
MTF1432	RAY (++)	5	34.9	61.7	51.8	18.2		37.0	93.5	**42.8**	60.1	57.6	58.5	57.1		58.0	98.2	**58.3**
MTCL1077	SY CLEARSTONE 2CL (P+,CL)	9	33.1	61.8	54.5	14.3		42.7	93.2	**42.7**	61.1	59.1	60.0	59.3		59.5	100.1	**59.4**
MT1465	FOUROSIX (++)	5	34.3	61.7	51.0	17.6		36.7	92.9	**42.5**	61.7	58.6	60.1	57.9		59.1	100.1	**59.4**
CWRF, 2018	BYRD CL PLUS (+,CL)	3		56.4	55.8	18.3		43.5	91.7	**42.0**		59.7	61.1	58.5		59.7	100.6	**59.8**
MTS0713	JUDEE (+)(saw fly tol)	9	31.6	59.0	57.1	15.2		41.6	90.9	**41.6**	62.6	60.2	61.1	58.1		59.3	99.8	**59.2**
ACS55017	KELDIN (P+)	6	33.4	63.9	56.3	15.7		39.7	90.8	**41.6**	61.9	59.7	60.0	57.6		59.3	100.3	**59.6**
MT0552	DECADE (+)	8	35.7	59.4	53.4			45.3	90.7	**41.5**	61.8	58.9	60.6			59.5	99.8	**59.3**
MTS0808	WARHORSE (+)(saw fly tol)	9	31.5	51.9	49.7	14.1		38.8	84.8	**38.8**	60.4	58.7	60.2	57.0		59.7	100.5	**59.7**
Syngenta, 2015	SY MONUMENT (P+)	5	27.2	55.2	51.9	14.2		33.5	84.6	**38.8**	61.2	58.8	60.0	57.4		58.5	99.2	**58.9**
LCS, 2015	LCS JET (P+)	4	32.6	55.4	45.1	11.5		36.1	81.0	**37.1**	58.8	56.4	58.1	55.7		57.3	95.6	**56.8**
MT1564	FLATHEAD (++)	4	28.1	52.2	43.4	18.7		35.6	79.7	**36.5**	61.7	59.3	60.9	59.4		60.3	100.7	**59.8**
CWRF, 2011	BRAWL CLP (+,CL)	5	22.0	46.6	33.9	16.3		27.0	68.4	**31.3**	62.7	59.8	61.8	60.7		60.6	102.6	**60.9**
MEANS (For Entries Listed)			32.8	60.2	52.4	16.9				**41.6**	61.5	59.0	60.3	57.9				**59.3**
6/ Growing Season Precipitation (in.)			4.7	3.0	5.9	3.7		7.0										
Soil PAW (in.) to SD @ Planting			7.3	7.6	9.4	6.1		7.1										
Total Plant Available Water (in.)			12.0	10.5	15.3	9.8		14.5										
Soil NO3 (lbs.) to SD at Planting			64	115	231	106		83										
SD (Sampling Depth in Inches)			38	48	45	42		44										
Fertilizer Applied	(# N)		125	125	125	125	125	113										
	(# P_2O_5)		20	20	20	20	20	20										
	(# K_2O)		10	10	10	10	10	10										
	(#S)		10	10	10	10	10	5										

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

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

5/ 8-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 = 8-Yr average yield or test weight for the check variety Yellowstone.

6/ April 1 to 14 days prior to harvest.

TABLE 2. Eight-Year Protein and Sawfly Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at the Max Cederberg Farm, Turner. Northern Agricultural Research Center. Havre, Montana. 2013-2022. (Exp# 3851-WW).

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ PROTEIN % (Adjusted to 13% grain moisture) 2018	2019	2020	2021	2022 3/	AVE. for YEARS TESTED 3/	% of CHECK Protein 4/	**8-YR COMP. AVE. Protein 5/**	SAWFLY RATING (% of cut and lodged stems) 2018	2019	2020	2021	2022 3/	AVE. for YEARS TESTED 3/	% of CHECK SAWFLY 4/	**8-YR COMP. AVE. SAWFLY 5/**
MTS0713	JUDEE (+)(saw fly tol)	8	16.6	14.6	14.7	17.1		14.4	106.7	**14.4**	0.0	0.0	4.1	2.3		0.9	15.4	**0.9**
LCS, 2015	LCS JET (P+)	4	14.6	13.7	13.8	16.0		14.5	98.7	**13.3**	0.0	0.0	5.0	1.0		1.5	15.5	**0.9**
MTS1224	LOMA (++)	7	16.1	14.7	14.3	15.4		14.3	103.6	**14.0**	0.3	0.0	4.5	1.0		0.9	15.6	**0.9**
MTS1588	BOBCAT (++)(saw fly res)	5	15.3	13.8	14.0	16.3		14.7	101.3	**13.7**	0.0	0.7	4.5	0.7		1.3	16.5	**1.0**
MTS0808	WARHORSE (+)(saw fly tol)	8	15.7	14.4	14.5	16.3		14.2	105.3	**14.2**	0.3	0.3	5.0	1.0		1.0	16.7	**1.0**
MT1564	FLATHEAD (++)	4	16.1	14.7	14.3	15.0		15.1	102.2	**13.8**	0.0	1.0	4.7	2.3		2.0	20.8	**1.2**
MTCS1601	STANDCLEAR CLP (P+,CL)	4	15.8	14.0	13.6	13.9		14.3	97.4	**13.2**	0.0	0.3	9.4	0.7		2.6	26.8	**1.5**
Syngenta, 2015	SY MONUMENT (P+)	5	14.8	13.4	13.0	14.2		13.5	93.0	**12.6**	0.0	0.3	8.5	5.3		3.0	37.6	**2.2**
CWRF, 2011	BRAWL CLP (+,CL)	5	16.1	15.2	14.5	15.3		14.8	102.0	**13.8**	0.3	0.7	11.1	3.7		3.1	39.9	**2.3**
MT0978	NORTHERN (+)	8	15.8	14.3	14.1	15.8		14.1	104.1	**14.1**	0.0	0.3	15.4	8.3		3.2	55.1	**3.2**
MT1465	FOUROSIX (++)	5	15.5	14.3	13.9	15.4		14.7	101.0	**13.6**	0.7	0.3	13.0	13.3		5.5	70.0	**4.0**
MT0552	DECADE (+)	7	16.3	14.7	14.4			14.1	106.8	**14.4**	1.0	0.0	17.5			3.0	81.1	**4.7**
ACS55017	KELDIN (P+)	6	15.2	13.9	14.1	14.9		13.7	98.8	**13.3**	1.0	1.0	10.1	20.0		5.5	83.9	**4.8**
MT00159	YELLOWSTONE (+)	8	15.3	14.1	14.0	15.5		13.5	100.0	**13.5**	0.7	1.0	17.1	20.0		5.8	100.0	**5.8**
MTF1432	RAY (++)	5	15.1	13.8	13.8	14.5		14.1	97.5	**13.2**	1.0	0.7	17.7	20.0		7.9	100.6	**5.8**
MTCL1077	SY CLEARSTONE 2CL (P+,CL)	8	16.0	14.4	14.1	16.4		13.8	102.4	**13.8**	1.0	1.0	23.5	20.0		5.9	101.4	**5.9**
CWRF, 2018	BYRD CL PLUS (+,CL)	3		13.2	12.8	14.3		13.4	92.3	**12.5**		0.7	22.1	16.7		13.1	103.4	**6.0**
SECAN, 2015	AAC WILDFIRE (+)	3		13.8	13.7	15.2		14.2	97.8	**13.2**		0.7	12.8	26.7		13.4	105.1	**6.1**
MEANS (For Entries Listed)			15.6	14.2	14.0	15.4				**13.6**	0.4	0.5	11.5	9.6				**3.2**
6/ Growing Season Precipitation (in.)			4.7	3.0	5.9	3.7		7.0										
Soil PAW (in.) to SD @ Planting			7.3	7.6	9.4	6.1		7.1										
Total Plant Available Water (in.)			12.0	10.5	15.3	9.8		14.5										
Soil NO3 (lbs.) to SD at Planting			64	115	231	106		83										
SD (Sampling Depth in Inches)			38	48	45	42		44										
Fertilizer Applied	(# N)		125	125	125	125	125	113										
	(# P2O5)		20	20	20	20	20	20										
	(# K2O)		10	10	10	10	10	10										
	(#S)		10	10	10	10	10	5										

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

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

5/ 8-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 Yellowstone for the same years, and z = 8-Yr average protein or sawfly rating for the check variety Yellowstone.

6/ April 1 to 14 days prior to harvest.

TABLE 3. Dryland Fallow Winter Wheat Cultivar Evaluation Nursery Grown Off-Station at McKeever Farm & Seed, Inc., Loma. Northern Agricultural Research Center. Havre, Montana. 2022. (Exp# 22-3853-WW)

ID	ORIGIN or PEDIGREE	PLNT HT Inches	1/ YIELD Bu/Ac	TEST WT Lbs/Bu	2/ PROTEIN %	3/ FN Seconds	4/ SAWFLY %
AAC Wildfire	Alberta: SECAN, 2015	25.1	35.6	56.1	14.6	484	58.3
Bobcat	Montana, 2019	22.5	**41.5**	56.7	15.0	436	**1.0**
Brawl CL Plus	Colorado Research Foundation, 2011	22.6	36.1	**59.1**	14.6	508	45.0
Flathead	Montana, 2019	24.0	31.4	**58.7**	14.7	486	**11.7**
FourOsix	Montana, 2018	23.5	32.4	57.6	14.8	491	53.3
Judee	Montana, 2011	25.1	33.8	57.7	**15.6**	508	**13.3**
Keldin	Westbred, 2011	23.1	35.9	55.3	**15.4**	578	73.3
LCS Jet	Limagrain Cereal Seeds, 2015	19.7	33.9	54.4	14.5	455	65.0
Loma	Montana, 2016	23.0	36.5	56.4	15.1	454	**13.3**
MT WarCat	Loma*2/AAC Gateway	21.5	**39.2**	56.4	14.9	461	**8.3**
Northern	Montana, 2015	24.3	34.7	55.1	**15.5**	**669**	65.0
Ray	Montana, 2018	28.1	34.7	56.3	14.9	535	41.7
StandClear CLP	Montana/Nutrien	25.2	**40.1**	**58.0**	14.5	453	**16.7**
SY Clearstone 2CL	Montana/Syngenta, 2012	25.9	37.9	57.1	15.1	568	50.0
SY Monument	Syngenta, 2015	22.6	34.0	**58.7**	14.1	508	51.7
Warhorse	Montana, 2013	23.7	27.7	56.8	15.1	591	**7.0**
Yellowstone	Montana 2005	26.8	**40.2**	56.0	14.8	586	56.7
MT1745	Decade*2/NI06732	24.9	37.9	56.7	14.4	568	41.7
MT19175	SD08198/Northern	22.4	37.1	55.0	15.0	535	51.7
MTCL19151	MT0871/(06X445B1-2, SY Clearstone sib)	23.4	**38.4**	57.7	14.8	**640**	55.0
MTCS20156	Bobcat//(Bobcat sib, MTS1589)/StandClear CLP	24.0	36.7	56.4	**15.3**	485	**3.7**
MTF20189	MT10121*2/MV11-04	**32.6**	32.2	**57.8**	**15.3**	562	45.0
MTFH19132	MT1078//Colter/Emerson	25.6	26.3	56.7	**15.3**	555	41.7
MTS1903	(Judee sib, MTS0819)//08X350-A6/Warhorse	23.6	32.5	56.9	14.5	489	**2.3**
MTS1908	(Judee sib, MTS0819)//08X350-A6/Warhorse	25.4	35.0	55.9	14.6	519	**5.3**
EXPERIMENTAL MEANS		24.4	35.3	56.8	14.9	525.0	35.1
LSD (0.05)		1.4	3.3	1.3	0.4	42.5	19.2
C.V.%		3.6	5.7	1.4	1.6	4.9	33.3
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 highest value within a column.

Bold indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05).

Management Information (22-3853-WW)	
Seeding Date:	September 21, 2021
Harvest Date:	August 16, 2022
Fertility:	125-20-10-10 side banded
System:	No Till
Herbicide:	none
Insecticide:	none
Previous Crop:	Chemical Fallow - Spring Wheat
Precipitation:	1.46" April 1 to harvest maturity

TABLE 4. Ten-Year Yield and Test Weight Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at McKeever Farms and Seed Inc., Loma. Northern Agricultural Research Center. Havre, Montana. 2013-2022. (Exp# 3853-WW)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ YIELD (Bushels Per Acre) 2018	2019	2020	2021	2022	AVE. for YEARS TESTED 3/	% of CHECK YIELD 4/	**10-YR COMP. AVE. YIELD 5/**	TEST WEIGHT (Pounds Per Bushel) 2018	2019	2020	2021	2022	AVE. for YEARS TESTED 3/	% of CHECK TEST WT 4/	**10-YR COMP. AVE. TEST WT 5/**
MTS1588	BOBCAT (++)(saw fly res)	6	66.5	73.9	59.2	31.8	41.5	53.8	114.5	**55.5**	61.0	61.8	60.4	54.3	56.7	59.2	102.6	**59.1**
CWRF, 2011	BRAWL CLP (++)(CL)	6	61.4	61.0	62.1	36.3	36.1	51.0	108.5	**52.6**	62.1	61.6	61.5	55.2	59.1	60.2	104.3	**60.1**
Syngenta, 2015	SY MONUMENT (P+)	6	63.3	74.2	59.4	26.7	34.0	49.6	105.6	**51.2**	60.3	60.4	58.9	52.2	58.7	58.4	101.3	**58.4**
MTS0978	NORTHERN (+)	10	63.3	60.7	67.8	28.1	34.7	51.2	105.6	**51.2**	60.1	60.3	60.0	52.8	55.1	57.8	100.4	**57.8**
ACS55017	KELDIN (P+)	7	62.7	63.6	58.4	27.2	35.9	48.3	103.7	**50.3**	60.2	60.7	59.5	53.5	55.3	58.0	101.2	**58.3**
MT1465	FOUROSIX (++)	6	59.6	61.3	56.4	29.9	32.4	47.2	100.5	**48.7**	59.6	60.5	59.6	51.9	57.6	58.3	101.1	**58.3**
MT00159	YELLOWSTONE (+)	10	58.9	53.2	59.6	27.5	40.2	48.5	100.0	**48.5**	58.9	59.2	59.8	52.5	56.0	57.6	100.0	**57.6**
MTF1432	RAY (++)	6	59.2	61.6	58.7	26.0	34.7	46.9	99.9	**48.5**	57.6	59.6	59.2	53.2	56.3	57.4	99.4	**57.3**
MTCL1077	SY CLEARSTONE 2CL (P+)(CL)	10	59.9	55.4	66.2	24.3	37.9	48.1	99.2	**48.1**	58.5	59.4	59.2	53.9	57.1	57.8	100.3	**57.8**
MTS18149	MT WARCAT	3			57.3	26.9	39.2	41.1	96.9	**47.0**			59.9	52.7	56.4	56.4	100.5	**57.9**
MTS0713	JUDEE (+)(saw fly tol)	10	56.8	62.0	55.8	23.6	33.8	46.9	96.7	**46.9**	60.2	62.4	59.8	54.7	57.7	58.9	102.2	**58.9**
MTS1224	LOMA (++)	8	57.7	60.0	61.7	30.5	36.5	45.0	96.7	**46.9**	58.5	60.7	59.8	53.0	56.4	57.3	100.2	**57.8**
SECAN, 2015	AAC WILDFIRE (+)	4		60.0	56.3	22.5	35.6	43.6	96.6	**46.9**		59.9	58.6	51.4	56.1	56.5	99.4	**57.3**
MT1564	FLATHEAD (++)	5	54.6	54.5	61.0	29.3	31.4	46.2	96.5	**46.8**	61.3	60.9	59.7	54.4	58.7	59.0	103.0	**59.4**
MTCS1601	STANDCLEAR CLP (P+,CL)	5	54.5	50.5	56.1	29.1	40.1	46.1	96.3	**46.7**	60.8	60.9	61.2	54.5	58.0	59.1	103.2	**59.4**
LCS, 2015	LCS JET (P+)	5	51.4	58.3	46.8	25.3	33.9	43.1	90.2	**43.7**	56.7	57.8	57.3	50.9	54.4	55.4	96.8	**55.8**
MTS0808	WARHORSE (+)(saw fly tol)	10	43.5	44.5	52.4	28.1	27.7	42.4	87.5	**42.4**	59.5	61.4	59.8	52.2	56.8	58.5	101.6	**58.5**
MEANS (For Entries Listed)			58.2	59.7	58.5	27.8	35.6			**48.4**	59.7	60.5	59.7	53.1	56.8			**58.2**
6/ Growing Season Precipitation (in.)			n/a	n/a	n/a	n/a	1.6	6.1										
Soil PAW (in.) to SD @ Planting			7.5	8.2	7.4	7.9	7.1	7.8										
Total Plant Available Water (in.)			n/a	n/a	n/a	n/a	8.7	14.9										
Soil NO3 (lbs.) to SD at Planting			147	100	115	97	299	135										
SD (Sampling Depth in Inches)			48	48	48	45	48	48										
Fertilizer Applied	(# N)		100	125	125	125	125	110										
	(# P_2O_5)		20	20	20	20	20	20										
	(# K_2O)		10	10	10	10	10	10										
	(#S)		10	10	10	10	10	5										

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 Line, HW = Hard White.

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

4/ Percent of Yellowstone 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 Yellowstone for the same years, and z = 10-Yr average yield or test weight for the check variety Yellowstone.

6/ April 1 to 14 days prior to harvest.

TABLE 5. Ten-Year Protein and Sawfly Summary of Selected Entries from Dryland Fallow Winter Wheat Variety Nurseries Grown Off-Station at McKeever Farms and Seed Inc., Loma. Northern Agricultural Research Center. Havre, Montana. 2013-2022. (Exp# 3853-WW)

2/ VARIETY or SELECTION		No. of YEARS TESTED 3/	1/ PROTEIN % (Adjusted to 13% grain moisture) 2018	2019	2020	2021	2022	AVE. for YEARS TESTED 3/	% of CHECK PROTEIN 4/	**10-YR COMP. AVE. PROTEIN 5/**	SAWFLY RATING (% of cut and lodged stems) 2018	2019	2020	2021	2022	AVE. for YEARS TESTED 3/	% of CHECK SAWFLY 4/	**10-YR COMP. AVE. SAWFLY 5/**
MTS1588	BOBCAT (++)(saw fly res)	6	13.6	11.8	13.5	14.8	15.0	14.0	98.1	**14.2**	7.2	6.3	4.3	15.9	1.0	9.8	18.9	**6.6**
MTS0808	WARHORSE (+)(saw fly tol)	10	14.6	14.1	13.9	15.1	15.1	14.9	102.8	**14.9**	17.2	16.6	3.9	16.9	7.0	8.5	24.3	**8.5**
MTS18149	MT WARCAT	3			14.2	15.3	14.9	14.8	103.5	**15.0**			6.0	52.5	8.3	22.3	46.5	**16.3**
MTS1224	LOMA (++)	8	14.5	13.3	13.8	15.1	15.1	14.9	102.0	**14.8**	32.3	22.3	13.1	68.0	13.3	25.5	62.0	**21.7**
MTCS1601	STANDCLEAR CLP (P+,CL)	5	14.0	12.8	13.7	14.5	14.5	13.9	98.8	**14.3**	48.4	45.0	11.6	57.5	16.7	35.8	63.5	**22.2**
MT1564	FLATHEAD (++)	5	13.7	13.3	13.5	15.0	14.7	14.0	99.8	**14.4**	65.4	55.7	6.1	62.6	11.7	40.3	71.5	**25.0**
MTS0713	JUDEE (+)(saw fly tol)	10	13.9	12.1	14.3	15.7	15.6	15.0	103.6	**15.0**	65.0	41.0	4.2	61.3	13.3	26.2	74.9	**26.2**
CWRF, 2011	BRAWL CLP (++)(CL)	6	14.9	13.3	13.0	14.7	14.6	14.2	99.6	**14.4**	73.9	39.3	2.4	61.1	45.0	42.2	81.0	**28.3**
SECAN, 2015	AAC WILDFIRE (+)	4		12.9	13.9	15.2	14.6	14.2	101.0	**14.6**		20.3	10.9	79.4	58.3	42.2	85.7	**30.0**
MTF1432	RAY (++)	6	14.6	11.9	13.5	14.2	14.9	14.0	98.4	**14.2**	67.1	31.9	11.7	74.8	41.7	46.3	88.9	**31.1**
Syngenta, 2015	SY MONUMENT (P+)	6	12.8	12.0	12.3	13.6	14.1	13.1	91.7	**13.3**	65.8	38.2	3.4	74.8	51.7	47.9	92.0	**32.2**
MT0978	NORTHERN (+)	10	14.3	13.1	13.9	15.5	15.5	15.0	103.8	**15.0**	75.7	50.5	4.7	57.9	65.0	32.3	92.4	**32.3**
LCS, 2015	LCS JET (P+)	5	13.9	11.6	13.1	14.5	14.5	13.5	96.2	**13.9**	89.9	52.8	14.9	46.9	65.0	53.9	95.6	**33.5**
MT00159	YELLOWSTONE (+)	10	14.1	13.3	13.5	14.6	14.8	14.5	100.0	**14.5**	84.8	53.5	5.5	81.4	56.7	35.0	100.0	**35.0**
MTCL1077	SY CLEARSTONE 2CL (P+)(CL)	10	14.5	12.4	13.7	15.0	15.1	14.6	100.6	**14.6**	79.4	62.2	10.3	64.6	50.0	35.8	102.4	**35.8**
MT1465	FOUROSIX (++)	6	13.9	12.1	13.9	14.9	14.8	14.1	98.9	**14.3**	74.6	65.5	17.4	84.1	53.3	58.8	112.9	**39.5**
ACS55017	KELDIN (P+)	7	13.9	12.5	13.4	14.3	15.4	14.4	98.6	**14.3**	80.7	48.9	14.6	76.8	73.3	54.1	120.3	**42.1**
MEANS (For Entries Listed)			14.1	12.7	13.6	14.8	14.9			**14.4**	61.8	40.6	8.5	61.0	37.1			**27.4**
6/ Growing Season Precipitation (in.)			n/a	n/a	n/a	n/a	1.6	6.1										
Soil PAW (in.) to SD @ Planting			7.5	8.2	7.4	7.9	7.1	7.8										
Total Plant Available Water (in.)			n/a	n/a	n/a	n/a	8.7	14.9										
Soil NO3 (lbs.) to SD at Planting			147	100	115	97	299	135										
SD (Sampling Depth in Inches)			48	48	48	45	48	48										
Fertilizer Applied	(# N)		100	125	125	125	125	110										
	(# P_2O_5)		20	20	20	20	20	20										
	(# K_2O)		10	10	10	10	10	10										
	(#S)		10	10	10	10	10	5										

Check variety is Yellowstone.

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

4/ Percent of Yellowstone protein or sawfly 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 Yellowstone for the same years, and z = 10-Yr average protein or sawfly rating for the check variety Yellowstone.

6/ April 1 to 14 days prior to harvest.