



2021 MONTANA WINTER WHEAT VARIETY PERFORMANCE SUMMARY

Montana Counties and Agricultural Districts



[Released Winter 2022]

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Introduction

In this publication, the agronomic characteristics of hard winter wheat varieties recently developed or evaluated by the Montana Agricultural Experiment Station (MAES) are compared with other varieties commonly grown in Montana. A brief description of each variety is given, including their particular advantages or disadvantages. The information presented in this publication was extracted from the Intrastate Winter Wheat Nursery. This data is provided by research personnel of MAES, NDSU, and private entities. Where available, up to four years of yield data are shown for the varieties. In some years data are not available because of hail, winter-kill, or other unavoidable circumstances.

Variety Testing Procedures

Locations

Hard winter wheats were planted at 8 Montana and 1 North Dakota location (Fig. 1) including Conrad, Ft. Benton, and Havre (North Central District), Moccasin (Central District), Huntley

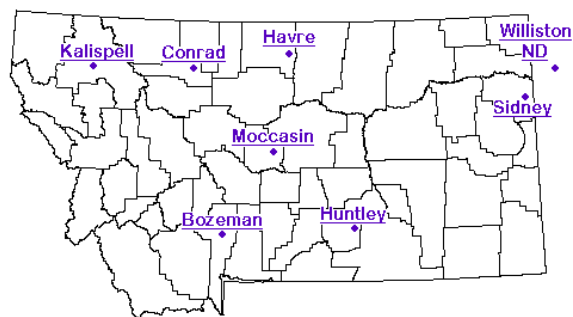


Figure 1. Test Locations for Montana hard winter wheat performance tests in 2021.

(Southern District), Sidney and Williston, ND (Northeast District), Kalispell (Northwest District), and Bozeman (Southwest District).

Entries

Names of commercially available hard winter wheat varieties and experimental lines evaluated in 2021 are listed in Table 2 with their origins, experimental designation, release year, and pedigrees. Forty-nine hard wheats are included in this summary comprising 32 varieties (14 public and 18 private) and 17 experimental lines (14 public and 3 private). Numbered

entries preceded by a state designation [e.g. MT1745 (Montana) or private company, LCS18-7071, (Limagrain Cereals)] are experimental lines provided by the breeder. During the season, the 3 private experimental lines were given variety names.

Experimental Design and Seeding Methods

The Intrastate Winter Wheat Test consists of 49 entries with 3 replicates. These tests are planted as 7x7 lattices or a randomized complete block design at each location. Plot size varies by location, from 35 ft² at Conrad to 60 ft² at Havre. Row number also varies; Bozeman and Havre are 3-row, Conrad, Huntley, Ft. Benton, and Sidney are 4-row, Moccasin (5-row), Kalispell (7-row), and Williston (8-row). Row spacing at all locations was on 1 ft. centers, except at Williston and Kalispell (6" centers). All plots were seeded at 1 million seeds/acre, except at Kalispell (1.25 million) and Williston (1.17 million seeds/acre). Information on cropping history, seeding date, fertilizer applications, and harvest date is available for all testing locations in Table 1. All seed, for each nursery, was treated with CruiserMaxx Vibrance Cereals® seed treatment and Gaucho® insecticide seed treatment, at recommended rates, before seeding.

2021 Test Conditions

The Montana Agricultural Statistics Service reported statewide winter wheat yields at 31 bushels per acre (bu/ac) for 2021, down 20 bu/ac from the 2020 season. This represents the lowest yield for Montana since 28 bu/ac in 2002. The harvested acreage in 2021 was 1.73 million acres (total production = 53.63 million bu) compared to 1.49 million acres harvested in 2020 (total production = 75.99 million bu).

Rainfall for the 2020-2021 crop year was generally below average at all locations except Huntley. Extremes, from historical averages, ranged from +1.88 inches at Huntley to -7.15 inches at Williston (Table 14).

Grain yield for the 9 locations harvested averaged 50.9 bushels per acre (bu/ac). Across locations, average yield ranged from 23.7 bu/ac at Williston, N.D. (severe drought, spring emergence) to 122.4 bu/ac at Kalispell. Grain yield of named varieties, across the 9 locations, ranged from a low of 43.1 bu/ac for 'Judee' to a high of 57.6 bu/ac for 'Flathead'.

Test weight averaged 58.7 pounds per bushel (lb/bu) across the 9 locations, down 3.5 lb/bu from 2020 (62.2 lb/bu average).

Data Collection & Reporting

Yield

All rows of each plot are trimmed and measured prior to harvesting with an experimental plot combine. Grain yields are reported in bushels per acre based on a 60-pound standard bushel weight. In addition to yields obtained in 2021, data is provided for two (2020-2021), three (2019-2021) and four (2018-2021) year averages for hard wheat entries tested during previous cropping seasons.

Test Weight

Test weights (pounds per bushel) were obtained for each plot by using a DICKEY-john® Grain Analysis Computer (GAC) at some locations. Other locations use a Seedburo® test weight apparatus. In this case, a sample is dropped through a funnel at a given height into a quart brass bucket, excess grain is removed by a flat stick then weighed on a gram scale, and grams

per quart are converted into pounds per bushels.

Heading Date

Heading date is recorded when 50% of the heads in a plot are extended above the flag-leaf collar. Heading dates are recorded both in ordinal date (number of days from January 1) and the actual calendar date.

Plant Height

Plant height is measured, in inches, from the soil surface to the top of the head, excluding the awns.

Grain Protein

Grain protein is sampled from a composite of all 3 replicated plots at each location. It is reported as a percentage by NIR (near-infrared reflectance) using an Infratec® whole grain analyzer. Samples are adjusted to a 12% moisture basis.

Winter Survival

Percent winter survival is estimated for each plot after initial spring green-up at locations where significant winter injury has occurred. Table 12 contains information on winter survival and associated yield in winter-kill environments from 2018 to 2021. The Sidney and Williston (District 6) testing sites consistently have the most severe winter-kill for winter wheat out of all of our testing locations.

Wheat Stem Sawfly

Wheat stem sawfly (WSS) is a persistent and economic problem for wheat growers in Montana. Currently, Montana wheat acreage infested by WSS is primarily in the north central (District 5), central (District 4), and south central (District 3) cropping districts. Host plant

resistance in the form of stem solidness has been effective in reducing sawfly losses in both spring and winter wheat. Current MSU/MAES solid-stemmed winter wheat varieties include: Judee, (released in 2011), Bearpaw (2011), Warhorse (2013), Loma (2016), Bobcat (2019) and StandClear CLP (2020).

Table 13 contains information on grain yield and sawfly cutting percentage at locations where sawfly pressure was present during the years 2018-2021. Stem solidness scores (rated on a 5-25 scale) are shown for solid and semi-solid varieties in Table 15.

Cereal Quality

Milling and baking characteristics for varieties are presented in Table 15. They are rated for each variety on a 1-5 scale (5 = superior quality). A quantitative polyphenol oxidase (PPO) score has been determined for varieties since the 2006 mill and bake evaluation. These varieties are reported in Table 15 as low to high. A lower PPO value is associated with better Asian noodle quality.

Disease Reactions

Disease reactions for hard red wheat varieties are listed in Table 15. There is information on dwarf smut, stripe rust, and stem rust.

Statistical Analyses and Interpretation

The data collected at each winter wheat location was analyzed as a three-replication lattice or randomized complete block design. Least significant difference at the 0.05 probability level (LSD, $p = 0.05$) and coefficients of variation (CV) were calculated from analysis of variance at each location. The LSD is used to compare the performance of two specific varieties at a time. If the difference between two varieties exceeds the LSD, this is interpreted as a true difference

because a difference between two varieties this large will only occur 5% of the time due to chance.

Variety Selection

Tables 3 through 11 present data for hard winter wheat varieties harvested at all experiment station sites in 2021. Where a variety has been in the Intrastate test for two, three, or four years, combined analyses of the yield data over years are presented.

Variety selection should be based on yield stability at a particular location or within a particular district over a period of years. Selection should also consider important trait performance based on test weight, winter-hardiness, heading date, plant height, protein, stem-solidness, and disease resistance.

Table 1. Summary of agronomic practices used on hard winter wheat performance trials in 2021.

Location	District	Field Cropping History		Fertilizer Application ¹¹ (lb/ac)					Seeding Date	Harvest Date
				Nitrogen (N)		P ₂ O ₅	K ₂ O	S		
		2019	2020	Fall '20	Spring '21				2020	2021
Kalispell	1	Barley	Canola	65	150	10	226	0	28-Sep	24-Aug
Bozeman	2	Oats	Fallow	254	NA	31	0	0	30-Sep	1-Aug
Huntley	3	Barley (recrop)	Fallow	100	NA	0	0	0	7-Oct	28-Jul
Moccasin	4	Proso Millet	Legume CC	10	53	15	10	5	21-Sep	28-Jul
Havre	5	Spring Wheat	Fallow	125	77	20	10	10	17-Sep	16-Jul
Conrad	5	-	Fallow	4	NA	21	0	0	8-Oct	12-Aug
Ft. Benton	5	Winter Wheat	Fallow	16	115	20	0	14	1-Oct	26-Jul
Sidney	6	-	Fallow	35	40	26	0	0	11-Sep	28-Jul
Williston	6	Winter Wheat	Field Pea	7	NA	24	0	6	15-Sep	5-Aug

¹ = Fall nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O) were preplant applied and incorporated.

NA = No Application

- = Data not available

Table 2. Public and Private Hard Winter Wheat Varieties and Experimental Lines in 2021 Intrastate Test

Variety	Experimental Designation	Origin	Release Year	Pedigree
Public Varieties				
AAC Wildfire	W512	Alberta/ SECAN	2015	((Norstar*5/PGR16635, AMN4LV) /6/ (RWA53, PI294994/3/ I3C//Norwin/Blizzard/4/2*AC Readymade /5/ Norstar*5/PGR16635// 2*Redwin/3/ AC Readymade) /7/ (A7257W-71-2-1/ A77695W, ID337-R1)// CDC Kestrel, <u>L99-1236</u>) /8/ <u>AC Bellatrix</u>
Battle AX	CO15A018	Colorado: Plainsgold/ Colorado Research Foundation/ Montech	2019	AF28/Byrd//AF26/Byrd/3/AF28/Byrd//AF10 M3/2*Byrd
Bobcat	MTS1588	Montana	2019	selection from a composite of 2 crosses: 07X291, ((SMN82164/ SMN82140//Rocky/Tiber, MT9659)/3/S87-101/4/Pronghorn, <u>MT0598</u>)/5/((98X366E29-1, Heyne/Rampart//((MT9513, BigSky sib)) and 07X295, (((Lew/Tiber//Redwin ,MTS92021)/3/Judith/Arapahoe, MTS0023)/4/Pryor/ Genou, <u>01X258C1</u>)/5/ <u>MT0598</u>
Brawl CL Plus	CO06052	Colorado: Plainsgold/ Colorado Research Foundation	2011	Teal 11A/Above//((CO99314, TX91V4931/ Halt)
Byrd CL Plus	CO13003C	Colorado: Plainsgold/ Colorado Research Foundation	2018	CO06072/4*Byrd (Als1, Als2)
Flathead	MT1564	Montana	2019	selection from a composite of 2 crosses: 07X76, <u>Yellowstone</u> *2/5/ (<u>PI640431</u> , BC4F4 line derived from WA007900*5/4/WA007900// Yr5/6*Avocet/3/ WA007900//Yr15/ 6*Avocet) and 07X77, <u>Yellowstone/PI640431/4/((Yellowstone(340,233), Yellowstone*5/3/ (Yellowstone sib, MT9982))//((MTS0222, Rampart*2/Judith))</u>
Fortify SF	CO15SFD107	Colorado: Plainsgold/ Colorado Research Foundation	2019	Byrd/Bearpaw//Byrd
FourOsix	MT1465	Montana	2018	selection from a composite of 5 crosses: 06X272, Yellowstone/ (MT0684, a composite - see pedigree); 06X276, Yellowstone/ (MT06102, , a composite - see pedigree); 06X278, Yellowstone/7/ (MT06110, (Arapahoe/3/Brule//Hiplains/ Newton, SD93528)/6/ (MT9409, Tiber/5/ (TAM W-103/Froid/4/Yogo//Turkey Red/ Oro/3/Centurk, MT8030))); 06X282, Yellowstone/3/((MT06123, '2174'/(MT9440, BigSky sib)//BigSky); and 06X285, Yellowstone/7/ (98X168E1, (Nuwest/4/ (MT88001, Sawmont/Tendoy /3/Yogo// Norin 10/Brevor) /5/((MT7863, Froid/Winoka/ Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn);
Judee	MTS0713	Montana	2011	(Vanguard/Norstar//Judith dwf, 93X312E14)/3/ NuHorizon
Loma	MTS1224	Montana	2016	<u>Yellowstone/5/((Lew/Tiber//Redwin, MTS92045)/3/2*Erhardt, <u>MTS0112</u>)/4/((MTS0125, selection from a composite of 4 crosses)</u>
Northern	MT0978	Montana	2015	selection from a composite of 2 crosses: 00X248, (Yellowstone sib, MT9982)/4/((MT8709, Erhardt sib)/NuWest//Erhardt, MTW0072)/3/ (NW97S151, KSSB0192-3/NE89529) and 00X249, (Judith/(PI262605, Karagach, RWA resis.)/3/(S86-740, Norstar/Plainsman V //Ulianovka) ,MTW0047)/4/MTW0072/NW97S151

Table 2. Public and Private Hard Winter Wheat Varieties and Experimental Lines in 2021 Intrastate Test

Variety	Experimental Designation	Origin	Release Year	Pedigree
Warhorse	MTS0808	Montana	2013	selection from a composite of 3 crosses: 00X182, ((Froid/Winoka/7/ ((Sinvalocho/Wichita// Hope/Cheyenne /3/Wichita/4/Seu Seun 27, TX55-391-56-D8)/5/Westmont, MT6928)/6/ Trader, MT85200)/8/ Redwin, MT9908)/9/ Nuplains/6/(MTS9862, (NuWest/ Lovrin 24 /4/((Rego/Cheyenne, Sel. 39-18-7)/ Winalta, MT7431)/3/(MT7115, Yogo/T. polonicum-70-5), MT91366)/5/ (MTS92137, Lew/Tiber//Redwin)); 00X183, Nuplains/MTS9862/4/ (MTW0047, Judith/(PI262605, Karagach, RWA resis.)/3/(S86-740, Norstar/ Plainsman V //Ulianovka)); and 00X184, Nuplains/MTS9862/5/(MTS0028, Vanguard/4/(Lew/Tiber//Redwin, MTSF1570)/3/ Norstar)
Whistler	CO13D1783	Colorado: Plainsgold/ Colorado Research Foundation	2018	CO08W218/Snowmass//Byrd
Yellowstone	MT00159	Montana	2005	F ₂ composite of Promontory/Judith and Judith-dwarf/Promontory

Private Varieties

AP18 AX	CO14A136	Colorado Research Foundation/ Syngenta	2020	AF10/2*Byrd//AF26/Byrd
Balance	WA8248	Washington; Nutrien	2020	BC002-2/Norwest 553-0
CP7869		Winfield Solutions, LLC, Arden Hills, MN	2018	na
CP7909		Winfield Solutions, LLC, Arden Hills, MN	2018	na
CP7017AX	LCH15ACC-15-17	Limagrain LLC: Winfield Solutions, LLC, Arden Hills, MN	2020	na
CP7050AX	LCH15ACC-7-2	Limagrain LLC: Winfield Solutions, LLC, Arden Hills, MN	2020	na
Keldin	ACS55017	Peter Franck: Seed Link Inc.; Ontario, Canada, Westbred LLC	2011	Barenburg 235/Carlisle//TRX-A16-3-2
LCS Helix AX	LCS15ACC-8-21	Limagrain LLC	2020	na
LCS Julep	LCH13D-47-1675	Limagrain LLC	2020	na
Milestone		Dr. Peter Franck, Germany; Nutrien	2020	na

Table 2. Public and Private Hard Winter Wheat Varieties and Experimental Lines in 2021 Intrastate Test

Variety	Experimental Designation	Origin	Release Year	Pedigree
StandClear CLP	MTCS1601	Montana/ Loveland Products Inc; Loveland, CO	2020	((L'Govskaya 167/Rampart/6/(MT9409, Tiber/5/ (MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk)) , <u>MTS0531</u>) /13/ (MTS0532, same pedigree as MTS0531) /12/ (Morgan/5/ (88X24D247-?, (Wasatch/Yogo//Rescue/3/Tendoy, Sel. 251, MT88006)/4/Judith)), <u>96X17E69</u>) /9/((Tiber/5/(MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk), MT9409)*2/6/IMI Fidel, <u>MTCL0309</u>)/7/ <u>CDC Teal</u> 11A/8/((MTW01143, Promontory/5/ (MT91366, NuWest/ Lovrin 24 /4/((Rego/ Cheyenne, Sel. 39-18-7)/Winalta, MT7431)/3/NuWest)) /10/(MTCL0510, Rampart*3/Fidel/6/ (MTS9720, Nuwest/4/(MT88001, Sawmont/Tendoy /3/Yogo//Norin 10/Brevor)/5/(MT7863, Froid/Winoka/Centurk))) /11/ (<u>MTS0531</u> , see above)
SY 517 CL2	07CL039-7	Syngenta	2017	(BC950811-2-6 / BC98343-09-7, <u>03B212#4</u>) // (<u>CL03040-6-1</u> , iW98-362A1 (imiJagalene, Als3) / AP502CL (Als1) /3/ <u>Art</u>
SY Clearstone 2CL	MTCL1077	Syngenta, Montana	2012	Yellowstone*4/3/MTCL01158/CDC Teal 11A/Jagalene
SY Wolverine	08BC379-40-1	Syngenta	2019	Everest / Platte // SY Wolf
WB4401	XC4109	Bayer: WestBred-Monsanto:	2020	na
WB4418	XA4402	WestBred-Monsanto:	2018	TUKURU-S-3 /3/ KS920750-A-13-1 // KS89180B-2-1-1 / CMBW91M02959T /4/ TX92U3060 / TX91D6564
WB4505	MODI4-5179, XC4209	Bayer: WestBred-Monsanto:	2019	na
WB4792	XB4711	Bayer: WestBred-Monsanto:	2019	na

Public Elite Lines

	MTCL1737			Yellowstone-2CL /3/ Yellowstone*2 /Pelsart// Promontory/ 3*Yellowstone
	MT1745			Decade*2/3/(NI06732, HBK0630-4-5// (NE98632, Niobrara/NE91525)
	MTS1831			selection from a composite of 2 crosses: 09X203, (selection from a composite of 2 crosses, see pedigree , <u>MTS0907</u>)/ (<u>MTS0827</u> , selection from a composite of 2 crosses, see pedigree) and 09X211, (selection from a composite of 2 crosses, see pedigree , <u>MTS0916</u>)/ <u>MTS0827</u>
	MTS1855			selection from a composite of 2 crosses: 10X199, (05X438-aC71, (Erhardt //Judith / CDC Kestrel, MT0097)*2 /3/ Jagalene / Choteau) /4/ Roughrider and 10X200, (05X438-aB30-2, (Erhardt //Judith / CDC Kestrel, MT0097)*2 /3/ Jagalene / Choteau) /4/ (MT0890, selection from a composite of 2 crosses, see pedigree)
	MT1872			selection from a composite of 2 crosses: 09X83, ((MT8709, Erhardt sib)/ NuWest// Erhardt, MT0071) /10/ (Wesley sib, N95L1229) /9/ (MT9834, (Froid/ Winoka/7/ ((Sinvalcho/ Wichita/ Hope/ Cheyenne/3/ Wichita/4/ Seu Seun 27, TX55-391-56-D8)/5/ Westmont, MT6928)/6/ Trader, MT85200) /8/ Tiber), <u>MT0859</u>) /11/ ((Judith/(PI262605, Karagach, RWA resis.)/3/(S86-740, Norstar/Plainsman V //Ulianovka) ,MTW0047)/4/(G97019, G33/Tomahawk//Karl 92), <u>MT0840</u>) /5/ (<u>MT0873</u> , selection from a composite of 2 crosses, see pedigree) and 09X84, MT0859*2 / (MT0872, selection from a composite of 2 crosses, see pedigree)
	MTS18116			Loma*2/Warhorse
MT WarCat	MTS18149		2022	Loma*2/AAC Gateway
	MTS1903			selection from a composite of 2 crosses: 11X1, (Judee sib, <u>MTS0819</u>) /10/ (Yellowstone loppo plant seln, MT08189) /8/ (Yellowstone loppo plant seln, MT08188) /7/ (MT0419-1, Erhardt /5/ (KS92H21-4, (Plainsman IV / Cheney // Odessa / 2*Eagle /3/ Pawnee / DURM, KS82H238-1) /4/ HF5761 / TAM 105 //Bounty 203) /6/ Pronghorn)), <u>08X350-A6</u> /9/ Warhorse and 11X2, <u>Spur</u> // <u>08X350-A6</u> / Warhorse

Table 2. Public and Private Hard Winter Wheat Varieties and Experimental Lines in 2021 Intrastate Test

Variety	Experimental Designation	Origin	Release Year	Pedigree
	MTS1908			selection from a composite of 2 crosses: 11X1, (Judee sib, <u>MTS0819</u>) /10/ (Yellowstone loppy plant seln, MT08189) /8/ (Yellowstone loppy plant seln, MT08188) /7/ (MT0419-1, Erhardt /5/ (KS92H21-4, (Plainsman IV / Cheney // Odessa / 2*Eagle /3/ Pawnee / DURM, KS82H238-1) /4/ HF5761 / TAM 105 //Bounty 203) /6/ Pronghorn)), <u>08X350-A6</u> /9/ <u>Warhorse</u> and 11X2, <u>Spur</u> // <u>08X350-A6</u> / <u>Warhorse</u>
	MTS1915			(selection from a composite of 2 crosses containing Judee and Decade, see pedigree , <u>MTS1596</u>) // <u>Emerson</u> / <u>Spur</u>
	MTFH19132			((Karl 92 /10/ (UT000190 (SRW?), Hansel // "wheat" / Ag. podperae /5/ Najah /4/ Delmar /3/ Delmar / PI173438 // Columbia /6/ Hansel, UT1802) /9/ (UT1812, Weston /6/ Delmar /3/ Delmar / PI173438 /4/ Colorow /5/ Warrior / Cl13837 /7/ "wheat" / Ag. podperae /8/ PI166921 / Hanse I/3/ Delmar / Columbia // Cl13837), MT02113)*4 /11/(MTS0359, Rampart / Mironovskaya 61), <u>MT1078</u> /12/ <u>Colter</u> / <u>Emerson</u>
	MTCL19149			((Judith / Yogo, MT9417) // Ogallala, MT0277) /8/ ((Tiber /5/ (MT8030, TAM W-103 /Froid /4/ Yogo // Turkey Red / Oro /3/ Centurk), MT9409)*2/ 6/ IMI Fidel, MTCL0309) /7/ CDC Teal 11A /9/ (MT02136, selection from a composite of 2 crosses - see pedigree), <u>MTCL1125</u>) /9/ (<u>MT1091</u> , Reeder/6*Yellowstone)
	MTCL19151			(selection from a composite of 2 crosses: 00X248, (Yellowstone sib, MT9982) /4/ ((MT8709, Erhardt sib) / NuWest // Erhardt, MTW0072) /3/ (NW97S151, KSSB0192-3 / NE89529) and 00X249, (Judith / (PI262605, Karagach, RWA resis.) /3/ (S86-740, Norstar / Plainsman V //Ulianovka) ,MTW0047)/ 4/ MTW0072 / NW97S151, <u>MT0871</u>) /5/ (<u>06X445B1-2</u> , SY Clearstone sib)
	MT19175			selection from a composite of 2 crosses: 11X202, (Wesley / NE93613, <u>SD08198</u>) // <u>Northern</u> ; 11X203, <u>SD08198</u> /12/ <u>MT1078</u> , ((Karl 92 /10/ (UT000190 (SRW?), Hansel // "wheat" / Ag. podperae /5/ Najah /4/ Delmar /3/ Delmar / PI173438 // Columbia /6/ Hansel, UT1802) /9/ (UT1812, Weston /6/ Delmar /3/ Delmar / PI173438 /4/ Colorow /5/ Warrior / Cl13837 /7/ "wheat" / Ag. podperae /8/ PI166921 / Hanse I/3/ Delmar / Columbia // Cl13837), MT02113)*4 /11/(MTS0359, Rampart / Mironovskaya 61); and 11X204, <u>SD08198</u> /4/ (<u>MT10121</u> , Yellowstone*2 /3/ (Yellowstone sib, MT9982) // (MTS0222, Rampart*2 / Judith))

Private Elite Lines (variety name designated during the 2021 crop season)

LCS Steel	LCS 18-7071 AX	Limagrain LLC	2021	na
Ramsay	NAS-7653	Nutrien	2021	na
AP Solid	NP13005004#49	Syngenta	2021	na

Table 3. Hard Winter Wheat: District 1 - Kalispell

Cultivar/Line	Grain Yield (bu/ac)				2021 Data				
					Test Weight (lb/bu)	Heading Date		Plant Height (in)	Protein (%)
	2021	2020-21	2019-21	2018-21		Ordinal	Calendar		
Combined years of data:	1yr	2yr	3yr	4yr					
AAC Wildfire	126.0	141.5	139.1	125.1	59.4	169.3	18-Jun	36.0	11.8
AP Solid	102.0				58.8	166.4	15-Jun	29.6	12.0
AP18 AX	123.8				57.2	160.7	10-Jun	31.1	11.7
Balance	128.6				57.8	166.4	15-Jun	32.3	12.2
Battle AX	115.8				58.6	162.6	12-Jun	30.4	11.9
Bobcat	123.3	131.4	126.8	118.6	58.7	166.0	15-Jun	32.5	12.0
Brawl CL Plus	107.6	121.6	117.7	110.0	58.7	158.8	8-Jun	31.6	13.6
Byrd CL Plus	129.3	144.0	138.1	121.1	57.3	165.3	14-Jun	35.3	11.1
CP7017AX	104.7				56.8	162.5	11-Jun	26.5	11.9
CP7050AX	100.7				58.2	158.0	7-Jun	29.6	12.8
CP7869	112.0				57.5	158.3	7-Jun	27.6	11.9
CP7909	101.3	111.9			58.5	154.3	3-Jun	30.6	12.9
Flathead	133.8	146.7	143.4	134.1	58.1	159.0	8-Jun	29.9	11.7
Fortify SF	123.1				58.6	161.0	10-Jun	33.8	11.5
FourOsix	130.4	137.1	134.4	123.9	58.2	166.6	16-Jun	31.1	11.4
Judee	102.5	124.4	128.0	119.6	59.1	165.6	15-Jun	33.1	12.2
Keldin	130.9	149.3	144.6	133.8	59.1	165.9	15-Jun	32.7	11.7
LCS Helix AX	112.3	135.8			57.9	160.8	10-Jun	30.0	11.3
LCS Julep	121.1				57.9	161.0	10-Jun	30.9	12.2
LCS Steel AX	114.2	132.3			56.6	166.3	15-Jun	34.6	11.8
Loma	138.6	150.7	143.9	129.8	58.3	168.9	18-Jun	31.1	11.7
Milestone	140.2				56.7	166.6	16-Jun	30.8	11.2
MT1745	137.7	152.3	143.0		58.4	168.4	17-Jun	33.6	11.4
MT1872	127.7	141.3			57.5	165.8	15-Jun	32.3	11.5
MT19175	117.5				56.2	169.7	19-Jun	30.2	11.8
MTCL1737	125.1	140.9	138.1		56.6	170.8	20-Jun	30.4	11.5
MTCL19149	125.6				57.8	166.1	15-Jun	32.5	11.1
MTCL19151	113.1				57.1	164.3	13-Jun	29.2	12.1
MTFH19132	130.8				57.5	165.7	15-Jun	34.6	11.3
MTS18116	111.3	133.7			57.3	170.8	20-Jun	27.1	11.4
MT WarCat	144.1	145.4			58.2	168.5	17-Jun	31.7	12.0
MTS1831	130.1	148.1			57.8	172.3	21-Jun	29.5	11.2
MTS1855	111.6	132.6			59.4	167.9	17-Jun	32.2	11.8
MTS1903	139.0				59.2	169.9	19-Jun	33.7	11.3
MTS1908	138.8				59.2	170.2	19-Jun	33.9	11.2
MTS1915	127.8				57.7	171.4	20-Jun	32.3	11.5
Northern	129.2	146.6	144.1	127.6	57.8	167.1	16-Jun	34.2	11.7
Ramsay	140.5				58.0	166.0	15-Jun	31.8	11.2
StandClear CLP	113.0	131.2	128.3	117.6	58.7	164.9	14-Jun	33.6	12.0
SY 517 CL2	94.7	108.4	103.4	90.9	58.8	159.2	8-Jun	29.6	13.0
SY Clearstone 2CL	134.7	148.4	145.7	131.7	57.9	166.2	15-Jun	36.0	11.8
SY Wolverine	102.7	129.8	123.6		57.2	159.2	8-Jun	29.6	11.6
Warhorse	110.9	124.7	122.6	115.0	56.4	166.1	15-Jun	33.9	12.7
WB4401	122.6				58.1	158.7	8-Jun	31.2	11.0
WB4418	119.7	132.8	129.2		56.2	161.2	10-Jun	28.6	11.4
WB4505	126.1				58.4	160.0	9-Jun	30.8	10.8
WB4792	134.2	153.9			60.1	165.4	14-Jun	33.1	11.0
Whistler	119.5				58.8	163.8	13-Jun	33.8	11.1
Yellowstone	146.3	154.0	145.3	129.9	57.1	165.7	15-Jun	33.6	12.0
Average	122.4	137.5	133.6	121.9	58.0	164.8	14-Jun	31.7	11.7
LSD (0.05)	17.6	15.0	11.3	11.8	1.1	1.6		2.1	0.6
C. V. (%)	8.3	5.7	5.1	6.8	1.1	0.6		4.1	3.3

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)

Environment: Dryland (High Rainfall)

Table 4. Hard Winter Wheat: District 2 - Bozeman

Cultivar/Line	Grain Yield (bu/ac)				2021 Data				
	2021	2020-21	2019-21	2018-21	Test Weight (lb/bu)	Heading Date		Plant Height (in)	Protein (%)
						Ordinal	Calendar		
Combined years of data:	1yr	2yr	3yr	4yr					Bulk
AAC Wildfire	59.6	76.7	92.9	103.5	58.2	170.7	20-Jun	29.9	15.6
AP Solid	63.9				61.2	166.7	16-Jun	27.3	14.2
AP18 AX	64.0				56.0	164.2	13-Jun	29.2	14.4
Balance	65.4				57.5	165.5	14-Jun	28.3	15.9
Battle AX	58.6				54.5	164.1	13-Jun	28.9	14.9
Bobcat	55.4	73.0	88.5	100.0	58.3	167.8	17-Jun	26.8	15.2
Brawl CL Plus	69.9	71.9	90.0	96.3	57.7	162.3	11-Jun	31.3	14.7
Byrd CL Plus	67.5	80.4	99.6	108.6	56.1	164.2	13-Jun	30.4	14.6
CP7017AX	61.8				55.8	163.9	13-Jun	27.8	14.1
CP7050AX	61.2				59.5	162.1	11-Jun	31.2	13.9
CP7869	61.0				53.7	162.7	12-Jun	28.5	15.0
CP7909	72.6	73.5			56.7	160.7	10-Jun	31.6	14.3
Flathead	69.9	75.3	95.1	104.0	57.6	164.8	14-Jun	30.9	15.3
Fortify SF	65.7				59.4	164.4	13-Jun	29.9	13.8
FourOsix	61.8	82.9	98.1	107.2	57.3	166.6	16-Jun	28.6	15.6
Judee	55.5	73.9	90.1	99.6	57.4	166.5	15-Jun	29.3	16.2
Keldin	68.6	84.4	107.2	116.5	57.6	166.1	15-Jun	30.2	14.8
LCS Helix AX	60.5	70.5			57.6	164.0	13-Jun	27.7	14.2
LCS Julep	78.1				60.6	163.1	12-Jun	29.0	14.6
LCS Steel AX	68.1	80.7			58.6	168.1	17-Jun	31.5	13.8
Loma	63.9	80.2	96.4	107.2	58.0	169.3	18-Jun	28.2	14.8
Milestone	66.7				54.2	165.8	15-Jun	26.9	15.1
MT1745	65.7	79.3	98.6		58.1	166.8	16-Jun	28.6	14.3
MT1872	62.9	78.9			56.6	167.2	16-Jun	27.2	14.9
MT19175	65.6				57.0	168.3	17-Jun	27.8	15.1
MTCL1737	57.0	74.9	91.6		60.0	169.6	19-Jun	27.8	15.3
MTCL19149	62.2				57.2	167.6	17-Jun	27.7	15.9
MTCL19151	67.8				57.5	164.3	13-Jun	26.5	15.3
MTFH19132	67.3				55.3	165.9	15-Jun	31.0	14.6
MTS18116	52.0	74.3			59.0	169.4	18-Jun	25.5	14.8
MT WarCat	61.8	77.5			59.5	169.8	19-Jun	28.4	14.6
MTS1831	52.5	73.0			58.9	169.2	18-Jun	25.6	14.7
MTS1855	62.4	81.0			59.7	169.2	18-Jun	27.5	15.2
MTS1903	63.8				59.2	169.6	19-Jun	29.0	15.3
MTS1908	65.4				59.4	170.0	19-Jun	27.2	15.1
MTS1915	47.7				59.1	169.6	19-Jun	26.2	14.9
Northern	68.4	84.2	104.5	115.3	58.2	169.1	18-Jun	28.9	15.6
Ramsay	72.1				57.0	166.6	16-Jun	29.7	14.3
StandClear CLP	59.1	74.3	92.1	102.9	58.4	166.3	15-Jun	28.8	14.6
SY 517 CL2	61.3	61.4	80.0	88.5	56.4	162.5	11-Jun	29.5	14.9
SY Clearstone 2CL	60.9	76.5	99.2	110.0	56.6	167.3	16-Jun	30.0	16.1
SY Wolverine	63.3	71.6	85.2		58.6	164.2	13-Jun	28.2	14.9
Warhorse	53.2	63.5	82.0	91.7	56.6	167.6	17-Jun	28.3	16.1
WB4401	62.9				54.8	163.1	12-Jun	27.9	14.5
WB4418	55.4	64.6	80.4		55.8	163.3	12-Jun	27.9	14.8
WB4505	63.8				57.6	164.3	13-Jun	29.2	14.4
WB4792	63.6	76.6			59.4	166.8	16-Jun	30.2	14.2
Whistler	63.3				56.1	165.5	14-Jun	30.9	14.6
Yellowstone	65.4	79.2	100.2	109.5	56.9	167.9	17-Jun	30.7	15.1
Average	63.0	75.5	93.2	104.0	57.6	166.2	15-Jun	28.8	14.9
LSD (0.05)	6.2	ns	11.9	9.5	1.0	1.0		1.8	
C.V. (%)	5.6	11.0	7.7	6.4	1.0	0.3		3.5	

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)

Environment: Dryland (Moderate Rainfall)

Table 5. Hard Winter Wheat: District 3 - Huntley

Cultivar/Line	Grain Yield (bu/ac)				2021 Data		
	2021	2020-21	2019-21	2018-21	Test Weight	Plant Height	Protein (%)
					(lb/bu)	(in)	
Combined years of data:	1yr	2yr	3yr	4yr			
AAC Wildfire	48.4	62.7	74.4	80.5	57.4	31.6	15.9
AP Solid	56.7				60.5	30.0	14.1
AP18 AX	55.7				56.3	30.9	13.9
Balance	50.6				57.5	31.5	16.4
Battle AX	61.4				55.8	31.7	14.6
Bobcat	57.2	67.4	78.2	83.9	57.9	28.9	15.0
Brawl CL Plus	60.2	70.3	87.9	94.5	59.2	33.8	15.1
Byrd CL Plus	56.8	77.6	91.6	100.1	57.5	33.9	15.0
CP7017AX	57.1				56.8	30.9	14.0
CP7050AX	61.7				62.2	32.3	13.7
CP7869	48.7				57.4	30.0	15.0
CP7909	69.5	73.6			61.0	33.7	13.3
Flathead	58.6	70.0	86.9	94.4	57.2	32.7	15.5
Fortify SF	60.1				60.7	34.3	13.7
FourOsix	63.4	73.7	84.2	90.9	59.1	32.3	14.6
Judee	53.2	66.1	76.0	82.1	58.2	33.4	15.9
Keldin	59.0	75.7	94.8	105.2	58.1	31.1	15.1
LCS Helix AX	57.5	68.0			59.3	30.7	13.4
LCS Julep	55.1				61.0	32.6	15.1
LCS Steel AX	54.2	67.8			58.0	31.8	14.3
Loma	63.8	73.8	80.3	84.7	58.2	30.8	14.8
Milestone	54.0				53.6	29.6	15.1
MT1745	59.3	71.0	84.9		58.8	32.9	14.8
MT1872	48.3	70.1			56.9	29.6	14.4
MT19175	53.9				55.8	29.8	15.3
MTCL1737	57.7	71.8	86.8		59.1	29.6	15.0
MTCL19149	61.6				58.0	32.2	15.1
MTCL19151	65.6				59.2	32.3	14.6
MTFH19132	55.9				57.0	35.5	15.3
MTS18116	39.8	55.4			57.6	26.7	16.1
MT WarCat	55.0	66.1			58.4	30.4	15.4
MTS1831	50.0	63.5			58.1	29.3	14.9
MTS1855	46.7	65.4			57.5	31.1	16.4
MTS1903	60.3				58.4	30.1	14.9
MTS1908	60.2				58.0	30.0	14.7
MTS1915	44.2				57.6	28.0	15.2
Northern	55.8	70.0	83.6	89.8	57.7	31.8	15.7
Ramsay	63.1				58.1	31.8	14.7
StandClear CLP	60.5	72.6	85.3	90.2	58.9	31.7	14.9
SY 517 CL2	55.2	65.2	85.7	94.5	58.6	32.7	15.3
SY Clearstone 2CL	64.8	76.7	88.2	92.0	58.8	35.0	15.2
SY Wolverine	58.6	70.8	91.5		59.9	30.4	14.7
Warhorse	50.8	63.8	78.3	86.4	57.2	32.3	16.3
WB4401	60.0				56.0	31.5	14.2
WB4418	58.1	66.8	80.4		59.5	31.1	14.0
WB4505	59.2				58.7	33.5	14.0
WB4792	61.3	67.0			60.1	33.1	14.3
Whistler	54.3				56.7	34.2	14.8
Yellowstone	58.8	71.5	82.9	88.3	56.8	33.6	15.2
Average	56.8	69.1	84.3	90.5	58.2	31.6	14.9
LSD (0.05)	9.2	ns	ns	9.8	1.8	1.9	1.1
C. V. (%)	9.4	7.9	8.4	7.6	1.9	51.7	4.3

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)

Environment: Dryland

Table 6. Hard Winter Wheat: District 4 - Moccasin

Cultivar/Line	Grain Yield (bu/ac)				2021 Data				
	2021	2020-21	2019-21	2018-21	Test Weight (lb/bu)	Heading Date		Plant Height (in)	Protein (%)
						Ordinal	Calendar		
Combined years of data:	1yr	2yr	3yr	4yr					
AAC Wildfire	31.0	45.2	56.1	58.4	59.0	174.1	23-Jun	24.0	11.6
AP Solid	31.6				63.8	168.9	18-Jun	22.3	10.8
AP18 AX	35.5				61.0	166.6	16-Jun	21.3	9.6
Balance	30.2				60.3	167.6	17-Jun	22.3	11.5
Battle AX	35.1				60.6	166.9	16-Jun	21.0	9.1
Bobcat	33.0	44.0	53.1	55.8	61.3	171.1	20-Jun	22.0	10.5
Brawl CL Plus	35.2	40.5	48.0	51.0	63.9	163.5	12-Jun	24.0	10.6
Byrd CL Plus	36.5	51.4	59.6	61.7	60.2	168.4	17-Jun	25.3	9.5
CP7017AX	34.0				59.8	165.3	14-Jun	23.7	10.6
CP7050AX	32.8				63.6	164.2	13-Jun	23.3	11.1
CP7869	22.5				61.1	165.9	15-Jun	22.7	11.7
CP7909	35.3	39.1			61.6	163.3	12-Jun	22.0	10.1
Flathead	38.6	42.8	50.0	53.9	61.9	166.5	15-Jun	23.3	10.7
Fortify SF	34.2				62.0	167.3	16-Jun	22.7	10.0
FourOsix	31.9	47.0	56.7	59.9	60.4	169.1	18-Jun	22.7	10.9
Judee	30.9	43.5	52.2	53.4	61.2	169.7	19-Jun	24.0	11.0
Keldin	33.9	47.3	55.9	58.3	61.5	170.3	19-Jun	26.7	10.3
LCS Helix AX	31.7	42.1			61.9	167.6	17-Jun	21.7	10.2
LCS Julep	32.0				64.4	165.9	15-Jun	22.3	11.2
LCS Steel AX	31.2	48.0			60.1	170.5	19-Jun	24.7	9.9
Loma	32.9	46.2	54.6	57.8	61.0	171.7	21-Jun	23.3	10.5
Milestone	32.3				60.2	169.2	18-Jun	22.7	10.9
MT1745	35.2	45.9	56.5		60.9	171.2	20-Jun	23.3	10.2
MT1872	32.0	44.4			61.4	169.4	18-Jun	23.7	10.4
MT19175	36.5				60.3	172.5	21-Jun	22.0	10.4
MTCL1737	29.7	45.9	54.4		61.2	172.3	21-Jun	22.3	11.1
MTCL19149	33.8				60.9	171.1	20-Jun	23.0	10.5
MTCL19151	34.8				62.1	166.5	15-Jun	22.7	10.0
MTFH19132	32.6				60.0	168.1	17-Jun	24.3	10.1
MTS18116	26.4	42.7			60.7	172.9	22-Jun	21.3	10.7
MT WarCat	34.5	47.6			60.5	173.6	23-Jun	21.3	11.4
MTS1831	27.7	41.3			60.5	172.1	21-Jun	23.0	11.3
MTS1855	31.7	44.5			61.2	171.8	21-Jun	22.0	10.8
MTS1903	33.9				61.2	172.3	21-Jun	23.7	10.6
MTS1908	31.4				60.9	173.1	22-Jun	24.0	11.1
MTS1915	28.4				60.8	173.4	22-Jun	20.7	11.8
Northern	35.0	47.4	58.1	59.9	61.0	171.6	21-Jun	24.0	10.7
Ramsay	31.5				61.1	170.3	19-Jun	25.7	10.6
StandClear CLP	31.5	43.2	51.4	55.7	61.4	168.4	17-Jun	21.7	10.9
SY 517 CL2	29.8	32.4	46.0	49.6	62.6	162.9	12-Jun	22.7	10.9
SY Clearstone 2CL	36.8	47.2	58.3	61.0	59.8	169.4	18-Jun	24.7	10.4
SY Wolverine	38.8	43.3	53.3		62.3	167.1	16-Jun	22.0	10.3
Warhorse	32.3	41.8	49.8	52.3	61.4	169.8	19-Jun	23.3	11.1
WB4401	32.1				59.4	165.4	14-Jun	21.7	11.0
WB4418	34.9	42.8	52.2		62.6	165.8	15-Jun	21.7	10.0
WB4505	34.4				61.6	167.1	16-Jun	22.7	10.4
WB4792	34.2	46.6			62.2	168.2	17-Jun	24.7	9.3
Whistler	34.7				61.6	167.5	16-Jun	24.3	9.9
Yellowstone	33.9	45.6	54.3	58.2	60.4	170.9	20-Jun	22.7	10.3
Average	32.9	44.2	53.7	56.4	61.2	168.9		23.0	10.6
LSD (0.05)	6.8	ns	ns	6.1	0.9	1.4		2.6	0.9
C. V. (%)	11.8	12.6	8.9	7.6	0.8	0.5		6.9	4.7

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)

Environment: Dryland

Table 7. Hard Winter Wheat: District 5 - Conrad

Cultivar/Line	Grain Yield (bu/ac)				2021 Data				
					Test Weight (lb/bu)	Heading Date		Plant Height (in)	Protein (%)
	2021	2020-21	2019-21	2018-21		Ordinal	Calendar		
Combined years of data:	1yr	2yr	3yr	4yr					
AAC Wildfire	53.5	80.6	70.5	68.3	61.9	174.3	23-Jun	31.6	10.6
AP Solid	48.6				63.8	169.0	18-Jun	27.1	11.2
AP18 AX	52.3				61.7	169.7	19-Jun	28.7	10.0
Balance	46.6				61.3	170.7	20-Jun	28.2	11.8
Battle AX	48.6				62.5	169.3	18-Jun	28.2	10.9
Bobcat	58.9	82.6	77.8	75.1	62.4	171.0	20-Jun	29.3	11.3
Brawl CL Plus	52.6	66.8	71.0	69.6	63.4	169.3	18-Jun	27.2	11.2
Byrd CL Plus	58.5	84.5	78.2	77.8	61.2	169.3	18-Jun	32.4	10.3
CP7017AX	49.9				61.4	170.0	19-Jun	25.4	11.1
CP7050AX	44.3				62.6	169.7	19-Jun	26.4	11.6
CP7869	46.5				62.4	169.0	18-Jun	26.9	11.2
CP7909	57.6	70.0			61.9	169.3	18-Jun	26.8	10.8
Flathead	60.6	80.8	74.9	69.4	62.3	170.0	19-Jun	31.3	11.2
Fortify SF	47.3				62.2	170.0	19-Jun	28.4	10.9
FourOsix	62.8	86.0	78.8	74.3	61.5	170.7	20-Jun	30.5	11.1
Judee	53.5	72.7	64.7	62.8	62.9	171.0	20-Jun	29.9	11.8
Keldin	56.2	72.1	72.3	69.6	62.2	170.7	20-Jun	28.8	10.9
LCS Helix AX	49.1	73.6			62.9	169.7	19-Jun	25.6	10.1
LCS Julep	66.3				64.7	169.3	18-Jun	29.1	12.4
LCS Steel AX	47.1	67.4			61.3	171.7	21-Jun	27.2	10.0
Loma	70.0	86.9	79.3	75.6	61.7	173.7	23-Jun	29.9	11.4
Milestone	55.0				60.1	170.3	19-Jun	28.3	10.5
MT1745	67.9	84.2	80.0		62.3	170.0	19-Jun	29.4	11.1
MT1872	61.6	79.9			61.9	172.3	21-Jun	29.1	10.9
MT19175	57.4				61.3	172.3	21-Jun	28.1	10.7
MTCL1737	45.7	72.1	71.6		60.7	173.3	22-Jun	26.6	11.3
MTCL19149	55.8				60.6	172.0	21-Jun	29.0	10.7
MTCL19151	48.9				61.8	169.7	19-Jun	25.9	11.4
MTFH19132	63.9				60.3	170.7	20-Jun	32.5	11.3
MTS18116	51.0	80.0			62.1	173.7	23-Jun	26.1	10.6
MT WarCat	61.6	84.4			61.4	173.3	22-Jun	29.0	11.1
MTS1831	58.5	80.0			61.9	173.3	22-Jun	26.2	10.9
MTS1855	57.2	76.4			62.1	172.3	21-Jun	27.3	11.1
MTS1903	55.3				61.6	172.7	22-Jun	29.3	10.8
MTS1908	54.1				61.5	173.7	23-Jun	28.9	11.0
MTS1915	62.3				61.5	174.0	23-Jun	28.4	10.6
Northern	58.5	88.2	81.8	75.1	61.8	172.3	21-Jun	30.1	10.6
Ramsay	53.9				61.7	170.7	20-Jun	29.6	11.2
StandClear CLP	53.6	80.4	75.1	74.2	62.7	170.0	19-Jun	29.9	11.2
SY 517 CL2	40.1	58.6	60.4	62.5	63.5	169.3	18-Jun	26.4	11.8
SY Clearstone 2CL	58.4	75.6	71.3	69.8	61.0	171.7	21-Jun	31.9	11.0
SY Wolverine	44.8	61.2	64.6		63.0	169.3	18-Jun	25.6	11.1
Warhorse	56.8	77.9	68.5	63.9	61.6	170.7	20-Jun	29.3	11.4
WB4401	56.7				61.9	170.0	19-Jun	25.5	10.0
WB4418	49.8	72.6	69.1		62.0	169.7	19-Jun	26.0	11.3
WB4505	54.9				61.5	169.0	18-Jun	29.4	10.0
WB4792	60.4	83.3			63.8	170.7	20-Jun	29.0	10.4
Whistler	53.0				62.6	170.0	19-Jun	29.7	10.8
Yellowstone	64.6	77.4	70.7	67.1	61.1	172.0	21-Jun	31.8	11.4
Average	54.9	77.0	72.7	70.3	62.0	170.9	20-Jun	28.5	11.0
LSD (0.05)	14.4	13.8	ns	ns	0.8	2.6		2.5	0.9
C. V. (%)	15.1	8.7	12.1	11.9	0.7	0.9		5.1	5.0

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)

Environment: Dryland

Table 8. Hard Winter Wheat: District 5 - Havre

Cultivar/Line	Grain Yield (bu/ac)				2021 Data					
	2021	2020-21	2019-21	2018-21	Test Weight (lb/bu)	Heading Date		Plant Height (in)	Sawfly Cutting (%)	Protein (%)
						Ordinal	Calendar			
Combined years of data:	1yr	2yr	3yr	4yr						
AAC Wildfire	17.6	34.8	41.2	49.0	54.1	164.5	13-Jun	27.1	17	17.6
AP Solid	28.9				56.9	161.3	10-Jun	28.2	25	16.1
AP18 AX	28.6				52.1	156.3	5-Jun	30.3	34	15.8
Balance	23.8				52.4	159.2	8-Jun	28.7	44	18.9
Battle AX	29.1				51.1	157.0	6-Jun	30.7	22	17.3
Bobcat	25.5	42.5	49.2	52.6	54.8	163.1	12-Jun	26.6	9	17.8
Brawl CL Plus	29.5	38.3	42.9	46.6	52.1	156.0	5-Jun	30.1	24	17.6
Byrd CL Plus	26.7	42.2	45.1	48.6	51.9	158.3	7-Jun	31.9	25	17.5
CP7017AX	31.1				51.1	156.1	5-Jun	28.7	26	16.0
CP7050AX	33.9				55.3	154.4	3-Jun	30.1	34	16.4
CP7869	32.5				50.3	155.4	4-Jun	27.6	27	17.1
CP7909	34.5	32.2			52.3	153.9	3-Jun	29.6	38	16.5
Flathead	35.2	42.8	44.9	49.0	51.8	156.3	5-Jun	30.4	35	17.1
Fortify SF	22.8				54.4	157.9	7-Jun	30.9	49	15.9
FourOsix	23.7	38.4	44.8	48.7	53.3	161.5	10-Jun	29.3	27	17.4
Judee	18.7	34.8	40.7	44.5	55.0	162.1	11-Jun	29.5	41	18.4
Keldin	28.5	43.3	46.3	51.9	52.7	162.7	12-Jun	31.5	37	18.7
LCS Helix AX	29.8	40.8			54.5	156.0	5-Jun	29.0	45	15.8
LCS Julep	29.1				53.4	156.7	6-Jun	29.6	15	17.8
LCS Steel AX	25.8	40.1			54.6	162.7	12-Jun	29.7	41	16.8
Loma	24.2	38.6	42.8	47.2	53.2	163.8	13-Jun	28.1	10	18.3
Milestone	25.8				51.8	162.6	12-Jun	26.0	41	16.8
MT1745	21.4	35.8	43.0		54.4	163.4	12-Jun	28.4	26	17.0
MT1872	21.3	37.1			53.9	162.1	11-Jun	28.3	12	17.2
MT19175	19.8				53.2	164.0	13-Jun	27.9	25	17.6
MTCL1737	18.8	35.3	42.3		55.8	163.7	13-Jun	27.7	5	17.2
MTCL19149	20.7				51.9	162.7	12-Jun	31.2	37	17.5
MTCL19151	31.1				50.2	159.5	8-Jun	29.9	35	17.5
MTFH19132	23.1				52.2	159.8	9-Jun	31.7	55	17.6
MTS18116	17.6	37.0			55.5	163.4	12-Jun	25.1	4	17.9
MT WarCat	25.9	41.3			54.5	163.7	13-Jun	26.9	19	18.2
MTS1831	17.7	35.0			56.2	164.7	14-Jun	24.2	0	17.8
MTS1855	19.4	36.3			52.9	163.7	13-Jun	27.6	13	18.9
MTS1903	19.4				54.0	164.7	14-Jun	28.2	3	18.0
MTS1908	21.0				54.3	165.0	14-Jun	26.6	0	18.0
MTS1915	16.5				54.6	164.1	13-Jun	23.8	0	17.3
Northern	22.8	36.1	43.3	46.6	51.6	164.1	13-Jun	27.5	33	18.2
Ramsay	27.2				51.9	162.9	12-Jun	29.1	32	18.7
StandClear CLP	23.7	38.6	46.3	48.6	54.4	162.7	12-Jun	29.8	55	17.9
SY 517 CL2	33.8	39.3	41.6	44.1	53.6	155.9	5-Jun	27.7	20	16.6
SY Clearstone 2CL	18.8	35.6	42.7	47.5	54.6	162.8	12-Jun	31.5	26	17.6
SY Wolverine	28.3	38.7	42.1		54.5	156.6	6-Jun	29.8	20	16.9
Warhorse	20.6	36.0	39.5	43.9	51.5	162.8	12-Jun	26.6	13	18.3
WB4401	23.3				51.9	157.5	6-Jun	26.7	24	16.1
WB4418	31.8	39.1	43.9		52.5	156.4	5-Jun	28.1	7	16.5
WB4505	29.2				52.7	157.6	7-Jun	30.0	51	16.9
WB4792	30.0	42.0			54.8	160.5	9-Jun	29.1	29	17.1
Whistler	21.4				54.4	160.7	10-Jun	30.5	41	16.9
Yellowstone	27.9	40.7	45.4	49.5	53.5	162.6	12-Jun	30.9	28	17.5
Average	25.3	38.3	43.6	47.9	53.4	160.5	9-Jun	28.7	26.1	17.4
LSD (0.05)	3.3	ns	ns	ns	1.4	1.7		2.1	14.4	0.4
C.V. (%)	7.6	16.9	11.1	10.0	1.5	0.6		5.1	31.9	1.4

bold = indicates highest or lowest value within a column**bold** = indicates varieties with values equal to highest or lowest variety within a column

based on Fisher's Protected LSD (p =0.05)

Environment: Dryland

Table 9. Hard Winter Wheat: District 5 - Ft. Benton (Nutrien)

Cultivar/Line	Grain Yield (bu/ac)				2021 Data			
					Test Weight (lb/bu)	Plant Height (in)	Sawfly Cutting (%)	Protein (%)
	2021	2020-21	2019-21	2018-21				
Combined years of data:	1yr	2yr	3yr	4yr	Bulk			Bulk
AAC Wildfire	30.5	50.0	48.3	53.8	57.0	31.7	22	14.7
AP Solid	45.7				63.3	28.3	15	12.4
AP18 AX	39.2				57.4	30.0	20	13.2
Balance	39.0				56.7	30.7	34	15.2
Battle AX	40.2				55.8	30.7	5	14.2
Bobcat	35.6	47.7	52.5	56.5	58.0	27.3	3	14.6
Brawl CL Plus	51.9	52.3	55.2	57.2	60.1	32.7	14	13.9
Byrd CL Plus	38.3	54.8	52.0	57.4	53.3	31.0	5	14.9
CP7017AX	38.9				56.1	29.0	24	13.7
CP7050AX	36.0				60.3	30.0	9	14.0
CP7869	43.0				56.8	29.0	44	13.7
CP7909	51.7	49.1			59.4	29.0	10	13.4
Flathead	50.4	54.0	55.6	56.4	61.0	31.3	22	13.4
Fortify SF	37.8				59.8	29.7	12	13.2
FourOsix	40.3	50.2	52.3	52.6	57.2	28.7	14	14.7
Judee	32.6	47.2	51.8	54.8	56.1	29.0	5	14.8
Keldin	55.4	58.8	57.7	58.3	60.2	31.0	24	12.9
LCS Helix AX	43.6	49.5			59.8	29.3	40	13.4
LCS Julep	45.7				60.9	29.7	27	14.3
LCS Steel AX	41.3	52.6			57.1	30.3	29	13.1
Loma	42.1	52.0	54.6	57.7	58.9	31.0	15	13.2
Milestone	52.7				56.6	30.0	27	13.3
MT1745	32.4	48.1	51.9		55.3	28.3	4	14.8
MT1872	31.0	47.8			53.5	28.7	4	13.8
MT19175	37.5				56.5	28.7	7	14.3
MTCL1737	37.0	52.9	53.1		57.3	28.0	9	15.2
MTCL19149	41.4				57.2	29.7	12	14.3
MTCL19151	42.3				57.8	29.0	20	14.2
MTFH19132	41.4				56.9	31.0	40	13.7
MTS18116	30.5	51.2			56.6	28.0	2	15.0
MT WarCat	44.0	57.7			60.5	28.0	5	12.9
MTS1831	38.3	50.8			58.1	28.3	3	13.9
MTS1855	35.1	53.7			56.7	29.0	4	14.8
MTS1903	52.0				59.5	29.3	2	13.3
MTS1908	49.9				59.7	29.7	2	13.0
MTS1915	33.9				57.9	27.0	1	14.4
Northern	37.0	55.1	55.4	59.0	56.6	30.0	9	15.0
Ramsay	55.1				58.7	31.7	34	13.5
StandClear CLP	41.4	52.0	53.5	53.4	58.1	30.0	19	14.1
SY 517 CL2	47.3	47.7	51.6	53.4	61.3	29.7	30	14.0
SY Clearstone 2CL	34.0	48.4	51.1	55.5	55.9	31.7	17	14.7
SY Wolverine	44.1	49.2	47.5		60.5	30.3	15	14.1
Warhorse	34.3	49.0	51.8	57.0	54.1	28.7	1	15.8
WB4401	39.9				57.8	28.7	14	13.1
WB4418	45.0	57.0	56.0		58.4	30.0	12	13.3
WB4505	38.7				57.2	29.7	30	13.7
WB4792	43.7	52.0			61.5	30.7	27	12.9
Whistler	43.1				57.5	30.0	30	13.1
Yellowstone	40.5	50.4	50.9	55.7	56.2	29.7	30	14.3
Average	41.3	51.5	52.8	55.9	57.9	29.6	23.3	13.9
LSD (0.05)	11.5	ns	ns	ns		2.0	13.4	
C. V. (%)	17.3	17.0	13.4	12.7		4.1	35.4	

bold = indicates highest or lowest value within a column

bold = indicates varieties with values equal to highest or lowest variety within a column
based on Fisher's Protected LSD (p =0.05)

Environment: Dryland

Table 10. Hard Winter Wheat: District 6 - Sidney

Cultivar/Line	Grain Yield (bu/ac)				2021 Data						
	2021	2020-21	2019-21	2018-21	Test Weight (lb/bu)	Winter Survival (%)		Heading Date		Plant Height (in)	Protein (%)
						21-Apr	Later	Ordinal	Calendar		
Combined years of data:	1yr	2yr	3yr	4yr							
AAC Wildfire	53.5	56.5	67.3	68.0	59.0	84.0	95.6	162.6	12-Jun	24.5	12.0
AP Solid	11.6				64.5	4.1	6.1	159.0	8-Jun	19.7	12.8
AP18 AX	34.9				62.0	14.9	32.4	158.0	7-Jun	21.3	12.0
Balance	19.0				58.0	1.4	4.7	161.2	10-Jun	21.2	14.5
Battle AX	27.6				62.3	8.0	16.1	159.6	9-Jun	18.6	12.3
Bobcat	46.3	52.5	56.7	58.6	62.1	63.0	70.2	160.8	10-Jun	21.9	12.3
Brawl CL Plus	24.4	40.1	38.7	44.2	63.5	13.8	27.7	155.0	4-Jun	20.8	13.2
Byrd CL Plus	30.3	45.0	47.0	54.6	61.5	15.8	39.0	159.2	8-Jun	22.7	11.4
CP7017AX	30.4				61.3	15.1	31.0	159.2	8-Jun	22.0	11.6
CP7050AX	33.8				64.1	35.3	41.9	155.4	4-Jun	22.0	12.6
CP7869	47.5				63.0	66.5	90.5	155.7	5-Jun	19.4	11.6
CP7909	27.2	38.9			63.2	24.9	40.6	154.2	3-Jun	20.9	11.4
Flathead	45.1	52.7	57.3	57.3	62.9	57.6	68.4	157.3	6-Jun	21.4	12.1
Fortify SF	37.7				63.7	17.8	33.7	158.4	7-Jun	20.4	12.2
FourOsix	41.2	51.2	55.6	58.7	60.8	39.2	51.1	159.2	8-Jun	21.7	12.6
Judee	18.6	34.5	50.0	54.2	60.6	10.5	14.3	160.3	9-Jun	20.6	14.4
Keldin	40.5	51.9	56.9	65.7	61.8	39.3	39.5	160.5	9-Jun	21.1	11.7
LCS Helix AX	38.9	48.0			63.8	25.0	45.2	156.8	6-Jun	21.3	11.6
LCS Julep	23.8				65.3	11.9	19.1	157.1	6-Jun	21.6	13.0
LCS Steel AX	47.1	50.9			61.5	28.1	39.1	161.3	10-Jun	23.0	10.5
Loma	51.4	56.0	61.2	63.9	61.5	75.5	91.3	159.8	9-Jun	22.2	11.9
Milestone	23.6				58.7	2.0	8.9	163.5	12-Jun	22.7	12.3
MT1745	51.9	55.0	65.9		60.7	74.0	87.2	159.7	9-Jun	23.2	11.7
MT1872	40.0	48.9			61.1	40.5	69.1	159.7	9-Jun	20.6	11.8
MT19175	52.3				60.5	55.7	68.1	161.2	10-Jun	21.5	11.6
MTCL1737	46.8	55.2	62.2		60.1	48.6	69.7	160.5	9-Jun	20.5	13.1
MTCL19149	34.8				60.6	11.8	9.6	161.9	11-Jun	19.4	12.1
MTCL19151	47.9				61.3	54.7	72.5	158.9	8-Jun	20.6	12.7
MTFH19132	39.1				60.4	35.2	38.0	159.5	8-Jun	22.6	12.0
MTS18116	40.2	50.9			61.0	35.6	56.1	163.2	12-Jun	21.1	12.4
MT WarCat	53.9	57.0			61.1	65.0	80.1	162.8	12-Jun	18.7	12.1
MTS1831	39.3	49.8			60.9	36.3	50.8	163.1	12-Jun	21.2	12.2
MTS1855	48.4	54.1			60.4	57.0	61.5	159.8	9-Jun	19.4	13.2
MTS1903	38.3				61.0	18.1	32.0	163.2	12-Jun	20.9	12.1
MTS1908	38.6				60.7	21.0	52.7	164.7	14-Jun	23.2	11.9
MTS1915	44.8				60.7	39.4	59.6	161.1	10-Jun	20.5	12.1
Northern	43.2	54.2	65.0	69.7	61.1	49.1	58.1	159.6	9-Jun	21.1	12.7
Ramsay	37.5				61.9	31.3	43.5	159.8	9-Jun	20.5	11.5
StandClear CLP	44.3	49.5	59.4	62.0	62.8	42.7	72.9	160.0	9-Jun	25.1	12.1
SY 517 CL2	15.7	30.4	29.0	36.9	63.7	3.1	9.8	156.8	6-Jun	18.1	13.9
SY Clearstone 2CL	37.8	52.3	59.4	60.9	59.9	39.4	56.6	160.4	9-Jun	22.6	12.6
SY Wolverine	26.0	38.5	34.1		62.7	14.8	30.6	157.3	6-Jun	19.4	12.5
Warhorse	39.7	46.4	48.7	53.8	60.5	50.8	69.9	160.3	9-Jun	22.0	12.9
WB4401	27.4				61.3	22.5	27.8	157.2	6-Jun	18.0	11.4
WB4418	33.5	45.0	43.6		63.1	19.0	26.4	157.5	6-Jun	19.0	11.9
WB4505	37.7				63.0	29.1	41.3	157.5	6-Jun	20.3	11.8
WB4792	38.5	50.2			64.6	21.7	26.0	158.9	8-Jun	22.4	10.7
Whistler	50.6				61.7	42.9	70.5	159.0	8-Jun	22.3	11.5
Yellowstone	53.1	62.1	65.8	67.6	60.5	58.7	83.0	159.9	9-Jun	23.0	12.0
Average	37.9	49.2	53.9	58.4	61.7	34.1	47.5	159.5	9-Jun	21.2	12.2
LSD (0.05)	9.0	11.6	16.3	13.2	1.0	17.2	29.4	2.1		3.2	0.7
C. V. (%)	13.7	11.4	18.3	15.8	1.0	29.8	36.0	0.8		9.2	3.3

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)

Environment: Dryland

Table 11. Hard Winter Wheat: District 6 - Williston, North Dakota

Cultivar/Line	Grain Yield (bu/ac)				2021 Data	
	2021	2020-21	2019-21	2018-21	Test Weight (lb/bu)	Protein (%)
Combined years of data:	1yr	2yr	3yr	4yr		
AAC Wildfire	24.3	39.8	44.5	47.2	57.7	15.8
AP Solid	21.7				60.4	16.0
AP18 AX	22.1				58.2	15.4
Balance	26.2				58.1	16.7
Battle AX	23.6				59.1	15.3
Bobcat	25.6	38.2	44.6	45.2	58.2	15.6
Brawl CL Plus	16.4	31.3	35.4	36.2	59.2	16.7
Byrd CL Plus	21.3	36.6	40.6	41.3	58.4	14.8
CP7017AX	22.0				58.5	14.7
CP7050AX	17.7				59.5	17.1
CP7869	22.6				58.9	15.4
CP7909	19.2	31.8			59.1	15.7
Flathead	25.8	36.3	39.1	40.4	58.5	15.9
Fortify SF	20.3				59.4	15.7
FourOsix	25.6	39.6	45.3	45.7	58.2	15.7
Judee	22.0	34.9	39.7	40.8	59.3	16.6
Keldin	26.1	39.2	43.6	44.0	58.2	14.9
LCS Helix AX	21.0	35.2			58.3	14.8
LCS Julep	23.8				61.3	15.9
LCS Steel AX	27.6	41.9			58.4	13.5
Loma	25.5	37.9	44.5	45.1	58.1	15.4
Milestone	25.3				56.9	15.0
MT1745	25.1	37.9	42.7		58.9	14.7
MT1872	27.0	34.9			58.9	15.1
MT19175	25.7				58.8	15.5
MTCL1737	24.4	38.4	44.3		58.4	16.2
MTCL19149	27.2				58.0	15.4
MTCL19151	23.9				58.5	15.5
MTFH19132	23.7				57.2	16.4
MTS18116	25.2	37.7			59.3	14.6
MT WarCat	27.6	39.2			58.1	16.1
MTS1831	24.9	37.0			58.8	14.7
MTS1855	22.9	37.3			58.8	15.9
MTS1903	26.7				58.6	15.2
MTS1908	23.8				57.7	15.8
MTS1915	26.9				59.4	15.6
Northern	26.8	42.3	45.9	45.8	58.1	15.5
Ramsay	28.2				58.3	14.7
StandClear CLP	20.4	35.2	40.4	41.0	59.0	16.2
SY 517 CL2	17.4	31.9	35.9	36.8	60.4	17.7
SY Clearstone 2CL	25.4	39.5	41.5	42.5	57.8	14.7
SY Wolverine	21.2	33.3	38.1		59.4	15.9
Warhorse	23.3	33.5	39.3	40.8	57.6	16.2
WB4401	20.7				58.9	14.9
WB4418	18.9	33.3	35.1		58.5	16.3
WB4505	22.6				59.8	14.5
WB4792	21.9	38.0			61.1	14.6
Whistler	25.2				58.9	14.7
Yellowstone	27.4	38.1	43.9	44.7	57.8	15.5
Average	23.7	36.8	41.3	42.8	58.7	15.5
LSD (0.05)	3.1	5.5	4.8	3.8	0.9	0.6
C. V. (%)	7.4	7.2	7.0	6.3	0.9	2.0

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)

Environment: Dryland

*Severe drought in 2021 - plots emerged in late spring after rains

Table 12. 2018-2021 Hard Winter Wheat: Combined Locations Winter Survival and Associated Yield

[Locations: Conrad ('20), Sidney ('18, '19, '21), & Williston ('19, '20)]

Cultivar/Line	Winter Survival (%)				Yield (bu/ac)			
	2021	2020-21	2019-21	2018-21	2021	2020-21	2019-21	2018-21
Location-years:	1	3	5	6	1	3	5	6
AAC Wildfire	<u>96</u>	<u>85</u>	<u>73</u>	<u>71</u>	53.5	72.1	<u>71.9</u>	71.6
AP Solid	6				11.6			
AP18 AX	32				34.9			
Balance	5				19.0			
Battle AX	16				27.6			
Bobcat	70	69	59	58	46.3	67.7	65.2	65.0
Brawl CL Plus	28	61	56	54	24.4	50.5	46.2	48.6
Byrd CL Plus	39	69	58	58	30.3	64.2	58.5	61.6
CP7017AX	31				30.4			
CP7050AX	42				33.8			
CP7869	91				47.5			
CP7909	41	57			27.2	51.3		
Flathead	68	79	69	65	45.1	64.2	60.8	60.2
Fortify SF	34				37.7			
FourOsix	51	72	61	59	41.2	68.0	65.0	65.5
Judee	14	58	56	55	18.6	52.8	57.7	59.2
Keldin	40	60	54	55	40.5	60.3	60.0	65.4
LCS Helix AX	45	68			38.9	62.1		
LCS Julep	19				23.8			
LCS Steel AX	39	48			47.1	63.6		
Loma	91	83	70	66	51.4	68.5	67.0	67.9
Milestone	9				23.6			
MT1745	87	80	70		51.9	67.7	68.6	
MT1872	69	71			40.0	60.3		
MT19175	68				52.3			
MTCL1737	70	74	64		46.8	65.9	66.0	
MTCL19149	10				34.8			
MTCL19151	72				47.9			
MTFH19132	38				39.1			
MTS18116	56	68			40.2	66.4		
MT WarCat	80	75			<u>53.9</u>	70.6		
MTS1831	51	68			39.3	63.2		
MTS1855	62	71			48.4	65.2		
MTS1903	32				38.3			
MTS1908	53				38.6			
MTS1915	60				44.8			
Northern	58	75	63	61	43.2	<u>72.9</u>	71.7	<u>73.7</u>
Ramsay	44				37.5			
StandClear CLP	73	79	68	67	44.3	67.1	66.3	66.9
SY 517 CL2	10	43	43	42	15.7	46.4	41.9	45.0
SY Clearstone 2CL	57	74	65	62	37.8	61.3	60.6	61.4
SY Wolverine	31	57	48		26.0	49.6	44.4	
Warhorse	70	76	64	62	39.7	60.8	57.3	59.3
WB4401	28				27.4			
WB4418	26	59	54		33.5	58.9	51.2	
WB4505	41				37.7			
WB4792	26	61			38.5	66.3		
Whistler	70				50.6			
Yellowstone	83	78	67	66	53.1	64.0	64.2	65.6
Average	47.5	68.6	61.1	60.0	37.9	62.6	60.2	62.5
LSD (0.05)	29.4	22.6	15.3	13.4	9.0	10.9	11.2	9.8
C.V.	36.0	20.1	19.8	19.3	13.7	10.7	14.7	13.6

= indicates highest value within a column

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

Table 13. 2018-2021 Hard Winter Wheat: Combined Locations Sawfly Cutting and Yield

[Locations: Conrad, Ft. Benton, & Havre]

Cultivar/Line	Sawfly Cutting ¹ (%)				Yield ¹ (bu/ac)			
	2021	2020-21	2019-21	2018-21	2021	2020-21	2019-21	2018-21
Location-years:	2	4	7	9	2	4	7	9
AAC Wildfire	20	26	35	30	24.1	52.0	51.0	54.3
AP Solid	20				37.3			
AP18 AX	27				33.9			
Balance	39				31.4			
Battle AX	14				34.7			
Bobcat (ss)	6	8	10	8	30.6	56.7	60.0	61.7
Brawl CL Plus	19	19	30	29	40.7	52.4	57.5	59.0
Byrd CL Plus	15	21	28	29	32.5	58.3	56.6	60.7
CP7017AX	25				35.0			
CP7050AX	21				35.0			
CP7869	35				37.8			
CP7909	24	31			43.1	49.6		
Flathead	29	26	38	41	42.8	59.2	58.3	57.8
Fortify SF	31				30.3			
FourOsix	20	33	44	46	32.0	56.6	57.8	57.7
Judee (ss)	23	21	27	25	25.7	48.5	50.9	53.0
Keldin	31	36	47	45	42.0	57.5	58.7	59.1
LCS Helix AX	43	32			36.7	55.8		
LCS Julep	21				37.4			
LCS Steel AX	35	36			33.6	52.3		
Loma (ss)	13	18	24	22	33.2	55.8	56.9	58.9
Milestone	34				39.3			
MT1745	15	20	26		26.9	51.1	56.2	
MT1872	8	13			26.2	50.8		
MT19175	16				28.7			
MTCL1737	7	15	25		27.9	51.5	55.2	
MTCL19149	25				31.1			
MTCL19151	28				36.7			
MTFH19132	48				32.3			
MTS18116	3	5			24.1	53.3		
MT WarCat (ss)	12	15			35.0	58.4		
MTS1831	1	4			28.0	52.4		
MTS1855	9	22			27.3	50.8		
MTS1903	3				35.7			
MTS1908	1				35.5			
MTS1915	1				25.2			
Northern	21	20	30	30	29.9	56.8	58.6	59.4
Ramsay	33				41.2			
StandClear CLP (ss)	37	36	39	36	32.6	56.4	58.4	59.2
SY 517 CL2	25	26	33	31	40.6	50.7	53.2	55.6
SY Clearstone 2CL	21	30	44	46	26.4	49.5	53.4	56.5
SY Wolverine	18	25	32		36.2	49.7	51.9	
Warhorse (ss)	7	13	14	11	27.5	51.3	51.3	53.5
WB4401	19				31.6			
WB4418	10	15	22		38.4	54.6	55.5	
WB4505	41				34.0			
WB4792	28	24			36.9	58.5		
Whistler	36				32.3			
Yellowstone	29	32	42	45	34.2	53.0	53.7	55.8
Average	21.3	22.1	31.1	31.6	33.1	53.7	55.5	57.5
LSD (0.05)	17.4	12.6	10.0	11.0	8.1	ns	ns	ns
C.V.	40.7	40.5	30.4	37.4	12.1	14.2	12.3	12.2

bold = indicates highest or lowest value within a column**bold** = indicates varieties with values equal to highest or lowest variety within a column based on Fisher's protected LSD (p=0.05)

(ss) = Solid-stemmed sawfly resistant cultivar/line

¹ = Data reported only when sawfly cutting had exceeded 10% in the test

Table 14. Precipitation and Average Monthly Temperature for Crop Year 2020-2021

Agricultural Research Center		Sept. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	June 2021	July 2021	Aug. 2021		Historical Average
Western Triangle^{1/} (Conrad)	Precipitation (in):	0.00	0.36	0.32	0.27	0.29	0.33	0.00	0.44	2.85	0.00	0.00	2.16	Total: 7.02	9.72
	Mean Temperature (°F):	57.0	38.0	34.0	31.0	28.0	10.0	36.0	39.0	47.0	64.0	71.0	63.0	Average: 43.2	41.3
															[1987-2021]
Northern^{1/} (Havre)	Precipitation (in):	1.72	0.99	1.11	0.07	0.02	0.59	0.20	0.51	3.02	0.23	0.32	1.22	Total: 10.52	12.02
	Mean Temperature (°F):	58.8	39.1	32.1	29.8	28.2	10.0	37.6	42.6	49.8	66.9	74.7	67.7	Average: 43.1	42.8
															[1916-2021]
Northwestern^{2/} (Kalispell)	Precipitation (in):	0.37	2.65	1.80	1.21	1.39	1.07	0.44	0.69	1.90	1.98	0.20	1.76	Total: 15.46	19.87
	Mean Temperature (°F):	56.0	40.0	34.0	28.0	30.0	21.0	38.0	43.5	50.5	64.0	71.5	65.0	Average: 45.1	43.3
															[1980-2021]
Central^{1/} (Moccasin)	Precipitation (in):	0.77	1.11	0.16	0.16	0.44	0.42	0.15	1.03	2.68	0.60	1.06	2.74	Total: 11.32	15.30
	Mean Temperature (°F):	58.4	41.2	39.1	34.7	31.0	13.6	36.8	40.2	49.5	64.4	72.9	63.8	Average: 45.5	42.9
															[1910-2021]
Southern^{1/} (Huntley)	Precipitation (in):	0.55	2.06	0.23	0.32	0.27	6.29	0.58	1.20	1.92	0.38	0.13	1.49	Total: 15.42	13.54
	Mean Temperature (°F):	60.3	40.4	35.4	30.4	29.1	13.6	38.1	43.8	52.7	70.1	75.9	66.6	Average: 46.4	45.6
															[1911-2020]
Northeastern^{2/} (Sidney)	Precipitation (in):	0.30	0.62	0.19	0.01	0.08	0.11	0.04	0.38	1.81	2.38	0.01	1.34	Total: 7.27	13.95
	Mean Temperature (°F):	61.0	40.5	34.0	27.5	25.5	10.0	39.5	46.0	55.5	71.0	78.0	70.5	Average: 46.6	43.3
															[1949-2020]
Williston (WREC)^{3/} (North Dakota)	Precipitation (in):	0.06	0.12	-	-	-	-	-	0.29	1.43	3.43	0.68	1.35	Total: 7.36	14.51
	Mean Temperature (°F):	58.0	38.0	31.0	25.0	22.0	8.0	37.0	43.0	53.0	69.0	76.0	69.0	Average: 44.08	44.2
															[1990-2020]
Nutrien^{2/} (Ft. Benton)	Precipitation (in):	0.79	1.77	1.10	0.14	0.07	0.98	0.35	0.85	2.87	0.26	0.84	2.01	Total: 12.03	13.01
	Mean Temperature (°F):	59.5	40.5	38.0	33.5	32.0	13.5	40.0	44.0	52.0	68.5	76.5	68.5	Average: 47.2	44.8
															[1949-2020]
Post Farm^{2/} Bozeman	Precipitation (in):	0.74	1.29	0.24	0.27	0.73	0.89	0.57	1.10	3.11	0.80	0.83	2.05	Total: 12.62	15.85
	Mean Temperature (°F):	58.7	43.4	35.1	29.1	27.7	17.2	37.2	42.6	50.2	65.5	72.5	65.2	Average: 45.4	43.7
															[1958-2021]

1/ = Climate Data supplied by experiment station

2/ = Climate Data collected from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC)

3/ = Climate Data collected from the North Dakota Agricultural Weather Network (NDAWN) Center

Table 15. Agronomic characteristics, cereal quality, and disease reactions of 2021 hard winter wheat varieties.

Cultivar/Line	Agronomic Characteristics						Cereal Quality			Disease Reactions (9)		
	Maturity	Chaff Color	Winter Survival	Straw Strength	Stem Solidness	Herbicide Resistance	Milling	Baking	PPO	Dwarf Smut	Stripe Rust	Stem Rust
	(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)			
AAC Wildfire	L	Red	4	M	-	No	3	4	M	-	MR	-
AP Solid	M	White	1	-	NA	No	-	-	-	-	-	-
AP18 AX	M-E	White	1	-	-	AX	-	-	-	-	-	-
Balance	M	-	1	-	-	No	-	-	-	-	-	-
Battle AX	M-E	-	1	-	-	AX	-	-	-	-	-	-
Bobcat	M	White	3	S	23	No	4	3	M	S	R	MS
Brawl CL Plus	E	White	3	S	-	CL	4	3	M-H	S	S	-
Byrd CL Plus	E	White	3	M-S	-	CL	2	2	M-H	-	S	-
CP7017AX	M-E	-	1	-	-	AX	-	-	-	-	-	-
CP7050AX	E	-	2	-	-	AX	-	-	-	-	-	-
CP7869	E	-	5	-	-	No	-	-	-	-	-	-
CP7909	E	White	3	-	-	No	3	1	L	-	R	-
Flathead	E	White	4	S	-	No	4	4	M	MR	R	MR
Fortify SF	M-E	-	2	-	15	No	-	-	-	-	-	-
FourOsix	M-E	White	3	S	-	No	4	4	M	S	R	MS
Judee	M	White	3	M-S	19	No	4	4	M	S	R	S
Keldin	M	White	3	S	-	No	2	3	H	S	MS	-
LCS Helix AX	E	White	4	-	-	AX	2	2	H	-	MR	-
LCS Julep	M-E	-	1	-	-	No	-	-	-	-	-	-
LCS Steel AX	M-L	-	2	-	-	AX	2	3	H	-	-	-
Loma	M-L	White	4	M-S	18	No	4	4	L	S	R	R
Milestone	M-L	-	1	-	-	No	-	-	-	-	-	-
MT WarCat	L	White	4	-	17	No	4	5	L	-	R	-
Northern	M	White	4	M-S	-	No	3	3	L	S	R	R
Ramsay	M-L	-	2	-	-	No	-	-	-	-	-	-
StandClear CLP	M	White	4	M-S	18	CL	4	3	H	-	R	MS
SY 517 CL2	E	White	2	S	-	CL	4	4	M-H	S	MS	-
SY Clearstone 2CL	M-L	White	4	M	-	CL	2	3	M	R	R	MR
SY Wolverine	M-E	White	2	S	-	No	3	2	M	-	MS	-
Warhorse	M	White	4	-	21	No	3	4	M	S	R	R
WB4401	M-E	-	1	-	-	No	-	-	-	-	-	-
WB4418	E	White	3	S	-	No	2	2	L	-	MR	-
WB4505	M-E	-	2	-	-	No	-	-	-	-	-	-
WB4792	M-E	White	4	-	-	No	2	2	M-H	-	MR	-
Whistler	M	-	4	-	-	No	-	-	-	-	-	-
Yellowstone	M	White	4	S	7	No	3	5	M	MS	R	S

(1) Maturity based on heading dates; E = Early, M = Medium, L = Late

(2) 5 = Best Winter survival. When available, Winter survival is combined over locations (Williston, Sidney, & Conrad) up to four years

(3) Straw strength based on lodging data; W = Weak, M = Medium, S = Strong

(4) Scale 5-25 (25 = most solid)

(5) Herbicide Resistance; CL = Clearfield, AX = CoAxiom

(6) Milling Quality (0-5 scale) based on Flour Yield, Flour Protein, & Flour Ash (5 = Best)

(7) Baking Quality (0-5 scale) based on Loaf Volume, Mixing & Baking Water Absorption, and Mixing Tolerance (5 = Best)

(8) PPO = Polyphenol Oxidase, low values are better for noodle quality; L = low, M = medium, H = high

(9) R = Resistant, MR = Moderately Resistant, M = Moderate, MS = Moderately Susceptible, S = Susceptible, VS = Very Susceptible

- = no information

NA = Stem Solidness data not yet available (line may be semi-solid or solid-stemmed)

Additional Descriptive Information for 2021 Winter Wheat Varieties

New for the 2022 Bulletin:

AP18 AX - hard red winter wheat developed by Colorado Wheat Research Foundation and Syngenta; released in 2020. AP18 AX is a medium-early maturing wheat with white chaff. AP18 AX had below average yield, test weight, and protein in its first year of testing in Montana. Mill and bake characteristics of AP18 AX have not been evaluated under Montana growing conditions. PVP, Title V has been issued (Certificate #202000351). Additionally, the CoAxiu® genes are patented.

AP Solid – hard red winter wheat developed by Syngenta and released in 2021. AP Solid is a medium-maturing white chaff wheat with high test weight and below average yield and protein in limited testing. Stem solidness and mill and bake characteristics of AP Solid have not been determined under Montana growing conditions.

Balance - hard red winter wheat developed by the Washington Agricultural Experiment Station and released by Nutrien in 2020. Balance is a medium-early maturing, high protein wheat with white chaff. Balance had below average yield and test weight in its first year of testing in Montana. Mill and bake characteristics of Balance have not been determined under Montana growing conditions. PVP, Title V is pending (Certificate #202100490).

Battle AX – CoAxiu® herbicide resistant hard red winter wheat developed by Colorado Wheat Research Foundation and released in 2019. Battle AX had below average yield and average test weight and protein in its first year of testing in Montana. Mill and bake characteristics of Battle AX have not been determined under Montana growing conditions. PVP, Title V has

been issued (Certificate #201900406). Additionally, the CoAxiu® genes are patented.

CP7017AX - hard red CoAxiu® herbicide resistant winter wheat developed by Limagrain and released in 2020. CP7017AX had below average yield and test weight and average protein in its first year of testing in Montana. Mill and bake characteristics of CP7017AX have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #202000232). Additionally, the CoAxiu® genes are patented.

CP7050AX - hard red CoAxiu® herbicide resistant winter wheat developed by Limagrain and released in 2020. CP7050AX had high test weight and below average yield and protein in its first year of testing in Montana. Mill and bake characteristics of CP7050AX have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #202000233). Additionally, the CoAxiu® genes are patented.

CP7869 - hard red winter wheat developed by Winfield and released in 2018. CP7869 is an early maturing wheat that had below average yield and average test weight and protein under limited testing in Montana. CP7869 appeared to have high winter survival under its first year of testing. Mill and bake characteristics of CP7869 have not been determined under Montana growing conditions. *CP7869 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

Fortify SF - hard red winter wheat developed by Colorado Wheat Research Foundation and released in 2019. Fortify SF is a semi-solid, medium-early maturing wheat that had average yield, above average test weight, and below average protein in its first year of testing in Montana. Mill and bake characteristics of Fortify

SF have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #202100004).

LCS Julep – hard red winter wheat developed by Limagrain and released in 2020. LCS Julep had above average yield, test weight, and protein in its first year of testing in Montana. Mill and bake characteristics of LCS Julep have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #202000267).

LCS Steel AX – CoAxiom® herbicide resistant hard red winter wheat developed by Limagrain and released in 2021. LCS Steel AX had average yield and test weight and below average protein in its first year of testing in Montana. Mill and bake characteristics of LCS Steel AX have not been determined under Montana growing conditions. PVP, Title V is pending (Certificate #202100229). Additionally, the CoAxiom® genes are patented.

Milestone – hard red winter wheat developed in Germany and released by Nutrien in 2020. Milestone had above average yield, below average test weight, and average protein in its first year of testing in Montana. Mill and bake characteristics of Milestone have not been determined under Montana growing conditions. PVP, Title V is pending (Certificate #202100493).

MT WarCat – hard red winter wheat developed by the Montana Agricultural Experiment Station and available to certified seed growers in fall 2022. MT WarCat is a medium-late maturing, semisolid-stemmed, semi-dwarf wheat with white chaff. MT WarCat has above average yield, test weight, and protein. MT WarCat has good resistance to cutting by wheat stem sawfly, excellent stripe rust resistance, good winter survival, and aluminum/acid soil tolerance.

Ramsay – hard red winter wheat released by Nutrien in 2021. Ramsay is a medium-late maturing wheat with high yield and average test

weight and protein under limited testing in Montana. Mill and bake characteristics of Ramsay have not been determined under Montana growing conditions.

WB4401 - hard red winter wheat developed by WestBred and released in 2020. WB4401 had below average yield and protein and average test weight under limited testing in Montana. Mill and bake characteristics of WB4401 have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #202000427). *WB4401 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

WB4505 - hard red winter wheat developed by WestBred and released in 2019. WB4505 had above average yield, average test weight, and below average protein under limited testing in Montana. Mill and bake characteristics of WB4505 have not been determined under Montana growing conditions. *WB4505 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

Whistler - hard red winter wheat developed by Colorado Wheat Research Foundation and released in 2019. Whistler had above average yield and test weight in its first year of testing in Montana. Mill and bake characteristics of Whistler have not been determined under Montana growing conditions. PVP, Title V has been issued (Certificate #201900412).

Varieties previously in bulletin:

AAC Wildfire – hard red winter wheat developed by Agriculture and AgriFoods Canada in Alberta, released in 2015, and marketed by SECAN. AAC Wildfire is a late maturing, hollow-stemmed, tall wheat with red chaff. AAC Wildfire has average yield, test weight, and protein, with above average winter survival. AAC Wildfire is moderately resistant to stripe rust. AAC Wildfire has high PPO, average milling and above

average baking characteristics. PVP, Title V is pending (Certificate #202000008).

Bobcat – hard red winter wheat developed by the Montana Agricultural Experiment Station and available to certified seed growers in fall 2019. Bobcat is a medium maturing, solid-stemmed, short wheat with white chaff. Bobcat has above average yield and test weight, average protein, with average winter survival. Bobcat has the highest yield and lowest percent sawfly cutting, of all varieties, in trials where sawfly pressure was above 10% cutting. Bobcat has excellent resistance to stripe rust and is moderately susceptible to stem rust. Bobcat has medium-low PPO and above average milling and baking characteristics. PVP, Title V has been issued (Certificate #202000117).

Brawl CL Plus – hard red winter wheat developed by Colorado and released in 2011. Brawl CL Plus is an early maturing, medium short statured wheat, with white chaff. Brawl CL Plus has average yield and above average test weight and protein. Brawl CL Plus is susceptible to stripe rust. Brawl CL Plus is a high PPO variety with average mill and bake characteristics. PVP, Title V has been issued (Certificate #201200434). Additionally, the Clearfield® genes are patented.

Byrd CL Plus – hard red winter wheat developed by Colorado and released in 2018. Byrd CL Plus is an early maturing, hollow-stemmed, medium-tall wheat with white chaff. Byrd CL Plus has above average yield, average test weight, and below average protein, with average winter survival. Resistance or susceptibility to stripe rust, under Montana conditions, has not been determined for Byrd CL Plus. Byrd CL Plus has high PPO and average milling and baking characteristics. PVP, Title V is pending (Certificate #201900417). Additionally, the Clearfield® genes are patented. *Byrd CL Plus will not be in the Montana Intrastate Winter Wheat Test for 2022.*

CP7909 – hard red winter wheat developed by Winfield United (Croplan) and released in 2018. CP7909 is an early maturing, medium short statured wheat, with white chaff. CP7909 has average winter hardiness under limited testing, average yield, and average test weight and protein. CP7909 has shown resistance to stripe rust conditions. CP7909 is a low PPO variety with average milling and below average baking characteristics.

Flathead – hard red winter wheat developed by the Montana Agricultural Experiment Station and available to certified seed growers in fall 2019. Flathead is an early maturing (especially for a Montana line), hollow-stemmed, medium height wheat with white chaff. Flathead has average yield, above average test weight, and average protein, with average winter survival. Flathead has excellent resistance to stripe rust and is moderately resistant to both stem rust and dwarf bunt. Flathead has medium PPO and above average milling and baking characteristics. PVP, Title V has been issued (Certificate #202000202).

FourOsix - hard red winter wheat developed by the Montana Agricultural Experiment Station and available to seed growers in fall 2018. FourOsix is a medium maturing, short to medium statured wheat, with average winter-hardiness. FourOsix is a high yielding variety with above average test weight and average protein. FourOsix (50% Yellowstone, in pedigree) is similar in grain yield of Yellowstone - but with significantly earlier heading, shorter plant height, and significantly higher test weight and protein. FourOsix is resistant to stripe rust and this resistance is either similar or significantly higher than that of Yellowstone. FourOsix is moderately susceptible to stem rust. FourOsix has excellent milling and baking qualities, comparable to Decade and parental cultivar, Yellowstone. PVP, Title V has been issued (Certificate #201900053).

Judee – hard red winter wheat developed by the Montana Agricultural Experiment Station in 2011. Judee is a white chaff, solid-stem, semi-dwarf (Rht1) wheat with medium maturity. Judee has average yield, test weight, and protein, and below average winter hardiness. Judee is susceptible to prevalent races of stem and leaf rust but resistant to stripe rust. Stem-solidness of Judee is most similar to Genou. Judee is a high PPO variety with average mill and above average bake properties. PVP, Title V has been issued (Certificate #201200161).

Keldin – hard red winter wheat developed by Peter Franck (Germany) and released by WestBred in 2011. Keldin is a medium maturing, medium short statured wheat, with white chaff. Keldin has above average yield and test weight and average protein. Keldin is moderately susceptible to stripe rust. Keldin is a high PPO variety with average mill and below average bake characteristics. PVP, Title V has been issued (Certificate #201300462).

LCS Helix AX – hard red CoAxiom® herbicide resistant winter wheat developed by Limagrain and released in 2020. LCS Helix AX is an early maturing, medium statured wheat with white chaff. LCS Helix AX appears to have average winter hardiness under limited testing in 2020. LCS Helix AX has average yield, above average test weight and below average protein. LCS Helix AX appears to be moderately resistant to stripe rust under Pacific Northwest conditions. LCS Helix AX is a high PPO variety with below average mill and bake characteristics. PVP, Title V has been issued (Certificate #202000235). Additionally, the CoAxiom® genes are patented.

Loma – hard red winter wheat developed by the Montana Agricultural Experiment Station and released in 2016. Loma is a semi-solid stemmed (similar to Genou), medium-late maturing, medium short statured wheat, with white chaff. Loma has above average yield and average test weight and protein. Loma is resistant to both stripe and stem rust. Loma is a medium-low PPO line with above average mill and bake.

PVP, Title V has been issued (Certificate #201700021).

Northern – hard red winter wheat developed the Montana Agricultural Experiment Station and available to growers in fall 2015. Northern is a medium-late maturing, medium-short statured wheat, with white chaff. Northern has average yield (similar to Yellowstone and Colter), average test weight, and average protein. Northern is resistant to both stem and stripe rust. Northern is a low PPO variety with average milling and baking properties. PVP, Title V has been issued (Certificate #201600092).

StandClear CLP – hard red winter wheat developed by the Montana Agricultural Experiment Station for exclusive license to Nutrien Ag Solutions (Loveland Products Inc., Loveland, CO) with a full partnership agreement with BASF Chemical Company. StandClear CLP will be available to certified seed growers in fall 2020. StandClear CLP is a medium maturing, semisolid-stemmed, medium height wheat with white chaff. StandClear CLP has average yield, above average test weight, and average protein, with good winter survival. StandClear CLP has high PPO and average milling and baking characteristics. PVP, Title V has been issued (Certificate #202000183). Additionally, the Clearfield® genes are patented.

SY 517 CL2 – a 2-gene Clearfield® hard red winter wheat developed by Syngenta and released in 2017. SY 517 CL2 is an early maturing, short statured wheat, with white chaff. Winter-hardiness is below average. SY 517 CL2 has below average yield, above average test weight, and average protein. SY 517 CL2 is moderately susceptible to stripe rust. SY 517 CL2 is a medium PPO variety with average mill and below average bake characteristics. PVP, Title V is issued (Certificate #201700216). Additionally, the Clearfield® genes are patented. *SY 517 CL2 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

SY Clearstone 2CL – a 2-gene Clearfield® hard red winter wheat developed by Montana Agricultural Experiment Station in 2012 and licensed exclusively to Syngenta Seeds. SY Clearstone wheat 2CL is very similar to Yellowstone. It is a medium maturing, medium tall, white chaffed wheat with average winter hardiness. It is a high yielding wheat with average test weight and protein. SY Clearstone 2CL is resistant to stripe rust and has moderate resistance to stem rust, the latter an improvement over Yellowstone. SY Clearstone 2CL is resistant to common bunt. SY Clearstone 2CL is a medium PPO variety with average mill and above average bake properties. PVP, Title V has been issued (Certificate #201300357). Additionally, the Clearfield® genes are patented.

SY Wolverine – hard red winter wheat developed by Syngenta and released in 2019. SY Wolverine is a medium early maturing, hollow-stemmed, short wheat with white chaff. SY Wolverine has below average yield, above average test weight, and above average protein, with below average winter survival. SY Wolverine appears to be moderately susceptible to stripe rust under Pacific Northwest conditions. SY Wolverine has high PPO with average mill and below average baking characteristics. PVP, Title V has been issued (Certificate #201900271).

Warhorse - is an awned, white chaff, solid-stemmed hard red winter wheat released in 2013 by the Montana Agricultural Experiment Station. Warhorse has medium maturity and has medium short, semi-dwarf height. Warhorse's winter hardiness, rated at 4 on 0-5 scale, is an improvement over other solid stem varieties. Stem solidness is similar to that of Bearpaw and Rampart, while sawfly cutting of stems is very low (similar to Rampart). Warhorse yield is similar to Judee, while test weight and protein are above average. Warhorse is resistant to both

stem and stripe rust. Warhorse has acceptable mill and bake qualities. PVP, Title V has been issued (Certificate #201400131).

WB4418 - hard red winter wheat developed by WestBred and released in 2018. WB4418 is a medium-early maturing, hollow-stemmed, short wheat with white chaff. WB4418 has below average yield, below average test weight, and average protein, with average winter survival. WB4418 appears to be moderately resistant to stripe rust under Pacific Northwest conditions. WB4418 has medium PPO with below average mill and baking characteristics. PVP, Title V has been issued (Certificate #201800530). *WB4418 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

WB4792 - hard red winter wheat developed by WestBred and released in 2019. WB4792 is a medium maturing, medium statured wheat, with white chaff. WB4792 appears to have good winter hardiness. WB4792 has above average yield, high test weight and below average protein. WB4792 appears to be moderately resistant to stripe rust under Pacific Northwest conditions. WB4792 has medium-high PPO and below average milling and baking characteristics. PVP, Title has been issued (Certificate #201900398). *WB4792 will not be in the Montana Intrastate Winter Wheat Test for 2022.*

Yellowstone – hard red winter wheat developed by the Montana Agricultural Experiment Station and released to seed growers in 2005. Yellowstone is a very high yielding winter hardy variety with medium test weight, maturity, height, and grain protein. Yellowstone has excellent baking and good Asian noodle quality. It is moderately resistant to TCK smut and resistant to stripe rust, but susceptible to stem rust. PVP, Title V has been issued (Certificate #200600284).

Plant Variety Protection

The Plant Variety Act, signed into law in 1970, offers legal protection to developers of new varieties of plants which reproduce sexually – that is, through seeds. The law provides for a Plant Variety Protection Office in the U.S. Department of Agriculture. The office receives and processes applications and when “novelty” is established, issues a certificate granting protection rights specified by the applicant.

The owner (or developer) holding a “certificate of protection” has complete control over the variety for 20 years. The law provides two types of protection:

1. Without Seed Certification

The owner of the protected variety may exclude others from reproducing the variety, selling it, offering it for sale, importing or exporting it, or use it in the commercial production of a hybrid or a different variety without permission. In this sense, the owner of a protected variety may bring civil damage action against anyone who infringes upon his rights.

2. Certified Seed Option

The owner may specify that the seed of his variety “...be sold or advertised only as a class of Certified Seed”. Production and sale of such seed by variety name, when not certified, constitute a violation of the Federal Seed Act. This means of protection may be used extensively for publicly as well as privately developed varieties.

Amendments to the Plant Variety Protection Act (PVPA) have passed both houses of Congress and been signed into law by the President. These amendments went into effect in 1995. The farmers exemption has been changed for new varieties. Seed for varieties issued a certificate after April 4, 1995, may only be purchased from the owner or his agent. A farmer can only save seed of these varieties for use on his own farm and cannot sell seed of the protected variety to his neighbor.

A variety protected under the certification option does not permit a farmer producing seed to sell or offer for sale or advertise by variety name unless it is certified. Sale of such seed by variety name as uncertified seed will constitute a violation of the Federal Seed Act. Interstate movement of seed is subject to inspection by Federal Seed Control officials. Seed within the state is subject to inspection by State Department of Agriculture inspectors.

Owners of protected varieties will give public notice that their variety is protected by affixing to the label or container the words: “Unauthorized Propagation Prohibited” or the words, “Unauthorized Seed Multiplication Prohibited”. Producers must check the label (tag) or the container for the above wording.

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