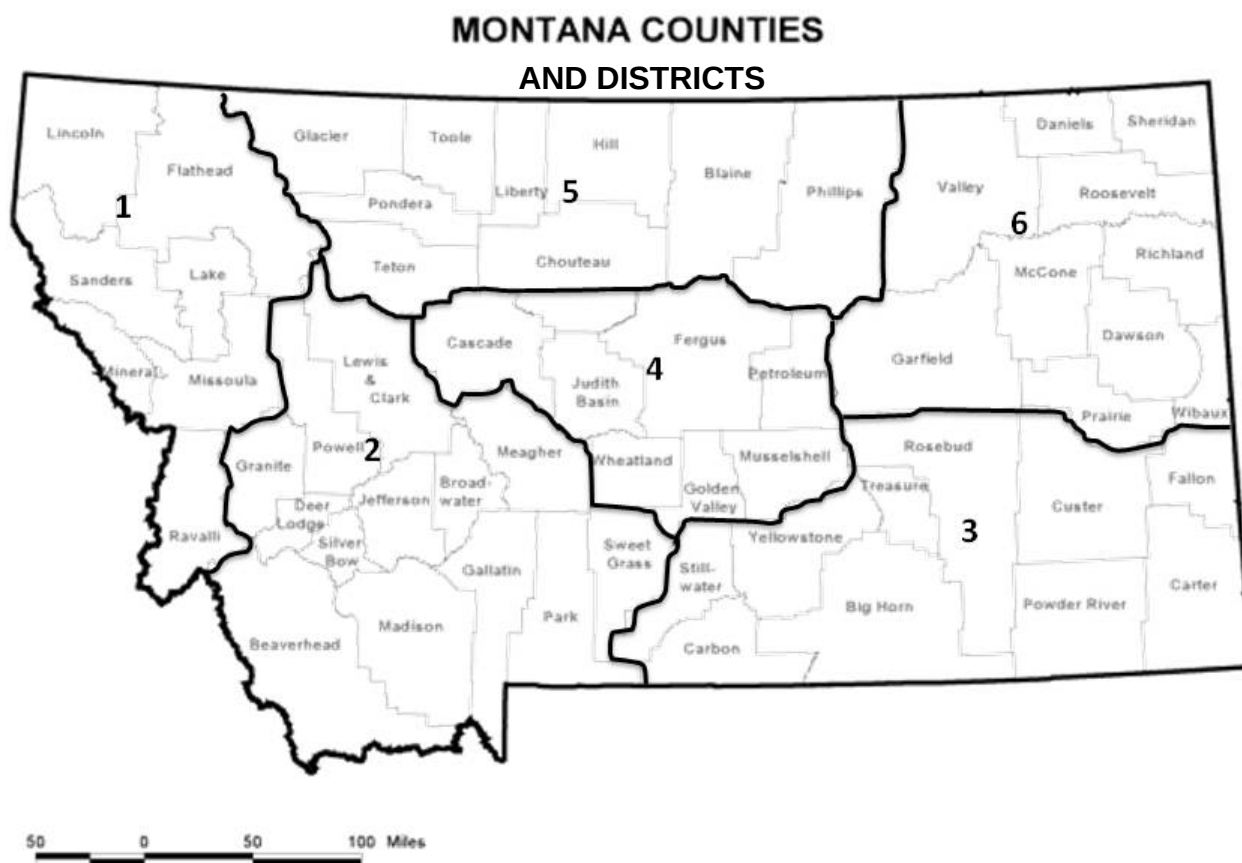


2018 WINTER WHEAT VARIETIES

Performance Evaluation and Recommendations

Recommendations are made for the districts shown on the map below



by the Montana State University
Agricultural Experiment Station

The information in this publication can also be found at a link on:

<http://plantsciences.montana.edu/crops>

Another variety selection tool is available at :

<http://www.sarc.montana.edu/php/varieties.html>

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WINTER WHEAT VARIETY PERFORMANCE SUMMARY IN MONTANA

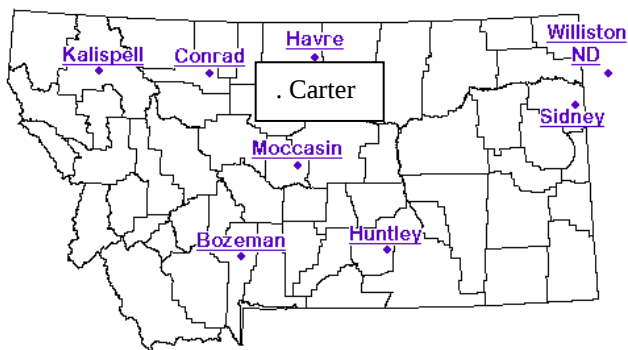
J. E. Berg, P. L. Bruckner, P. Carr, C. Chen, C. Cook, J. Eberly, K. D. Kephart, K. Kowatch-Carlson, P. Lamb, A.T. Link, J. H. Miller, G. Pradhan, R.N. Stougaard, D. Holen, D. Nash, and H. Unverzagt

Introduction

The agronomic characteristics of winter wheat varieties recently developed or evaluated by the Montana Agricultural Experiment Station are compared in this publication with other varieties grown in the state. A brief description of each variety is given which may include a variety's particular advantages or disadvantages. The information was extracted from the Intrastate Winter Wheat Nursery. This data is prepared by research personnel of the Montana Agricultural Experiment Station. 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 causes.

Variety Testing Procedures

Fig. 1. Test Locations for Montana winter wheat performance tests in 2017.



Locations

Hard winter wheats were planted at 8 Montana and 1 North Dakota location (Fig. 1) including Carter/Ft. Benton, Conrad and Havre in the North Central district, Moccasin in the Central district, Huntley in the Southern district, Sidney and Williston, ND representing the Northeast district, Kalispell in the Northwest and Bozeman in the Southwest districts of the state.

Entries

Names of commercially available varieties and experimental lines evaluated in 2017 are listed with their origins, experimental designation, release year, and pedigrees in Table 2 for the hard winter wheats. Forty-nine hard wheats are included in this summary comprising 24 varieties (10 public and 14 private) and 25 experimental lines (21 public and 4 private). Numbered entries preceded by a state designation [e.g. MT1348 (Montana), CO13003C (Colorado) or private company, PSB13NEDH-7-140, (Limagrain)] are experimental lines provided by the breeder.

Experimental Design and Seeding Methods

The Intrastate Winter Wheat Test consists of a 49 entry test with 3 replicates. These tests are planted as 7x7 lattices or a randomized complete block design at each location. Plot size varied by location, from 35 ft² at Conrad to 60 ft² at Havre. Row number varies: Bozeman and Havre are 3-row, Conrad, Huntley, Carter, 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 previous crop, planting date, fertilizer use and harvest date is available in Table 1.

All seed, for each nursery, was treated with Cruiser Maxx Cereals seed treatment, at recommended rates, before planting.

Description of Data Collected

Yield

All rows of each plot were trimmed and measured and harvested using 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 2017, data is provided for two (2016-2017), three (2015-2017) and four (2014-2017) year averages for hard wheat entries tested during previous cropping seasons

Table 1. Summary of agronomic practices used on hard winter wheat performance trials in Montana in 2016. Fall nitrogen (N), phosphorus (P₂O₅) and potassium (K₂O) were preplant applied and incorporated.

Location	2016 Crop	2015 Crop	2016 Planting Date	Fertilizer				2017 Harvest Date
				N		P ₂ O ₅	K ₂ O	
				Fall	Spring			
----- Pounds per acre -----								
Kalispell	mixed forage	winter wheat	Sep 28	0	-	30	70	no harv.
Bozeman	fallow	barley	Sep 27	242	-	10	10	Jul 29
Huntley	chem. fallow	fallow	Sep 29	6	-	26	0	Jul 18
Moccasin	fallow	barley	Sep 27	50	190	0	0	Jul 25
Conrad	chem. fallow	barley	Sep 29	41	140	22	20	Jul 27
Havre	fallow	barley	Sep 19	100	100	20	10	Jul 14
Carter	chem. fallow	na	Oct 19	-	-	-	-	Jul 25
Sidney	fallow	winter wheat	Sep 18	69	-	0	0	Jul 20
Williston, ND	peas	safflower	Sep 15	6	26	0	0	no harv.

Test Weight

Test weights (pounds per bushel) were obtained for each plot by using 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 taken when 50% of the heads in a plot were 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 was 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 determined as a % by NIR (near infrared reflectance) on the 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 occurred. There was differential winter-kill at Sidney, ranging from 0-63% (average = 40%) on May 8th, in 2017. Severe winter-kill occurred in Williston and the trial was abandoned.

Table 12 contains information on % winter survival and associated yield in winter-kill environments from 2012 to 2017. The data summarizes 4 tests in which significant winter-kill occurred (test average for winter survival was less than 90%). All sites with winter-kill were in District 6 (Sidney and Williston) which are the most severe location for winter wheat survival of our testing locations.

The Kalispell test was abandoned due to severe spring flooding followed by a heavy weed infestation.

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 solid-stemmed varieties include: Judee, (released in 2011), Bearpaw (2011), WB-Quake

(2011), Warhorse (2013), Loma (2016), and WB4483 (2016).

Table 13 contains information on yield and % sawfly cutting at 11 testing locations where sawfly pressure was present during the years 2012-2017. The data is from Havre, Loma (15 miles northeast of Ft. Benton), Turner (60 miles east-northeast of Havre), Carter (13 miles west of Ft. Benton), Fly Creek (about 25 east-southeast of Huntley), and Willow Creek (35 miles west-northwest of Bozeman). Solidness scores (rated on a 5-25 scale) are shown for solid and semi-solid varieties in Table 15.

Coleoptile Length

Coleoptile length evaluation is performed in Bozeman under controlled (growth chamber) conditions. Twenty-five seeds per variety were planted in wetted vermiculite. After 15 days the coleoptile (sheath covering the emerging shoot that helps penetration to the soil surface) is measured. This test is replicated 3 times for each variety. Results from previous years are reported in Table 15. Long coleoptiles are generally longer than 3.5 inches, medium from 2.7-3.5 in, and short are under 2.7 in. Care should be taken not to plant short coleoptile varieties too deep.

Other Agronomic Characters

Table 15 contains information on grain maturity, chaff color, relative winter survival and straw strength for the hard wheat varieties listed in this publication.

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). A quantitative polyphenol oxidase (PPO) 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 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, stem rust and leaf 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.

Tables 3 through 11 show 2017 data for hard winter wheat collected at all harvested experiment station sites. Where a variety has been in the 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 over a period of years. Selection should also consider test weight, winter-hardiness, heading date, plant height, protein and disease resistance.

2017 Test Conditions

Statewide winter wheat yields were projected by the Montana Agricultural Statistics Service at 42 bushels per acre (bu/a), for 2017. This is a decrease over the 49 bu/a for the 2016 harvest year. The harvested acreage in 2017 was 1.59 million acres (total production = 66.8 million bu) compared 2.15 million acres in 2016 (total production = 105.4 million bu).

Rainfall for the 2016-2017 crop year was evenly divided between above (Bozeman, Huntley, and Kalispell), average (Moccasin, Williston, and Carter/Fort Benton), and below (Conrad, Havre, and Sidney) average (Table 14), with a range of -5.71 inches at Sidney to +1.60 at Kalispell. Average yearly temperatures were above long term at all locations, except Conrad and Kalispell, ranging from Kalispell (-1.1°F) to +1.8°F at Williston.

In 2017, 'Yellowstone' was miss-planted (as another plot of Warhorse), so no direct comparisons could be made at any of the harvested locations.

Yields, for the 7 locations harvested averaged 68 bu/a {range 38 (Sidney) to 114 bu/a (Huntley)}. Yields of named varieties, across the 7 harvested locations, ranged from a low of 53 bu/a (WB4575) to a high of 79 bu/a for LCS Jet.

Test weight averaged 60.6 lb/bu across all locations. Kalispell (53.7 lb/bu, rain delayed harvest and stripe rust), Bozeman (59.7), Moccasin (58.1) and Carter/Fort Benton (56.6) were below 60 lb/bu, while the other 4 locations were above.

Heading dates were earlier in 2017 than long term averages at the 6 harvested locations where comparisons are available. Sidney at -12 days had the greatest differences, while the least change occurred at Huntley (-8 days).

Stripe rust at both Bozeman (average = 27%, range 2 - 94%) and Huntley (average = 13%, range 0 – 100%) were a factor in yield reduction for highly susceptible varieties (Bearpaw, Brawl CL Plus, Decade, Denali, WB4483, and WB4575).

There was sawfly cutting recorded at the Northern Seeds Carter/Ft. Benton site averaging 54%, ranging from 2 (Warhorse) to over 70% (Langin, LCS Chrome, Long Branch, SY Clearstone 2CL, SY Monument, and SY Sunrise) of stems cut, across all entries.

Protein content averaged 12.7% across all locations (location range = 9.4 – 14.0%) tested. The range of named varieties across all locations was from a low of 11.4% (Langin) to a high of 13.5% (WB4575).

Dwarf Smut (TCK)

Dwarf smut (TCK) can be controlled with 'Dividend' seed treatment (see page 5). Dwarf smut or dwarf bunt (*Tilletia controversa* Kuhn) is a fungal disease that occurs in areas where winter wheat is subjected to prolonged snow cover or unfrozen ground. The planting of dwarf smut resistant varieties (Promontory and SY Clearstone 2CL are resistant) is a practical means of control.

The amount of wheat lost each year because of dwarf smut is small in relation to the state's total crop, but individual operators may experience severe losses in heavily infested, localized areas.

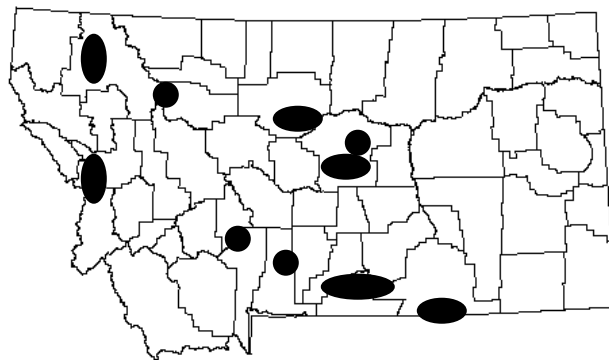


Fig. 2. Known areas of dwarf smut (TCK) infestations.

If you farm in the vicinity of one of the shaded areas in the map (Figure 2.), you would be well advised to observe closely your winter wheat crop and consider using seed treatment.

Producing Winter Wheat

Plant **CERTIFIED CLASS SEED** of varieties **RECOMMENDED** by the Montana Agricultural Experiment Station.

Seed Treatment

Treat all winter wheat seed with a recommended fungicide to reduce losses caused by cereal smut or other seed-borne diseases. Several non-mercurial compounds are registered for grain seed treatment.

Dwarf smut (bunt) can be controlled with difenoconazole. Dividend® contains this compound and is available in Montana. If you farm in a dwarf smut area contact your seed dealer or chemical representative for more information about this seed treatment. See page 4 for known areas of dwarf smut infestations.

Diseases are best controlled when all seeds are coated with a seed treatment. Do not over-treat-- Follow recommendation of manufacturer of product as to rate.

Truck-mounted seed treaters, which apply the fungicide as the seed is augered into the drill box, do a good job of treating if operated according to manufacturer's specifications.

Drill box treatments are not effective for general use.

When using any pesticide materials, read the information on the label as to rate of application, specific uses, methods of handling, precautions, etc.

Seeding Rate and Date

The following rates and dates for seeding are general (Figure 3). The heavier seeding rate, where indicated, is applicable to plump seed of high test weight (above 60 lbs/bu) or for seed having a kernel size larger than normal for most other varieties. The lighter rates are for the smaller seeded varieties or when test weight is below normal for larger seeded varieties. Seeding rates may be lower if adequate nitrogen and phosphorus amounts are applied at planting.

Winter wheat seed lots may vary in the number of seeds per pound depending on the ratio of large-to-small seeds in a seed lot. The average is approximately 15,000 seeds per pound. A precise count of the number of seeds per pound should be made on your seed lot to help calibrate your drill. You can also calculate how many pounds of seed you will need to plant an acre.

Figure 3. Seeding rate (lb/acre) and date for winter wheat

Districts	Dryland	Irrigated	Date of Seeding
5,6 1,2,3,4	30-60 30-60 (10-20 seeds/sq. ft.)	60-75 60-75 (20-25 seeds/sq. ft.)	Sept. 1-15 Sept. 10-25

As to seeding date -- DO NOT SEED TOO EARLY in areas where root rot diseases are prevalent. In areas where Cephalosporium stripe, wheat streak mosaic virus or other root rot diseases have caused losses, delay seeding until the soil temperature in the seed zone will stay below 55°F except for brief periods during the day. In the southern half of Montana, this is usually September 10 to 20. In Districts 5 and 6, plant between September 1 and 15. Cooler soil temperatures slow root development and reduce the probability of winter

root injury and invasion by soil-borne organisms. To reduce the incidence of root and foot rots, plant winter wheat on land previously seeded to other crops such as barley, oats or spring wheat. Extreme seeding delay, however, reduces seedling vigor and increases chances of winter-kill.

Seeding Depth

Set the drill to place the seed 1 to 2 inches below the soil surface. Deeper seeding reduces tillering and lowers crop yields. With the furrow drills, wind-driven soil particles settle in the furrows covering the seed deeper than desired.

Yield in Winter Wheat as Influenced by Percent Stand

During periods of winter injury farmers are frequently faced with a decision as to whether or not a field should be torn up and re-seeded. A 40 to 50 percent winter wheat stand, if general over field, may produce as much as re-seeded spring wheat. Thinner stands will likely demand more attention for weed control.

The guidelines for evaluating winter wheat stands are to determine the average number of healthy plants per square yard. We suggest making a square frame out of 3/8 inch rod. Walk the field in a zigzag pattern counting at ten random locations.

Fields that have 80 or more plants per square yard will probably produce more than if replanted to spring wheat (information taken from 1995 Master's Thesis, "Critical Overwintering Plant Population for Successful Winter Wheat Production in Montana" by Doug Holen).

Table 2. List of public, private, and experimental hard winter wheat varieties.

Variety	Experimental Designation	Origin	Release Year	Pedigree
Public Varieties				
Bearpaw	MTS0721	Montana	2011	selection from a composite of 5 crosses: 99X96, DMS/Rampart//Pronghorn/3/2*Rampart; 99X97, DMS/Rampart//Pronghorn/3/Rampart/4/(MTW9806, Redwin/Rio Blanco//NuWest) ; 99X98, DMS/Rampart//Pronghorn/3/Rampart/4/NuPlains; 99X99, DMS/Rampart//Pronghorn/3/Rampart/4/(MT9513, NuWest/5/(TAM W-103/Froid/4/Yogo//Turkey Red/3/Centurk, MT8030)); and 99X100, DMS/Rampart//Pronghorn/3/Rampart/6/(MT98113, Judith/5/ (MT8764, Crest/(VT1230, French male sterile line)/4/((PI178383/ Cheyenne//3*Tendoy, ID5011)/3/(ID5006, Norin 10/Staring//2*Cheyenne), ID745101)))
Brawl CL Plus	CO06052	Colorado	2011	Teal 11A/Above/(CO99314, TX91V4931/ Halt)
Decade	MT0552	Montana; North Dakota	2010	selection from composite of 3 crosses:((Sumner sib, KS831936-3, (Plainsman V/Odesskaya 51)/(NE86501, Colt/Cody), N95L159, Wesley sib)/3/ CDC Clair, N95L159/(MT9602, NuWest/Tiber) and N95L159/4/ (MT9609, Froid/SD1287// Redwin/3/NuWest)
Denali	CO050303-2	Colorado	2011	(Yuma/T-57/4/(CO850034, NS14/NS603// Newton /3/Probrand 835)/5/ 4*Yuma /6/(NEWS12, KS91H174/RBL// KS91HW29/3/ N87V106), CO980829)/7/ <u>TAM 111</u>
Judee	MTS0713	Montana	2011	(Vanguard/Norstar//Judith dwf, 93X312E14)/3/ NuHorizon
Langin	CO11D446	Colorado	2016	(Hatcher/(NW97S295, Antelope sib), CO050270)//Byrd
Loma	MTS1224	Montana	2016	Yellowstone/5/((Lew/Tiber//Redwin, MTS92045)/3/2*Erhardt, MTS0112)/4/(MTS0125, selection from a composite of 4 crosses)
name pending	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);
name pending	MTF1432	Montana	2018	Yellowstone*2/7/(98X168E1, (Nuwest/4/(MT88001, Sawmont/ Tendoy /3/Yogo//Norin 10/Brevor) /5/(MT7863, Froid/Winoka/ Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn)
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
Warhorse	MTS0808	Montana	2013	selection from a composite of 3 crosses: 00X182, ((Froid/Winoka/7/ ((Sinvaloch/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)
Yellowstone	MT00159	Montana	2005	F ₂ composite of Promontory/Judith and Judith-dwarf/Promontory

Private Varieties

Keldin	ACS55017	Peter Franck: Seed-Link Inc.; Ontario,Canada, Westbred LLC	2011	Barenburg 235/Carlisle//TRX-A16-3-2
LCS Chrome	LCH13DH-20-87	Limagrain	2016	na

Table 2. List of public, private, and experimental hard winter wheat varieties.

Variety	Experimental Designation	Origin	Release Year	Pedigree
LCS Jet	NSA10-7208	Limagrain Europe s.a.	2015	Apache/Autan
Long Branch	LCH12-012, HRX1652	Limagrain; Dyna-Gro Wheat	2015	na
SY 517 CL2	07CL039-7	Syngenta	2017	na, Clearfield Plus variety
SY Clearstone 2CL	MTCL1077	Syngenta, Montana	2012	Yellowstone*4/3/MTCL01158/CDC Teal 11A/Jagalene
SY Monument	04BC574-2	Syngenta	2014	(KS89180B-2-1-1/CM75113, F1//X920750-A-11-2, <u>BC991149-11</u>)/3/(00x0090-4, W95091/W98-183
SY Sunrise	06BC796#68	Syngenta Seeds	2015	((X920709B-5-2/KS90WGRC10//Ogallala, BC98337-10-53)/3/CDC Falcon, <u>06BC308</u>)/4/ (<u>NE03458</u> , (McVey 78015/NE88521, NE95544)// W91-348/3/Millennium)
SY Wolf	BC01007-7	AgriPro, Syngenta	2010	((TAM-108/Veery sib, SWM1524)//TX84V2029, TX91V3308)/3/(W93-359, W188-052/W96-180), W99-331)/4/(97x0906-8, (Mesa/W89-328, W96-180))/(W95-188, Karl 92/W98-232))
WB4483	BZ9W09-2212	WestBred-Monsanto:	2016	(solid stem)
WB4575	BZ9W09-2075	WestBred-Monsanto:	2016	(hollow stem)
WB4614	BZ9W07-2034	WestBred-Monsanto:	2013	BZ9W96-788-B/Pryor
WB4623CLP	BZ9WM09-1663	WestBred-Monsanto:	2014	(B152/Rampart, DH990356, BZ9W02-2073)// Above/CDC Teal-11A
WB-Quake	BZ9W05-2043	WestBred LLC (Monsanto)	2011	Rampart/Kestrel

Public Elite Lines

	CO13003C			CO06072/4*Byrd (Als1, Als2)
	MTCL1131			Yellowstone*4/4/(Fidel/Tiber (IMI), MTCL01158)//CDC Teal 11A/3/Jagalene
	MT1265			<u>Yellowstone*4</u> /(KS96WGRC40, KS93U69*2/TA 2397) (Lr41, wcm)
	MT1348			selection from a composite of 2 crosses: 04X494, (PI572290 = STARS-9303W = (Bobwhite/PI 149898), rwa2)//BigSky and 4X495, (Yellowstone sib, MT9982)/PI572290
	MT1444			selection from a composite of 2 crosses: 06X165, Yellowstone*2/ (MTW0590, selection from a composite of 2 crosses: 00X3, ((MT8709, Erhardt sib)/NuWest// Erhardt, MTW0072)/3/(NW97S151, KSSB0192-3/NE89529) and 00X4, (MT8713, Erhardt sib)/NuWest, MTW9911)// NW97S151) and 06X166, (NuWest// (SD88191, Brule/Dawn), MTW01133/3/Yellowstone/MTW0590
	MT1471			selection from a composite of 2 crosses: 06X304, Yellowstone/ NuDakota; 06X306, (Erhardt/Halt, MTR0441)//NuDakota, and 06X308, ((Tiber/5/(MT8030, TAM W-103/ Froid /4/Yogo//Turkey Red /Oro/3/ Centurk), MT9409)/6/(MT9659, SMN82164/ SMN82140// Rocky/ Tiber)/7/Jerry, MT06125)/8/NuDakota
	MT1488			selection from a composite of 2 crosses: 03X316, ((Karagach, RWA resis., PI262605)/4/ (MT7863, Froid/Winoka// Centurk)/3/ Redwin, MTR00118)/10/ (MT0241, (WWP4394/NuWest /4/(Rego/ Cheyenne// Winalta, MT7431)/3/(MT7978, Centurk/Marias), MT91192)/9/(NuWest/ Redwin//Rio Blanco, 88X9D105-6)/8/ (((Carstens V/A. intermedium// Lathrop, CIt15092)/3/T. speltoides/4/Fletcher/5/ 5*Centurk, CIt17884)*4/6/Karl, KS93WGRC27) /7/(MT9415, Judith/Yogo)) /11/CDC Falcon and 03X317, (Erhardt// Judith/CDC Kestrel, MT0097) /3/ MTR00118/ MT0241
	MTW1491 (HWW)			(Yellowstone (Low PPO) plant seln, MT08184)//(Yellowstone (Low PPO) plant seln, MT08188/(MT08175, Colter sib)

Table 2. List of public, private, and experimental hard winter wheat varieties.

Variety	Experimental Designation	Origin	Release Year	Pedigree
	MTF1435			(Yellowstone (Low PPO) plant seln, <u>MT08186</u>)/8/ <u>Yellowstone(L)*2</u> /7/ (<u>98X168E1</u> , (Nuwest/4/(MT88001, Sawmont/ Tendoy /3/Yogo//Norin 10/Brevor) /5/(MT7863, Froid/Winoka/ Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn)
	MT1507			selection from a composite of 2 crosses: 07X19, ((BigSky sib, MT9523)/(NE94653, Wahoo sib), <u>MT0686</u>)/ <u>Yellowstone/Duster</u> ; and 07X20, <u>Yellowstone*2/Duster</u>
	MT1540			selection from a composite of 2 crosses: 06X165, <u>Yellowstone*2/ (MTW0590</u> , selection from a composite of 2 crosses - see pedigree) and 06X166, (NuWest/(SD88191, Brule/Dawn), <u>MTW01133</u>)/3/ <u>Yellowstone/MTW0590</u>
	MT1542			selection from a composite of 3 crosses: 05X101, (Erhardt/Judith/ CDC Kestrel, <u>MT0097</u>)/10/ <u>Yellowstone/9/(MT03108</u> , (NuWest/Tiber, MT9524)/8/((Carstens V/Ae. intermedium (TA25)/Lathrop, CIt13092)/3/T. speltoides/4/Fletcher/5/5*Centurk, CIt17884)*4/ 6/Karl, KS93WGRC27)/7/Judith); 05X103, (((Carstens V/Ae. intermedium (TA25)/Lathrop, CIt13092)/3/T. speltoides/4/Fletcher/5/ 5*Centurk, CIt17884)*4/6/Karl, KS93WGRC27)/7/ 2*Judith, <u>MT03177</u>)/8/ <u>Yellowstone/MT03108</u> ; and 05X104, ((Arapahoe/ NE87U121, N92L005) /4/(MT9608, Froid/SD1287// Redwin/3/ (MT7863, Froid/ Winoka//Centurk)), <u>MT0403</u>)/5/ <u>Yellowstone/ MT03108</u>
	MT1547			selection from a composite of 5 crosses: 06X272, <u>Yellowstone/ (MT0684</u> , selection from a composite of 5 crosses - see pedigree); and 06X276, <u>Yellowstone/(MT06102</u> , selection from a composite of 2 crosses - see pedigree); 06X278, <u>Yellowstone/7/ (MT06110</u> , (Arapahoe/3/Brule//Hiplains/Newton, SD93528)/6/ (MT9409, Tiber/5/(TAM W-103/Froid/4/ Yogo//Turkey Red/Oro/3/ Centurk, MT8030))); 06X282, <u>Yellowstone/3/(MT06123</u> , "2174"/ (MT9440, BigSky sib)/BigSky); and 06X285, <u>Yellowstone/7/ (98X168E1</u> , (Nuwest/4/ (MT88001, Sawmont/Tendoy /3/Yogo//Norin 10/Brevor) /5/(MT7863, Froid/Winoka/Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn)
	MT1563			selection from a composite of 2 crosses: 07X76, <u>Yellowstone*2/5/ (PI640431</u> , BC4F4 line derived from WA007900*5/4/WA007900// Yr5/6*Avocet/3/ WA007900//Yr15/ 6*Avocet) and 07X77, <u>Yellowstone/PI640431//Yellowstone(340,233)</u>
	MT1564			selection from a composite of 2 crosses: 07X76, <u>Yellowstone*2/5/ (PI640431</u> , BC4F4 line derived from WA007900*5/4/WA007900// Yr5/6*Avocet/3/ WA007900//Yr15/ 6*Avocet) and 07X77, <u>Yellowstone/PI640431//Yellowstone(340,233)</u>
	MTF1559			<u>Yellowstone*2/7/(98X168E1</u> , (Nuwest/4/(MT88001, Sawmont/ Tendoy /3/Yogo//Norin 10/Brevor) /5/(MT7863, Froid/Winoka/ Centurk), MTS9720)/6/(PI 191303, Alba = Belgian variety)/Elkhorn)
	MT1565			selection from a composite of 3 crosses: 09X284, 09X285, and 09X277, all with the same pedigree; <u>Decade*2//Promontory/ 3*Yellowstone</u>
	MTS1573 (HWW)			selection from a composite of 2 crosses: 06X224, <u>Danby/7/ 2*(MTS04114</u> , L'Govskaya 167/Rampart/6/(MT9409, Tiber/5/ (MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk))) and 06X225, (L'Govskaya 167/Rampart/6/(MT9409, Tiber/5/ (MT8030, TAM W-103/Froid /4/Yogo//Turkey Red /Oro/3/Centurk)), <u>MTS0531</u>)/7/ <u>Danby/MTS04114</u>
	MTS1588			selection from a composite of 2 crosses: 07X291, ((SMN82164/ SMN82140//Rocky/Tiber, MT9659)/3/S87-101/4/Pronghorn, <u>MT0598</u>)/5/(<u>98X366E29-1</u> , Heyne/Rampart//((MT9513, BigSky sib)) and 01X295, (((Lew/Tiber//Redwin ,MTS92021)/3/Judith/Arapahoe, MTS0023)/4/Pryor/ Genou, <u>01X258C1</u>)/5/ <u>MT0598</u>

Table 2. List of public, private, and experimental hard winter wheat varieties.

Variety	Experimental Designation	Origin	Release Year	Pedigree
Private Elite Lines				
	BZ9W09-2216	WestBred-Monsanto:		(solid stem)
	BZ9WM09-1620	WestBred-Monsanto:		Clearfield Plus exp. line
	PSB13NEDH-7-45	Limagrain		Smoky Hill/McGill
	PSB13NEDH-7-140	Limagrain		Smoky Hill/McGill

Table 3. HARD WINTER : District 1-- Kalispell - Dryland (High Rainfall)

Spring flooding, weeds - plots not harvested in 2017										
Cultivar/Line	Grain Yield (bushels/acre)			Test weight lb/bu	Heading Date		Plant height in	Lodg- ing %	Stripe rust %	Protein %
	2016	2015-16	2014-16		Ordinal	Calendar				
	1 yr	2 yr	3 yr		from Jan1					
07CL039-7,SY 517CL2 (P)++										
Bearpaw +	16.4	48.9	72.2	39.4	148.5	28-May	37.5	1	96	15.4
Brawl CL Plus +	54.4	72.5		43.3	143.2	22-May	41.0	0	84	13.9
BZ9W09-2216 (P)										
BZ9WM09-1620 (P)										
CO13003C										
Decade +	18.5	43.9	67.0	42.9	149.8	29-May	38.1	20	93	14.2
Denali +										
Judee +	118.8	122.1	126.9	58.3	148.9	28-May	41.2	12	27	12.2
Keldin (P)+	101.1	111.7	122.5	55.6	149.2	28-May	39.2	0	82	11.3
Langin ++										
LCS Chrome (P)++										
LCS Jet (P)+										
Loma ++	128.0	136.4	137.5	57.4	150.9	30-May	40.1	43	35	11.8
Long Branch (P)++										
MT1265	130.0	134.9	139.6	57.3	152.2	31-May	44.7	13	67	10.9
MT1348	132.2	132.6		57.7	149.1	28-May	43.1	70	56	11.6
MT1444	136.1			57.9	151.2	30-May	43.8	0	70	11.1
MT1465 ^{2/}	135.0			58.5	150.2	29-May	39.5	0	37	11.8
MT1471	148.9			59.5	151.7	31-May	43.5	0	35	12.6
MT1488	135.1			60.0	152.4	31-May	40.8	36	22	12.3
MT1507										
MT1540										
MT1542										
MT1547										
MT1563										
MT1564										
MT1565										
MTCL1131	121.6	131.1	138.7	55.8	151.5	31-May	45.4	0	87	11.0
MTF1432 ^{2/}										
MTF1435										
MTF1559										
MTS1573 (HWW)										
MTS1588										
MTW1491 (HWW)	138.8			59.6	151.2	30-May	43.7	22	51	10.9
Northern +	133.7	132.3	138.4	56.8	152.6	1-Jun	43.0	14	52	11.7
PSB13NEDH-7-140 (P)										
PSB13NEDH-7-45 (P)										
SY Clearstone 2CL (P)+	117.2	124.6	131.8	54.9	150.6	30-May	43.6	0	86	11.4
SY Monument (P)+	127.0	124.3		54.9	148.5	28-May	40.9	0	33	12.3
SY Sunrise (P)+	130.6	121.0		57.7	144.1	23-May	37.3	0	38	12.0
SY Wolf (P)+	98.6	102.2	113.9	52.2	145.6	25-May	41.0	0	50	12.6
Warhorse +	126.7	129.6	129.5	59.7	150.9	30-May	41.8	15	37	13.0
WB4483 (P)++	88.9			56.8	153.3	1-Jun	37.3	7	68	12.3
WB4575 (P)++	21.8			46.1	151.7	31-May	35.0	2	96	13.9
WB4614 (P)+	64.2	85.6	103.3	51.2	149.9	29-May	37.5	1	82	13.6
WB4623CLP (P)+	145.1	130.5		59.2	150.3	29-May	41.9	14	29	13.8
WB-Quake (P)+	117.5	122.5	122.5	58.7	153.3	1-Jun	41.3	6	67	11.5
Yellowstone +	94.9	117.7	125.3	55.9	150.4	29-May	42.6	1	86	11.1
Average	97.3	106.0	113.3	53.7	149.4	28-May	41.0	8.0	69.5	12.3
LSD (0.05)	10.2	31.4	29.0	1.9	2.3		2.2	16.6	15.6	0.6
C.V.	6.5	14.6	15.6	2.0	0.9		3.0	125.1	13	2.7

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)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 4. HARD WINTER : District 2-- Bozeman - Dryland (Moderate Rainfall)

Cultivar/Line	Grain Yield (bushels/acre)				2017 Data					
					Test weight	Heading Date		Plant height	Stripe rust	Protein
	2017	2016-17	2015-17	2014-17		Ordinal	Calendar			
	2 yr	3 yr	4 yr		lb/bu	from Jan1		in	%	%
07CL039-7,SY 517CL2 (P)++	79.0				59.1	155.1	4-Jun	32.6	52	12.8
Bearpaw +	46.0	46.5	45.0	57.0	58.0	159.5	9-Jun	36.7	82	13.7
Brawl CL Plus +	62.7	72.0	71.8		56.3	155.3	4-Jun	36.7	79	13.5
BZ9W09-2216 (P)	40.0				57.3	161.8	11-Jun	33.0	89	12.5
BZ9WM09-1620 (P)	102.5				61.2	159.7	9-Jun	40.3	11	12.7
CO13003C	62.4				56.4	157.8	7-Jun	38.7	73	12.5
Decade +	42.7	46.9	46.8	58.8	56.4	159.6	9-Jun	35.5	71	13.2
Denali +	65.8				60.4	157.8	7-Jun	38.8	94	11.6
Judee +	90.0	79.2	74.3	80.4	60.6	159.8	9-Jun	36.8	9	13.5
Keldin (P)+	97.7	91.6	89.4	95.3	60.1	159.6	9-Jun	36.7	60	12.7
Langin ++	79.0				57.2	155.7	5-Jun	34.9	44	12.0
LCS Chrome (P)++	107.2				61.1	158.0	7-Jun	39.9	3	13.3
LCS Jet (P)+	124.6				59.1	158.9	8-Jun	34.5	3	13.4
Loma ++	95.9	94.0	92.6	95.4	60.4	162.8	12-Jun	35.7	7	12.9
Long Branch (P)++	109.8				61.3	154.8	4-Jun	37.2	7	12.0
MT1265	108.6	107.2	98.8	101.6	60.0	162.4	11-Jun	40.5	20	12.6
MT1348	99.4	98.4	95.2		60.1	159.2	8-Jun	39.7	20	12.4
MT1444	103.8	96.6			60.3	161.7	11-Jun	39.2	14	13.1
MT1465 ^{2/}	104.5	96.4			61.1	160.6	10-Jun	36.1	11	13.3
MT1471	111.5	103.1			61.3	161.6	11-Jun	37.9	3	13.8
MT1488	93.9	94.0			61.9	161.9	11-Jun	38.5	5	13.0
MT1507	96.1				61.1	160.4	9-Jun	37.1	10	13.2
MT1540	99.6				61.1	160.2	9-Jun	38.1	11	13.1
MT1542	113.0				61.1	160.7	10-Jun	38.4	2	12.5
MT1547	102.9				61.4	160.1	9-Jun	36.3	6	13.5
MT1563	96.5				59.5	162.8	12-Jun	39.9	19	12.8
MT1564	118.6				63.1	157.8	7-Jun	39.1	3	12.7
MT1565	85.0				59.6	158.7	8-Jun	35.5	14	13.3
MTCL1131	99.3	95.1	91.8	95.6	60.3	162.6	12-Jun	39.6	21	12.6
MTF1432 ^{2/}	107.5				58.9	166.0	15-Jun	43.7	14	12.7
MTF1435	100.8				61.6	163.1	12-Jun	45.6	24	12.8
MTF1559	102.5				56.7	167.4	16-Jun	43.0	15	12.7
MTS1573 (HWW)	98.3				61.9	158.9	9-Jun	40.0	12	12.5
MTS1588	91.2				60.5	161.4	10-Jun	34.3	9	13.7
MTW1491 (HWW)	115.6	111.9			62.5	162.5	12-Jun	39.7	11	12.3
Northern +	90.4	87.3	85.9	88.8	58.6	162.4	11-Jun	37.3	14	13.4
PSB13NEDH-7-140 (P)	90.3				61.6	159.4	8-Jun	39.6	24	13.3
PSB13NEDH-7-45 (P)	65.0				55.0	158.3	7-Jun	36.9	66	13.9
SY Clearstone 2CL (P)+	98.9	94.5	90.5	94.5	58.5	160.9	10-Jun	38.9	18	12.3
SY Monument (P)+	99.2	96.1	92.7		57.9	158.7	8-Jun	35.3	7	12.5
SY Sunrise (P)+	97.1	94.7	95.3		61.7	157.2	6-Jun	33.7	21	12.7
SY Wolf (P)+	77.5	79.2	80.5	86.0	58.4	159.0	8-Jun	35.7	35	13.2
Warhorse +	93.4	85.5	80.2	83.1	60.3	162.6	12-Jun	36.2	4	13.6
WB4483 (P)++	53.3	52.4			56.0	162.6	12-Jun	34.0	66	14.7
WB4575 (P)++	24.2	33.6			55.2	160.6	10-Jun	31.9	91	15.1
WB4614 (P)+	60.5	63.9	63.2	71.9	60.1	159.8	9-Jun	35.0	35	13.6
WB4623CLP (P)+	101.1	99.8	90.7		63.0	159.0	8-Jun	37.5	7	13.2
WB-Quake (P)+	82.8	80.1	75.0	79.4	60.6	163.0	12-Jun	38.0	19	12.9
Yellowstone + ^{1/}	-	-	-	-	-					
Average	89.3	84.0	81.1	83.7	59.7	160.2	9-Jun	37.5	27.2	13.1
LSD (0.05)	10.2	14.6	11.2	11.9	1.0	1.1		2.1	13.2	
C.V.	6.9	8.4	8.4	9.9	0.9	0.4		3.5	29	

bold = indicates highest value within a column

1/ = Yellowstone misplanted as Warhorse in 2017

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

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 5. HARD WINTER : District 3-- Huntley - Dryland

Cultivar/Line	*** Test not planted in 2015 ***							
	Grain Yield (bushels/acre)			2017 Data				
				Test weight	Heading Date		Plant height	Stripe rust
					Ordinal	Calendar		
				lb/bu	from Jan1		in	%
07CL039-7,SY 517CL2 (P)++	103.7			64.5	143.3	May 22	40.4	9
Bearpaw +	82.3	88.7	87.9	60.4	153.0	Jun 1	41.2	96
Brawl CL Plus +	115.8	112.3		64.5	143.3	May 22	43.1	61
BZ9W09-2216 (P)	78.0			59.8	155.0	Jun 3	38.3	100
BZ9WM09-1620 (P)	110.1			63.1	152.7	May 31	43.2	9
CO13003C	125.3			62.0	148.3	May 27	44.2	68
Decade +	100.9	99.3	94.7	62.1	153.3	Jun 1	42.3	77
Denali +	119.4			63.9	149.7	May 28	43.7	99
Judee +	115.4	108.6	98.8	63.1	153.0	Jun 1	42.3	0
Keldin (P)+	135.1	124.4	116.5	63.8	152.3	May 31	40.9	21
Langin ++	128.8			62.5	143.7	May 22	40.7	12
LCS Chrome (P)++	122.3			63.0	149.0	May 28	43.0	0
LCS Jet (P)+	140.3			61.7	150.3	May 29	38.9	1
Loma ++	111.3	110.9	105.4	61.4	156.7	Jun 4	39.0	1
Long Branch (P)++	127.7			62.6	147.0	May 26	44.6	5
MT1265	113.5	113.2	108.0	61.4	154.7	Jun 2	43.5	1
MT1348	126.0	117.2		62.9	152.3	May 31	42.7	3
MT1444	117.4	115.7		61.9	153.7	Jun 1	42.3	6
MT1465 ^{2/}	116.4	114.2		62.9	153.7	Jun 1	39.6	1
MT1471	119.8	109.9		62.4	154.7	Jun 2	43.0	3
MT1488	106.8	106.9		62.0	155.0	Jun 3	41.3	2
MT1507	123.3			62.5	153.0	Jun 1	42.0	2
MT1540	110.8			62.7	154.0	Jun 2	40.3	4
MT1542	114.6			61.9	154.0	Jun 2	40.8	1
MT1547	113.8			62.5	153.3	Jun 1	40.7	2
MT1563	113.5			61.8	154.3	Jun 2	43.0	5
MT1564	131.8			63.1	147.0	May 26	44.8	3
MT1565	116.0			61.7	152.7	May 31	38.3	2
MTCL1131	128.7	120.9	112.4	62.5	155.0	Jun 3	45.0	6
MTF1432 ^{2/}	113.2			60.3	156.3	Jun 4	48.2	7
MTF1435	95.5			62.2	155.3	Jun 3	52.5	4
MTF1559	106.4			58.0	159.0	Jun 7	47.3	1
MTS1573 (HWW)	116.2			62.9	152.0	May 31	41.6	10
MTS1588	109.9			62.3	153.0	Jun 1	37.3	1
MTW1491 (HWW)	125.8	120.3		62.9	154.3	Jun 2	44.7	3
Northern +	113.1	115.3	109.9	61.4	155.3	Jun 3	40.6	1
PSB13NEDH-7-140 (P)	115.3			64.0	152.7	May 31	43.4	6
PSB13NEDH-7-45 (P)	115.0			61.7	150.0	May 29	42.9	25
SY Clearstone 2CL (P)+	119.4	116.0	110.9	61.5	154.7	Jun 2	46.1	14
SY Monument (P)+	129.9	121.7		62.8	149.3	May 28	42.5	0
SY Sunrise (P)+	119.2	112.8		64.2	149.0	May 28	38.3	0
SY Wolf (P)+	122.8	120.4	113.3	64.0	149.3	May 28	42.8	7
Warhorse +	110.5	106.2	102.3	63.0	154.3	Jun 2	40.6	6
WB4483 (P)++	101.5	104.5		60.6	155.3	Jun 3	39.8	73
WB4575 (P)++	74.5	86.1		60.9	153.0	Jun 1	36.8	100
WB4614 (P)+	116.4	112.4	98.2	62.3	152.7	May 31	38.8	7
WB4623CLP (P)+	115.1	108.8		63.3	152.0	May 31	42.1	2
WB-Quake (P)+	100.2	97.8	93.5	62.2	154.7	Jun 2	41.1	5
Yellowstone + ^{1/}	-	-	-					
Average	114.4	110.6	104.0	62.3	152.3	1-Jun	42.1	13.3
LSD (0.05)	11.9	14.9	12.1	1.0	1.3		1.7	4.4
C.V.	6.4	6.5	6.9	1.0	0.5		2.4	35.0

bold = indicates highest value within a column

1/ = Yellowstone misplanted as Warhorse in 2017

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

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 6. HARD WINTER : District 4-- Moccasin - Dryland

Cultivar/Line	Grain Yield (bushels/acre)				2017 Data				
					Test weight	Heading Date		Plant height	Protein
	2017	2016-17	2015-17	2014-17		Ordinal	Calendar		
		2 yr	3 yr	4 yr	lb/bu	from Jan1		in	%
07CL039-7,SY 517CL2 (P)++	62.1				58.5	152.6	2-Jun	24.2	12.7
Bearpaw +	58.9	57.0	57.3	55.4	59.0	155.7	5-Jun	27.8	13.4
Brawl CL Plus +	65.8	62.4	58.3		62.0	153.0	2-Jun	25.6	12.6
BZ9W09-2216 (P)	52.5				60.2	160.5	10-Jun	27.4	12.5
BZ9WM09-1620 (P)	55.5				57.7	157.0	6-Jun	28.9	13.5
CO13003C	62.9				56.0	154.2	2-Jun	28.1	12.0
Decade +	59.0	57.0	56.4	56.7	58.4	155.6	5-Jun	26.4	13.7
Denali +	64.7				58.4	157.0	6-Jun	27.7	12.0
Judee +	60.2	54.5	50.3	50.3	59.1	157.9	7-Jun	27.6	14.0
Keldin (P)+	69.1	68.8	66.4	63.9	58.3	160.9	10-Jun	28.6	13.4
Langin ++	66.5				58.1	153.1	2-Jun	23.3	11.4
LCS Chrome (P)++	65.6				58.8	154.2	3-Jun	27.3	13.1
LCS Jet (P)+	65.5				54.4	161.9	11-Jun	27.2	13.0
Loma ++	58.5	58.4	57.0	57.2	58.0	160.5	10-Jun	25.0	13.6
Long Branch (P)++	62.9				59.0	153.3	2-Jun	25.8	12.6
MT1265	65.6	65.8	62.8	62.4	56.4	159.4	8-Jun	31.4	13.8
MT1348	64.3	65.1	63.2		58.4	154.9	4-Jun	26.3	13.1
MT1444	65.6	66.2			58.4	157.9	7-Jun	28.5	13.9
MT1465 ^{2/}	59.4	65.6			58.2	158.2	7-Jun	27.0	13.6
MT1471	72.5	65.7			58.5	158.0	7-Jun	28.9	14.0
MT1488	53.5	57.4			57.4	159.1	8-Jun	27.0	13.6
MT1507	65.7				58.9	158.1	7-Jun	28.0	12.9
MT1540	60.3				58.8	156.3	5-Jun	28.1	13.1
MT1542	59.5				56.6	156.9	6-Jun	28.3	13.3
MT1547	68.0				58.1	158.0	7-Jun	28.4	13.4
MT1563	66.6				59.1	159.6	9-Jun	30.2	13.7
MT1564	69.3				58.3	154.5	5-Jun	27.4	13.1
MT1565	61.9				57.4	154.2	3-Jun	25.8	13.7
MTCL1131	68.8	66.1	64.9	64.9	58.5	159.2	8-Jun	32.3	13.3
MTF1432 ^{2/}	61.4				56.4	166.2	15-Jun	31.0	13.7
MTF1435	70.7				57.9	161.4	10-Jun	37.6	13.3
MTF1559	59.7				54.4	169.8	19-Jun	35.4	14.2
MTS1573 (HWW)	60.4				59.5	155.7	5-Jun	27.3	13.1
MTS1588	60.7				59.2	159.7	9-Jun	25.8	13.1
MTW1491 (HWW)	66.9	66.0			58.6	158.4	7-Jun	28.7	13.1
Northern +	60.4	58.9	60.7	60.0	57.3	161.1	10-Jun	25.6	14.4
PSB13NEDH-7-140 (P)	67.1				59.0	157.8	7-Jun	28.0	13.6
PSB13NEDH-7-45 (P)	68.0				56.8	154.1	3-Jun	27.4	13.0
SY Clearstone 2CL (P)+	63.6	64.6	62.0	61.9	58.1	158.9	8-Jun	30.4	13.3
SY Monument (P)+	70.0	66.5	64.2		57.6	156.9	6-Jun	26.5	11.9
SY Sunrise (P)+	63.1	62.2	60.0		60.7	154.4	3-Jun	25.3	13.2
SY Wolf (P)+	59.2	61.3	58.3	58.6	60.1	155.9	5-Jun	26.6	12.6
Warhorse +	63.4	63.5	59.6	57.7	57.2	158.7	8-Jun	27.3	13.6
WB4483 (P)++	57.2	55.8			55.3	159.1	8-Jun	26.6	13.9
WB4575 (P)++	54.7	58.1			60.5	157.7	7-Jun	26.0	13.1
WB4614 (P)+	60.8	57.3	57.3	57.2	56.5	156.5	6-Jun	26.1	13.5
WB4623CLP (P)+	54.7	54.7	52.4		59.5	158.0	7-Jun	25.3	13.9
WB-Quake (P)+	53.2	53.9	51.4	50.8	57.4	161.7	11-Jun	29.3	14.0
Yellowstone + ^{1/}	-	-	-	-					
Average	62.5	61.3	59.0	58.2	58.1	157.8	7-Jun	27.8	13.3
LSD (0.05)	10.2	8.4	5.6	5.0	2.6	3.0		3.0	0.5
C.V.	9.3	6.6	5.7	6.0	2.7	1.1		6.1	2.0

bold = indicates highest value within a column^{1/} = Yellowstone misplanted as Warhorse in 2017**bold** = indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

^{2/} = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 7. HARD WINTER : District 5-- Conrad - Dryland

Cultivar/Line	Grain Yield (bushels/acre)				2017 Data				
	2017	2016-17	2015-17	2014-17	Test weight lb/bu	Heading Date		Plant height in	Protein %
						Ordinal	Calendar		
		2 yr	3 yr	4 yr		from Jan1			
07CL039-7,SY 517CL2 (P)++	76.4				63.2	152.4	1-Jun	28.4	12.5
Bearpaw +	72.8	84.1	78.4	83.4	60.5	156.9	6-Jun	29.0	13.4
Brawl CL Plus +	80.4	86.8	86.4		63.6	152.4	1-Jun	28.8	12.5
BZ9W09-2216 (P)	68.5				62.8	158.4	7-Jun	30.2	12.9
BZ9WM09-1620 (P)	69.7				61.5	156.4	5-Jun	31.8	12.3
CO13003C	83.3				60.8	154.4	3-Jun	31.2	12.0
Decade +	67.3	81.5	78.6	86.4	62.0	156.6	6-Jun	29.8	13.0
Denali +	85.1				62.1	155.2	4-Jun	29.1	12.5
Judee +	73.5	81.5	75.4	80.9	61.9	156.8	6-Jun	29.2	13.5
Keldin (P)+	80.1	94.8	93.1	98.7	62.3	156.7	6-Jun	29.2	13.1
Langin ++	86.8				61.6	153.2	2-Jun	28.0	11.3
LCS Chrome (P)++	75.9				61.7	155.9	5-Jun	31.2	13.2
LCS Jet (P)+	85.0				58.1	157.6	7-Jun	25.9	12.5
Loma ++	72.7	84.4	83.2	89.3	60.5	158.0	7-Jun	28.6	13.5
Long Branch (P)++	91.9				62.4	152.5	2-Jun	29.2	11.9
MT1265	77.5	88.6	85.9	94.3	60.3	158.4	7-Jun	32.1	13.1
MT1348	78.5	89.9	89.9		60.5	156.0	5-Jun	28.7	13.0
MT1444	71.0	88.2			60.1	157.7	7-Jun	31.1	13.3
MT1465 ^{2/}	71.3	87.8			60.8	157.1	6-Jun	28.4	13.0
MT1471	69.9	86.6			59.4	157.9	7-Jun	30.6	14.4
MT1488	54.8	77.5			57.5	159.1	8-Jun	29.7	13.4
MT1507	74.0				61.0	157.2	6-Jun	32.4	12.9
MT1540	71.8				60.7	156.3	5-Jun	30.4	13.3
MT1542	77.6				59.4	157.6	7-Jun	31.6	12.8
MT1547	69.4				60.5	157.0	6-Jun	30.7	13.3
MT1563	75.6				59.8	158.0	7-Jun	31.8	12.9
MT1564	72.9				61.5	154.3	3-Jun	28.4	12.4
MT1565	69.0				60.7	155.4	4-Jun	28.5	13.8
MTCL1131	69.8	86.6	87.4	94.0	60.0	158.3	7-Jun	32.6	13.0
MTF1432 ^{2/}	69.3				57.3	159.9	9-Jun	36.1	13.0
MTF1435	67.2				60.4	159.3	8-Jun	35.9	12.8
MTF1559	66.7				56.2	161.4	10-Jun	35.4	12.9
MTS1573 (HWW)	72.9				61.5	155.9	5-Jun	29.9	13.2
MTS1588	79.5				60.8	158.3	7-Jun	29.0	13.8
MTW1491 (HWW)	70.8	86.1			60.3	157.6	7-Jun	29.9	12.8
Northern +	74.2	88.9	88.5	95.1	60.1	158.4	7-Jun	31.3	13.0
PSB13NEDH-7-140 (P)	71.9				62.1	155.5	5-Jun	31.5	13.3
PSB13NEDH-7-45 (P)	74.2				60.0	154.7	4-Jun	29.2	12.8
SY Clearstone 2CL (P)+	80.9	89.3	87.2	92.6	60.2	158.0	7-Jun	34.4	13.2
SY Monument (P)+	79.0	95.1	91.4		59.7	156.1	5-Jun	29.3	12.1
SY Sunrise (P)+	76.7	83.7	83.2		62.9	154.5	4-Jun	25.5	12.6
SY Wolf (P)+	79.6	94.6	93.3	97.9	61.7	156.0	5-Jun	29.6	13.1
Warhorse +	66.0	75.3	69.6	75.2	59.2	157.3	6-Jun	27.7	13.4
WB4483 (P)++	67.6	85.0			61.3	158.7	8-Jun	29.5	14.5
WB4575 (P)++	74.6	85.8			61.8	156.1	5-Jun	29.0	13.5
WB4614 (P)+	73.7	90.6	85.5	89.2	62.4	156.4	5-Jun	27.7	13.1
WB4623CLP (P)+	68.0	82.3	77.2		60.4	157.2	6-Jun	29.5	13.4
WB-Quake (P)+	63.5	75.7	68.6	75.7	62.5	158.9	8-Jun	30.4	13.4
Yellowstone + ^{1/}	-	-	-	-					
Average	73.7	86.0	83.5	88.7	60.8	156.8	6-Jun	30.1	13.0
LSD (0.05)	10.3	ns	9.0	7.2	1.5	1.0		2.2	0.6
C.V.	8.1	6.4	6.5	5.7	1.4	0.4		4.3	2.7

bold = indicates highest value within a column

1/ = Yellowstone misplanted as Warhorse in 2017

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

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 8. HARD WINTER : District 5-- Havre - Dryland

Cultivar/Line	Grain Yield (bushels/acre)				2017 Data			
					Test weight	Heading Date		Plant height
	2017	2016-17	2015-17	2014-17		Ordinal	Calendar	
	2 yr	3 yr	4 yr		lb/bu	from Jan1		in %
07CL039-7,SY 517CL2 (P++)	35.7				62.9	146.2	25-May	25.0 14.3
Bearpaw +	42.9	53.5	55.7	55.1	61.5	150.8	30-May	21.3 14.7
Brawl CL Plus +	43.6	66.7	61.9		62.7	146.4	25-May	27.7 14.1
BZ9W09-2216 (P)	50.1				62.5	152.0	1-Jun	22.7 14.0
BZ9WM09-1620 (P)	44.9				63.2	153.4	2-Jun	27.1 13.5
CO13003C	52.4				61.3	149.0	28-May	25.1 13.7
Decade +	48.3	64.5	62.8	61.1	61.8	151.4	30-May	25.1 14.4
Denali +	53.0				62.9	149.5	28-May	25.7 13.3
Judee +	49.5	67.4	65.1	64.1	62.9	151.2	30-May	26.2 14.3
Keldin (P)+	56.7	82.3	75.3	70.9	62.2	151.8	31-May	27.1 12.9
Langin ++	49.2				61.9	146.2	25-May	23.0 13.1
LCS Chrome (P)++	47.5				61.6	149.0	28-May	26.3 14.2
LCS Jet (P)+	48.3				60.3	155.2	4-Jun	20.2 13.0
Loma ++	48.7	64.8	61.7	59.0	62.1	154.3	3-Jun	22.2 14.1
Long Branch (P)++	50.5				60.3	147.1	6-Jun	25.8 13.2
MT1265	54.9	81.0	73.4	69.8	62.6	153.3	2-Jun	27.5 14.4
MT1348	52.9	81.6	76.8		62.3	150.4	29-May	26.4 13.3
MT1444	54.5	77.4			62.7	152.2	1-Jun	26.8 13.7
MT1465 ^{2/}	50.4	74.6			62.5	150.4	29-May	25.0 14.4
MT1471	50.4	73.2			62.1	152.4	1-Jun	25.3 14.9
MT1488	50.2	74.0			62.4	152.9	2-Jun	23.3 14.6
MT1507	52.4				62.8	151.3	30-May	26.5 13.7
MT1540	48.0				62.6	151.8	31-May	26.7 14.9
MT1542	52.6				62.4	152.9	1-Jun	24.6 13.9
MT1547	49.9				62.4	151.3	30-May	25.9 14.4
MT1563	59.3				62.8	152.6	2-Jun	27.5 13.6
MT1564	51.5				62.4	147.6	27-May	28.6 13.7
MT1565	52.7				61.1	150.3	29-May	23.4 14.6
MTCL1131	50.9	74.1	68.6	65.8	62.4	153.5	3-Jun	26.2 14.3
MTF1432 ^{2/}	52.3				61.7	155.0	4-Jun	28.1 13.3
MTF1435	44.9				62.4	153.8	3-Jun	32.2 13.9
MTF1559	50.2				60.7	156.6	6-Jun	25.8 14.2
MTS1573 (HWW)	51.7				62.1	150.3	29-May	24.8 13.5
MTS1588	56.1				62.3	153.3	2-Jun	23.4 14.1
MTW1491 (HWW)	60.0	85.2			62.9	152.8	2-Jun	27.4 13.5
Northern +	52.0	77.9	72.3	69.8	62.2	153.8	3-Jun	22.9 14.5
PSB13NEDH-7-140 (P)	53.7				62.7	150.0	29-May	27.7 14.4
PSB13NEDH-7-45 (P)	48.2				59.8	148.3	27-May	25.7 14.4
SY Clearstone 2CL (P)+	47.8	73.1	68.1	65.7	62.1	152.3	1-Jun	26.4 14.6
SY Monument (P)+	53.0	78.2	74.1		61.4	149.8	29-May	25.8 12.8
SY Sunrise (P)+	52.5	72.7	69.8		62.2	149.4	28-May	22.4 13.5
SY Wolf (P)+	53.8	75.8	70.5	70.6	63.1	149.9	29-May	25.2 13.7
Warhorse +	44.0	66.9	64.7	60.5	62.1	152.9	2-Jun	23.6 15.0
WB4483 (P)++	51.3	69.5			62.4	152.8	2-Jun	22.5 14.3
WB4575 (P)++	51.0	63.4			62.8	150.6	30-May	24.2 14.9
WB4614 (P)+	51.2	74.4	69.5	66.9	62.0	152.0	1-Jun	24.0 13.9
WB4623CLP (P)+	43.7	64.3	61.2		61.9	150.9	30-May	23.1 13.7
WB-Quake (P)+	42.8	65.1	62.4	58.5	62.6	153.5	3-Jun	23.1 14.3
Yellowstone + ^{1/}	-	-	-	-				
Average	50.1	72.0	67.4	64.4	62.1	151.4	30-May	25.2 14.0
LSD (0.05)	5.2	12.8	9.8	8.6	0.5	1.1		2.8 0.6
C.V.	6.0	8.6	8.7	9.4	0.5	0.4		6.8 2.4

bold = indicates highest value within a column^{1/} = Yellowstone misplanted as Warhorse in 2017**bold** = indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

^{2/} = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 9. HARD WINTER : District 5-- Carter/Ft. Benton (Northern Seeds) - Dryland

Cultivar/Line	*** Test not planted 2014-2015 ***				
	Grain Yield (bushels/acre)		2017 Data		
			Test	Sawfly	Protein
	2017	2016-17	weight	cutting	
	2 yr		lb/bu	%	%
07CL039-7,SY 517CL2 (P)++)	59.2		59.8	28	12.8
Bearpaw +	46.2	55.3	57.2	18	12.3
Brawl CL Plus +	47.9	61.1	57.2	62	13.0
BZ9W09-2216 (P)	53.9		58.2	18	12.6
BZ9WM09-1620 (P)	48.6		57.2	52	12.2
CO13003C	52.3		57.1	72	12.0
Decade +	52.8	62.8	58.0	37	13.0
Denali +	47.8		56.8	70	12.0
Judee +	54.3	58.5	55.7	22	13.0
Keldin (P)+	57.2	65.0	56.9	48	12.8
Langin ++	44.8		57.0	92	12.2
LCS Chrome (P)++)	41.6		56.6	92	12.7
LCS Jet (P)+	55.8		56.8	47	12.3
Loma ++	57.0	67.4	58.3	27	12.8
Long Branch (P)++)	48.7		57.9	72	11.5
MT1265	43.6	57.1	55.7	67	13.7
MT1348	45.3	56.3	58.1	85	13.0
MT1444	41.9	55.1	57.0	67	12.1
MT1465 ^{2/}	52.7	61.3	57.6	68	12.8
MT1471	40.8	54.0	56.8	50	13.4
MT1488	39.2	53.1	56.8	43	12.6
MT1507	44.2		56.5	68	12.8
MT1540	46.1		57.0	88	12.8
MT1542	47.1		57.0	60	12.4
MT1547	48.0		55.1	83	13.2
MT1563	41.4		53.5	72	12.6
MT1564	59.8		57.4	47	12.7
MT1565	50.4		55.4	73	13.3
MTCL1131	41.0	59.8	55.4	75	12.7
MTF1432 ^{2/}	39.9		56.7	60	12.8
MTF1435	40.1		54.5	57	12.5
MTF1559	49.7		56.5	50	12.9
MTS1573 (HWW)	61.0		60.0	3	11.9
MTS1588	57.5		58.1	2	12.5
MTW1491 (HWW)	52.5	62.2	54.8	63	13.2
Northern +	42.7	56.6	54.5	62	12.5
PSB13NEDH-7-140 (P)	54.2		58.2	90	13.0
PSB13NEDH-7-45 (P)	46.8		57.4	88	12.7
SY Clearstone 2CL (P)+	43.5	57.8	56.1	78	12.8
SY Monument (P)+	44.4	61.6	53.8	72	12.4
SY Sunrise (P)+	48.2	55.6	57.3	77	12.1
SY Wolf (P)+	46.5	58.2	53.6	43	12.9
Warhorse +	53.0	57.8	55.9	2	12.8
WB4483 (P)++)	59.4	64.9	57.7	42	13.2
WB4575 (P)++)	48.3	61.3	58.7	50	12.9
WB4614 (P)+	55.2	55.4	56.8	53	12.7
WB4623CLP (P)+	48.8	53.0	56.2	52	12.8
WB-Quake (P)+	49.5	56.8	56.2	7	13.4
Yellowstone + ^{1/}	-	-			
Average	48.9	58.7	56.6	54.2	12.7
LSD (0.05)	ns	ns	2.6	21.1	
C.V.	19.0	10.6	2.9	24.1	

bold = indicates highest value within a column 1/ = Yellowstone misplanted as Warhorse in 2017**bold** = indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

(HWW) = Hard White Winter Wheat

2/ = approved for release in 2018, name pending

Table 10. HARD WINTER : District 6-- Sidney - Dryland

Cultivar/Line	2014, 2015 = severe winter-kill, no harvest							
	Grain Yield (bushels/acre)		Test weight	Winter survival	2017 Data		Plant height	Protein
					Heading Date			
	2017	2016-17	lb/bu	%	Ordinal	Calendar	in	%
	2 yr			from Jan1				
07CL039-7,SY 517CL2 (P)++	25.8		<u>66.2</u>	20.6	149.7	29-May	19.1	10.3
Bearpaw +	35.5	39.4	64.5	35.5	152.6	1-Jun	20.9	9.6
Brawl CL Plus +	28.6	51.6	65.2	27.2	150.2	29-May	21.6	10.7
BZ9W09-2216 (P)	46.9		65.6	34.5	152.9	2-Jun	20.0	9.1
BZ9WM09-1620 (P)	20.3		62.7	0.9	155.2	4-Jun	21.7	11.6
CO13003C	42.1		64.7	34.7	151.0	30-May	20.6	7.1
Decade +	50.7	54.1	64.9	62.4	151.4	30-May	21.6	8.7
Denali +	41.3		65.1	48.2	152.2	1-Jun	24.8	8.4
Judee +	13.7	33.7	64.1	23.7	155.5	4-Jun	17.5	12.2
Keldin (P)+	29.9	54.4	64.6	29.3	153.8	3-Jun	22.3	9.3
Langin ++	34.8		64.1	36.1	149.1	28-May	20.0	8.5
LCS Chrome (P)++	40.1		65.3	41.0	151.7	31-May	20.6	10.1
LCS Jet (P)+	32.0		62.2	11.0	154.0	3-Jun	18.7	9.1
Loma ++	36.5	41.7	62.9	39.3	155.8	5-Jun	18.1	10.6
Long Branch (P)++	33.7		64.9	50.1	149.8	29-May	20.7	8.8
MT1265	44.5	60.9	64.0	45.3	153.7	3-Jun	23.7	8.2
MT1348	42.3	55.8	64.5	46.8	152.2	1-Jun	21.8	9.0
MT1444	41.4	57.2	64.4	48.0	153.1	2-Jun	21.6	9.4
MT1465 ^{2/}	41.1	50.6	64.8	45.8	152.2	1-Jun	20.7	8.3
MT1471	30.0	52.0	64.9	35.0	153.5	3-Jun	20.2	9.0
MT1488	38.3	42.7	63.3	43.6	155.2	4-Jun	19.8	10.3
MT1507	<u>52.6</u>		64.9	45.0	151.6	31-May	24.3	7.9
MT1540	40.2		64.8	55.4	153.2	2-Jun	21.2	9.7
MT1542	38.7		64.5	32.8	155.1	4-Jun	19.2	8.5
MT1547	45.8		64.8	49.8	152.3	1-Jun	21.7	9.2
MT1563	43.6		64.4	54.1	152.6	2-Jun	23.5	9.0
MT1564	39.3		66.1	48.5	150.4	29-May	22.4	9.6
MT1565	42.4		64.8	53.0	151.0	30-May	22.9	9.4
MTCL1131	43.3	52.2	64.5	36.4	154.8	4-Jun	23.1	9.0
MTF1432 ^{2/}	43.5		63.2	33.6	155.4	4-Jun	24.2	9.1
MTF1435	42.4		63.4	44.9	154.8	4-Jun	26.0	8.6
MTF1559	36.7		61.4	33.8	157.3	6-Jun	23.3	9.3
MTS1573 (HWW)	30.6		64.6	39.8	152.4	1-Jun	20.6	9.3
MTS1588	37.8		64.8	19.0	154.9	4-Jun	19.7	9.3
MTW1491 (HWW)	37.1	51.7	64.7	44.6	154.6	4-Jun	21.8	9.4
Northern +	36.7	47.7	64.3	36.7	155.3	4-Jun	17.7	9.4
PSB13NEDH-7-140 (P)	38.2		65.0	47.7	151.5	31-May	24.0	10.2
PSB13NEDH-7-45 (P)	45.7		65.8	54.5	150.8	30-May	18.1	8.9
SY Clearstone 2CL (P)+	41.3	51.7	64.4	46.8	152.6	2-Jun	22.0	8.4
SY Monument (P)+	45.0	57.6	63.6	48.6	152.0	1-Jun	21.4	7.7
SY Sunrise (P)+	47.6	61.7	65.6	<u>63.1</u>	149.8	29-May	18.4	9.4
SY Wolf (P)+	33.3	54.8	65.9	36.8	151.4	30-May	19.5	9.4
Warhorse +	32.6	39.5	63.4	49.4	154.4	3-Jun	19.3	10.4
WB4483 (P)++	34.7	46.0	65.7	42.2	154.6	4-Jun	16.7	9.3
WB4575 (P)++	43.4	54.1	65.7	49.4	152.9	2-Jun	23.0	10.2
WB4614 (P)+	41.7	58.2	65.4	33.5	153.1	2-Jun	20.3	9.0
WB4623CLP (P)+	5.3	32.4	63.0	0.0	155.9	5-Jun	20.1	<u>12.7</u>
WB-Quake (P)+	37.7	40.0	64.9	35.8	154.9	4-Jun	21.0	9.4
Yellowstone + ^{1/}	-	-						
Average	37.7	49.7	64.5	39.6	153.0	2-Jun	21.0	9.4
LSD (0.05)	13.2	ns	1.3	15.7	1.9		3.0	1.6
C.V.	19.8	19.7	1.1	22.2	0.7		8.2	9.9

bold = indicates highest value within a column

1/ = Yellowstone misplanted as Warhorse in 2017

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

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 11. HARD WINTER : District 6-- Williston, North Dakota - Dryland

		*** No harvest in 2014 and 2017 due to severe winterkill ***						
Cultivar/Line	Grain Yield (bushels/acre)			Test weight	2016 Data		Plant height	Protein
	2016	2015-16	Ordinal		Calendar			
	1y	2y						
				lb/bu	from Jan1		in	%
07CL039-7,SY 517CL2 (P)++) Bearpaw +	45.4	44.2		57.3	147.3	26-May	21.8	11.6
Brawl CL Plus + BZ9W09-2216 (P)	50.0	37.8		59.8	145.7	25-May	24.0	10.7
BZ9WM09-1620 (P) CO13003C								
Decade + Denali +	49.8	48.8		58.3	147.7	27-May	21.7	11.2
Judee +	46.7	37.3		59.4	148.0	27-May	21.5	12.5
Keldin (P)+	54.9	41.5		59.5	147.3	26-May	21.3	11.3
Langin ++ LCS Chrome (P)++)								
LCS Jet (P)+ Loma ++	47.8	50.0		58.6	150.7	30-May	23.9	11.9
Long Branch (P)++) MT1265	60.4	54.4		58.9	147.7	27-May	27.2	11.1
MT1348	57.5	48.0		59.2	147.0	26-May	24.2	12.1
MT1444	56.8			58.8	148.3	27-May	25.5	9.3
MT1465 ^{2/}	49.3			58.6	147.0	26-May	23.3	12.7
MT1471	56.1			58.9	148.7	28-May	25.3	10.9
MT1488	48.9			59.8	150.3	29-May	21.5	12.3
MT1507								
MT1540								
MT1542								
MT1547								
MT1563								
MT1564								
MT1565								
MTCL1131 MTF1432 ^{2/}	60.1	57.8		58.7	150.3	29-May	28.3	10.8
MTF1435 MTF1559								
MTS1573 (HWW) MTS1588								
MTW1491 (HWW)	62.5			58.3	150.3	29-May	26.6	9.7
Northern +	50.3	50.4		59.2	149.7	29-May	20.5	12.7
PSB13NEDH-7-140 (P) PSB13NEDH-7-45 (P)								
SY Clearstone 2CL (P)+	53.1	49.4		59.0	147.3	26-May	25.6	10.9
SY Monument (P)+	55.7	48.3		57.4	147.7	27-May	22.1	10.2
SY Sunrise (P)+	52.7	38.5		58.5	147.3	26-May	19.4	11.8
SY Wolf (P)+	58.7	47.3		59.6	146.7	26-May	23.6	11.1
Warhorse +	41.0	40.9		58.9	150.7	30-May	18.8	13.9
WB4483 (P)++)	50.9			58.5	150.7	30-May	23.4	11.4
WB4575 (P)++)	51.5			59.9	147.7	27-May	23.6	11.3
WB4614 (P)+	51.9	47.9		58.6	147.0	26-May	21.8	12.0
WB4623CLP (P)+	55.5	35.0		58.7	147.7	27-May	22.9	11.6
WB-Quake (P)+	49.8	48.6		58.3	150.3	29-May	24.3	11.6
Yellowstone +	58.6	61.4		58.4	147.7	27-May	26.8	10.6
Average	51.8	51.8	48.0	57.4	148.1	27-May	23.4	11.6
LSD (0.05)	9.4	9.4	ns	0.5	0.9		3.3	ns
C.V.	10.7	10.7	18.4	0.5	0.4		8.6	13.4

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)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

2/ = approved for release in 2018, name pending

(HWW) = Hard White Winter Wheat

Table 12. 2012//2017 Intrastate Winter Wheat Test (Exp. 35): Combined Locations Winter Survival and associated Yield (Locations: Williston (2012, 2013, 2015), Sidney (2017) = 4 locations

		*** No recordable Winterkill, with a harvest, in 2014 and 2016 ***							
	location-years	Winter Survival (%)				Yield under Winterkill conditions			
		2017	2015//17	2013//17	2012//17	2017	2015//17	2013//17	2012//17
		1	2	3	4	1	2	3	4
07CL039-7,SY 517CL2 (P)++)		21				25.8			
Bearpaw +		36	54	43	39	35.5	39.2	43.2	43.4
Brawl CL Plus +		27	40			28.6	27.1		
BZ9W09-2216 (P)		34				46.9			
BZ9WM09-1620 (P)		1				20.3			
CO13003C		35				42.1			
Decade +		62	70	56	54	50.7	49.2	56.1	49.7
Denali +		48				41.3			
Judee +		24	32	26	21	13.7	20.8	25.7	25.1
Keldin (P)+		29	29			29.9	29.0		
Langin ++		36				34.8			
LCS Chrome (P)++)		41				40.1			
LCS Jet (P)+		11				32.0			
Loma ++		39	67			36.5	44.3		
Long Branch (P)++)		50				33.7			
MT1265		45	66			44.5	46.5		
MT1348		47	50			42.3	40.4		
MT1444		48				41.4			
MT1465 ^{2/}		46				41.1			
MT1471		35				30.0			
MT1488		44				38.3			
MT1507		45				52.6			
MT1540		55				40.2			
MT1542		33				38.7			
MT1547		50				45.8			
MT1563		54				43.6			
MT1564		48				39.3			
MT1565		53				42.4			
MTCL1131		36	58	55		43.3	49.4	54.9	
MTF1432 ^{2/}		34				43.5			
MTF1435		45				42.4			
MTF1559		34				36.7			
MTS1573 (HWW)		40				30.6			
MTS1588		19				37.8			
MTW1491 (HWW)		45				37.1			
Northern +		37	61	50	41	36.7	43.6	50.0	47.5
PSB13NEDH-7-140 (P)		48				38.2			
PSB13NEDH-7-45 (P)		54				45.7			
SY Clearstone 2CL (P)+		47	60	47	38	41.3	43.5	47.0	44.0
SY Monument (P)+		49	62			45.0	42.9		
SY Sunrise (P)+		63	50			47.6	35.9		
SY Wolf (P)+		37	46	38	31	33.3	34.6	38.4	37.5
Warhorse +		49	64	53	46	32.6	36.7	53.4	43.6
WB4483 (P)++)		42				34.7			
WB4575 (P)++)		49				43.4			
WB4614 (P)+		33	56			41.7	42.8		
WB4623CLP (P)+		0	8			5.3	9.9		
WB-Quake (P)+		36	55	46	40	37.7	42.5	46.4	48.0
Yellowstone + ^{1/}		-	-	-	-	-	-	-	-
Average		39.6	51.4	46.1	38.5	37.7	37.7	44.8	42.3
LSD (0.05)		15.7	30.1	14.5	11.4	13.2	14.0	7.1	6.8
C.V.		22.2	27.7	18.2	20.2	19.8	17.6	9.2	10.9

+ = new for 2017, # = paid entry

1/ = Yellowstone misplanted as Warhorse in 2017

bold = indicates highest value within a column

2/ = approved for release in 2018, name pending

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

Table 13. HARD WINTER WHEAT: Yield Performance under Sawfly Pressure and % Sawfly Cutting (2012//2017)
(Note: Sawfly cutting in each location-year $\geq 10\%$)

Cultivar/Line	Location-years	Grain Yield (bu/a)						Sawfly Cutting (%)					
		2017	2016-17	2015-17	2013//17	2012//17		2017	2016-17	2015-17	2013//17	2012//17	
		3	5	6	8	11		3	5	6	8	11	
Bearpaw + (ss)		34.6	46.9	40.7	51.4	47.5		13	12	9	11	12	
Brawl CLP +		45.1						55					
Decade +		42.5	56.7	47.2	57.1	52.1		44	39	28	29	31	
Judee + (ss)		42.6	61.5	50.1	61.2	54.7		24	25	18	20	18	
Keldin +		46.8	67.0					54	54				
Loma ++ (ss)		45.3	59.4	49.0				27	23	18			
MT1265		42.8	58.2	49.2				55	53	40			
MT1348		41.8	58.7					60	61				
MT1444		39.5						53					
MT1465^{2/}		46.8						53					
MT1471		40.0						47					
MT1488		34.6						59					
MTF1432^{2/}		39.1						46					
MTF1435		39.4						40					
MTS1573 (HWW, ss)		49.9						15					
MTS1588 (ss)		47.2						11					
MTW1491 (HWW)		42.9						52					
Northern +		39.8	56.0	47.9	60.3			42	34	27	26		
SY Clearstone 2CL (P)+		41.1	61.9	51.2	62.0	57.2		52	51	39	39	39	
SY Monument (P)+		42.5						56					
SY Wolf (P)+		42.6	60.4	50.2				47	40	31			
Warhorse + (ss)		43.4	54.9	45.5	56.2	52.0		6	4	3	5	4	
WB-Quake (P)+ (ss)		41.8	55.0	45.6	56.9	50.3		14	18	13	19	14	
Yellowstone^{1/}		-	-	-	-	-		-	-	-	-	-	
Average		42.3	58.0	55.6	57.9	52.3		40	35	26	21	20	
LSD (0.05)		ns	ns	ns	ns	5.9		22	16	14	12	12	
C.V. (%)		11.6	13.9	13.3	12.5	13.1		34	37	45	58	70	

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 ($p=0.05$)

(P) = Private Variety; + = Protected Variety; ++ = PVP Pending

(HWW) = Hard White Winter Wheat

1/ = Yellowstone misplanted as Warhorse in 2017 Intrastate Tests

(ss) = solid-stemmed sawfly resistant variety

2/ = approved for release in 2018, name pending

Table 14. Precipitation (top, in inches) and Average Monthly Temperature (bottom, °F) for Crop Year 2016-2017

Agricultural Research Center	Sept. 2016	Oct. 2016	Nov. 2016	Dec. 2016	Jan. 2017	Feb. 2017	Mar. 2017	Apr. 2017	May 2017	June 2017	July 2017	Aug 2017	Total
													Average
Western Triangle, Conrad	2.43	1.06	0.15	0.23	0.49	0.48	0.52	2.16	0.64	2.59	0.84	0.04	11.67
	53.4	41.6	39.4	13.3	16.4	21.5	32.0	41.2	54.0	61.1	71.9	66.3	42.7
Northern, Havre	2.37	3.04	0.21	0.13	0.41	0.72	0.07	0.25	0.45	1.57	0.14	0.12	9.48
	56.7	42.2	40.4	13.9	13.7	23.7	33.9	44.4	54.3	63.8	73.6	67.3	44.0
Northwestern, Kalispell	0.97	5.48	1.06	1.66	0.84	2.80	2.99	2.33	0.71	2.62	0.07	0.19	21.72
	52.0	43.5	38.4	17.3	12.5	22.1	35.8	40.4	52.6	59.6	68.0	64.3	42.2
Central, Moccasin	3.37	2.76	0.14	0.43	0.23	0.39	0.37	2.07	2.93	1.68	0.66	0.31	15.34
	55.4	46.3	42.9	45.6	19.1	26.9	37.2	42.2	52.4	60.0	71.4	65.9	44.6
Southern, Huntley	1.87	3.06	0.27	1.17	0.37	0.74	2.30	1.75	1.53	1.13	0.21	0.24	14.64
	59.8	47.6	41.9	14.1	14.1	25.6	40.4	46.9	55.9	65.6	75.8	68.4	46.3
Northeastern, Sidney	1.86	0.59	0.09	0.59	0.17	0.30	0.58	0.31	0.47	1.27	0.60	1.47	8.30
	57.5	46.1	39.2	11.0	11.1	23.6	32.6	44.0	56.6	64.5	73.8	66.4	43.9
Williston (WREC), N. Dakota	3.69	1.03	0.10	0.61	1.12	0.15	0.78	0.73	0.88	1.37	1.43	2.26	14.15
	62.5	49.4	41.6	11.6	13.0	23.6	32.9	46.3	59.3	67.2	77.8	69.3	46.2
Northern Seeds, Carter/Ft. Benton	2.83	2.48	0.08	0.30	0.91	0.64	0.35	3.22	1.20	1.63	0.14	0.12	13.90
	57.1	45.4	42.2	17.1	15.2	26.4	36.4	45.6	56.6	64.6	75.0	68.4	45.8
Post Farm, Bozeman	2.39	2.81	0.50	0.86	0.52	0.63	1.47	2.60	2.56	2.23	0.11	0.55	17.23
	56.1	48.2	39.9	17.6	16.1	29.3	42.5	43.7	52.7	60.7	71.2	66.9	45.4

Table 15. Selected agronomic characters, cereal quality evaluations and disease reactions of hard winter wheat varieties.

Variety	Agronomic Characters							Cereal Quality			Disease Reactions ^{8/}			
	Maturity ^{1/}	Chaff Color	Winter Survival ^{2/}	Straw Strength ^{3/}	Stem solid ^{4/}	Clear-field	Coleoptile length ^{5/}	Milling ^{6/}	Baking ^{6/}	PPO ^{7/}	Dwarf Smut	Stripe Rust	Stem Rust	Leaf Rust
Bearpaw	M	White	2	M	21	N	M	4	2	H	S	S	R	S
Brawl CL Plus	E	White	2	S		Y	L	3	3	H	S	S	-	-
Decade	M	White	4	S		N	M	3	4	H	S	S	R	MS
Denali	M	White	3	-		N	-	-	-	-	S	S	-	-
Judee	M	White	2	M	20	N	L	3	4	H	S	R	S	S
Keldin	M	White	2	S		N	S	3	2	H	S	MS	-	-
Langin	E	White	3	-		N	M	-	-	-	S	MS	-	-
LCS Chrome	M-E	White	3	-		N	M-L	-	-	-	S	R	-	-
LCS Jet	M	White	2	-		N	L	-	-	-	S	R	-	-
Loma	M-L	White	4	M	19	N	S	4	4	ML	S	R	R	-
Long Branch	E	White	3	-		N	M	-	-	-	S	R		-
Northern	M	White	3	S		N	S	3	3	L	S	R	R	-
MT1465^{9/}	M	White	3	S		N	M	3	4	M	S	R	MS	-
MTF1432^{9/}	L	White	2	MS		N	M	3	3	L	S	R	S	-
SY 517 CL2	E	White	2	-		Y	M-L	-	-	-	S	MS	-	-
SY Clearstone 2CL	M	White	3	S		Y	S	3	3	M	R	R	MR	-
SY Monument	M	White	3	S		N	M	3	2	ML	S	R	-	-
SY Sunrise	E	White	2	S		N	M	3	2	H	S	R	-	-
SY Wolf	M	White	3	S		N	M	3	2	M	S	R	R	-
Warhorse	M	White	4	MS	22	N	M	3	3	H	S	R	R	MR
WB4483	L	White	3	S	20	N	S	3	2	H	S	MS	-	-
WB4575	M	White	3	S		N	M	3	4	M	S	S	-	-
WB4614	M	White	4	S		N	M	3	3	H	S	R	-	-
WB4623CLP	M-L	White	1	M		Y	M	3	4	ML	S	R	-	-
WB-Quake	M-L	White	3	S	20	N	M	4	4	H	S	R	MR	MR
Yellowstone	M	White	4	S		N	S	3	4	M	MS	R	S	MS

1/ VE = Very Early, E = Early, M = Medium, L = Late, VL = Very Late

2/ 5 = Best Winter survival (over several years at Sidney, Williston and Moccasin)

3/ W = Weak

MW = Medium Weak

M = Medium

MS = Medium Strong

S = Strong

5/ L = long

M = medium

S = short

- = no info.

9/ = approved for release in 2018, name pending

6/ 5 = Superior

4

3

2

1 = Inferior

7/ PPO = Polyphenol Oxidase

(low is better for noodles)

L = low

M = medium

H = high

4/ scored 5-25, 25 = most solid

Combined 2013-2017 Bozeman, Carter, Conrad, Havre, Gildford, Loma, and Moccasin data; varieties with no number were not evaluated

8/ R = Resistant

MR = Moderately Resistant

M = Moderate

MS = Moderately Susceptible

S = Susceptible

VS = Very Susceptible

- = no information

Additional Descriptive Information for Winter Wheat Varieties

New for the 2018 Bulletin:

Denali – hard red winter wheat developed by Colorado and released in 2011. Denali is a medium maturing, medium statured wheat, with white chaff. Winter-hardiness is average. Denali has average yield and test weight and below average protein. Denali is susceptible to stripe rust. Mill and bake characteristics, under Montana conditions, have not been determined. PVP, Title V has been issued (Certificate #201200433). *Denali will not be in the Montana Intrastate Winter Wheat Test for 2018.*

Langin – hard red winter wheat developed by Colorado and released in 2016. Langin is an early maturing, short statured wheat, with white chaff. Winter-hardiness is average. Langin has average yield and test weight and below average protein. Langin is moderately susceptible to stripe rust. Mill and bake characteristics, under Montana conditions, have not been determined. PVP, Title V is pending (Certificate #201700298).

LCS Chrome – hard red winter wheat developed by Limagrain LLC and released in 2016. LCS Chrome is an early to medium maturing, medium statured wheat, with white chaff. Winter-hardiness is average. LCS Chrome has above average yield and test weight and average protein. LCS Chrome is resistant to stripe rust. Mill and bake characteristics, under Montana conditions, have not been determined. PVP, Title V is pending (Certificate #201600404).

LCS Jet – hard red winter wheat developed by Limagrain LLC and released in 2015. LCS Jet is a medium maturing, short statured wheat, with white chaff. Winter-hardiness is below average. LCS Jet has above average yield (#1 in 2017 across 7 locations tested) and below average test weight and average protein. LCS Jet is resistant to stripe rust. Mill and bake characteristics, under Montana conditions, have not been determined. PVP, Title V has been issued (Certificate #201600094).

Long Branch – hard red winter wheat developed by Limagrain LLC, licensed by Dyna Gro Wheat, and released in 2015. Long Branch is an early maturing, short statured wheat, with white chaff. Winter-hardiness is average. Long Branch has above average yield and test weight and below average protein. Long Branch is resistant to stripe rust. Mill and bake characteristics, under Montana

conditions, have not been determined. PVP, Title V is pending (Certificate #201700105).

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. Mill and bake characteristics, under Montana conditions, have not been determined. PVP, Title V is pending (Certificate #201700216). Additionally, the CLEARFIELD genes are patented.

Lines approved for variety release in 2018, names are pending:

MTF1432 – a hard red winter wheat developed by the Montana Agricultural Experiment Station and available to seed growers in fall 2018. MTF1432 is a late maturing, tall, awnless line developed for **forage** production as a possible replacement (or supplement to) Willow Creek (MT, 2005). Compared to Willow Creek, MTF1432 has similar forage yield and forage quality, but superior seed yield. Compared to conventional bread wheats; MTF1432 has average to above average yield, below average test weight, and average protein. MTF1432 is resistant to stripe rust and susceptible to stem rust. MTF1432 has low PPO and average milling and baking characteristics. PVP, Title V will be applied for.

MT1465 – hard red winter wheat developed by the Montana Agricultural Experiment Station and available to seed growers in fall 2018. MT1465 is a medium maturing, short to medium statured wheat, with average winter-hardiness. MT1465 is a high yielding variety with above average test weight and average protein. MT1465 (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. MT1465 is resistant to stripe rust and this resistance is either similar or significantly higher than that of Yellowstone. MT1465 is moderately susceptible to stem rust. MT1465 has excellent milling and baking qualities, comparable to Decade and parental cultivar, Yellowstone. PVP, Title V will be applied for.

Varieties previously in bulletin:

Bearpaw – hard red winter wheat developed by the Montana Agricultural Experiment Station in 2011. Bearpaw is a white-glumed, solid-stem, semi-dwarf (*Rht1*) wheat with medium maturity. Bearpaw has average yield, test weight, and protein, and below average winter hardiness. Bearpaw is resistant to prevalent races of stem rust but susceptible to stripe and leaf rust. Stem-solidness of Bearpaw is most similar to Rampart. Bearpaw is a high PPO variety with above average milling and below average baking properties. PVP, Title V option has been issued (Certificate #201200407).

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.

Decade – hard red winter wheat developed by the Montana Agricultural Experiment Station and released jointly with North Dakota (pending at publication) in 2010. Decade is an early to medium maturing reduced height wheat with white chaff. Decade is a high yielding wheat with good winter hardiness and medium to high test weight and protein. Decade is resistant to prevalent races of stem rust but very susceptible to stripe rust. Decade has excellent milling and baking quality. PVP, Title V has been issued (Certificate #201100096).

Judee – hard red winter wheat developed by the Montana Agricultural Experiment Station in 2011. Judee is a white-glumed, 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).

Loma – hard red winter wheat developed by the Montana Agricultural Experiment Station and available to growers in fall 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 is pending (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 average baking properties. PVP, Title V has been issued (Certificate #201600092).

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 Monument – hard red winter wheat developed by Syngenta and released in 2015. SY Monument is a medium maturing, medium short statured wheat, with white chaff. SY Monument has average yield, below average test weight and average protein. SY Monument is resistant to stripe rust. SY Monument is a medium low PPO variety with average mill and below average bake characteristics. PVP, Title V has been issued (Certificate #201400332).

SY Sunrise – hard red winter wheat developed by Syngenta and released in 2015. SY Sunrise is an early maturing, short statured wheat, with white chaff. SY Sunrise has average yield, above average test weight, and average protein. SY Sunrise is resistant to stripe rust. SY Monument is a high PPO variety with average mill and below average bake characteristics under Montana conditions. PVP, Title V has been issued (Certificate #201500370).

SY-Wolf – hard red winter wheat developed by Syngenta (AgriPro) Seeds in 2010. SY-Wolf is a medium maturing, short statured wheat with white glumes. SY-Wolf has above average yield and test weight and average protein. Winter-hardiness is average. SY-Wolf is moderately susceptible to moderately resistant (MS/MR) to stripe rust, but resistant to stem rust. SY Wolf has average milling and below average baking properties. PVP, Title V has been issued (Certificate #201100390).

Warhorse - is an awned, white glumed, 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).

WB4483 – hard red winter wheat developed by WestBred/Monsanto in 2016. WB4483 is solid stemmed, late maturing, short to medium statured wheat, with white chaff. WB4483 has slightly below average yield and average test weight and protein. WB4483 is moderately susceptible to stripe rust. WB4483 is a high PPO variety with average mill and below average bake characteristics under Montana conditions. PVP, Title V is pending (Certificate #201600380).

WB4575 – hard red winter wheat developed by WestBred/Monsanto in 2016. WB4575 is a medium maturing, short to medium statured wheat, with white chaff. WB4575 has below average yield and above average test weight and protein. Avery is susceptible to stripe rust. WB4575 is a medium PPO variety with average mill and above average bake characteristics under Montana conditions. PVP, Title V is pending.

WB4614 – hard red winter wheat developed by WestBred and released in 2013. WB4614 is a medium maturing, medium short statured wheat, with white chaff. WB4614 has average yield and protein and above average test weight. WB4614 is resistant to stripe rust. WB4614 is a high PPO variety with average mill and bake characteristics. PVP, Title V has been issued (Certificate #201500188).

WB4623CLP – hard red winter wheat developed by WestBred and released in 2015. WB4623CLP is a medium late maturing, short statured wheat, with white chaff. WB4623CLP has average yield, test weight, and protein. WB4623CLP is resistant to stripe rust. WB4623CLP is a medium low PPO variety with average mill and above average bake characteristics. PVP, Title V has been issued (Certificate #201500189). Additionally, the CLEARFIELD genes are patented.

WB-Quake – hard red winter wheat developed by WestBred (Monsanto) in 2011. WB-Quake is a medium to late maturing, medium statured solid-stemmed wheat, with white chaff. WB-Quake has above average yield, average test weight and protein with average winter hardiness. WB-Quake is resistant to stripe rust and moderately resistant to stem rust. WB-Quake is a high PPO variety with above average milling and baking properties. PVP, Title V is issued (Certificate #201100471). *WB-Quake will not be in the Montana Intrastate Winter Wheat Test for 2018.*

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. Yellowstone has been the leading winter wheat variety planted in Montana since 2012. 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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Note: Information in this article is available on the web at:

<http://plantsciences.montana.edu/crops>