

2001 Recommended Varieties: Hard Red Winter Wheat and Soft White Winter Wheat for Montana by District

Variety	Districts (see map on cover)					
	1	2	3	4	5	6
Hard Red Winter Wheat						
Bighorn (P)+	D ^{3/}	D	D	D	D	
BigSky ++			D	D	D	
Blizzard ^{1/}	D					
Elkhorn +						D
Erhardt		D	D	D	D	D
Judith	D ^{3/}	D	D	D	D	
Manning ^{1/}	D	D	D			
McGuire		D	D	D	D	
Morgan (P)+		D	D	D	D	D
Neeley	D ^{3/}	D	D	D	D	
Promontory + ^{1/}	D	D	DI	D		
Quantum 542 (P)	D ^{3/}	D	D	D	D	
Rampart ^{2/}			D	D	D	
Rocky (P)			D	D	D	
Tiber		DI	DI	DI	DI	
Vanguard ^{2/}			D	D	D	
Soft White Winter Wheat						
Eltan	D	D				
Hill 81	D	D				
Lewjain	D					
Malcolm	D	D				

D = Dryland

I = Irrigated

(P) = a Private Variety

+ = a "Protected" variety under the Plant Variety Protection Act

++ = PVP Title V pending

^{1/} = dwarf smut resistant

^{2/} = sawfly areas only

^{3/} = recommended with application of Dividend seed treatment for control of dwarf smut (TCK)

TABLE OF CONTENTS

	<u>Page</u>
Hard Red Winter and Soft White Winter Wheat Varieties Recommended by the Montana Agricultural Experiment Station	Inside Cover
Introduction	1
Variety Testing Procedures	1
Table 1. Summary of Agronomic Practices	2
Description of Data Collected	2
Statistical Analyses and Interpretation	3
2000 Test Conditions	3
Dwarf Smut (TCK).....	4
What Recommendation by MAES Means	4
Producing Winter Wheat.....	5
Yield in Winter Wheat as Influenced by Percent Stand	6
Hard Red Winter Wheat Comparisons:	
Table 2. List of Varieties	7
Table 3. District 1 - Kalispell - Dryland (High Rainfall)	8
Table 4. District 2 - Bozeman - Dryland	9
Table 5. District 3 - Huntley - Dryland	10
Table 6. District 4 - Moccasin - Dryland	11
Table 7. District 5 - Conrad - Dryland.....	12
Table 8. District 5 - Havre - Dryland	13
Table 9. District 6 - Sidney - Dryland.....	14
Table 10. Williston, North Dakota - Dryland	15
Table 11. Yield in winter-kill environments.....	16
Table 12. Yield performance under sawfly pressure.....	17
Table 13. Precipitation for Crop Year, 1999 – 2000.....	17
Table 14. Coleoptile length.....	18
Table 15. Selected agronomic characters, cereal quality evaluations and disease reactions	19
Soft White Winter Wheat Comparisons:	
Table 16. List of Varieties	20
Table 17. District 1 - Kalispell - Dryland (High Rainfall)	21
Table 18. District 2 - Bozeman - Dryland	22
Table 19. Huntley - Dryland.....	23
Table 20. Moccasin - Dryland.....	24
Table 21. Selected agronomic characters and disease reactions	25
Additional Descriptive Information for Winter Wheat Varieties:	
Hard Winter Wheat	26
Soft White Winter Wheat	29
Plant Variety Protection	31

WINTER WHEAT VARIETY PERFORMANCE SUMMARY IN MONTANA

J. E. Berg, P. L. Bruckner, G.R. Carlson, J. Eckoff, G.D. Kushnak, K. D. Kephart, N. Riveland R.N. Stougaard, D.M. Wichman, D. Habernicht, R. Johnston and D. Mathre

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. Varieties recommended for production in the respective districts of Montana are designated by an **R**. 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 and the Soft White Winter Wheat Nursery Reports. These reports are 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, frost, or other unavoidable causes.

Variety Testing Procedures

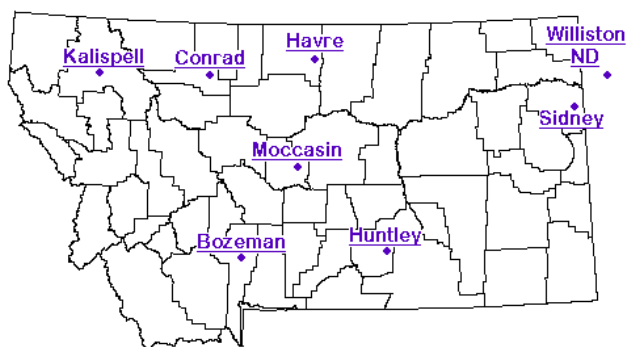


Fig. 1. Test Locations for Montana winter wheat performance tests in 2000.

Locations

Hard winter wheats were planted at 7 Montana and 1 North Dakota location (Fig. 1) including 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. Separate tests comparing soft white winter wheat

varieties were planted at Bozeman, Kalispell, Huntley and Moccasin.

Entries

Names of commercially available entries evaluated in 2000 are listed with their origins, release year and pedigrees in Table 2 for the hard winter wheats and in Table 16 for the soft white wheats. Forty-nine hard wheats are included in this summary comprising 32 varieties (26 public and 6 private) and 17 experimental lines (11 public and 6 private). Numbered entries preceded by a state designation (e.g. ID513, MT9426) are experimental lines provided by the breeder of the originating state. Private experimental lines (e.g. BZW96-895, GM10001) are provided by Western Plant Breeders and General Mills and are submitted for testing on a fee basis. The soft white evaluation contains 16 varieties [13 public, 2 private and one hard wheat check (Neeley)].

Experimental Design and Seeding Methods

The Intrastate Winter Wheat Test consisted of a 49 entry test with 3 replicates. It was planted in the form of 7x7 lattice at all locations except Kalispell, where it was in a randomized complete block design. Plot size varied by location, from 35 ft² at Conrad to 60 ft² at Havre. All plots were 4-row, except Havre (3-row), Williston (8-row) and Kalispell (7-row). Row spacing at all locations was on 1 ft. centers, except at Williston and Kalispell (6" centers). All plots were seeded at 0.6 grams seeds/ft², which is roughly equivalent to 1 bushel per acre, except at Williston where the seeding rate was about 77 pounds per acre. Information on previous crop, planting date, fertilizer use and harvest date is available in Table 1.

Soft white winter wheat nurseries were planted similar to the hard wheat test, except all tests were planted in a randomized complete block design.

All seed for each nursery was treated with Dividend-XL seed treatment at recommended rates before planting.

Table 1. Summary of agronomic practices used on hard winter wheat performance trials in Montana in 2000. Fall nitrogen (N), phosphorus (P₂O₅) and potassium (K₂O) were preplant applied and incorporated.

Location	1999 Crop	1998 Crop	1999 Planting Date	Fertilizer				2000 Harvest Date
				N		P ₂ O ₅	K ₂ O	
				Fall	Spring			----- Pounds per acre -----
Kalispell	pea manure	pea manure	Sept. 23	60	-	30	15	Aug. 16
Bozeman	fallow	oats	Oct. 5	88	-	35	35	Aug. 8
Huntley	chem. fallow	winter wheat	Sept. 17	18	80	46	0	July 17
Conrad	fallow	barley	Sept. 16	51	-	30	20	July 31
Havre	fallow	barley	Sept. 23	70	-	40	25	July 27
Sidney	fallow	safflower	Sept. 20	0	-	0	0	July 26
Williston, ND	fallow	spring wheat	Sept. 23	10	65	25	0	July 28

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 2000, data is provided for two (1999-2000), three (1998-2000) and four (1997-2000) year averages for both hard red and soft white wheat entries tested during previous cropping seasons.

Test Weight

Test weight (pounds per bushel) were obtained for each plot by using a Seedburow test weight apparatus. 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. Grams per quart are converted into pounds per bushels. Test weight, heading date, plant height and protein percentage are reported for 2000 data only (except Moccasin, 1999 data).

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 Julian days (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. In 2000, Sidney and Williston were the only locations with significant winter-kill, averaging 84 and 63% stands, respectively, at each location.

Table 11 contains information on yield in winter-kill environments from 1997 to 2000. The data summarizes 6 tests in which significant winter-kill occurred (test average for winter survival was less than 90%). Most of the testing sites with winter-kill were in District 6 (Sidney and Williston) which is the most severe location for winter wheat survival 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. Solid-stemmed winter wheats, 'Vanguard' and 'Rampart' were released in 1995 and 1996, respectively and increased in production during the 2000 crop year. Both these varieties have marginal winter hardiness.

Table 12 contains information on yield at 10 testing locations where sawfly pressure was present during the years 1997-2000. The data is mainly from Off Station winter wheat nurseries. Big Sandy and Loma are 'satellite' locations of Havre; The Knees of Conrad, Highwood of Moccasin and Broadview of Huntley.

Coleoptile Length

Coleoptile length evaluation was performed in Bozeman under controlled (growth chamber) conditions. Twenty-five seeds per variety were planted in wetted vermiculite and grown in the dark for 15 days then the coleoptile (sheath covering the emerging shoot that helps penetration to the soil surface) was measured. This test was replicated 3 times for each variety. Results are reported in inches in Table 14. 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, straw strength and shattering reactions for the hard wheat varieties listed in this publication. Information on shattering is not available for all varieties.

Table 21 has information on maturity, winter survival and lodging for soft white winter wheats.

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 general leaf spot complex. Table 21, for soft white winter wheat, contains information on dwarf smut, snow mold, stem rust and stripe 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 mean of a variety exceeds that of another variety by more than the LSD, then the difference observed will be a true difference in 19 out of 20 times under conditions similar to those of the test.

Tables 3 through 10 show data collected in 2000 for each district at all experiment station sites for the hard winter wheats. (Data for Moccasin is 1999 because of loss of the 2000 test to hail.) Tables 16 - 19 contain 2000 data for the soft white wheats. Where a variety has been in the test for two, three or four years, combined analyses of the yield data over years are presented. Not all years are present at each location due to hail or stand problems.

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.

2000 Test Conditions

The Moccasin nursery was destroyed by hail on July 9. Experimental yields in 2000 at the other experiment stations were greater than the 10 year average at all locations tested except Huntley and Conrad. Statewide winter wheat yields were impacted by drought and projected by the Montana Agricultural Statistics Service at 33 bu/a yield for 2000 compared to 38 bu/a for the 1997-1999 harvest years. Most locations in Montana had average rainfall up to heading, except Conrad. Below average summer rainfall occurred at all locations except Sidney and Williston (see Table 13 for precipitation data). Test weight averaged above 60 lb/bu at all locations except Kalispell. Due to the relatively mild winter of 1999-2000 there was very little winterkill or stand reduction at any location except Sidney and Williston (which had very little effect on final yield). Utah 100 showed the most stand loss and yield reduction at these 2 locations. Diseases were minimal at all locations. There was no sawfly cutting at any of the Experiment Station locations. Protein content was average to above average at all stations tested except Havre.

Dwarf Smut (TCK)

Dwarf smut (TCK) can be controlled with 'Dividend' seed treatment (see page 5). Dwarf smut (*Tilletia controversa* Kuhn); also called dwarf bunt, is a fungus disease known to infect winter wheat in certain foothill areas in the intermountain region of Montana. The planting of dwarf smut resistant varieties (Blizzard, Manning, Promontory and Lewjain are currently recommended) as one 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.

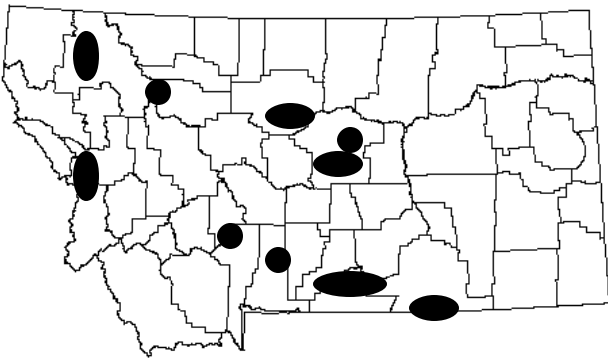


Fig. 2. Known areas of dwarf smut (TCK) infestations.

The disease occurs more frequently in the foothill areas where early fall snow cover is received, protecting the wheat from freezing or below freezing temperatures for an extended period of time and permitting the fungus to invade the plant.

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 planting a resistant variety (Tables 15 and 21) or use an appropriate seed treatment.

What Recommendation by MAES Means

Classification of winter wheat varieties is determined on a yearly basis by the Montana Agricultural Experiment Station (MAES) Wheat Variety Release Committee. This 15 member committee is composed of two wheat breeders, one cereal quality scientist, one plant pathologist, one entomologist, one extension specialist, one representative of Foundation Seed Stocks, six

Research Center agronomists, one Montana Wheat and Barley Committee member and one representative of the Montana Seed Growers Association.

A variety is eligible for recommendation when a minimum of 16 location-years of performance data is obtained from the Montana State University statewide winter wheat performance trials. Test results indicate that the variety is equal to or superior in overall merit to specified check cultivars and has end-use quality equal to or exceeding currently recommended varieties. For varieties originating from private companies, recommendation is considered only at the request of the company when adequate data is available.

Recommendations of varieties are considered on a case by case basis. Yield performance of a variety is an important criteria, but also considered are test weight, grain protein content, winter survival, pest resistance and end-use quality data. In general, yield needs to be at least equal to currently recommended varieties in a particular district, unless the variety is being recommended for a specific purpose, e.g. winter hardiness, sawfly resistance. For example, Rampart and Vanguard, which are not competitive in the absence of wheat stem sawfly, are recommended in Districts 3, 4 and 5 for sawfly areas only. Only three varieties are recommended for the Northeast district due to severe winter conditions and a higher probability of stem rust in this region. Thus varieties recommended for District 6 must have higher winter survival and stem rust resistance.

If a serious defect in the variety is identified during performance testing, the variety will not be recommended. Examples of defects resulting in non-recommendation include: high probability of winter-kill, low grain protein, low baking quality, etc.

Lack of variety recommendation by MAES may occur to a decision by the originating company not to test the variety in statewide performance trials. In this case the lack of recommendation is due to inadequate or no data rather than a specific varietal defect.

Montana produces primarily hard red winter and hard red spring wheats. Continuous improvement of the milling and/or baking quality of Montana grown winter wheat is one of many objectives of the Montana Agricultural Experiment Station breeding and cultivar development program. All varieties recommended by the Montana Agricultural

Experiment Station have been evaluated and found to be acceptable for milling and baking performance by the Cereal Quality Laboratory at Montana State University.

The quality of Montana recommended varieties, if grown and marketed within their respective classes, is acceptable by domestic users. Montana's future as a hard red and hard white winter wheat producing state for both the domestic and export markets rests on the quality of the product.

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 a new chemical compound called Difenconazole. '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 and date for winter wheat

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

Two options available for fields with less than 80 plants per square yard:

1. Interseed with an early maturing hard red spring wheat variety.
2. Tear up and replant, but risk loss of moisture.

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

Variety	Origin	Release Year	Pedigree
Public Varieties			
Akron	Colorado	1994	TAM-107/Hail
BigSky	Montana	2001	NuWest/Tiber
Blizzard	Idaho	1989	((Orfed/Elgin/3/(UT112a-520-6-1, Redit/ Kanred //Sevier), UT216c-12-10)/4/Cheyenne /5/PI476212/4/Burt/3/Rio /Rex//Nebred, A68203W-E-1-3-3)/6/(A68203W-1-6-1, same pedigree as previous)
Culver	Nebraska	1998	(Trapper//Comanche/Ottawa/3/CIMMYT wheat/ Scout//Buckskin sib/4/Homestead, NE82419) /5/Arapahoe
Elkhorn	N. Dakota	1995	Norstar/4/Centurk/Winoka/Uljanovka/3/(SD76694, Centurk*5/Hand)
Erhardt	Montana	1996	Roughrider/6/(MT6928, (Sinvalocho/Wichita// Hope/ Cheyenne/3/ Wichita/4/Seu Seu 27, TX55-391-56-D8)/5/ Westmont)
Golden Spike (HWW)	Utah, General Mills	1999	Arbon/Hansel/4/(ID0281, Hansel/3/(Snow Mold Sel. 1, Cltr14106)/ Columbia//McCall)
Halt	Colorado	1994	Sumner/5/(CO820026, Siete Cerros/Ciano 67 //Calidad /3/Baca /4/Vona)/6/PI372169/7/TAM-107
Harding	So. Dakota	2000	Brule//Bennett/Chisholm/3/Arapahoe
Judith	Montana	1989	Lancota/Froid/9/((Seu Seu 27/3/(Cltr12500, Nebraska 60// Mediterranean/Hope)/4/Red Chief/Ponca/5/ Cheyenne/6/Atlas 66/ Comanche, NE69559)/7/ (CO634011, Lancer sel.)/8/Winoka
Manning	Utah	1979	Delmar/PI178383/7/Columbia/6/Delmar/5/(Hussar/Turkey Red// Redit/3/Oro/Ridit, UT173-53)/4/Norin 10/Brevor
McGuire	Montana	1996	Plainsman V//((MT77003, Froid/Bezostaya)/7/(Favorit/5/Cirpiz/4/ Jang Kwang//Atlas 66/Comanche/3/Velvet, HP344, NE7060)/6/Froid
Neeley	Idaho	1980	Heglar/3/Norin 10/Staring//2*Cheyenne
Norstar	Alberta	1977	Winalta/Alabasskaya
Nuplains (HWW)	Nebraska	1998	Abilene/3/(KS831872, Plainsman V//Newton/Arthur 71)
NuSky (HWW)	Montana	2001	NuWest/Tiber
Promontory	Utah	1990	Manning/Bezostaya-1
Pronghorn	NE, SD, WY	1995	Centura/Dawn//Colt sib
Prowers 99	Colorado	1999	modified bulk procedure following single plant selection for improved Russian wheat aphid resistance from cultivar Prowers (CO850060/ PI372169//5*Lamar)
Rampart	Montana	1996	Lew/Tiber//Redwin
Ransom	North Dakota	1998	Seward//((SD76705, Centurk*5/Hand)
Redwin	Montana	1979	(Yogo/Cheyenne, MT6324)/3/(MT7302, Norin 10/Brevor// Yogo)
Tiber	Montana	1988	Redwin pure line selection
Utah 100	Utah	1996	Weston/Ark//Manning
Vanguard	Montana	1995	Lew/Tiber//Redwin
Windstar	Nebraska	1997	(TAM W-101/(KS73167, Newton sib.), TX79A2729)//Caldwell/Brule field selection 6 /4/Siouxland

Private Varieties

Bighorn	Hybritech, Western Plant Breeders	1985	Warrior/5/(III-54-12, Cltr12382, Wis. H255-49-5-1-4, Minturki/4/ (H143-1-14-27, ((Illinois No. 1/Chinese, Pd266A-2-15-6-3)// P1194761/ Triticum timopheevi D357-1, H139)/3/Wis. Pedigree No. 2))/6/Sturdy /7/Winoka/Ark
CDC Falcon	Western Plant Breeders/Saskatchewan	1999	Norstar*2/Vona//Abilene
Morgan	Western Plant Breeders/Saskatchewan	1996	Archer/Norstar
NuWest (HWW)	Montana, General Mills	1994	Froid/Winoka/7/((Sinvalocho/Wichita//Hope/ Cheyenne/3/ Wichita /4/ Seu Seu 27, TX55-391-56-D8)/5/Westmont, MT6928)/6/Trader
Quantum 542	Western Plant Breeders	1988	F1 Hybrid
Rocky	AqriPro	1978	Centurk pure line selection

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

Cultivar/Line	Grain Yield (bushels/acre)				Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000	1998-2000 ^{2/}	1997-2000 ^{2/}		Julian	Calendar		
		2 yr	3 yr	4 yr					
Akron +	129.7*	138.9*	112.1*	107.5*	62.3	157	5-Jun	47.9	11.4
R Bighorn (P)+	114.1	132.8*	106.3*	109.4*	62.7	158	6-Jun	44.9	12.0
BigSky ++	110.6	127.5	103.0	103.1	63.5	160	8-Jun	49.6	12.8
R Blizzard ^{1/}	104.2	122.1	100.1	105.3	63.4	160	8-Jun	53.0	13.3
BZ9W96-895 (P)	124.4*				61.6	158	6-Jun	45.5	11.5
BZ9W96-919 (P)	133.8*				61.9	159	7-Jun	45.0	11.3
BZ9W97-761 (P, HWW)	116.3				63.1	158	6-Jun	48.4	12.6
CDC Falcon (P)	115.2				61.0	159	7-Jun	43.4	11.7
Culver +	130.1*	142.2*			62.4	156	4-Jun	46.2	12.6
Elkhorn +	90.7	109.2	91.4	89.6	62.8	160	8-Jun	53.1	13.5
Erhardt	112.4	128.2	99.7	101.7	63.2	159	7-Jun	46.6	13.1
GM10001 (P, HWW)	125.7*				63.3	156	4-Jun	46.3	10.7
GM10002 (P, HWW)	111.4				63.0	156	4-Jun	42.8	11.8
GM10003 (P, HWW)	117.7*				62.5	156	4-Jun	43.6	10.6
Golden Spike (HWW)+	106.9				61.8	160	8-Jun	48.2	10.9
Halt +	116.3	126.5	103.1	100.0	62.2	155	3-Jun	44.1	12.0
Harding	132.9*	132.3*	104.6*		62.5	160	8-Jun	49.7	13.4
ID513	113.9	132.4*			62.6	159	7-Jun	46.2	12.2
ID537 (HWW)	132.2*	134.8*			60.0	159	7-Jun	51.7	12.7
ID550 (HWW)	97.4				61.1	159	7-Jun	50.1	11.6
R Judith	122.3*	139.8*	111.5*	110.0*	61.2	158	6-Jun	49.5	11.7
R Manning ^{1/}	107.5	133.8*	107.7*	109.8*	62.4	158	6-Jun	48.7	11.7
McGuire	122.2*	131.0*	103.1	103.1	63.2	157	5-Jun	47.7	14.0
Morgan (P)+	91.1	112.8	93.1	100.2	61.7	160	8-Jun	48.3	12.5
MT9426	123.8*	145.9*			62.0	160	8-Jun	45.9	12.0
MT9513	120.6*	140.0*			60.3	159	7-Jun	48.2	12.6
MT98110	115.1				60.2	159	7-Jun	47.1	12.3
MT9822	128.8*				62.5	156	4-Jun	49.3	11.7
MT9857	114.5				61.4	160	8-Jun	47.0	12.6
MTS9720	123.0*	138.2*	112.6*		62.0	159	7-Jun	47.3	12.3
MTS9882	113.1				62.6	159	7-Jun	44.3	11.1
MTW9724 (HWW)	116.9	132.1*			60.0	160	8-Jun	50.0	11.9
R Neeley	120.3*	139.0*	112.2*	111.7*	62.2	160	8-Jun	49.7	12.2
Norstar	77.9	101.9	85.7	87.7	62.5	163	11-Jun	55.1	13.2
Nuplains (HWW)	125.4*	129.4*			64.4	158	6-Jun	45.1	12.0
NuSky (HWW) ++	103.2	121.6	100.0	101.2	61.5	160	8-Jun	48.7	12.7
NuWest (P, HWW) +	111.1	130.5*	107.8*	106.4	61.9	159	7-Jun	48.7	12.4
R Promontory + ^{1/}	137.4**	145.8*	117.0**	119.9**	63.8	158	6-Jun	47.9	11.3
Pronghorn	135.4*	139.2*	110.8*	109.7*	63.5	155	3-Jun	49.3	12.9
Prowers 99 +	124.3*				64.8	156	4-Jun	50.1	13.0
R Quantum 542 (P)	124.7*	139.4*	114.6*	113.0*	62.3	156	4-Jun	49.6	11.7
Rampart	113.3	121.5	99.5	98.1	63.3	159	7-Jun	48.8	13.2
Ransom +	104.9	118.0			61.0	160	8-Jun	48.9	12.7
Redwin	101.2	117.6	95.7	96.1	63.5	161	9-Jun	50.7	14.2
Rocky (P)	115.0	128.4*	105.3*	106.5	64.4	157	5-Jun	50.3	12.5
Tiber	112.4	128.5*	105.4*	103.5	63.4	160	8-Jun	51.7	12.6
Utah 100 ^{1/}	129.1*	146.7**	115.6*		60.6	160	8-Jun	51.6	11.5
Vanguard	123.7*	128.0	102.8	101.7	63.6	157	5-Jun	49.9	13.1
Windstar +	116.7	136.0*	110.1*		60.7	158	6-Jun	47.4	12.0
Average	116.5	130.6	104.8	104.1	62.3	159	7-Jun	48.2	12.3
LSD (0.05)	19.9	18.4	14.4	12.3		1.9		4.0	
C.V.	10.6	7.3	8.0	8.4		0.7		5.2	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

^{2/} = Rhizoctonia root rot caused severe stand reductions and resultant yield loss in 1998

Table 4. HARD WINTER WHEAT: District 2 -- Bozeman - Dryland

Cultivar/Line	Grain Yield (bushels/acre)				Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1998-2000 3 yr	1997-2000 4 yr		Julian	Calendar		
R Akron +	120.5*	116.0	115.0*	109.3*	61.4	161	9-Jun	36.3	11.4
R Bighorn (P)+	111.4	100.3	103.6	99.7	61.3	165	13-Jun	36.1	13.0
BigSky ++	105.2	100.7	103.7	100.3	61.8	167	15-Jun	41.5	14.3
Blizzard ^{1/}	116.3	114.2	113.2	112.2*	62.4	169	17-Jun	43.8	14.2
BZ9W96-895 (P)	111.1				61.1	165	13-Jun	37.4	12.8
BZ9W96-919 (P)	119.2*				61.0	166	14-Jun	34.7	12.5
BZ9W97-761 (P, HWW)	104.9				61.3	166	14-Jun	40.6	13.6
CDC Falcon (P)	115.5				60.3	164	12-Jun	32.7	12.4
Culver +	121.3*	118.0*			60.8	160	8-Jun	38.3	13.1
R Elkhorn +	93.5	88.9	89.8	92.1	61.0	168	16-Jun	44.7	15.0
R Erhardt	102.9	106.6	104.2	97.6	62.2	167	15-Jun	38.5	14.4
GM10001 (P, HWW)	119.6*				63.3	161	9-Jun	35.4	11.1
GM10002 (P, HWW)	126.6**				62.6	160	8-Jun	30.6	12.5
GM10003 (P, HWW)	106.1				59.6	160	8-Jun	29.6	11.5
Golden Spike (HWW)+	118.8*				60.9	167	15-Jun	40.5	11.6
R Halt +	119.0*	114.6	108.0	100.3	61.1	159	7-Jun	30.6	12.6
Harding	106.9	105.0	103.3		60.4	164	12-Jun	39.8	14.2
ID513	115.3	116.8			61.5	167	15-Jun	38.6	12.7
ID537 (HWW)	123.6*	123.3*			60.1	165	13-Jun	42.6	13.7
ID550 (HWW)	123.5*				61.1	166	14-Jun	41.6	12.2
R Judith	111.5	112.0	114.4*	107.6	60.2	164	12-Jun	42.1	13.4
R Manning ^{1/}	125.8*	127.3*	123.0*	116.2*	61.8	165	13-Jun	39.7	12.2
R McGuire	106.1	102.1	99.4	94.4	61.1	161	9-Jun	34.6	15.2
R Morgan (P)+	119.2*	112.1	112.3	109.7*	60.6	169	17-Jun	40.1	14.2
MT9426	117.9	114.3			60.2	167	15-Jun	37.5	13.4
MT9513	113.3	110.3			59.2	166	14-Jun	40.8	13.6
MT98110	116.0				59.9	164	12-Jun	38.9	13.2
MT9822	119.9*				61.9	161	9-Jun	39.1	13.3
MT9857	112.2				61.9	167	15-Jun	33.7	14.1
MTS9720	102.5	100.4	104.2		58.0	167	15-Jun	38.4	14.2
MTS9882	109.5				60.6	167	15-Jun	34.1	12.8
MTW9724 (HWW)	116.2	120.8*			60.3	165	13-Jun	39.9	12.3
R Neeley	117.7	116.0	117.0*	114.6*	61.8	168	16-Jun	40.3	13.8
Norstar	85.9	80.2	87.7	88.2	61.2	172	20-Jun	50.0	14.5
Nuplains (HWW)	118.2	113.2			63.1	163	11-Jun	34.0	13.4
NuSky (HWW) ++	110.6	108.7	108.6	100.8	61.0	167	15-Jun	41.8	13.6
NuWest (P, HWW) +	113.3	111.5	108.4	104.2	61.1	166	14-Jun	39.6	13.8
R Promontory + ^{1/}	124.9*	128.4**	125.4**	118.2**	62.8	165	13-Jun	38.1	11.6
Pronghorn	118.0	114.9	106.3	101.0	61.6	160	8-Jun	39.6	13.0
Prowers 99 +	119.2*				63.0	160	8-Jun	39.8	13.2
R Quantum 542 (P)	124.7*	123.9*	121.7*	113.8*	62.0	163	11-Jun	41.9	13.0
Rampart	112.6	107.8	107.0	103.3	62.0	164	12-Jun	38.8	13.8
Ransom +	102.2	104.1			60.4	166	14-Jun	40.5	13.6
Redwin	100.8	100.0	97.5	89.0	62.4	167	15-Jun	41.9	14.6
Rocky (P)	114.3	111.9	110.4	104.4	62.7	162	10-Jun	38.9	12.5
R Tiber	102.0	101.1	102.4	99.3	62.2	167	15-Jun	43.6	13.7
Utah 100 ^{1/}	122.3*	128.0*	124.6*		60.0	167	15-Jun	41.5	12.5
Vanguard	117.3	111.1	108.7	101.4	61.9	163	11-Jun	40.6	14.1
Windstar +	114.9	105.4	104.0		60.4	162	10-Jun	37.6	12.4
Average	113.7	110.6	108.3	103.4	61.2	165	13-Jun	38.8	13.2
LSD (0.05)	8.0	6.4	11.2	11.2	0.5	0.9		1.9	
C.V.	4.3	5.1	5.3	6.5	2.8	0.3		2.8	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

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

1998 Crop destroyed by hail

Cultivar/Line	Yield (bushels/acre)			Test weight lb/bu	Heading		Plant Height in	Protein %
	2000	1999-2000	1997-2000		Julian	Calendar		
		2 yr	3 yr					
Akron +	60.4	68.4	79.4*	63.2	146	25-May	31.7	12.3
R Bighorn (P)+	61.4	63.0	71.9	62.6	151	30-May	29.3	14.7
R BigSky ++	70.6	70.0	79.9*	62.7	152	31-May	35.7	14.6
Blizzard ^{1/}	59.7	64.8	75.2*	62.4	152	31-May	33.9	15.1
BZ9W96-895 (P)	78.0			62.5	149	28-May	31.5	13.8
BZ9W96-919 (P)	67.5			62.1	150	29-May	29.5	14.4
BZ9W97-761 (P, HWW)	65.4			62.1	150	29-May	34.6	14.3
CDC Falcon (P)	60.8			62.3	151	31-May	29.6	14.5
Culver +	66.9	71.6		62.6	146	25-May	33.2	13.5
Elkhorn +	56.6	58.7	67.4	62.3	153	1-Jun	35.5	14.7
R Erhardt	59.8	61.8	70.8	62.6	150	29-May	32.8	14.6
GM10001 (P, HWW)	65.2			64.0	146	25-May	32.1	13.0
GM10002 (P, HWW)	64.7			63.6	147	26-May	26.9	12.3
GM10003 (P, HWW)	48.7			59.8	147	26-May	27.0	12.9
Golden Spike (HWW)+	71.5			61.8	152	31-May	30.8	13.0
Halt +	55.4	69.9	76.5*	62.0	144	23-May	29.0	12.8
Harding	67.4	68.9		62.2	149	28-Feb	33.7	13.9
ID513	58.8	63.9		62.3	150	29-May	31.9	14.8
ID537 (HWW)	60.2	58.2		59.4	149	28-Feb	36.3	15.1
ID550 (HWW)	65.5			62.1	152	31-May	29.5	13.6
R Judith	58.1	67.5	80.0*	61.7	147	26-May	34.6	14.1
R Manning ^{1/}	78.5	82.9	84.8**	62.6	151	30-May	33.8	12.9
R McGuire	59.2	66.4	72.5*	62.4	146	25-May	32.4	15.3
R Morgan (P)+	54.9	60.3	72.4*	61.6	152	31-May	30.8	14.8
MT9426	61.6	63.0		60.5	153	1-Jun	29.0	15.0
MT9513	75.8	71.4		61.2	152	31-May	33.2	12.9
MT98110	55.8			60.0	149	28-May	31.0	15.4
MT9822	62.7			61.5	147	26-May	35.0	14.6
MT9857	54.2			60.9	155	3-Jun	27.9	15.8
MTS9720	72.7	67.5		60.7	152	31-May	30.7	14.3
MTS9882	69.2			62.3	153	1-Jun	28.1	12.6
MTW9724 (HWW)	58.4	65.1		61.4	150	29-May	32.0	13.6
R Neeley	71.9	69.7	79.4*	62.9	151	30-May	32.7	14.4
Norstar	60.3	62.6	69.6	62.2	157	5-Jun	38.2	14.2
Nuplains (HWW)	52.7	59.0		63.3	148	27-May	28.4	14.6
NuSky (HWW) ++	54.8	58.6	71.3	61.8	153	1-Jun	30.1	14.8
NuWest (P, HWW) +	74.5	75.2	82.3*	61.0	152	31-May	33.9	13.5
R Promontory + ^{1/}	69.2	68.8	80.0*	63.7	150	29-May	32.9	14.0
Pronghorn	59.0	65.0	72.7*	63.2	146	25-May	35.0	14.5
Prowers 99 +	59.6			64.0	147	26-May	35.0	14.3
R Quantum 542 (P)	63.6	68.3	80.4*	62.9	147	26-May	36.8	13.5
R Rampart	67.3	69.5	73.4*	62.4	149	28-May	33.1	15.2
Ransom +	53.5	57.8		61.2	151	30-May	32.9	14.0
Redwin	62.7	64.6	68.8	62.1	149	28-May	32.8	14.7
R Rocky (P)	62.7	68.4	78.8*	63.7	148	27-May	34.9	13.9
R Tiber	73.9	72.8	79.4*	63.0	151	30-May	36.1	14.2
Utah 100 ^{1/}	77.0	75.9		61.2	153	1-Jun	33.4	13.6
R Vanguard	67.0	63.2	70.3	62.5	149	28-May	32.0	14.9
Windstar +	65.3	68.3		62.2	147	26-May	32.0	12.7
Average	63.7	66.6	75.5	62.2	150	29-May	32.3	14.1
LSD (0.05)	ns	ns	12.5	1.3	1.8		3.2	
C.V.	17.4	16.7	13.3	1.2	0.7		5.7	

ns = indicates no significant differences among varieties at P = 0.05

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

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

2000 Crop destroyed by hail

Cultivar/Line	Grain Yield (bushels/acre)			Test weight lb/bu	Heading Date		Plant Height in	Protein %
	1999	1998-1999 2 yr	1997-1999 3 yr		Julian	Calendar		
Akron +	62.5	64.5	65.0	61.5	167	15-Jun	33.2	10.7
R Bighorn (P)+	63.0	66.2*	64.6	61.1	168	16-Jun	31.0	12.1
R BigSky ++	55.5	63.9	64.4	60.5	169	17-Jun	37.8	11.9
Blizzard ^{1/}	55.8	62.5	62.1	60.3	171	19-Jun	36.0	11.6
BZ9W96-895 (P)								
BZ9W96-919 (P)								
BZ9W97-761 (P, HWW)								
CDC Falcon (P)								
Culver +	56.9			60.5	164	12-Jun	32.6	12.0
Elkhorn +	47.7	52.7	56.1	58.5	171	19-Jun	36.9	12.5
R Erhardt	51.1	56.3	58.5	61.9	169	17-Jun	31.5	12.6
GM10001 (P, HWW)								
GM10002 (P, HWW)								
GM10003 (P, HWW)								
Golden Spike (HWW)+								
Halt +	59.8	60.4	60.4	60.8	164	12-Jun	31.0	11.0
Harding	50.1	57.9		57.0	168	16-Jun	36.1	12.6
ID513	59.8			60.6	170	18-Jun	30.4	11.3
ID537 (HWW)	58.2			58.6	170	18-Jun	36.2	10.6
ID550 (HWW)								
R Judith	69.4*	71.4**	71.3**	59.9	168	16-Jun	36.6	12.2
Manning ^{1/}	57.0	62.8	63.5	59.6	169	17-Jun	33.6	10.6
R McGuire	51.6	53.2	52.8	60.5	166	14-Jun	35.9	13.1
R Morgan (P)+	57.8	65.0*	66.4*	60.3	171	19-Jun	34.1	11.9
MT9426	71.1**			61.1	169	17-Jun	30.5	10.4
MT9513	66.7*			60.3	170	18-Jun	35.8	10.7
MT98110								
MT9822								
MT9857								
MTS9720	60.5	63.6		59.6	171	19-Jun	30.9	11.2
MTS9882								
MTW9724 (HWW)	54.9			59.5	170	18-Jun	35.0	10.5
R Neeley	63.4	65.1*	69.3*	61.4	171	19-Jun	33.8	11.1
Norstar	50.4	57.6	57.2	58.8	174	22-Jun	38.9	11.6
Nuplains (HWW)	48.9			62.4	168	16-Jun	30.6	12.5
NuSky (HWW) ++	62.7	66.0*	66.0*	60.0	171	19-Jun	35.4	11.6
NuWest (P, HWW) +	54.2	60.3	63.4	60.2	169	17-Jun	33.4	11.3
R Promontory + ^{1/}	60.3	65.0*	64.2	61.1	168	16-Jun	33.2	11.9
Pronghorn	54.6	57.8	60.2	60.5	164	12-Jun	38.3	11.3
Prowers 99 +								
R Quantum 542 (P)	60.0	64.4	64.4	60.4	167	15-Jun	35.4	12.0
R Rampart	53.4	60.3	59.5	59.5	169	17-Jun	35.0	12.8
Ransom +	54.6			59.9	168	16-Jun	39.0	11.7
Redwin	52.0	57.9	57.9	60.0	169	17-Jun	36.3	12.9
R Rocky (P)	54.7	62.3	64.2	60.9	166	14-Jun	33.5	12.4
R Tiber	52.5	59.9	61.2	60.5	169	17-Jun	36.5	12.1
Utah 100 ^{1/}	60.4	61.7		59.3	170	18-Jun	34.5	12.1
R Vanguard	46.1	55.3	57.1	58.6	169	17-Jun	35.0	13.6
Windstar +	50.8	56.8		59.0	166	14-Jun	34.8	11.4
Average	57.2	61.1	62.2	60.1	169	17-Jun	34.6	11.8
LSD (0.05)	6.6	6.8	5.8	0.8	0.9		2.6	
C.V.	6.7	7.3	7.1	0.7	0.3		4.3	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

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

Cultivar/Line	1999 Crop not harvested due to poor stands				Test weight	Heading Date		Plant Height	Protein %
	Yield (bushels/acre)			lb/bu		Julian	Calendar		
	2000	1998, 2000 2 yr	1997-2000 3 yr						
Akron +	41.9	56.1	63.4	60.0	158	6-Jun	27	15.0	
R Bighorn (P)+	48.6*	64.3	67.2	61.5	159	7-Jun	26	14.6	
R BigSky ++	46.3*	64.3	68.1	60.1	161	9-Jun	31	15.4	
Blizzard ^{1/}	46.3*	66.1*	68.1	57.7	161	9-Jun	30	14.6	
BZ9W96-895 (P)	46.0			61.7	160	8-Jun	29	14.5	
BZ9W96-919 (P)	52.8**			62.3	160	8-Jun	28	13.5	
BZ9W97-761 (P, HWW)	41.5			59.2	161	9-Jun	29	15.3	
CDC Falcon (P)	43.7			61.7	160	8-Jun	27	14.6	
Culver +	43.9			57.9	157	5-Jun	28	15.7	
Elkhorn +	37.0	54.8	59.4	60.3	164	12-Jun	32	14.6	
R Erhardt	39.9	59.3	63.3	61.5	166	14-Jun	28	15.5	
GM10001 (P, HWW)	45.8			62.7	160	8-Jun	25	13.5	
GM10002 (P, HWW)	49.2*			62.6	157	5-Jun	27	14.6	
GM10003 (P, HWW)	48.3*			61.8	158	6-Jun	26	14.1	
Golden Spike (HWW)+	38.7			61.4	162	10-Jun	30	14.0	
Halt +	47.1*	58.9	64.0	59.8	157	5-Jun	26	15.0	
Harding	45.0	59.2		57.7	161	9-Jun	29	15.7	
ID513	46.6*			60.6	162	10-Jun	26	14.2	
ID537 (HWW)	50.8*			60.7	160	8-Jun	31	14.2	
ID550 (HWW)	47.2*			61.4	161	9-Jun	30	13.9	
R Judith	49.7*	67.2*	70.0	58.7	160	8-Jun	30	14.9	
Manning ^{1/}	47.2*	61.4	65.6	60.1	162	10-Jun	28	14.3	
R McGuire	39.6	57.0	58.0	61.4	159	7-Jun	25	16.0	
R Morgan (P)+	49.6*	68.6*	70.9*	61.4	162	10-Jun	33	14.5	
MT9426	49.9*			62.0	161	9-Jun	29	14.4	
MT9513	49.7*			61.4	161	9-Jun	30	15.1	
MT98110	46.9*			61.1	160	8-Jun	27	14.8	
MT9822	42.5			61.5	158	6-Jun	29	15.8	
MT9857	45.7			61.3	165	13-Jun	25	14.8	
MTS9720	42.8	59.3		58.1	163	11-Jun	31	15.0	
MTS9882	48.8*			60.9	163	11-Jun	27	13.7	
MTW9724 (HWW)	47.8*			61.1	161	9-Jun	29	14.3	
R Neeley	46.5*	66.1*	68.9	59.6	160	8-Jun	33	14.3	
Norstar	38.5	55.4	57.0	59.6	165	13-Jun	37	14.7	
Nuplains (HWW)	39.5			61.2	159	7-Jun	26	15.8	
NuSky (HWW) ++	43.4	63.1	67.4	60.5	157	5-Jun	31	14.7	
NuWest (P, HWW) +	42.2	61.0	64.7	58.4	164	12-Jun	30	15.4	
Promontory + ^{1/}	46.8*	65.6*	69.1	61.9	159	7-Jun	31	13.7	
Pronghorn	42.4	58.5	65.4	61.8	156	4-Jun	30	15.5	
Prowers 99 +	41.0			61.0	160	8-Jun	29	14.8	
R Quantum 542 (P)	52.4*	73.4**	76.7**	62.7	158	6-Jun	32	13.8	
R Rampart	44.1	57.2	63.6	62.0	160	8-Jun	21	15.6	
Ransom +	41.6			61.3	161	9-Jun	29	14.6	
Redwin	40.9	56.7	58.3	60.3	163	11-Jun	21	15.2	
R Rocky (P)	48.6*	56.7	69.4	63.1	159	7-Jun	31	14.5	
R Tiber	37.5	61.5	65.8	58.5	164	12-Jun	31	14.5	
Utah 100 ^{1/}	51.8*	60.6		61.1	161	9-Jun	32	14.6	
R Vanguard	42.3	55.9	61.9	61.2	163	11-Jun	28	15.5	
Windstar +	42.8	55.1		61.0	158	6-Jun	31	14.5	
Average	45.1	61.3	65.5	60.8	161	9-Jun	28.8	14.7	
LSD (0.05)	6.7	8.3	6.7						
C.V.	8.4	8.1	8.6						

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

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

Cultivar/Line	Grain Yield (bushels/acre)				Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1998-2000 3 yr	1997-2000 4 yr		Julian	Calendar		
Akron +	62.9	64.4*	58.8*	55.3*	62.3	153	1-Jun	30.3	10.8
R Bighorn (P)+	58.0	67.8*	60.1*	57.3*	62.2	156	4-Jun	28.9	11.7
R BigSky ++	54.5	60.2*	57.1*	54.2*	61.3	156	4-Jun	32.2	12.2
Blizzard ^{1/}	63.3	60.1*	56.4*	53.5*	62.6	157	5-Jun	32.6	12.2
BZ9W96-895 (P)	67.0*				62.1	155	3-Jun	30.1	11.5
BZ9W96-919 (P)	71.0**				61.8	155	3-Jun	29.3	11.5
BZ9W97-761 (P, HWW)	59.1				61.2	156	4-Jun	32.5	11.4
CDC Falcon (P)	66.0*				61.5	154	2-Jun	28.0	11.0
Culver +	60.5	63.3*			61.5	152	31-May	29.7	11.2
Elkhorn +	48.7	42.1	42.4	42.4	60.5	156	4-Jun	32.9	11.2
R Erhardt	52.3	51.5	49.0	48.6	62.0	156	4-Jun	30.1	13.1
GM10001 (P, HWW)	63.5				63.6	153	1-Jun	29.6	9.4
GM10002 (P, HWW)	61.0				63.9	152	31-May	26.8	11.0
GM10003 (P, HWW)	64.9				61.3	154	2-Jun	28.4	10.7
Golden Spike (HWW)+	59.1				61.2	157	5-Jun	33.3	11.3
Halt +	66.6*	65.1*	57.5*	54.3*	61.5	151	30-May	27.3	10.9
Harding	57.0	60.9*	54.6*		59.0	155	3-Jun	31.9	12.6
ID513	56.6	59.9*			61.2	157	5-Jun	30.0	11.1
ID537 (HWW)	62.7	62.4*			57.4	156	4-Jun	33.6	12.6
ID550 (HWW)	55.5				61.2	157	5-Jun	30.8	11.0
R Judith	62.2	69.9**	62.6*	58.7**	59.8	154	2-Jun	34.7	12.0
Manning ^{1/}	59.1	66.1*	57.9*	54.7*	61.0	156	4-Jun	31.8	11.4
R McGuire	57.2	58.3*	52.6	49.3	61.5	153	1-Jun	30.3	12.1
R Morgan (P)+	56.3	58.8*	54.2*	53.0*	60.8	157	5-Jun	31.9	12.1
MT9426	65.4	67.2*			60.6	157	5-Jun	29.3	11.7
MT9513	64.0	67.4*			60.0	156	4-Jun	31.9	11.5
MT98110	63.2				61.0	155	3-Jun	30.3	11.1
MT9822	60.3				61.4	152	31-May	33.7	11.5
MT9857	58.8				60.1	156	4-Jun	26.3	13.1
MTS9720	60.3	65.9*	59.9*		60.4	157	5-Jun	30.3	11.7
MTS9882	59.2				60.3	157	5-Jun	27.7	11.9
MTW9724 (HWW)	57.5	52.8			59.8	156	4-Jun	32.7	11.0
R Neeley	69.0*	66.7*	64.0**	56.4*	61.7	156	4-Jun	33.7	11.3
Norstar	49.0	43.7	46.9	45.3	61.0	158	6-Jun	36.9	11.9
Nuplains (HWW)	57.2	54.9			63.5	154	2-Jun	27.0	11.5
NuSky (HWW) ++	59.7	59.8*	55.2*	54.7*	61.8	156	4-Jun	31.2	11.1
NuWest (P, HWW) +	57.9	59.5*	54.9*	53.4*	61.7	156	4-Jun	31.5	11.8
Promontory + ^{1/}	59.1	68.2*	60.2*	56.0*	62.6	156	4-Jun	32.4	11.3
Pronghorn	60.9	57.1	52.7	50.0	61.7	151	30-May	30.1	10.4
Prowers 99 +	57.7				62.7	152	31-May	31.2	11.6
R Quantum 542 (P)	64.7	61.9*	58.6*	58.1*	61.2	152	31-May	34.9	11.2
R Rampart	55.8	54.8	53.2	51.2*	59.8	155	3-Jun	30.9	12.8
Ransom +	52.2	47.6			60.5	154	2-Jun	29.9	11.0
Redwin	55.2	52.4	49.0	46.7	62.0	156	4-Jun	34.4	12.3
R Rocky (P)	62.7	61.6*	56.7*	55.1*	62.4	154	2-Jun	33.6	10.7
R Tiber	61.8	61.1*	55.7*	53.5*	61.3	156	4-Jun	33.9	11.9
Utah 100 ^{1/}	61.1	67.1*	59.1*		60.5	158	6-Jun	34.0	11.2
R Vanguard	52.4	50.9	48.1	48.1	60.1	154	2-Jun	30.2	12.0
Windstar +	57.4	50.7	48.9		60.6	152	31-May	32.6	10.7
Average	59.7	59.5	54.9	52.6	61.2	155	3-Jun	31.2	11.5
LSD (0.05)	5.3	12.2	10.6	8.5	0.7	1.4		2.1	
C.V.	5.0	8.3	9.0	9.6	0.7	0.5		3.9	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

Table 9. HARD WINTER WHEAT: District 6 -- Sidney - Dryland

Note: Test not grown in Sidney 1997, 1998

Cultivar/Line	Yield (bushels/ac)		Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr		Julian	Calendar		
Akron +	61.6	60.3	63.0	151	30-May	30.3	12.1
Bighorn (P)+	63.3	65.2*	62.9	157	5-Jun	27.6	12.9
BigSky ++	61.4	59.5	63.4	156	4-Jun	32.6	12.7
Blizzard ^{1/}	59.8	60.4	62.8	159	7-Jun	31.7	12.2
BZ9W96-895 (P)	68.5*		63.1	153	1-Jun	28.4	11.5
BZ9W96-919 (P)	76.4**		62.9	157	5-Jun	28.2	10.7
BZ9W97-761 (P, HWW)	61.0		62.5	157	5-Jun	31.3	13.1
CDC Falcon (P)	71.0*		61.1	155	3-Jun	27.4	10.8
Culver +	58.0	56.8	61.6	151	30-May	29.8	11.5
R Elkhorn +	62.9	62.3	62.2	157	5-Jun	33.7	12.3
R Erhardt	59.0	60.9	63.3	156	4-Jun	29.4	13.6
GM10001 (P, HWW)	63.3		62.6	151	30-May	28.3	9.9
GM10002 (P, HWW)	68.3*		64.1	151	30-May	27.9	11.6
GM10003 (P, HWW)	65.4		60.6	151	30-May	28.6	10.4
Golden Spike (HWW)+	61.7		62.3	157	5-Jun	30.9	11.0
Halt +	67.1	60.7	61.9	149	28-May	27.0	11.5
Harding	56.2	61.5	61.0	155	3-Jun	31.6	12.7
ID513	65.1	59.5	62.7	156	4-Jun	27.5	11.2
ID537 (HWW)	71.6*	65.5*	60.1	156	4-Jun	31.8	11.2
ID550 (HWW)	68.6*		62.2	157	5-Jun	30.7	10.4
Judith	63.0	66.4*	61.4	153	1-Jun	31.4	12.5
Manning ^{1/}	65.5	61.3	62.8	156	4-Jun	28.9	10.9
McGuire	53.9	54.7	62.3	151	30-May	29.7	14.3
R Morgan (P)+	70.0*	70.4*	62.5	154	2-Jun	32.4	11.1
MT9426	74.0*	73.4**	62.8	157	5-Jun	29.4	10.7
MT9513	66.5	67.5*	62.6	157	5-Jun	30.8	11.2
MT98110	71.4*		62.4	154	2-Jun	29.5	11.6
MT9822	56.0		63.1	153	1-Jun	31.4	12.7
MT9857	66.6		63.0	157	5-Jun	28.5	11.9
MTS9720	63.8	68.3*	62.1	157	5-Jun	30.5	12.1
MTS9882	72.2*		63.1	157	5-Jun	26.5	10.1
MTW9724 (HWW)	71.6*	69.6*	61.9	155	3-Jun	31.2	11.5
Neeley	69.9*	67.9*	62.9	157	5-Jun	31.4	10.9
Norstar	66.6	66.6*	63.1	160	8-Jun	38.8	12.3
Nuplains (HWW)	62.2	60.9	64.0	154	2-Jun	26.9	13.6
NuSky (HWW) ++	63.8	64.2	62.7	157	5-Jun	31.6	13.2
NuWest (P, HWW) +	64.3	62.0	62.4	157	5-Jun	30.9	13.5
Promontory + ^{1/}	68.0	62.1	64.0	155	3-Jun	29.9	10.4
Pronghorn	62.2	59.7	62.3	151	30-May	32.4	12.7
Prowers 99 +	56.6		63.6	155	3-Jun	31.7	12.1
Quantum 542 (P)	66.4	69.5*	63.1	153	1-Jun	32.9	10.5
Rampart	58.0	53.8	62.7	156	4-Jun	30.7	13.0
Ransom +	64.2	64.3	61.0	156	4-Jun	30.3	11.1
Redwin	57.3	57.5	63.0	155	3-Jun	31.5	12.6
Rocky (P)	68.2*	63.9	63.3	154	2-Jun	31.0	11.5
Tiber	64.5	63.3	63.8	157	5-Jun	33.0	12.3
Utah 100 ^{1/}	54.5	52.3	61.4	157	5-Jun	33.3	12.2
Vanguard	59.4	57.9	62.9	156	4-Jun	30.2	13.0
Windstar +	66.0	60.5	61.4	151	30-May	30.5	11.5
Average	64.5	62.6	62.5	155	3-Jun	30.4	11.8
LSD (0.05)	8.3	9.5	0.5	1.1		1.4	0.8
C.V.	7.4	8.4	0.5	0.4		2.6	3.8

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

Table 10. HARD WINTER WHEAT: District 6 -- Williston, North Dakota - Dryland

Cultivar/Line	Grain Yield (bushels/acre)				Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1998-2000 3 yr	1997-2000 4 yr		Julian	Calendar		
Akron +	54.0	60.6	55.4	47.0	62.7	152	31-May	28.7	14.8
Bighorn (P)+	55.8	53.8	50.6	42.8	62.1	158	6-Jun	25.3	14.3
BigSky ++	59.5	62.9*	55.9	47.8	63.1	157	5-Jun	31.0	14.8
Blizzard ^{1/}	56.6	58.9	55.4	47.3	61.1	161	9-Jun	32.3	15.0
BZ9W96-895 (P)	63.5				62.7	157	5-Jun	27.3	14.0
BZ9W96-919 (P)	68.3*				63.2	159	7-Jun	27.6	13.4
BZ9W97-761 (P, HWW)	54.7				62.0	157	5-Jun	28.9	13.8
CDC Falcon (P)	64.6				62.3	156	4-Jun	27.2	12.6
Culver +	51.9	58.1			61.4	153	1-Jun	27.8	14.0
R Elkhorn +	57.5	60.1	57.0	47.8	62.0	159	7-Jun	34.4	13.9
R Erhardt	53.6	55.9	51.2	43.5	62.5	157	5-Jun	28.5	15.3
GM10001 (P, HWW)	62.9				63.6	153	1-Jun	26.3	12.0
GM10002 (P, HWW)	51.5				64.0	152	31-May	25.1	13.8
GM10003 (P, HWW)	54.9				61.2	151	30-May	24.5	11.7
Golden Spike (HWW)+	58.3				62.1	158	6-Jun	29.4	13.1
Halt +	52.9	54.7	50.2	42.6	62.6	150	29-May	24.9	14.2
Harding	52.0	58.1	54.0		60.9	156	4-Jun	30.7	14.5
ID513	58.7	60.8			62.9	157	5-Jun	26.0	14.2
ID537 (HWW)	49.2	50.6			58.0	160	8-Jun	31.6	13.9
ID550 (HWW)	59.3				62.9	158	6-Jun	30.7	13.3
Judith	57.2	59.7	56.6	47.9	60.5	156	4-Jun	29.5	14.2
Manning ^{1/}	54.2	54.4	48.9	40.4	62.9	156	4-Jun	27.6	15.1
McGuire	46.0	51.9	48.6	40.6	61.5	151	30-May	26.9	15.9
R Morgan (P)+	62.6	63.0*	59.4*	50.5*	62.4	160	8-Jun	32.0	14.1
MT9426	66.7*	72.1**			62.1	158	6-Jun	28.2	13.7
MT9513	63.3	64.7*			61.6	159	7-Jun	32.6	14.2
MT98110	65.7				62.2	157	5-Jun	26.5	13.8
MT9822	50.9				61.7	153	1-Jun	31.9	14.3
MT9857	64.3				63.2	159	7-Jun	26.5	14.9
MTS9720	59.1	63.7*	56.4		61.4	159	7-Jun	31.0	14.3
MTS9882	66.4*				62.5	158	6-Jun	27.3	12.6
MTW9724 (HWW)	63.9	59.9			61.3	157	5-Jun	28.9	12.8
Neeley	71.3**	69.4*	65.0**	54.3**	62.9	157	5-Jun	27.6	13.6
Norstar	62.3	63.9*	60.3*	51.5*	62.7	161	9-Jun	38.3	14.2
Nuplains (HWW)	54.5	53.5			63.5	158	6-Jun	24.5	12.9
NuSky (HWW) ++	60.9	62.5*	56.8	47.9	61.9	159	7-Jun	31.1	12.7
NuWest (P, HWW) +	59.6	64.2*	57.9*	48.4*	61.9	158	6-Jun	30.6	14.6
Promontory + ^{1/}	58.2	54.7	49.9	41.4	63.3	155	3-Jun	28.1	13.6
Pronghorn	57.2	58.5	54.9	47.3	62.8	151	30-May	28.9	14.7
Prowers 99 +	55.2				63.7	153	1-Jun	29.0	14.0
Quantum 542 (P)+B69	58.8	61.6	59.9*	51.3*	62.3	153	1-Jun	29.1	13.5
Rampart	50.4	39.4	40.4	34.6	61.7	158	6-Jun	29.8	15.4
Ransom +	59.7	63.1*			61.8	157	5-Jun	29.5	14.8
Redwin	53.0	56.5	51.1	43.8	62.0	158	6-Jun	30.7	15.9
Rocky (P)	59.6	57.2	55.7	47.0	63.1	156	4-Jun	27.6	13.6
Tiber	59.0	63.4*	58.7*	50.1*	62.7	158	6-Jun	31.8	15.0
Utah 100 ^{1/}	48.5	45.9	44.4		60.8	159	7-Jun	32.0	13.9
Vanguard	53.9	55.7	52.2	44.6	62.5	155	3-Jun	28.9	15.3
Windstar +	54.2	55.8	52.7		62.6	154	2-Jun	28.0	14.0
Average	57.9	58.5	54.1	46.1	62.2	156	4-Jun	29.1	14.0
LSD (0.05)	5.3	10.1	7.8	6.0	0.7	2.0		2.1	
C.V.	5.7	8.5	8.9	9.3	0.5	3.5		4.4	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

Table 11. HARD WINTER WHEAT: Yield (bushels/acre) in Winter-kill Environments, 1997-2000

Cultivar/Line	Sidney 2000	Williston, ND			Moccasin		6 Location/ Year Avg.	% Winter Survival
		1997	1999	2000	1997	1999		
Akron +	61.6	21.9*	67.1	54.0	66.6	62.5	55.6	61.9
Bighorn (P)+	63.3	19.2	51.7	55.8	63.3	63.0	52.7	58.3
BigSky ++	61.4	23.7*	66.2	59.5	63.7	55.5	55.0	71.0*
Blizzard ^{1/}	59.8	23.1*	61.1	56.6	60.7	55.8	52.9	54.8
BZ9W96-895 (P)	68.5*			63.5				
BZ9W96-919 (P)	76.4**			68.3*				
BZ9W97-761 (P, HWW)	61.0			54.7				
CDC Falcon (P)	71.0*			64.6				
Culver +	58.0		64.2	51.9		56.9		
Elkhorn +	62.9	20.2	62.7	57.5	63.2	47.7	52.4	70.1*
Erhardt	59.0	20.4	58.1	53.6	63.5	51.1	50.9	70.7*
GM10001 (P, HWW)	63.3			62.9				
GM10002 (P, HWW)	68.3*			51.5				
GM10003 (P, HWW)	65.4			54.9				
Golden Spike (HWW)+	61.7			58.3				
Halt +	67.1	19.6	56.4	52.9	59.2	59.8	52.5	63.6
Harding	56.2		64.2	52.0		50.1		
ID513	65.1		62.9	58.7		59.8		
ID537 (HWW)	71.6*		52.0	49.2		58.2		
ID550 (HWW)	68.6*			59.3				
Judith	63.0	21.7	62.2	57.2	72.7*	69.4*	57.7*	62.9
Manning ^{1/}	65.5	14.8	54.6	54.2	64.3	57.0	51.7	56.2
McGuire	53.9	16.6	57.7	46.0	51.9	51.6	46.3	67.3
Morgan (P)+	70.0*	23.7*	63.3	62.6	70.0*	57.8	57.9*	76.0**
MT9426	74.0*		77.4**	66.7*		71.1**		
MT9513	66.5		66.1	63.3		66.7*		
MT98110	71.4*			65.7				
MT9822	56.0			50.9				
MT9857	66.6			64.3				
MTS9720	63.8		68.3	59.1		60.5		
MTS9882	72.2*			66.4*				
MTW9724 (HWW)	71.6*		55.8	63.9		54.9		
Neeley	69.9*	22.2*	67.5	71.3**	77.2*	63.4	61.9**	64.6
Norstar	66.6	24.8*	65.5	62.3	56.2	50.4	54.3	66.6
Nuplains (HWW)	62.2		52.5	54.5		48.9		
NuSky (HWW) ++	63.8	21.1	64.0	60.9	64.6	62.7	56.2	71.4*
NuWest (P, HWW) +	64.3	20.0	68.7	59.6	71.4*	54.2	56.4	70.9*
Promontory + ^{1/}	68.0	15.8	51.1	58.2	62.8	60.3	52.7	51.6
Pronghorn	62.2	24.7*	59.7	57.2	65.8	54.6	54.0	67.1
Prowers 99 +	56.6			55.2				
Quantum 542 (P)	66.4	25.4*	64.3	58.8	65.2	60.0	56.7	62.3
Rampart	58.0	17.1	28.4	50.4	59.8	53.4	44.5	49.7
Ransom +	64.2		66.4	59.7		54.6		
Redwin	57.3	21.9*	59.9	53.0	57.6	52.0	50.3	63.4
Rocky (P)	68.2*	20.7	54.8	59.6	65.3	54.7	53.9	61.5
Tiber	64.5	24.1*	67.7	59.0	64.6	52.5	55.4	67.1
Utah 100 ^{1/}	54.5		43.2	48.5		60.4		
Vanguard	59.4	21.7	57.5	53.9	57.6	46.1	49.4	56.0
Windstar +	66.0		57.4	54.2		50.8		
Average	64.4	21.1	60.0	57.9	63.8	56.8	53.5	63.7
LSD (0.05)	8.3	5.7	7.3	5.3	8.5	6.6	5.1	8.2
C.V.	7.4	17.0	6.8	5.7	7.6	6.7	8.4	11.3

** = indicates highest winter-hardiness variety within a column

* = indicates varieties with winter-hardiness equal to highest winterhardy variety within a column based on Fisher's protected LSD (p=0.05)

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

Table 12. HARD WINTER WHEAT: Yield Performance under Sawfly Pressure (1997-2000)

Variety	Yield (bushels per acre)							Average 7 Tests
	Havre 1997	Big Sandy 1997	The Knees 1997	Highwood 1997	Broadview 1997	Loma 1999	Loma 2000	
Bighorn (P)+	49.6	40.8*	37.5*	55.0*	25.2	37.3	34.2	39.9
BigSky ++	45.5	46.1*	44.9**	52.4*	29.4*	39.6*	38.5	42.3
Elkhorn +	42.6					25.1	36.7	
Erhardt	46.9	48.6**	30.1	49.5*	29.2*	38.3*	34.3	39.6
Halt +	44.3					33.1	46.9	
Judith	47.7	38.4	38.2*	50.6*	23.9	43.7*	36.1	39.8
McGuire	39.1	40.4*	35.4	50.8*	22.3	34.6	37.3	37.1
Morgan (P)+	49.6					40.6*	37.2	
MT9426							33.5	
MT9513							37.3	
MTS9720						45.2**	39.2	
MTS9882							37.7	
MTW9441 (HWW)	52.7*					35.8	27.5	
Neeley	42.6	41.7*	34.3	51.1*	27.3*	34.9	39.5	38.8
Norstar	41.3	47.8*	34.4	45.2	25.5	35.8	36.5	38.1
Nuplains (HWW)							37.6	
NuWest (HWW) +	49.8*	41.6*	43.5*	48.8*	26.3*	32.8	34.0	39.5
Promontory + ^{1/}	43.1	33.0	34.8	55.2*	20.6	35.8	39.7*	37.5
Pronghorn	41.8					33.6	45.1*	
Quantum 542 (P)	57.0**	41.6*	39.0*	53.7*	26.2*	32.2	42.5*	41.7
Rampart	45.2	47.9*	39.5*	52.3*	28.8*	35.9	42.7*	41.8
Rocky (P)	50.2*	43.8*	41.7*	55.9**	24.2	33.2	47.0**	42.3
Tiber	47.1	36.9	42.8*	54.5*	26.4*	36.7	44.9*	41.3
Vanguard	48.3	45.9*	41.4*	50.5*	31.0**	32.6	41.4*	41.6
Average	46.5	42.5	38.4	51.8	26.2	35.8	38.6	40.1
LSD (0.05)	7.3	9.0	7.3	7.6	5.7	6.9	7.4	ns
C.V.	9.4	13.2	11.6	9.0	13.8	11.6	11.7	9.1

ns = no significant difference between varieties at P <= 0.05

** = indicates highest yielding variety within a column

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

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

1/ = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

Table 13. Precipitation Data for Crop Year, 1999-2000, in inches.

Agricultural Research Center	Sept. 1999	Oct. 1999	Nov. 1999	Dec. 1999	Jan. 2000	Feb. 2000	Mar. 2000	Apr. 2000	May 2000	June 2000	July 2000	Aug 2000	Total
Western Triangle, Conrad	1.07	0.60	0.55	0.05	0.19	0.52	0.19	0.15	1.50	1.50	0.36	0.12	6.80
	1985-2000 Average = 11.72												
Northern, Havre	1.09	1.24	0.31	0.04	0.42	0.25	0.63	0.72	1.57	1.81	1.91	0.28	10.27
	1916-2000 Average = 12.03												
Northwestern, Kalispell	0.36	1.72	2.33	1.08	1.46	1.81	1.30	2.21	0.89	1.80	0.84	0.35	16.15
	1949-2000 Average = 19.92												
Central, Moccasin	1.29	0.26	0.52	0.11	0.47	0.29	0.31	1.37	1.85	2.27	1.84	0.54	11.12
	1909-2000 Average = 15.39												
Southern, Huntley	1.30	0.15	0.62	0.28	0.18	1.83	0.49	1.33	1.46	0.81	1.24	0.14	9.83
	1961-1990 Average = 13.24												
Northeastern, Sidney		0.17	0.07	0.40	0.25	0.43	0.21	0.61	3.34	1.48	4.43	0.63	13.93
	1949-2000 Average = 13.82												
Williston, North Dakota	1.47	0.12	0.00	0.33	0.23	0.24	0.28	1.66	1.44	2.85	3.17	0.80	12.59
	1957-2000 Average = 14.54												
Post Farm, Bozeman	0.63	0.31	0.32	0.65	0.76	0.83	1.50	1.42	3.46	1.89	0.59	0.51	12.87
	1958-2000 Average = 16.22												

Table 14. HARD WINTER WHEAT: Coleoptile Length (inches), from growth chamber determination

Variety	Coleoptile length (inches)				
	2000	1999-2000	1998-2000	1997-2000	
		2 yr	3 yr	4 yr	
Rampart	4.6**	4.8*	4.7*	4.7*	long coleoptile
Vanguard	4.6*	4.9**	4.8**	4.8**	
Blizzard ^{1/}	4.4*	4.4	4.3	4.4	
Prowers 99 +	4.4*				
McGuire	4.2	4.4	4.4	4.4	
MT9822	4.1				medium coleoptile
Harding	4.1	4.2	4.1		
ID537 (HWW)	4.0	4.2			
Tiber	4.0	4.2	4.2	4.2	
BigSky ++	3.8	4.0	4.1	4.0	
Utah 100 ^{1/}	3.8	4.1	4.2		medium coleoptile
GM10002 (P, HWW)	3.7				
Norstar	3.7	3.7	3.8	3.8	
Rocky (P)	3.7	4.0	3.9	3.9	
Quantum 542 (P)	3.6	3.8	3.8		
Ransom +	3.6	3.9			medium coleoptile
Neeley	3.6	3.8	3.6	3.7	
MT9857	3.6				
Redwin	3.5	3.7	3.7	3.8	
Pronghorn	3.5	3.8	3.9	3.9	
GM10001 (P, HWW)	3.3				medium coleoptile
ID513	3.3	3.5			
Manning ^{1/}	3.3	3.5	3.5	3.3	
Culver +	3.2	3.5			
Bighorn (P)+	3.2	3.4	3.4	3.4	
Elkhorn +	3.2	3.5	3.6	3.6	medium coleoptile
ID550 (HWW)	3.1				
MTW9724 (HWW)	3.1	3.4			
Nuplains (HWW)	3.1	3.3			
BZ9W97-761 (P, HWW)	3.0				
Erhardt	2.9	3.2	3.3	3.2	medium coleoptile
Windstar +	3.0	3.0	3.0		
Akron +	2.9	3.1	3.1	3.1	
MTS9882	2.9				
Halt +	2.9	3.1	3.2	3.1	
Golden Spike (HWW)+	2.8				medium coleoptile
MT9513	2.8	3.1			
MT9426	2.8	3.2			
Judith	2.8	3.0	3.2	3.1	
NuSky (HWW) ++	2.8	3.1	3.1	3.1	
BZ9W96-919 (P)	2.8				short coleoptile
GM10003 (P, HWW)	2.8				
MTS9720	2.8	3.0			
Nuwest (HWW) +	2.7	3.0	3.1	3.1	
MT98110	2.6				
CDC Falcon (P)	2.6				short coleoptile
Promontory + ^{1/}	2.6	2.9	3.0	3.0	
BZ9W96-895 (P)	2.6				
Morgan (P)+	2.4	2.6	2.5	2.5	
Average	3.3	3.6	3.6	3.7	
LSD (0.05)	0.2	0.3	0.3	0.3	
C.V.	3.7	3.2	4.6	4.4	

** = indicates highest yielding variety within a column

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

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

^{1/} = Dwarf Smut Resistant; (HWW) = Hard White Winter Wheat

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

Variety	Agronomic Characters					Cereal Quality ^{5/}		Disease Reactions ^{4/}			
	Maturity ^{1/}	Chaff Color	Winter Survival ^{2/}	Straw Strength ^{3/}	Shattering ^{4/}	Milling	Baking	Dwarf Smut	Stripe Rust	Stem Rust	Leaf Spot Complex
Akron	E	White	3	MS	-	2	2	S	S	MS	MS
Bighorn	M	White	3	MS	-	5	3	S	MS	R	MS
BigSky	M	White	4	S	-	4	3	S	MS	R	MR
Blizzard	M-L	White	2	M	M	5	3	R	MR	S	MS
CDC Falcon	M-L	White	4	MS	-	-	-	S	-	R	S
Culver	E	White	3	M	-	2	2	S	-	R	M
Elkhorn	M	White	4	M	-	4	3	S	MS	R	MR
Erhardt	M	White	4	MS	MS	4	4	S	S	R	R
Golden Spike	M	Brown	3	M	-	-	-	R	S	-	M
Halt	E	White	2	S	-	4	3	S	S	R	M
Harding	M	Brown	3	M	-	2	3	S	-	MR	MS
Judith	M-E	White	3	S	M	4	5	S	VS	R	MS
Manning	M	Brown	2	M	-	3	4	R	MR	S	MS
McGuire	E	Brown	3	MR	M	3	5	S	S	R	M
Morgan	M	White	5	MS	-	3	3	S	MS	R	MS
Neeley	M	White	3	MS	S	3	3	S	MS	S	MS
Norstar	L	White	5	W	MR	4	4	S	S	S	S
Nuplains	M	White	3	S	-	3	3	S	-	R	M
NuSky	M	White	4	M	R	5	4	S	MS	R	MR
NuWest	M	White	4	S	R	5	4	S	MS	R	MR
Promontory	E	Brown	2	MS	-	5	4	R	R	S	MS
Pronghorn	E	White	4	M	-	3	3	S	M	MR	M
Powers 99	M	White	3	M	-	-	-	S	-	M	M
Quantum 542	E	White	3	MS	M	3	4	S	MS	S	M
Rampart	M	Brown	2	M	M	4	4	S	S	MR	M
Ransom	M-L	White	5	S	-	4	3	S	-	-	MS
Redwin	M-E	Brown	3	S	VR	4	4	S	VS	S	MS
Rocky (P)	E	White	2	S	S	3	3	S	S	R	S
Tiber	M	White	3	S	VR	3	3	S	VS	S	MR
Utah 100	M-L	Brown	2	S	-	4	4	R	-	S	M
Vanguard	M	Brown	2	MS	M	4	4	S	S	S	S
Windstar	M-E	White	4	S	-	3	3	S	-	MR	MS

1/ E = Early; M = Medium, L = Late

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

3/ W = Weak

M = Medium

MS = Medium Strong

S = Strong

4/ VR = Very Resistant

R = Resistant

MR = Moderately Resistant

M = Moderate

MS = Moderately Susceptible

S = Susceptible

- = no information

5/ 5 = Superior

4

3

2

1 = Inferior

Table 16. List of soft white winter wheat varieties.

Cultivar	Origin	Release Year	Pedigree
Public Varieties			
Brundage	Idaho	1997	Stephens/Geneva
Daws	Washington	1976	((Norin 10/Brevor, Sel. 14)/6/(Sel. 53, (Turkey Red/Florence//Fortyfold/Federation/4/Oro//Turkey Red/Florence/3/Oro//Fortyfold/ Federation, Sel. 27-15)/5/Rio/Rex), Sel. 101, Cltr13438)/7/Odin/8/(Vogel 1, Cltr13431, (Norin 10/Brevor, Sel.14)/6/(Sel. 50-3
Eltan	Washington	1990	Luke/8/(BR-70443-3, PI167822)/7/(Cltr13438, (Norin 10/Brevor, Sel. 14, Cltr13253)/6/(Sel. 53, Cltr12597, (Turkey Red/Florence// Fortyfold /Federation/4/Oro//Turkey Red/ Florence/3/Oro //Fortyfold/Federation, Sel. 27-15, Cltr12250) /5/Rio/Rex)
Hill 81	Oregon	1981	Yamhill/Hyslop
Kmor	Washington	1990	Luke/10/(VH067375, (Sel. 101, Cltr13438, (Norin 10/Brevor, Sel. 14, Cltr13253)/6/(Sel. 53, (Turkey Red/Florence//Fortyfold/ Federation/4/Oro// Turkey Red/Florence /3/Oro//Fortyfold/ Federation, Sel. 27-15, Cltr12250)/5/Rio/Rex) /9/(Norin 10/Brevor, Sel.
Lambert	ID, OR, WA	1994	Stephens/Sprague
Lewjain	WA, OR, ID	1982	Luke/9/Super Helvia/8/Suweon 92/7/(Vogel 4, Cltr13645, (Oro//Turkey Red/Florence/3/3* Elgin, Elgin Sel. 19)/4/Elmar /5/Illinois No. 1/6/ Vogel 1813)
MacVicar	Oregon	1992	Yamhill/McDermid//Triticum spelta var Alba/3/Suweon 92/ Roedel/6/(Warrior//Atlas 66/ Comanche/3/Comanche/Ottawa, NE68513)/4/ Hyslop/5/Backa
Madsen	WA, OR, ID	1987	(Aegilops ventricosa/T. persicum//3*Marne, VPM)/3/Moisson /4/2*Hill 81
Malcolm	OR, ID	1985	Stephens//63-8-189-7/Bezostaya
Rod	Washington	1992	Luke/Daws//Hill 81
Stephens	Oregon	1977	Nord Deprez/7/(Sel. 101, Cltr13438, (Norin 10 /Brevor, Sel. 14, Cltr13253)/6/(Sel. 53, (Turkey Red/Florence//Fortyfold /Federation/4/ Oro//Turkey Red/Florence/3/Oro//Fortyfold/ Federation, Sel. 27-15, Cltr12250)/5/Rio/Rex)
W301	Oregon	1992	Daws/Snow Mold Sel. 4//McDermid/Snow Mold Sel. 11

Private Varieties

Cashup	Columbia Basin Seeds, Inc	1984	unknown
MAC-1	Plant Breeders 1, Lake Seeds	1992	unknown

Table 17. SOFT WHITE WINTER WHEAT: District 1 -- Kalispell - Dryland (High Rainfall)

No Data in 1997

Cultivar/Line	Grain Yield (bushels/acre)			Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1998-2000 ^{1/} 3 yr		Julian	Calendar		
Brundage +	130.0*	150.6*	117.7*	57.9	156	4-Jun	34.0	10.3
Cashup (P) +	110.5	141.2*	112.4*	57.1	160	8-Jun	35.0	10.0
Daws	119.5	148.8*	120.2*	59.3	160	8-Jun	35.0	10.2
R Eltan	128.0*	140.2*	110.8	59.7	164	12-Jun	36.4	10.1
R Hill 81	122.8	147.5*	116.0*	60.0	161	9-Jun	38.7	10.0
Kmor	113.1	147.6*	115.4*	55.4	161	9-Jun	35.6	9.9
Lambert	137.5**	153.4**	124.3**	59.6	159	7-Jun	41.2	9.9
R Lewjain	118.7	150.7*	118.6*	58.9	162	10-Jun	33.9	10.3
MAC-1 (P) +	124.7			59.9	158	6-Jun	38.1	11.3
MacVicar	118.4	148.0*	120.9*	58.1	159	7-Jun	36.7	9.9
Madsen	115.8	142.1*	109.7	58.2	161	9-Jun	36.6	11.1
R Malcolm	118.3	143.7*	117.2*	57.3	159	7-Jun	36.2	10.1
Neeley (HRW)	114.3	139.5*	110.7	61.0	162	10-Jun	43.4	11.4
Rod	129.3*	152.2*	121.9*	54.9	161	9-Jun	35.9	10.5
Stephens	97.7	129.2	105.1	58.6	162	10-Jun	38.5	10.2
W301	124.9	142.2*	11.1	59.1	158	6-Jun	36.2	10.5
Average	120.2	145.1	115.5	58.4	160	8-Jun	37.0	10.4
LSD (0.05)	10.1	19.6	13.0		1.7		2	
C.V.	5.0	5.0	5.8		0.7		3.2	

** = indicates highest yielding variety within a column

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

R = Recommended Variety; (P) = Private Variety; + = Protected Variety

^{1/} = Rhizoctonia root rot caused severe stand reductions and resultant yield loss in 1998

Table 18. SOFT WHITE WINTER WHEAT: District 2 -- Bozeman - Dryland (Moderate Rainfall)

Cultivar/Line	Grain Yield (bushels/acre)				Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1998-2000 3 yr	1997-2000 4 yr		Julian	Calendar		
Brundage +	110.0	114.2	112.3		60.4	162	10-Jun	29.8	11.8
Cashup (P) +	102.4	108.1	110.3	109.3	59.4	168	16-Jun	31.9	12.2
Daws	103.3	111.3	114.5	111.9	59.5	168	16-Jun	30.6	12.0
R Eltan	124.4**	129.2**	133.2**	127.2**	60.3	172	20-Jun	34.6	11.5
R Hill 81	111.6	116.0	120.0	119.2*	60.4	170	18-Jun	35.8	12.5
Kmor	113.7	118.0	122.3	119.2*	57.0	169	17-Jun	32.4	12.3
Lambert	114.8	117.9	121.5	113.2	58.9	167	15-Jun	34.3	12.4
Lewjain	111.7	117.3	123.0	120.5*	59.6	172	20-Jun	30.0	12.1
MAC-1 (P) +	119.2*				60.5	167	15-Jun	33.5	12.8
MacVicar	111.4	121.5	123.4	120.5*	58.1	166	14-Jun	32.7	12.2
Madsen	110.5	118.6	121.3	122.0*	59.6	168	16-Jun	33.5	12.7
R Malcolm	116.9	124.9*	127.3*	122.0*	58.6	167	15-Jun	32.2	12.3
Neeley (HRW)	114.9	119.6	120.8	116.1	62.2	167	15-Jun	39.1	13.2
Rod	116.6	121.8	124.9	118.9	57.8	170	18-Jun	32.7	12.0
Stephens	114.1	119.8	126.2	119.6*	60.4	169	17-Jun	33.9	11.5
W301	108.7	114.5	116.9	112.0	57.9	166	14-Jun	31.4	12.3
Average	112.8	118.2	121.2	118.0	59.4	168	18-Jun	33.0	12.2
LSD (0.05)	6.9	5.6	6.4	8.1	0.7	1.5		1.7	
C.V.	3.7	4.5	4.9	5.8	0.7	0.5		3.1	

** = indicates highest yielding variety within a column

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

R = Recommended Variety; (P) = Private Variety; + = Protected Variety

Table 19. SOFT WHITE WINTER WHEAT: Huntley - Dryland

1998 Crop destroyed by hail

Cultivar/Line	Grain Yield (bushels/acre)			Test weight lb/bu	Heading Date		Plant Height in	Protein %
	2000	1999-2000 2 yr	1997//2000 3 yr		Julian	Calendar		
Brundage +	63.1	65.8		60.7	152	31-May	26.1	12.9
Cashup (P) +	73.4	66.4	70.3	57.5	157	5-Jun	24.0	13.2
Daws	73.9	67.9	69.4	59.6	158	6-Jun	27.1	13.0
Eltan	82.8	73.1	80.4	58.8	158	6-Jun	30.5	14.2
Hill 81	89.3	71.3	76.2	60.5	158	6-Jun	30.9	13.1
Kmor	81.7	72.6	79.6	58.5	158	6-Jun	26.8	13.5
Lambert	83.6	71.4	78.7	58.3	155	3-Jun	31.8	13.2
Lewjain	78.6	69.7	77.7	59.4	160	8-Jun	26.7	14.0
MAC-1 (P) +	73.2			59.4	155	3-Jun	31.4	15.0
MacVicar	76.4	66.6	72.9	57.9	156	4-Jun	28.2	13.5
Madsen	69.7	63.3	70.2	59.3	156	4-Jun	28.4	14.8
Malcolm	84.9	71.2	74.2	58.7	153	1-Jun	28.0	13.7
Neeley (HRW)	78.9	70.8	71.0	60.9	156	4-Jun	32.9	13.8
Rod	75.7	66.2	71.3	56.5	159	7-Jun	25.6	14.0
Stephens	84.6	71.1	73.1	60.2	158	6-Jun	28.4	13.3
W301	75.2	64.1	69.8	58.3	154	2-Jun	27.8	13.9
Average	77.8	68.7	73.9	59.0	156	4-Jun	28.4	13.7
LSD (0.05)	ns	ns	ns	1.4	1.3		2.9	
C.V.	19.9	15.2	12.5	1.4	0.5		6.2	

ns = indicates no significant differences among varieties at P = 0.05

** = indicates highest yielding variety within a column

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

R = Recommended Variety; (P) = Private Variety; + = Protected Variety

Table 20. SOFT WHITE WINTER WHEAT: Moccasin - Dryland

2000 Crop destroyed by hail

Cultivar/Line	Grain Yield (bushels/acre)			Test weight lb/bu	Heading Date		Plant Height in	Protein %
	1999	1998-1999 2 yr	1997-1999 3 yr		Julian	Calendar		
Brundage +	64.1**	65.3*		57.8	169	17-Jun	30.3	10.8
Cashup (P) +	57.6*	66.5*	64.4*	55.0	173	21-Jun	27.3	11.6
Daws	51.0	62.0	58.9	56.1	173	21-Jun	28.7	11.9
Eltan	59.0*	67.0*	69.1*	54.2	176	24-Jun	33.3	11.5
Hill 81	52.0	65.1*	62.2	57.2	174	22-Jun	33.7	11.6
Kmor	48.5	61.3	61.3	54.9	175	23-Jun	27.7	11.5
Lambert	50.1	64.4*	57.1	54.6	172	20-Jun	33.7	12.3
Lewjain	54.4	65.2*	63.6*	55.2	175	23-Jun	26.7	12.5
MAC-1 (P) +								
MacVicar	53.3	61.8	60.2	54.0	172	20-Jun	30.3	12.1
Madsen	55.1	63.2*	57.9	56.5	173	21-Jun	30.0	12.0
Malcolm	47.3	58.6	59.2	54.8	172	20-Jun	30.0	11.8
Neeley (HRW)	57.9*	72.0**	70.4**	58.6	171	19-Jun	36.7	11.7
Rod	53.7	62.7*	59.0	52.3	176	24-Jun	29.0	11.9
Stephens	47.1	57.4	54.6	55.6	174	22-Jun	29.0	12.0
W301	47.2	55.1	53.7	54.1	171	19-Jun	29.0	12.7
Average	53.2	63.2	60.8	55.4	173	21-Jun	30.4	11.9
LSD (0.05)	8.6	9.9	7.9	1.4	1.2		2.2	
C.V.	9.7	9.7	11.7	1.5	0.4		4.4	

** = indicates highest yielding variety within a column

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

R = Recommended Variety; (P) = Private Variety; + = Protected Variety

Table 21. Selected agronomic characters and disease reactions of soft white winter wheats.

Variety	Agronomic Characters			Diseases ^{3/}			
	Winter Maturity ^{1/}	Survival ^{2/}	Lodging ^{3/}	Dwarf Smut	Snow Mold	Stem Rust	Stripe Rust
Brundage +	E	2	MR	-	-	-	MR
Cashup (P) +	M	2	M	S	S	MS	MR
Daws	M	2	MR	S	S	MS	R
Eltan	L	2	MS	MR	MR	MS	MS
Hill 81	M	1	MR	R	S	MS	R
Kmor	M-L	1	M	MR	S	MS	R
Lambert	E	1	M	S	MS	-	R
Lewjain	L	1	M	MR	MS	MS	R
MAC-1 (P) +	E-M	-	MR	-	-	-	-
MacVicar	E-M	1	MR	S	S	MS	MR
Madsen	M	2	R	S	S	MS	R
Malcolm	E	1	R	-	-	-	MS
Rod	M-L	1	MR	S	S	MS	R
Stephens	E	1	R	S	S	MS	R
W301	E	1	MR	-	MR	MS	R

(P) = Private Variety; + = Protected Variety

1/ E = Early; M = Medium, L = Late

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

3/ VR = Very Resistant

R = Resistant

MR = Moderately Resistant

M = Moderate

MS = Moderately Susceptible

S = Susceptible

- = no information

Additional Descriptive Information for Winter Wheat Varieties

Hard Winter Wheat

New for 2001 Bulletin:

Akron – hard red winter wheat released by the Colorado Agricultural Experiment Station in 1994. Awned, semidwarf height, white glumed. Spikes very lax which contributes to hail tolerance. Early heading, averaging 1 ½ days earlier than Rocky in Montana. Plant height averaged 3” shorter than Rocky and 3” taller than Halt. Average test weight, but lower than average protein in Montana testing. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Culver – hard red winter wheat released by the Nebraska Agricultural Experiment Station in 1999. Superior adaptation to dryland wheat production systems in southern and central Nebraska and similar growing areas in adjacent states. Awned, white glumed with medium maturity. Winter-hardiness good. Moderately resistant to stem rust and leaf rust. Test weight and protein average under Montana conditions. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

CDC Falcon – hard red winter wheat developed by the Crop Development Center, Saskatoon, Saskatchewan and registered in 1998. Licensed to Western Plant Breeders. Superior stem and leaf rust resistance over all current winter wheat varieties in western Canada. High yield, good winter-hardiness, semidwarf, short strong straw, especially good for direct seeding and straight cut harvest.

Golden Spike – hard **white** winter wheat released by the Utah Agricultural Experiment Station in 2000. Awned, brown-chaffed. It has an erect, twisted flag leaf, an elliptical seed with mid-wide seed crease. Has excellent resistance to current prevalent races of common bunt. Moderately resistant to snow molds. Susceptible to stripe rust and moderately susceptible to damage by Russian wheat aphid and cereal leaf beetle. Has very good milling and baking properties and is suitable for Asian noodles. This variety is protected under the Plant Variety Protection Act and can only be sold or

advertised by variety name as a class of certified seed.

Harding – hard red winter wheat released by the South Dakota Agricultural Experiment Station in 1999. Awned, red-glumed, medium tall and medium late maturity. Average winter-hardiness under Montana conditions. Moderately resistant or resistant to stem rust, leaf rust, tan spot, septoria leaf blotch and wheat streak mosaic virus. Heterogenous for resistance to the Great Plains biotype of the Hessian fly. Coleoptile above average and straw strength fair. End use quality characteristics include: average test weight, medium-high kernel weight, above average flour ash content, fair flour extraction, good flour protein content, good water absorption with average mixing time, good mixing tolerance and good loaf volume.

Nuplains – hard **white** wheat released by the Nebraska Agricultural Experiment Station in 1998. Moderately early maturing, medium-short with good straw strength. Excellent test weight and average protein under Montana conditions. Good baking quality characteristics.

NuSky – hard **white** winter wheat to be released by the Montana Agricultural Experiment Station as a public release in the fall of 2001. High yielding, medium maturity, good winterhardiness, intermediate height, good straw strength, average grain protein, and good milling, bread-baking, and Asian noodle characteristics. Field performance and end-use quality characteristics are very similar to NuWest. PVP, Title V will be applied for.

Pronghorn - hard red winter wheat developed by the University of Nebraska and released jointly by the Nebraska, South Dakota and Wyoming Agricultural Experiment Stations in 1995. Tall with medium maturity, white-chafed, awned. Moderately resistant to stem rust and moderately susceptible to leaf rust. Susceptible to the Great Plains biotype of the Hessian fly, soilborne mosaic virus and wheat streak mosaic virus. Winter-hardiness average for Montana conditions. Genetically high test weight. Coleoptile long and can be planted deep in dry seed beds. Tolerant to aluminum toxic soils. Milling and baking properties acceptable.

Prowers 99 – hard red winter wheat developed by Colorado State University and released by the Colorado Wheat Research Foundation in 1999. Awned, white-chaffed, medium tall. Improved resistance to Russian wheat aphid over Prowers. Tall, long coleoptile, medium late maturity, good quality characteristics. Above average test weight and average protein under Montana conditions. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Ransom – hard red winter wheat released by the North Dakota Agricultural Experiment Station in 1998. Plant height 2' shorter than Elkhorn and similar to Redwin. Spikes mid-dense, fusiform, awned and white at maturity. Glumes medium length and wide with rounded shoulders and acuminate beak. Seeds ovate, with rounded cheeks and medium brush. Field resistant to prevalent races of stem rust. Moderately resistant to prevalent races of leaf rust. Average test weight and slightly below average protein for Montana conditions. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Utah 100 – hard red winter wheat released by the Utah Agricultural Experiment Station in 1996. Awned bronze-chaffed, fusiform, mid-dense and inclined spike characteristics. White coleoptile and semi-erect juvenile growth. Heading date about 3 days later than Promontory. Plants green at boot growth stage and flag leaf recurved. Kernel ovate, rounded cheeks, with mid-wide, deep seed crease and medium-sized brush length. Resistant to dwarf bunt.

Windstar – hard red winter wheat released by the Nebraska Agricultural Experiment Station in 1997. A taller semidwarf developed for dryland production in the Nebraska panhandle and western South Dakota. Moderately resistant to stem rust. Moderately susceptible to leaf rust and wheat streak mosaic virus. Susceptible to the Great Plains biotype of the Hessian fly and soilborne mosaic virus. End use quality acceptable to milling and baking industry. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Varieties previously in bulletin:

BigSky - is a broadly adapted, high-yielding hard red winter wheat cultivar with medium maturity, good foliar disease resistance, and dual purpose (bread and Asian noodle) end-use quality. Yield performance is similar to Judith, Kestrel, Neeley and Rocky and higher than Tiber and Erhardt. Test weight is superior to all these varieties. BigSky is of medium maturity heading 1-2 days later than Judith, similar in height to Tiber, but with strong, stiff straw. BigSky is resistant to stem rust but susceptible to leaf and stripe rust. Resistance to Septoria and tan spot is good. Milling and baking qualities of BigSky are within acceptable ranges. BigSky will be released by the Montana AES in the fall of 2001 and PVP, Title V is pending.

Bighorn - Developed by Rohm-Haas and released in 1984. Bighorn was owned and merchandised by HybriTech Seed International, Inc until 2000 and now owned by Western Plant Breeders. It is a medium height variety with good winter-hardiness and medium-late maturity. It has white chaff and good straw strength. It is moderately susceptible to leaf rust but resistant to stem rust. It is rated as good in milling quality. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Blizzard – a hard red winter wheat released by the Idaho Agricultural Experiment Station and Agricultural Research Service, USDA, in 1987. It is a tall, stiff-strawed, awned variety with erect to inclined heads. At maturity the glumes are tannish-white to white. The kernels range from light to dark red/brown in color, depending on environmental conditions in which it is grown. Blizzard may contain up to five white kernels per pound of seed. It is tolerant to snow mold, resistant to stripe rust and dwarf smut (TCK). Blizzard produces excellent flour yield and has average baking quality.

Elkhorn - released by the North Dakota Agricultural Experiment Station in 1995. It is a hard red winter wheat. Elkhorn is an awned, white chaffed, tall variety, with a lax, tapering spike. Elkhorn is moderately resistant to stem rust with approximately 25 percent of the plants being susceptible to the prevalent races of stem rust. It is moderately susceptible to leaf rust. The milling and baking qualities of Elkhorn are acceptable by industry. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Halt - released by the Colorado Agricultural Experiment Station in 1994. Halt is a hard red winter wheat. It is a white chaffed semi-dwarf variety. Halt is resistant to the Russian wheat aphid. It is resistant to stem rust and moderately susceptible to leaf rust. Halt has acceptable milling and baking qualities. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Judith - A hard red winter wheat variety released by the Montana Agricultural Experiment Station in 1988. Judith is a bearded variety with white chaff. It is high yielding with good shatter resistance. Judith is medium in maturity and has a reasonable level of winter-hardiness. The heading date is similar to Rocky, and the winter-hardiness similar to Redwin. It is resistant to stem rust, but moderately susceptible to bacterial leaf blight and leaf spotting complex. The protein of Judith is somewhat lower than Redwin, but equal to or better than other varieties on the recommended list. The test weight is 1 - 2 lb/bu lower than many varieties. The milling and baking qualities of Judith are very good exhibiting high flour yield, absorption, flour protein, loaf volume and grain/texture scores.

Manning - Developed by the Utah Agricultural Experiment Station and released in 1979. Manning is a hard red winter wheat. It is a medium-short variety, spikes are awned brown-chaffed, oblong to fusiform, mid-dense and inclined at maturity. The kernels are red, elliptical to ovate, germ is mid-size, mid-deep crease and round cheeks. The brush is short to mid-long and uncollared. It is resistant to dwarf bunt (TCK) and moderately tolerant to snow mold, susceptible to leaf rust and powdery mildew.

McGuire – A hard red winter wheat developed by the Montana Agricultural Experiment Station and released in 1996. McGuire is an awned, bronze chaffed, medium-tall early maturing variety. The kernels are hard, red, with a mid-sized germ and a heavy brush. Kernel cheeks are round to angular and the crease is open. The kernel backing is long and sloping, and seed coat has a rough texture. McGuire is resistant to stem rust, but susceptible to dwarf smut, stripe rust and the wheat stem sawfly. It is susceptible to the wheat streak mosaic virus and has a moderate reaction to the leaf spot complex (Septoria and tan spot). McGuire has high milling and baking qualities producing a very good quality bread flour.

Morgan – Developed by the Crop Development Centre, University of Saskatchewan. Western Plant Breeders was granted the production rights. It is an awned, white chaffed, semidwarf hard red winter wheat. The spike is tapered, mid-dense and lacks a waxy bloom. The glumes are medium long, medium wide, no pubescence and have oblique shoulders. Morgan is moderately tolerant to stem rust and moderately susceptible to leaf rust. Morgan is protected under the Plant Variety Protection Act, but not the Title V option.

Neeley – Developed and released in 1980 by USDA-ARS and the Idaho Agricultural Research Station. It is a hard red wheat. It is a semidwarf variety with intermediate maturity. The spikes are fusiform and mid-dense, have white awns and white glumes and are erect to inclined. Neeley generally has 1 to 3 percent lower protein than most recommended hard red winter wheats. Neeley has average winter-hardiness.

Norstar – a hard red winter wheat developed at the Agriculture Canada Research Station, Lethbridge, Alberta. It was a hard red winter wheat released in 1977. Norstar is lodging susceptible, susceptible to stem rust, but is very winter-hardy. The spikes are long, inclined, tapering, mid-dense with white awns. The florets tend to spread. The glumes are white and glabrous with narrow beaks. The glume shoulders are narrow and oblique to wanting. The kernels are light red, mid-sized to small, mid-long, narrow to mid-wide and elliptical to oval in shape.

NuWest – Developed by the Montana Agricultural Experiment Station. It was released in 1994 and is currently licensed to General Mills. NuWest is a hard **white** winter wheat of intermediate height. The spike is awned, white chaffed and erect at maturity. The kernels are hard, white and elliptical. The germ is large, with a mid-long brush, cheeks are rounded with a narrow straight crease. There is approximately one red kernel per 1500 white kernels. NuWest is resistant to prevalent races of stem rust found in Montana. It is susceptible to leaf rust, wheat streak mosaic virus and dwarf bunt. It is moderately susceptible to stripe rust and Cephalosporium stripe. It is susceptible to Russian wheat aphid and the wheat stem sawfly. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Promontory – Released by the Utah Agricultural Experiment Station in 1991. It is a hard red winter wheat of medium height with awns and bronze

chaff. The spike is lax, with medium length and wide glumes. The kernels are ovate, medium-wide, medium-deep crease and a medium length brush. Promontory is resistant to dwarf bunt. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Quantum 542 – A standard height, hard red winter wheat hybrid variety developed and released by Hybritech Seed International, Inc. in 1987. It is now owned by Western Plant Breeders. It is about four days earlier in heading than Redwin and Neeley, and equal in maturity to Rocky. It has a bearded, drooping head similar to Winalta and has good resistance to shattering. It is medium in winter-hardiness. Test weight and protein are similar to Neeley and Redwin. Hybrid varieties must be treated differently than standard wheat varieties. Only the F₁ seed you buy from the seed dealer is recommended.

Rampart – Released by the Montana Agricultural Experiment Station in 1996. It is an awned, red chaffed, solid-stemmed hard red winter wheat variety. The kernel is long with a sloping back and a heavy brush. The cheeks are rounded to angular with an open crease. Rampart is resistant to the wheat stem sawfly. It is resistant to prevalent races of stem rust. It is susceptible to stripe rust, leaf rust, dwarf smut and the Russian wheat aphid. Rampart has excellent milling and baking properties and is a sister line to Vanguard.

Redwin – Released in 1979 by the Montana Agricultural Experiment Station. Redwin is a hard red winter wheat, with average yield potential, winter-hardiness, shatter and lodging resistance. Grain protein, milling and baking qualities of Redwin are excellent. Redwin is very susceptible to stripe rust, dwarf smut and stem rust.

Rocky – A pure line selection from Centurk developed and released by Nickerson American Plant Breeders (now Agripro Seed Company) in 1978. Rocky is a hard red winter wheat that has white glumes and awns. It is similar in most characteristics to Centurk but differs in glume shape and beak length and has better resistance to soil born mosaic. Rocky tends to be about three to four days later in heading than Centurk but dries down for harvest as early as Centurk. Rocky is adapted to the same areas as Centurk, but has superior yields under most conditions. Rocky has average milling and baking qualities when compared to Redwin.

Tiber – A standard height hard red winter wheat variety released by the Montana Agricultural Experiment Station in 1987. Tiber was selected from a Redwin population based on its tolerance to the leaf spot disease complex. Tiber is a bearded, brown chaffed, stiff-strawed variety. It has a high yield potential, good shatter resistance and good winter-hardiness (similar to Redwin). Tiber's resistance to lodging and shattering is equal to Redwin; shorter in straw height than Winalta. Tiber has moderate resistance to the leaf spot complex, but is susceptible to dwarf smut and very susceptible to stripe rust. Tiber has average milling and baking quality.

Vanguard – Developed by the Montana Agricultural Experiment Station and released in 1995. Vanguard is the first sawfly-tolerant winter wheat released in Montana since 1965. It is resistant to the wheat stem sawfly. It was released as an emergency measure to reduce yield losses due to the sawfly. Vanguard has awned spikes, with white chaff and the straw is white. The kernels are hard, red, long and elliptical. The germ is mid-sized with a short brush. Vanguard is susceptible to stem rust, stripe rust, leaf rust and dwarf smut.

Soft White Winter Wheat

New for 2001 Bulletin:

Brundage – soft white winter wheat released by the Idaho Agricultural Experiment Station in 1997. Early, awnletted, short semidwarf with excellent straw strength. Glumes white, shoulders oblique and beak obtuse. Kernels white, soft, ovate with crease mid-deep to deep. Foliage blue green. Moderate resistance to stripe rust. High yielding, high test weight with excellent end-use quality characteristics. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Cashup – soft white winter wheat developed by Columbia Basin Seeds, Moses Lake, WA in 1984. Awned, white glumed with stiff straw. Moderately resistant to leaf rust and stripe rust, but moderately susceptible to stem rust. Susceptible to common bunt and snow mold. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

MAC-1 – soft white winter developed by Plant Breeders 1, Moscow, ID in 1992. Currently licensed to Lake Seeds in Ronan, MT. Above average yield and test weight in first year of testing at Bozeman and Kalispell. High protein for soft white winter wheat. This variety is protected under the Plant Variety Protection Act and can only be sold or advertised by variety name as a class of certified seed.

Varieties previously in bulletin:

Daws – Developed cooperatively by USDA-ARS and the Washington Agricultural Experiment Station. Daws is a semidwarf soft white winter wheat. It was jointly released by the Washington, Oregon and Idaho Agricultural Experiments in 1976. The spike is awned, long, lax, mid-wide with white glumes. The kernels are white, soft, elliptical and mid-long, with a shallow crease. The kernel's germ is mid-sized. Daws is resistant to stripe rust races found in the tri-state area and resistant to common bunt. It is susceptible to dwarf smut (TCK), flag smut, leaf rust, stem rust and *Cercospora* foot rot.

Eltan – Developed cooperatively by USDA-ARS and the Washington Agricultural Experiment Station and released jointly by the Washington, Oregon and Idaho AES in 1990. Eltan is a semidwarf, soft white winter wheat. The spike is awned and white chaffed. It is resistant to dwarf bunt (TCK), snow mold and common bunt. Eltan is moderately susceptible to prevalent races of stripe rust, but susceptible to stem rust and leaf rust.

Hill 81 – Developed cooperatively by USDA-ARS and the Oregon Agricultural Experiment Station and released in 1982. Hill 81 is a white chaffed, stiff strawed, soft white winter wheat. The spike is awned, fusiform, mid-dense and inclined. Glumes are white, glabrous, mid-long, mid-wide, with wanting shoulders. Kernels are white, mid-long, elliptical with mid-sized germ, narrow to mid-wide crease and rounded cheeks. Hill 81 is resistant to stripe rust, leaf rust, moderately susceptible to powdery mildew and Septoria. It has fair resistance to dwarf bunt.

Kmor – developed by the USDA-ARS and the Washington Agricultural Experiment Station. Kmor is a semidwarf, white chaffed, soft white winter wheat. It was released jointly by the Washington, Oregon and Idaho AES in 1990. Kmor is resistant to stripe rust, moderately resistant to *Cephalosporium*, common bunt, strawbreaker foot

rot, and dwarf smut. It is susceptible to snow mold, leaf rust and stem rust.

Lambert – Developed by the Idaho AES and jointly released in 1995 by the Idaho, Oregon and Washington Agricultural Experiment Stations. Lambert is an awned, semidwarf, soft white winter wheat, The kernels are soft, white and ovate, with a mid-deep crease and a mid-sized germ. It is resistant to stripe rust, more tolerant than Stephens to both *Cephalosporium* stripe and snow mold. Lambert is susceptible to strawbreaker foot rot and dwarf bunt. Lambert's quality characteristics have been accepted by industry.

Lewjain – developed and jointly released by the Washington AES and the USDA-ARS in 1982. It is a semidwarf, soft white winter wheat. It is white chaffed, awned, with a common head type. Lewjain is resistant to some races of common smut and dwarf smut. In the adult stage it is resistant to stripe rust and moderately resistant to *Cephalosporium gramineum*. It is susceptible to leaf rust, stem rust, flag smut and foot rot.

MacVicar – Jointly released in 1980 by the Washington AES and the USDA-ARS. The spike is awned, white chaffed, fusiform and lax. Kernels are white, mid-long, ovate to elliptical, the crease is narrow and shallow. The brush is mid-long and cheeks are rounded. The glumes are glabrous, mid-long, mid-wide with narrow acuminate beaks and shoulders are wanting.

Madsen – developed by the USDA-ARS Wheat Genetics, Quality, Physiology and Disease Research Unit at Pullman, WA. It was jointly released in 1988 by USDA-ARS and the Washington, Oregon and Idaho AES, The spike is awned, the straw is white, but the glumes are both white and tan colored. The kernels are large, white, soft and ovate with a medium size germ. Madsen is resistant to strawbreaker foot rot, and expresses field resistance to prevalent races of stripe rust, leaf rust and stem rust in the Northwestern US. It is moderately susceptible to flag smut, powdery mildew and *Cephalosporium* stripe. Madsen has resistance to a few races of common bunt (smut). It is susceptible to dwarf smut (TCK).

Malcolm – Released as a soft wheat in 1987 by the Oregon AES. The spike is white chaffed, awned, oblong and mid-dense and nodding. Glumes are glabrous, with white narrow shoulders and beaks. Kernels are white, mid-sized with a shallow crease

and small germ. Malcolm is susceptible to leaf rust and Cephalosporium. It is moderately susceptible to Septoria and stripe rust.

Rod – Developed by Washington State University in cooperation with USDA-ARS. Released jointly by the Washington, Oregon and Idaho AES. Rod has some winter-hardiness (similar to Stephens), moderately weak straw and medium-late heading. Resistant to local races of stripe rust and common bunt, but susceptible to dwarf bunt, stem rust, leaf rust and snow mold.

Stephens – Developed and released by the Oregon AES in 1977. Stephens is a soft white winter wheat. It is a white chaffed, stiff strawed, semidwarf variety. The glumes are white, glabrous, and short to mid-long. The kernels are white with a small brush. Stephens is resistant to stripe rust, leaf rust and common bunt. It is moderately resistant to Septoria leaf blotch and susceptible to dwarf smut, flag smut and snow mold.

W301 – Developed and released in 1992 by the Oregon AES. The spike is white chaffed with linear to fusiform, lax awns that tend to spread. The spike tends to nod. The kernel is mid-long, ovate to elliptical, mid-size germ, shallow narrow crease. W301 is resistant to stripe rust and snow mold and moderately susceptible to stem rust.

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.