

2004 Recommended Varieties: Hard 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	
CDC Falcon (P)+	DI	DI	DI	DI	DI	DI
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
2003 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	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. Moccasin - Dryland.....	23
Table 20. Selected agronomic characters and disease reactions	24
Additional Descriptive Information for Winter Wheat Varieties:	
Hard Winter Wheat	25
Soft White Winter Wheat	28
Plant Variety Protection	30

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, W. Grey, D. Nash, R. Johnston and R. Larson

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

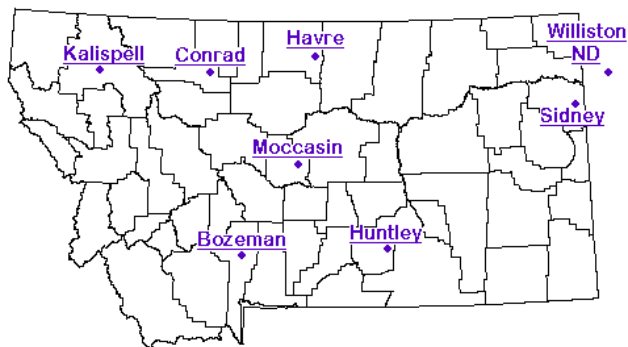


Fig. 1. Test Locations for Montana winter wheat performance tests in 2003.

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 2003 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 (21 public and 11 private) and 17 experimental lines (15 public and 2 private). Numbered entries preceded by a state designation [e.g. MT00159 (Montana)] are experimental lines provided by the breeder of the originating state. Private experimental lines [e.g. BZW96-788 (WestBred) and GM10004 (General Mills)] are submitted for testing on a fee basis. The soft white evaluation contains 16 varieties [12 public, 3 private (including one experimental line) 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 2002. Fall nitrogen (N), phosphorus (P₂O₅) and potassium (K₂O) were preplant applied and incorporated.

Location	2002 Crop	2001 Crop	2002 Planting Date	Fertilizer				2003 Harvest Date
				N		P ₂ O ₅	K ₂ O	
				Fall	Spring			----- Pounds per acre -----
Kalispell	green manure	green manure	Sept. 27	40	75	18	85	July 29
Bozeman	fallow	oats	Oct. 7	70	-	28	28	Aug. 5
Huntley	fallow	fallow	Sept. 24	11	30	52	0	July 18
Moccasin	chem. fallow	barley	Sept. 26	70	-	10	10	July 29
Conrad	fallow	barley	Sept. 26	51	-	52	0	Aug. 4
Havre	fallow	barley	Sept. 25	70	-	40	25	July 25
Sidney	fallow	safflower	Sept. 27	none	-	none	none	July 29
Williston, ND	fallow	safflower	Sept. 26	45	-	40	0	July 24

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 2003, data is provided for two (2002-2003), three (2001-2003) and four (2000-2003) year averages for both hard and soft wheat entries tested during previous cropping seasons.

There was no data in 2002 for Rampart, except at Havre, due to a seed mix-up prior to planting that wasn't discovered until after heading. Therefore the multiyear analyses do not contain information for Rampart if the location was harvested in 2002. For those locations, Rampart yields for 2000 and 2001 will be footnoted on each table.

Test Weight

Test weight (pounds per bushel) were obtained for each plot by using a Seedburo 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 2003 data only .

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 2003, Sidney and Williston had significant stand loss due to winter kill.

Table 11 contains information on yield in winter-kill environments from 2000 to 2003. The data

summarizes 6 tests in which significant winter-kill occurred (test average for winter survival was less than 90%). All 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. These 2 varieties were planted on 32% of the winter wheat acreage in the 2003 crop year (Rampart was the leading variety planted for the 2002-2003 crop year). Both these varieties have marginal winter hardiness.

Table 12 contains information on yield at 12 testing locations where sawfly pressure was present during the years 1997-2003. The data is mainly from Off Station winter wheat nurseries. Big Sandy, Loma and North Havre are 'satellite' locations of Havre; The Knees of Conrad, Highwood and Ft. Benton 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. After 15 days 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 20 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 20, 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 2003 data for hard winter wheat collected at all harvested experiment station sites. Tables 17 - 19 contain 2003 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.

2003 Test Conditions

Conditions were more "normal" at winter wheat testing sites at least compared to drought conditions over the last several years. Although terminal drought occurred again this past season, most winter wheat escaped severe drought stress and yields were generally good. Winter conditions were moderate at all testing sites except Sidney and Williston, where average stands were reduced

to about 70% and 40%, respectively. Montana winter wheat acreage increased in 2003 as fall planting conditions were more favorable than in previous years. Harvested acreage for Montana in 2003 was projected by the Montana Agricultural Statistics Service at 1.72 million acres averaging 37 bu/acre (total production 63.6 million bushels) compared to 990,000 acres with a 28 bu/a average (total production 28.2 million bushels) for the 2000-2002 harvest years. All locations except Sidney experienced below average precipitation (see Table 13 for precipitation data). Drought reduced yields at Kalispell. Havre had below average yield due to hail damage in late June. Mean yield for harvested locations ranged from 29 bu/a at Havre to 98 bu/a at Bozeman.

Leading winter wheat varieties planted for 2003 were Rampart (25.0%), Neeley (16.9%), Tiber (9.8%), Rocky (7.7%), Morgan (7.2%) and Vanguard (6.6%). Neeley had been the leading variety in Montana for the past 15 years.

Test weight averaged below 60 lb/bu only at Bozeman and Moccasin. Diseases were minimal at all locations. There was no sawfly cutting at any of the Experiment Station locations. Protein content was above 13.0% at all stations except Sidney.

Dwarf Smut (TCK)

Dwarf smut (TCK) can be controlled with 'Dividend' seed treatment (see page 5). Dwarf smut or dwarf bunt (*Tilletia controversa* Kuhn is a fungal disease that occurs in areas where winter wheat is subjected to prolonged snow cover or unfrozen ground. The planting of dwarf smut resistant varieties (Blizzard, Manning, Promontory and Lewjain are currently recommended) as one practical means of control. Newer varieties such as Golden Spike (HWW – Utah, 1999) and DW (HRW – Idaho, 2001) have been developed with dwarf bunt resistance.

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

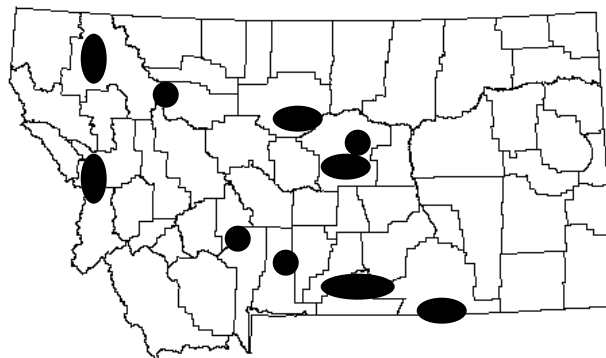


Fig. 2. Known areas of dwarf smut (TCK) infestations.

If you farm in the vicinity of one of the shaded areas in the map (Figure 2.), you would be well advised to observe closely your winter wheat crop and consider planting a resistant variety (Tables 15 and 20) or use 'Dividend' seed treatment, only.

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 four Plant Science and Plant Pathology members (two wheat breeders, one cereal quality scientist, and one plant pathologist), one entomologist, one extension specialist, one representative of Foundation Seed Stocks, six Research Center representatives, 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 four 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 due 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 1,2,3,4	30-60 30-60 (10-20 seeds/sq. ft.)	60-75 60-75 (20-25 seeds/sq. ft.)	Sept. 1-15 Sept. 10-25

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

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

Variety	Origin	Release Year	Pedigree
Public Varieties			
Above (CL)	Colorado	2001	TAM 110*4/FS2 [CLEARFIELD]
BigSky	Montana	2001	NuWest/Tiber
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 Seun 27, TX55-391-56-D8)/5/ Westmont)
Expedition	South Dakota	2002	Tomahawk/Bennett
Gary (HWW)	Idaho	2001	Manning*2/Survivor
Genou (MTS0031)	Montana	2004	(Lew/Tiber//Redwin, MTS92015)/3/Vanguard/ Norstar
Golden Spike (HWW)	Utah, General Mills	1999	Arbon/Hansel/4/(ID0281, Hansel/3/(Snow Mold Sel. 1, Cltr14106)/ Columbia//McCall)
Jerry	North Dakota	2001	Roughrider/Arapahoe
Judith	Montana	1989	Lancota/Froid/9//((Seu Seun 27/3/(Cltr12500, Nebraska 60// Mediterranean/Hope)/4/Red Chief/Ponca/5/ Cheyenne/6/Atlas 66/ Comanche, NE69559)/7/ (CO634011, Lancer sel.)/8/Winoka
Millennium	Nebraska	1999	Arapahoe/Abilene/4/(NE86488, Colt/3/ Warrior*5/Agent//Kavkaz)
Neeley	Idaho	1980	Heglar/3/Norin 10/Staring//2*Cheyenne
Norstar	Alberta	1977	Winalta/Alabasskaya
NuSky (HWW)	Montana	2001	NuWest/Tiber
Paul	Montana	2003	(TAM W-103/Froid/4/Yogo// Turkey Red/Oro/3/ Centurk, MT8030)/5/Neeley
Promontory	Utah	1990	Manning/Bezostaya-1
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
Tiber	Montana	1988	Redwin pure line selection
Vanguard	Montana	1995	Lew/Tiber//Redwin
Wahoo	Nebraska, Wyoming	2000	Arapahoe*2/Abilene
Private Varieties			
AP 502CL (CL)	AgriPro	2001	(TAM 110 sib, TXGH12588-26)/FS2 [CLEARFIELD]
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)// PI194761/ 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
Jagalene	AgriPro	2002	Jagger/Abilene
Morgan	Western Plant Breeders/Saskatchewan	1996	Archer/Norstar
NuFrontier, (HWW)	General Mills	2001	HBK0927
NuHorizon, (HWW)	General Mills	2001	W189-282/Arlin
NuWest (HWW)	Montana, General Mills	1994	Froid/Winoka/7//((Sinvalocho/Wichita//Hope/ Cheyenne/3/ Wichita /4/ Seu Seun 27, TX55-391-56-D8)/5/Westmont, MT6928)/6/Trader
Pryor	Western Plant Breeders	2002	Hatten/Abilene
Quantum 542	Western Plant Breeders	1988	F1 Hybrid
Rocky	AgriPro	1978	Centurk pure line selection

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

Cultivar/Line	Grain Yield (bushels/acre)				2003 Data				
	2003	2002-2003			Test weight	Heading Date		Plant height	Protein %
		2001-2003	2000-2003	2 yr		3 yr	4 yr		
Above (CL)++	56.2	84.2			62.7	150.5	31-May	21.5	13.1
AP 502CL (P,CL)++	54.9				61.8	149.7	30-May	21.3	13.2
Bighorn (P)+	56.8	83.6	80.4	88.8	62.9	153.4	2-Jun	23.3	12.6
BigSky ++	55.4	78.3	76.6	85.1	61.9	156.0	5-Jun	30.9	13.8
BZ9W96-788 (P)	66.5*				63.2	151.2	31-May	23.9	13.9
R CDC Falcon (P)+	55.7	83.6	76.8	86.2	60.4	152.1	1-Jun	22.8	12.6
Elkhorn +	55.6	86.6	84	85.7	60.3	157.6	7-Jun	33.3	13.8
Erhardt	55.2	82.4	78.7	87.1	62.0	153.3	2-Jun	26.0	14.6
Expedition ++	58.8	85.5			64.0	150.0	30-May	23.2	13.4
Gary (HWW)+ ^{1/}	59.7	100.0**	90.6*	92.3	61.1	153.2	2-Jun	27.9	11.5
GM10004 (P, HWW)	56.8	79.9	78.1	87.6	61.7	153.2	2-Jun	27.5	12.8
Golden Spike (HWW)+ ^{1/}	60.9	91.3	86.5*	91.6	62.0	157.1	6-Jun	25.2	11.7
Jagalene (P)++	57.2				64.2	150.1	30-May	22.5	13.9
Jerry	47.4	80.4			60.6	154.3	3-Jun	26.4	13.8
Judith	60.1	91.6	86.6*	95.5*	59.7	152.3	1-Jun	26.2	13.9
Millennium +	56.3				62.5	152.0	1-Jun	26.0	14.3
Morgan (P)+	55.8	88.1	81.5	83.9	60.8	156.0	5-Jun	26.5	13.0
MT00159	70.6**	97.4*			61.7	154.9	4-Jun	25.1	12.9
MT0097	61.2	94.6*			61.5	152.5	2-Jun	25.2	12.9
MT01148	59.1				60.8	158.2	7-Jun	27.2	13.5
MT0177	56.9				61.6	152.3	1-Jun	24.6	13.0
MT9982	60.3	90.9	87.5*		62.4	155.0	4-Jun	23.9	12.3
MT9989	66.2	89.9	86.3*		60.6	154.0	3-Jun	25.4	13.0
MTI01158	50.3				63.3	154.4	3-Jun	26.3	14.8
MTR01108	52.1				61.6	154.5	4-Jun	25.9	14.1
MTR9997	61.0	93.5*	90.8*		62.0	154.6	4-Jun	27.2	14.1
MTS0031 (Genou)	57.9	84.7			62.8	154.7	4-Jun	28.1	13.0
MTS0125	52.6				61.4	156.7	6-Jun	27.0	14.1
MTS0131	52.7				62.2	156.0	5-Jun	27.3	13.9
MTW01132	61.3				62.4	156.8	6-Jun	23.9	14.1
MTW01133	46.7				60.6	151.9	1-Jun	23.0	13.1
MTW01143	57.5				61.7	158.8	8-Jun	28.1	13.7
MTW01146	56.2				60.6	158.7	8-Jun	28.3	14.5
R Neeley	60.9	92.8*	86.1*	94.7	61.7	156.1	5-Jun	29.1	13.5
Norstar	54.9	83.9	81.6	80.7	60.9	159.0	8-Jun	34.4	13.1
NuFrontier (P,HWW)++	44.2	81.6	77.5	89.6	64.0	151.6	1-Jun	22.5	12.1
NuHorizon (P,HWW)++	44.9	80.4	73.6	83.0	63.7	150.9	31-May	21.0	12.8
NuSky (HWW)++	59.1	87.2	83.1	88.2	62.6	156.4	5-Jun	28.3	12.6
NuWest (P,HWW)+	58.3	89.8	83.7	90.5	61.1	154.9	4-Jun	25.9	12.3
Paul ++	59.8	92.7*	84.1	94.0	60.9	154.7	4-Jun	23.1	12.5
R Promontory ^{1/}	57.9	93.6*	86.3*	99.1*	63.0	151.8	1-Jun	24.2	13.7
Prowers 99 +	53.2	86.2	80.3	91.3	63.3	151.9	1-Jun	28.9	13.7
Pryor (P)++	63.7	96.4*	92.1**	102.5**	59.3	157.0	6-Jun	25.8	13.0
R Quantum 542 (P)	57.5	87.2	80.8	91.7	62.9	151.8	1-Jun	29.1	13.6
Rampart ^{2/}	42.4	-	-	-	61.9	156.2	5-Jun	25.9	14.1
Rocky (P)	58.3	93.2*	85.3	92.7	63.0	152.3	1-Jun	26.8	13.1
Tiber	51.0	82.8	83.5	90.7	61.9	157.0	6-Jun	32.7	14.1
Vanguard	52.6	82.4	77.1	88.8	61.9	152.0	1-Jun	27.2	13.4
Wahoo +	70.4*	96.2*			60.6	151.5	1-Jun	25.1	13.3
Average	56.8	88.0	82.9	90.1	61.9	154.1	2-Jun	26.1	13.3
LSD (0.05)	8.3	8.1	6.6	7.2		1.5		3.1	
C.V.	8.2	8.1	8.5	9.9		0.6		6.8	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = Rampart not planted in 2002: Yield in 2001 = 59.8, 2000 = 113.3

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

Cultivar/Line	Grain Yield (bushels/acre)				2003 Data				
					Test weight	Heading Date		Plant height	Protein %
	2003	2002-2003	2001-2003	2000-2003		Julian	Calendar		
		2 yr	3 yr	4 yr	lb/bu			in	
Above (CL)++	106.8*	105.6**			60.5	162.0	11-Jun	33.2	13.1
AP 502CL (P,CL)++	101.4				59.7	160.7	10-Jun	31.9	13.2
R Bighorn (P)+	96.5	93.5	94.5	98.7	58.9	167.7	17-Jun	35.7	14.3
BigSky ++	93.8	83.5	88.8	92.9	59.4	168.1	17-Jun	40.4	15.1
BZ9W96-788 (P)	97.5				60.2	166.3	15-Jun	34.3	13.5
R CDC Falcon (P)+	101.8*	95.7	94.5	99.8	57.7	166.7	16-Jun	33.2	13.5
Elkhorn +	86.5	77.0	83.6	86.1	58.9	169.7	19-Jun	44.2	15.2
Erhardt	92.7	86.3	87.8	91.6	61.2	168.0	17-Jun	37.6	15.1
Expedition ++	102.5*	99.8*			60.3	162.4	11-Jun	34.9	14.2
Gary (HWW)+ ^{1/}	107.1*	100.7*	101.9*	107.3*	58.3	169.0	18-Jun	40.5	13.5
GM10004 (P, HWW)	97.2	89.5	92.8	95.8	59.3	167.7	17-Jun	39.9	14.0
Golden Spike (HWW)+ ^{1/}	98.6	92.8	97.7	103	58.8	170.1	19-Jun	39.8	12.9
Jagalene (P)++	103.3*				61.9	164.0	13-Jun	34.0	14.1
Jerry	94.2	90.8			58.2	168.7	18-Jun	41.4	14.4
Judith	98.8	92.8	95.6	99.6	56.6	167.0	16-Jun	41.4	14.5
Millennium +	109.2*				61.2	165.3	14-Jun	37.9	13.6
R Morgan (P)+	91.6	89.5	92.6	99.3	58.4	169.3	18-Jun	37.5	14.3
MT00159	109.6**	104.8*			58.1	168.7	18-Jun	37.3	14.1
MT0097	100.0	93.3			59.5	168.6	18-Jun	38.7	14.3
MT01148	108.0*				58.9	169.7	19-Jun	40.1	14.3
MT0177	100.0				59.1	167.3	16-Jun	37.3	13.6
MT9982	103.8*	96.9	100.5		57.8	169.0	18-Jun	38.2	14.1
MT9989	93.9	89.3	95.4		56.0	167.0	16-Jun	39.6	14.7
MTI01158	98.4				60.5	167.4	16-Jun	35.6	14.2
MTR01108	93.4				58.8	168.1	17-Jun	37.4	14.6
MTR9997	105.0*	99.0	106.1**		59.9	168.7	18-Jun	38.7	14.9
MTS0031 (Genou)	90.1	86.2			59.7	168.4	17-Jun	39.7	14.9
MTS0125	86.2				57.8	170.0	19-Jun	38.5	15.4
MTS0131	83.0				58.5	169.3	18-Jun	38.6	15.4
MTW01132	98.9				60.9	169.0	18-Jun	36.6	14.5
MTW01133	99.4				58.7	164.6	14-Jun	32.1	14.1
MTW01143	97.2				56.2	172.0	21-Jun	39.1	15.4
MTW01146	92.2				57.0	171.0	20-Jun	39.5	14.9
R Neeley	97.0	92.0	96.1	101.5	59.2	168.6	18-Jun	40.3	14.9
Norstar	78.4	72.6	79.0	80.7	58.9	172.7	22-Jun	47.7	15.3
NuFrontier (P,HWW)++	106.5*	95.7	96.2	102.1	61.3	164.7	14-Jun	35.5	12.4
NuHorizon (P,HWW)++	102.7*	95.9	94.7	102.7	61.2	164.0	13-Jun	31.1	13.6
NuSky (HWW)++	95.4	88.7	91.5	96.3	58.7	169.1	18-Jun	40.6	14.7
NuWest (P,HWW)+	99.0	90.6	89.9	95.8	58.6	168.6	18-Jun	39.4	14.4
Paul ++	107.2*	98.1	101.3*	105.5*	56.7	168.3	17-Jun	37.2	14.6
R Promontory ^{1/}	105.4*	100.5*	101.3*	107.2*	61.1	167.7	17-Jun	36.6	13.6
Prowers 99 +	100.2	93.6	94.1	100.4	61.7	165.3	14-Jun	40.2	14.4
Pryor (P)++	100.7	91.9	98.4	103.6	56.3	169.3	18-Jun	37.0	14.1
R Quantum 542 (P)	104.9*	102.8*	104.2*	109.3**	60.1	166.1	15-Jun	40.4	14.0
Rampart ^{2/}	83.9				59.3	167.7	17-Jun	37.7	15.0
Rocky (P)	96.0	90.8	91.3	97.0	60.3	166.2	15-Jun	40.8	14.2
R Tiber	95.2	88.3	93.9	96.0	59.9	169.6	19-Jun	42.9	15.2
Vanguard	90.0	83.2	84.5	92.7	59.5	166.7	16-Jun	37.8	15.1
Wahoo +	101.8*	96.3			57.4	165.0	14-Jun	35.6	13.9
Average	98.0	92.6	94.4	98.5	59.1	167.6	17-Jun	38.1	14.3
LSD (0.05)	7.9	6.3	5.1	4.5	0.8	0.8		1.8	
C.V.	4.6	6.0	5.8	5.7	0.8	0.3		2.7	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = Rampart not planted in 2002: Yield in 2001 = 89.6, 2000 = 112.6

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

Cultivar/Line	Grain Yield (bushels/acre) ^{2/, 3/}		2003 Data				
	2003	2001//2003	Test weight	Heading Date		Plant height	Protein %
	2 yr			Julian	Calendar		
Above (CL)++	105.5*		62.3	150.2	30-May	34.6	12.2
AP 502CL (P,CL)++	99.9		60.2	150.5	31-May	32.8	12.7
R Bighorn (P)+	100.3	57.8*	62.3	157.3	6-Jun	35.6	13.5
R BigSky ++	83.7	50.0	61.3	156.2	5-Jun	44.6	14.8
BZ9W96-788 (P)	89.8		61.2	154.0	3-Jun	36.9	14.2
R CDC Falcon (P)+	81.7	50.9	59.0	155.1	4-Jun	35.0	13.9
Elkhorn +	74.9	45.3	62.6	159.2	8-Jun	46.8	16.0
Erhardt	83.0	45.7	62.4	157.0	6-Jun	37.4	14.6
Expedition ++	101.1		61.8	151.4	31-May	34.4	13.0
Gary (HWW)+ ^{1/}	93.9	54.5*	59.5	155.6	5-Jun	38.5	14.0
GM10004 (P, HWW)	85.0	53.0*	60.8	156.3	5-Jun	40.4	13.8
Golden Spike (HWW)+ ^{1/}	102.6	61.1*	60.8	157.8	7-Jun	39.9	13.1
Jagalene (P)++	115.9**		63.7	152.0	1-Jun	35.9	13.6
Jerry	87.3		61.0	158.9	8-Jun	45.9	14.2
Judith	83.0	49.7	57.1	155.0	4-Jun	40.7	15.5
Millennium +	106.2*		62.5	154.6	4-Jun	41.8	13.1
R Morgan (P)+	80.7	48.2	60.0	160.0	6-Jun	39.8	14.0
MT00159	106.3*		60.4	159.2	8-Jun	39.9	15.2
MT0097	86.4		61.3	157.7	7-Jun	39.1	14.2
MT01148	86.2		59.6	158.3	7-Jun	40.9	15.5
MT0177	97.8		60.5	155.2	4-Jun	40.8	13.9
MT9982	95.5	58.4*	60.7	159.5	9-Jun	40.4	13.2
MT9989	82.7	52.4	57.8	155.8	5-Jun	42.1	15.3
MTI01158	91.7		62.0	155.6	5-Jun	39.0	14.8
MTR01108	97.4		63.4	159.3	8-Jun	36.7	13.9
MTR9997	97.7	61.6**	62.2	156.7	6-Jun	39.6	15.3
MTS0031 (Genou)	87.1		62.7	157.2	6-Jun	42.2	14.2
MTS0125	85.6		61.7	159.1	8-Jun	42.3	16.5
MTS0131	77.9		60.6	157.9	7-Jun	40.7	15.2
MTW01132	82.4		59.4	156.8	6-Jun	37.3	15.1
MTW01133	96.9		60.2	153.2	2-Jun	33.2	13.7
MTW01143	84.2		60.6	159.4	8-Jun	39.1	15.8
MTW01146	88.5		60.5	158.7	8-Jun	40.2	16.0
R Neeley	94.9	54.8*	60.4	159.0	8-Jun	44.0	15.3
Norstar	75.8	43.1	63.0	163.2	12-Jun	47.7	15.5
NuFrontier (P,HWW)++	93.1	53.7*	63.7	152.7	2-Jun	36.6	12.0
NuHorizon (P,HWW)++	98.4	53.9	62.0	152.2	1-Jun	32.2	13.3
NuSky (HWW)++	89.3	52.2	61.7	157.7	7-Jun	40.2	13.4
NuWest (P,HWW)+	84.0	50.9	61.1	157.6	7-Jun	39.7	14.6
Paul ++	91.8	58.7*	58.3	157.1	6-Jun	35.9	14.7
R Promontory ^{1/}	98.9	52.0	62.8	154.9	4-Jun	38.8	14.6
Prowers 99 +	100.9	51.6	63.5	152.8	2-Jun	43.7	14.8
Pryor (P)++	85.7	47.8	59.4	158.7	8-Jun	34.7	14.9
R Quantum 542 (P)	97.7	59.2*	60.5	153.4	2-Jun	43.5	14.4
R Rampart	80.7	47.0	62.0	155.7	5-Jun	40.1	15.9
R Rocky (P)	103.3	58.3*	63.1	152.5	2-Jun	45.4	13.9
R Tiber	76.0	48.1	62.7	158.2	7-Jun	43.3	14.9
R Vanguard	85.5	45.5	62.3	156.2	5-Jun	44.2	15.9
Wahoo +	99.7		59.7	153.4	2-Jun	39.1	14.2
Average	91.3	52.3	61.2	156.2	5-Jun	39.7	14.4
LSD (0.05)	10.8	9.0	1.1	1.5		2.9	
C.V.	6.7	15.0	1.0	0.5		4.2	

** = indicates highest yielding variety within a column CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = 2002 crop destroyed by drought; ^{3/} = 2000 yield had high CV (24%), not used in analysis

Gary (HWW)+ ^{1/}	41.1	43.0	45.8*	52.1	168.3	17-Jun	35.7	14.7
GM10004 (P, HWW)	37.0	38.0	39.3	54.7	168.3	17-Jun	37.0	15.8
Golden Spike (HWW)+ ^{1/}	38.9	39.9	42.8	52.4	172.0	21-Jun	34.0	15.5
Jagalene (P)++	51.7*			59.7	165.0	14-Jun	34.7	14.7
Jerry	42.4	45.6*		54.7	169.3	18-Jun	38.3	16.1
Judith	43.3	45.8*	46.2*	53.2	167.0	16-Jun	36.7	15.7
Millennium +	54.0**			57.5	167.3	16-Jun	39.0	15.3
R Morgan (P)+	39.7	42.5	44.0	55.9	170.7	20-Jun	34.7	14.3
MT00159	46.2	48.4*		54.1	167.7	17-Jun	36.3	15.6
MT0097	41.4	44.3		54.9	168.3	17-Jun	34.7	15.9
MT01148	39.9			52.9	170.0	19-Jun	34.3	15.7
MT0177	45.3			56.8	166.3	15-Jun	36.7	14.5
MT9982	42.5	46.7*	48.1*	53.7	168.3	17-Jun	33.3	15.6
MT9989	42.8	46.9*	48.0*	53.4	167.7	17-Jun	36.3	15.1
MTI01158	41.3			55.0	167.3	16-Jun	36.0	16.6
MTR01108	45.2			55.8	167.3	16-Jun	34.7	15.5
MTR9997	42.4	44.0	46.0*	55.6	167.0	16-Jun	37.3	15.4
MTS0031 (Genou)	35.6	40.0		53.9	167.3	16-Jun	35.3	16.9
MTS0125	39.4			55.5	169.7	19-Jun	36.7	15.9
MTS0131	40.8			56.6	167.0	16-Jun	38.7	16.0
MTW01132	41.3			57.9	169.3	18-Jun	31.0	16.4
MTW01133	51.9*			57.3	166.0	15-Jun	32.3	13.6
MTW01143	41.4			54.3	171.3	20-Jun	37.0	15.8
MTW01146	38.0			53.6	171.0	20-Jun	36.0	15.8
R Neeley	40.4	44.8*	44.6	54.8	170.3	19-Jun	37.0	15.3
Norstar	32.7	36.5	37.3	57.1	172.0	21-Jun	43.0	15.3
NuFrontier (P,HWW)++	46.2	46.9*	47.0*	56.8	166.3	15-Jun	37.0	15.2
NuHorizon (P,HWW)++	48.9*	47.9*	49.0**	58.9	165.0	14-Jun	31.7	14.2
NuSky (HWW)++	37.6	42.5	46.8*	55.0	169.3	18-Jun	34.3	15.2
NuWest (P,HWW)+	44.2	46.4*	47.8*	57.3	168.0	17-Jun	37.0	14.0
Paul ++	40.2	42.3	45.4*	51.8	168.3	17-Jun	33.0	16.0
R Promontory ^{1/}	47.4	46.8*	47.4*	56.8	167.3	16-Jun	35.0	15.6
Prowers 99 +	43.8	44.2	44.5	58.8	166.3	15-Jun	42.0	15.3
Pryor (P)++	45.1	48.4**	47.1*	55.1	171.3	20-Jun	30.3	15.4
R Quantum 542 (P)	38.3	41.3	42.9	54.5	166.3	15-Jun	38.0	15.4
R Rampart ^{2/}	40.2	-	-	57.0	167.7	17-Jun	37.3	16.2
R Rocky (P)	43.5	45.2*	47.0*	56.5	167.0	16-Jun	41.0	15.9
R Tiber	38.0	43.3	43.4	56.4	169.7	19-Jun	38.7	15.2
R Vanguard	37.1	40.3	41.8	55.9	167.0	16-Jun	37.0	16.6
Wahoo +	42.5	44.2		53.7	166.0	15-Jun	34.3	16.0
Average	42.1	43.7	44.7	55.4	167.8	17-Jun	35.8	15.5
LSD (0.05)	5.7	3.6	3.7	2.4	4.1		2.9	
C.V.	4.8	7.3	8.9	1.5	0.9		2.9	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = Rampart not planted in 2002: Yield in 2001 = 43.5

^{3/} = 2000 Test destroyed by hail

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

Cultivar/Line	Grain Yield (bushels/acre) ^{2/}			2003 Data				
	2003	2001//2003		Test weight	Heading Date		Plant height	Protein %
		2 yr	3 yr		Julian	Calendar		
Above (CL)++	67.9*			62.2	161	10-Jun	31	13.9
AP 502CL (P,CL)++	58.3			61.3	160	9-Jun	29	14.1
R Bighorn (P)+	66.0*	39.3*	42.9*	62.7	166	15-Jun	32	13.9
R BigSky ++	56.4	33.1	37.5	61.8	167	16-Jun	40	14.7
BZ9W96-788 (P)	66.3*			63.7	162	11-Jun	31	13.3
R CDC Falcon (P)+	64.7*	38.9*	41.0*	63.0	165	14-Jun	31	13.2
Elkhorn +	52.8	29.9	32.2	59.2	170	19-Jun	45	14.8
Erhardt	61.1	35.9*	37.0	63.0	167	16-Jun	34	14.4
Expedition ++	65.0*			62.9	161	10-Jun	32	14.2
Gary (HWW)+^{1/}	56.9	36.2*	39.4	59.4	164	13-Jun	37	13.7
GM10004 (P, HWW)	64.0*	41.5**	42.4*	62.2	164	13-Jun	37	13.9
Golden Spike (HWW)+^{1/}	51.0	32.0	33.9	60.6	167	16-Jun	35	12.8
Jagalene (P)++	66.1*			64.9	161	10-Jun	32	14.4
Jerry	60.8			60.8	167	16-Jun	39	14.3
Judith	61.3	37.4*	41.8*	60.5	166	15-Jun	37	13.3
Millennium +	64.8*			63.9	162	11-Jun	35	13.6
R Morgan (P)+	61.6	37.0*	41.6*	60.2	169	18-Jun	38	13.9
MT00159	71.2*			61.5	168	17-Jun	36	13.3
MT0097	61.8			61.3	165	14-Jun	37	13.8
MT01148	58.6			60.8	168	17-Jun	36	14.1
MT0177	67.2*			63.2	163	12-Jun	36	13.6
MT9982	64.9*	40.2*		59.8	167	16-Jun	36	13.6
MT9989	61.9*	37.5*		60.8	165	14-Jun	38	13.4
MTI01158	63.0*			62.9	166	15-Jun	34	14.2
MTR01108	71.6**			62.4	169	18-Jun	34	14.4
MTR9997	64.1*	39.0*		62.0	164	13-Jun	35	14.4
MTS0031 (Genou)	58.6			61.2	166	15-Jun	37	14.0
MTS0125	54.8			60.6	171	20-Jun	36	14.5
MTS0131	66.4*			61.8	166	15-Jun	38	14.1
MTW01132	61.6			63.3	166	15-Jun	33	13.3
MTW01133	67.0*			61.8	161	10-Jun	31	13.9
MTW01143	59.3			60.1	170	19-Jun	38	13.8
MTW01146	52.9			59.3	168	17-Jun	37	14.2
R Neeley	64.0*	37.2*	39.9	61.3	170	19-Jun	39	13.7
Norstar	45.9	27.4	31.1	58.4	171	20-Jun	48	14.9
NuFrontier (P,HWW)++	65.5*	37.4*	41.2*	63.3	164	13-Jun	35	13.0
NuHorizon (P,HWW)++	66.2*	38.1*	42.0*	65.2	161	10-Jun	30	13.3
NuSky (HWW)++	63.4*	40.1*	40.9*	61.0	167	16-Jun	38	14.1
NuWest (P,HWW)+	61.9*	37.5*	38.7	61.4	166	15-Jun	39	13.6
Paul ++	65.3*	39.9*	43.2*	60.6	168	17-Jun	36	13.3
Promontory ^{1/}	59.1	36.6*	41.3*	64.2	165	14-Jun	34	12.9
Prowers 99 +	66.9*	38.9*	39.3	64.2	163	12-Jun	37	14.3
Pryor (P)++	64.9*	36.1*	42.2*	60.1	168	17-Jun	34	13.3
R Quantum 542 (P)	67.5*	40.1*	45.6**	63.2	164	13-Jun	37	13.7
R Rampart	60.9	36.1*	38.4	61.7	167	16-Jun	37	14.7
R Rocky (P)	67.0*	40.5*	43.5*	64.2	165	14-Jun	38	13.9
R Tiber	57.7	35.8*	36.9	62.0	167	16-Jun	40	14.4
R Vanguard	64.4*	41.1*	40.7*	62.9	164	13-Jun	39	13.9
Wahoo +	69.5*			62.2	163	12-Jun	35	13.4
Average	62.4	37.2	39.8	61.9	165.6	15-Jun	36.0	13.9
LSD (0.05)	9.7	6.1	5.0					
C.V.	8.9	14.4	13.5					

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = 2002 Crop destroyed by drought

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

Cultivar/Line	Grain Yield (bushels/acre)				2003 Data				
	2003	2002-2003 2 yr	2001-2003 3 yr	2000-2003 4 yr	Test weight lb/bu	Heading Date		Plant height in	Protein %
						Julian	Calendar		
Above (CL)++	33.2	31.3			59.7	151.4	31-May	25.4	14.2
AP 502CL (P,CL)++	29.5				58.3	152.1	1-Jun	25.0	14.2
R Bighorn (P)+	31.6	31.3	26.8	35.0	62.1	160.2	9-Jun	27.0	15.7
R BigSky ++	27.8	31.1	27.8	34.5	61.4	159.5	9-Jun	31.8	16.1
BZ9W96-788 (P)	32.3				61.1	157.5	7-Jun	27.0	15.3
R CDC Falcon (P)+	28.8	34.6*	32.2*	40.7*	60.1	159.2	8-Jun	26.6	15.8
Elkhorn +	17.8	24.9	23.0	28.6	60.6	162.5	12-Jun	30.1	16.7
Erhardt	26.2	29.8	27.2	33.1	61.6	161.6	11-Jun	27.6	17.1
Expedition ++	30.2	30.1			60.6	153.1	2-Jun	27.0	15.3
Gary (HWW)+ ^{1/}	29.7	33.1*	28.7	34.7	60.8	160.2	9-Jun	29.7	15.0
GM10004 (P, HWW)	27.2	30.9	27.0	35.2	60.8	159.7	9-Jun	30.8	16.1
Golden Spike (HWW)+ ^{1/}	27.6	30.3	26.4	34.9	61.1	161.7	11-Jun	30.6	15.2
Jagalene (P)++	24.6				60.7	155.5	5-Jun	27.4	15.8
Jerry	25.5	34.2*			60.2	161.0	10-Jun	31.5	16.6
Judith	30.5	32.0	29.4	37.8	58.7	159.9	9-Jun	30.5	16.1
Millennium +	28.0				60.3	157.4	6-Jun	30.8	15.6
R Morgan (P)+	25.4	32.2	28.5	35.7	60.2	163.2	12-Jun	29.8	16.6
MT00159	31.2	34.9*			60.0	160.7	10-Jun	29.9	15.9
MT0097	31.5	35.6*			61.6	161.5	11-Jun	28.5	16.1
MT01148	32.9				60.2	162.3	11-Jun	29.3	16.4
MT0177	29.0				61.1	162.0	11-Jun	30.0	15.6
MT9982	29.3	32.2	29.6		60.3	161.4	10-Jun	30.7	15.7
MT9989	30.7	34.4*	30.6*		59.4	160.0	9-Jun	31.6	16.0
MTI01158	28.1				60.9	158.9	8-Jun	30.3	15.8
MTR01108	32.0				61.8	160.9	10-Jun	29.0	16.7
MTR9997	31.5	35.5*	31.0*		61.3	159.2	8-Jun	29.8	16.9
MTS0031 (Genou)	30.2	30.7			61.3	161.4	10-Jun	29.6	16.2
MTS0125	27.9				61.1	163.2	12-Jun	29.3	16.7
MTS0131	31.4				61.8	161.4	10-Jun	29.3	16.3
MTW01132	28.6				61.9	159.6	9-Jun	26.8	15.8
MTW01133	32.3				60.3	159.9	9-Jun	26.2	16.2
MTW01143	27.7				61.4	163.5	13-Jun	29.9	16.5
MTW01146	31.4				60.9	162.4	11-Jun	31.1	16.5
R Neeley	30.3	32.4	28.1	38.1	61.3	161.6	11-Jun	29.0	15.6
Norstar	18.9	29.6	26.6	33.1	62.0	164.2	13-Jun	32.2	16.9
NuFrontier (P,HWW)++	33.6*	34.9*	30.7*	38.7	61.9	157.9	7-Jun	27.4	14.0
NuHorizon (P,HWW)++	35.0*	36.4*	32.4*	39.2	62.6	155.5	5-Jun	25.8	14.6
NuSky (HWW)++	28.4	35.3*	32.0*	38.9	60.8	161.0	10-Jun	30.8	16.3
NuWest (P,HWW)+	22.8	32.8*	30.3*	37.2	60.4	160.3	9-Jun	30.9	16.3
Paul ++	34.0*	33.5*	29.8	38.8	61.2	161.3	10-Jun	27.3	16.1
Promontory ^{1/}	30.3	30.9	28.1	35.4	61.4	157.7	7-Jun	29.9	14.8
Prowers 99 +	26.0	32.6	28.2	35.5	62.1	158.6	8-Jun	29.4	14.9
Pryor (P)++	37.3**	38.4**	33.6**	43.3**	62.0	161.3	10-Jun	28.6	15.5
R Quantum 542 (P)	25.6	32.5	29.3	37.7	60.3	157.0	6-Jun	28.6	15.7
R Rampart	30.5	34.6*	30.5*	37.5	61.2	161.2	10-Jun	29.4	16.0
R Rocky (P)	29.6	31.6	29.4	38.1	61.9	159.2	8-Jun	30.0	15.0
R Tiber	26.9	29.5	27.1	36.3	61.7	161.2	10-Jun	31.5	16.1
R Vanguard	32.1	30.8	28.0	34.4	61.2	158.8	8-Jun	31.1	15.7
Wahoo +	31.8	34.2*			60.4	156.6	6-Jun	29.1	15.5
Average	29.3	32.5	29.0	36.5	60.9	159.7	9-Jun	29.2	15.8
LSD (0.05)	4.2	5.5	3.6	3.3	0.7	2.1		2.0	
C.V.	8.0	14.9	13.4	11.1	0.6	0.7		4.0	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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 RED WINTER : District 6-- Sidney - Dryland

Cultivar/Line	Grain Yield (bushels/acre) ^{3/}			2003 Data					
	2003	2002-2003	2000/2003	Test weight lb/bu	Winter survival %	Heading Date		Plant height in	Protein %
						Julian	Calendar		
		2 yr	3 yr						
Above (CL)++	52.6	41.5		62.4	48.2	154.7	4-Jun	28.8	12.5
AP 502CL (P,CL)++	46.2			61.3	29.9	153.5	3-Jun	28.0	13.8
Bighorn (P)+	62.5	52.2	56.8	63.2	71.2	160.8	10-Jun	31.8	12.8
BigSky ++	61.7	52.7	55.0	63.2	75.0	161.1	10-Jun	39.4	12.4
BZ9W96-788 (P)	53.9			64.1	50.0	158.9	8-Jun	30.3	13.2
R CDC Falcon (P)+	65.8	60.5*	63.3*	63.1	76.2	159.7	9-Jun	31.1	11.1
Elkhorn +	62.2	52.5	56.2	61.2	89.0	162.6	12-Jun	42.6	13.6
Erhardt	64.3	52.8	54.4	63.9	82.7	161.2	10-Jun	34.3	14.0
Expedition ++	55.5	48.2		62.7	78.8	154.1	3-Jun	31.8	12.1
Gary (HWW)+ ^{1/}	68.5	52.8	57.7	60.8	69.7	161.3	10-Jun	35.1	12.6
GM10004 (P, HWW)	54.2	46.6	51.5	62.5	47.7	162.3	11-Jun	34.7	11.9
Golden Spike (HWW)+ ^{1/}	63.8	49.9	53.9	61.6	69.1	163.5	13-Jun	34.4	11.4
Jagalene (P)++	62.3			64.7	58.3	156.1	5-Jun	30.9	14.1
Jerry	67.3	59.1*		62.0	87.8	161.6	11-Jun	38.8	13.4
Judith	65.4	53.6		60.8	74.2	160.3	9-Jun	36.4	12.3
Millennium +	59.4			63.6	55.6	157.9	7-Jun	35.0	13.1
R Morgan (P)+	72.4*	59.9*	62.7*	62.1	86.9	163.3	12-Jun	36.2	11.9
MT00159	78.7**	62.7**		61.7	82.6	160.6	10-Jun	35.2	11.4
MT0097	72.5*	58.5*		63.2	79.4	161.7	11-Jun	34.3	12.6
MT01148	73.3*			61.9	80.4	163.5	13-Jun	36.0	12.5
MT0177	69.5			62.5	78.2	160.9	10-Jun	35.1	12.2
MT9982	75.1*	61.4*		62.0	78.1	160.9	10-Jun	35.1	12.3
MT9989	68.8	54		61.1	72.5	160.8	10-Jun	34.9	11.3
MTI01158	49.4			61.5	27.3	163.0	12-Jun	30.8	13.3
MTR01108	65.3			63.0	77.2	160.4	9-Jun	33.6	12.7
MTR9997	68.3	52.3		62.7	71.9	161.7	11-Jun	36.8	13.3
MTS0031 (Genou)	61.2	45.7		62.5	65.1	162.0	11-Jun	37.0	12.1
MTS0125	60.5			61.2	55.7	164.1	13-Jun	35.5	12.6
MTS0131	59.1			62.1	55.9	162.8	12-Jun	35.4	13.0
MTW01132	59.8			63.6	76.4	162.2	11-Jun	31.5	12.8
MTW01133	69.4			62.4	80.3	156.3	5-Jun	30.8	11.4
MTW01143	68.4			60.9	79.1	163.7	13-Jun	35.9	11.9
MTW01146	65.2			61.0	71.1	164.4	13-Jun	35.7	11.9
Neeley	69.3	57.0	61.2*	63.0	67.8	162.2	11-Jun	37.2	11.6
Norstar	68.8	56.5	61.0*	61.7	97.0	164.8	14-Jun	43.8	12.0
NuFrontier (P,HWW)++	58.8	46.7	51.6	64.1	55.4	159.1	8-Jun	32.0	11.4
NuHorizon (P,HWW)++	56.8	39.7	49.7	64.3	39.0	158.2	7-Jun	28.5	13.0
NuSky (HWW)++	68.8	57.1	59.2	62.0	83.1	162.1	11-Jun	36.5	12.4
NuWest (P,HWW)+	65.0	53.0	56.0	62.1	79.2	160.8	10-Jun	36.0	12.4
Paul ++	69.9	56.5	61.7*	60.5	69.0	163.4	12-Jun	32.9	11.9
Promontory ^{1/}	74.2*	57.2	60.1*	64.7	74.5	159.9	9-Jun	35.0	12.7
Prowers 99 +	50.7	40.6	45.0	63.5	49.3	159.5	9-Jun	34.8	13.5
Pryor (P)++	69.9	58.4*	64.1**	61.7	61.6	164.3	13-Jun	31.9	11.1
Quantum 542 (P)	69.3	54.8	59.1	63.1	72.1	159.0	8-Jun	37.3	12.5
Rampart ^{2/}	50.5	-	-	62.2	47.9	163.4	12-Jun	34.0	15.0
Rocky (P)	69.6	55.1	59.7*	63.6	80.7	158.0	7-Jun	38.5	11.3
Tiber	61.0	50.1	56.1	63.1	76.2	163.1	12-Jun	40.3	13.7
Vanguard	57.0	40.8	47.1	61.8	55.3	162.3	11-Jun	37.0	15.2
Wahoo +	68.3	56.3		62.5	79.0	157.7	7-Jun	34.6	12.2
Average	63.9	52.9	56.7	62.4	68.7	160.8	10-Jun	34.8	12.6
LSD (0.05)	7.3	5.0	4.5	0.9	12.4	1.6		1.7	
C.V.	6.6	8.2	8.6	0.9	10.4	0.6		2.7	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = Rampart not planted in 2002; Yield in 2000 = 60.8^{3/} = Severe winterkil in 2001, test not harvested.

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

Cultivar/Line	Grain Yield (bushels/acre) ^{3/}			2003 Data					
	2003	2002-2003	2000/2003	Test weight	Winter survival	Heading Date		Plant height	Protein %
						Julian	Calendar		
		2 yr	3 yr	lb/bu	%			in	
Above (CL)++	43.6	26.5		62.2	27.5	159.3	8-Jun	26.1	14.3
AP 502CL (P,CL)++	43.8			62.1	32.5	158.3	7-Jun	26.0	14.2
Bighorn (P)+	62.5	44.7	48.4	62.6	43.3	164.0	13-Jun	28.6	14.2
BigSky ++	59.8	47.6	51.6	62.9	46.7	164.0	13-Jun	35.4	15.3
BZ9W96-788 (P)	48.7			62.7	32.5	162.7	12-Jun	25.9	14.8
R CDC Falcon (P)+	60.7	50.8*	55.4*	62.4	53.3	164.3	13-Jun	27.4	13.3
Elkhorn +	67.3*	53.1*	54.5*	61.2	60.0	166.0	15-Jun	40.4	13.7
Erhardt	55.8	45.7	48.3	63.5	52.5	165.0	14-Jun	30.6	15.0
Expedition ++	46.9	38.7		63.6	42.5	158.7	8-Jun	28.7	14.8
Gary (HWW)+ ^{1/}	58.5	44.3	49.3	62.3	36.7	164.7	14-Jun	33.1	12.8
GM10004 (P, HWW)	49.1	35.9	42.1	61.4	27.5	165.0	14-Jun	31.0	14.1
Golden Spike (HWW)+ ^{1/}	52.8	35	42.8	61.3	29.2	166.7	16-Jun	32.2	13.6
Jagalene (P)++	54.7			64.5	35.0	160.3	9-Jun	28.6	14.9
Jerry	60.3	52.7*		62.1	50.8	165.7	15-Jun	34.1	14.2
Judith	63.5	47.9	51	60.1	50.8	163.0	12-Jun	32.9	14.0
Millennium +	46.2			63.2	33.3	161.7	11-Jun	29.4	14.8
R Morgan (P)+	67.5*	53.8*	56.7*	61.5	64.2	165.7	15-Jun	34.1	13.5
MT00159	72.1**	57.5**		62.1	50.8	165.3	14-Jun	33.1	14.2
MT0097	62.4	52.4*		62.3	46.7	164.7	14-Jun	30.3	14.3
MT01148	64.9			61.5	55.8	166.0	15-Jun	31.6	13.3
MT0177	57.6			62.8	48.3	164.3	13-Jun	32.3	14.1
MT9982	64.1	50.2*		62.6	54.2	165.3	14-Jun	31.6	14.0
MT9989	63.9	52.7*		60.4	49.2	164.0	13-Jun	32.3	13.9
MTI01158	48.5			62.7	21.7	165.0	14-Jun	29.7	14.6
MTR01108	57.8			63.1	49.2	165.3	14-Jun	27.4	14.6
MTR9997	62.7	43.0		62.6	45.0	164.3	13-Jun	32.5	15.6
MTS0031 (Genou)	59.1	40.8		61.7	36.7	165.0	14-Jun	33.7	14.8
MTS0125	45.7			60.3	19.2	167.3	16-Jun	30.6	15.1
MTS0131	49.8			61.9	30.0	165.3	14-Jun	31.9	14.7
MTW01132	62.6			63.1	44.2	164.0	13-Jun	32.3	14.4
MTW01133	59.4			62.3	45.8	160.3	9-Jun	27.6	14.4
MTW01143	61.8			61.3	39.2	167.3	16-Jun	31.9	13.8
MTW01146	60.6			61.3	45.0	167.0	16-Jun	32.4	13.6
Neeley	69.0*	52.5*	58.8**	62.4	50.8	165.3	14-Jun	32.0	13.6
Norstar	69.6*	55.5*	57.3*	61.6	73.3	167.3	16-Jun	43.2	13.6
NuFrontier (P,HWW)++	48.1	35.7	44.7	63.0	26.7	162.3	11-Jun	27.6	12.8
NuHorizon (P,HWW)++	45.8	28.2	36.0	63.0	17.5	161.0	10-Jun	25.6	14.5
NuSky (HWW)++	63.9	50.4*	53.9*	61.9	48.3	165.7	15-Jun	34.0	14.4
NuWest (P,HWW)+	57.0	45.6	50.3	62.0	46.7	163.7	13-Jun	32.3	14.2
Paul ++	64.7	51.6*	56.6*	60.7	47.5	165.3	14-Jun	29.3	13.6
Promontory ^{1/}	63.3	46.9	50.6	65.0	44.2	161.3	10-Jun	32.3	13.8
Prowers 99 +	46.4	32.8	40.2	63.8	28.3	161.0	9-Jun	31.5	15.1
Pryor (P)++	60.5	46.3	53.6*	60.9	34.2	167.3	16-Jun	28.7	13.2
Quantum 542 (P)	52.7	38.4	45.1	62.9	38.3	161.0	10-Jun	33.3	14.1
Rampart ^{2/}	47.4	-	-	61.2	22.5	165.7	15-Jun	31.1	15.4
Rocky (P)	57.3	43.5	48.9	63.4	41.7	163.3	12-Jun	32.8	13.8
Tiber	60.3	44.2	49.2	62.7	50.8	166.0	15-Jun	34.3	14.6
Vanguard	49.8	35.3	41.5	61.5	27.5	164.7	14-Jun	32.9	15.1
Wahoo +	59.2	48.8		62.2	43.3	161.3	10-Jun	31.8	14.2
Average	57.3	44.9	49.5	62.2	41.7	164.0	13-Jun	31.4	14.2
LSD (0.05)	5.8	8.2	6.7	0.7	10.5	1.6		2.7	
C.V.	6.3	9.0	8.2	0.7	15.5	7.4		5.3	

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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/} = Rampart not planted in 2002; Yield in 2000 = 50.4^{3/} = Severe winterkil in 2001, test not harvested.

Table 11. HARD RED WINTER : Yield (bu/a) in Winter-kill Environments, 2000-2003

Cultivar/Line	Sidney			Williston			6 Location	
	2003	2002	2000	2003	2002	2000	Yield bu/a	Winter survival %
Above (CL)++	52.6	32.1		43.6	9.4			
AP 502CL (P,CL)++	46.2			43.8				
Bighorn (P)+	62.5	40.1	66.0	62.5	26.8	55.8	51.5	51.2
BigSky ++	61.7	42.7	59.7	59.8	35.4	59.5	53.7	62.3
BZ9W96-788 (P)	53.9			48.7				
CDC Falcon (P)+	65.8	54.3**	68.8*	60.7	40.8*	64.6	59.3*	66.3
Elkhorn +	62.2	41.3	63.7	67.3*	38.8*	57.5	54.9	72.4*
Erhardt	64.3	41.9	57.5	55.8	35.5	53.6	51.7	68.0*
Expedition ++	55.5	43.1		46.9	30.5			
Gary (HWW)+^{1/}	68.5	35.1	67.5*	58.5	30.1	59.3	53.3	54.8
GM10004 (P, HWW)	54.2	38.1	61.2	49.1	22.6	54.7	45.7	46.3
Golden Spike (HWW)+^{1/}	63.8	38.0	61.8	52.8	17.2	58.3	48.8	51.2
Jagalene (P)++	62.3			54.7				
Jerry	67.3	51.9*		60.3	45.1**			
Judith	65.4	42.5	64.2	63.5	32.3	57.2	54.0	57.6
Millennium +	59.4			46.2				
Morgan (P)+	72.4*	47.4	68.4*	67.5*	40.0*	62.6	60.1*	71.0*
MT00159	78.7**	47.2		72.1**	42.8*			
MT0097	72.5*	48.0		62.4	42.4*			
MT01148	73.3*			64.9				
MT0177	69.5			57.6				
MT9982	75.1*	48.0		64.1	36.3			
MT9989	68.8	39.8		63.9	41.4*			
MTI01158	49.4			48.5				
MTR01108	65.3			57.8				
MTR9997	68.3	37.2		62.7	23.3			
MTS0031 (Genou)	61.2	32.5		59.1	22.5			
MTS0125	60.5			45.7				
MTS0131	59.1			49.8				
MTW01132	59.8			62.6				
MTW01133	69.4			59.4				
MTW01143	68.4			61.8				
MTW01146	65.2			60.6				
Neeley	69.3	44.5	69.5*	69.0*	36.0	71.3**	60.1**	58.0
Norstar	68.8	44.0	70.1*	69.6*	41.3	62.3	58.7*	78.2**
NuFrontier (P,HWW)++	58.8	36.0	61.3	48.1	23.2	62.9	48.6	52.4
NuHorizon (P,HWW)++	56.8	21.4	69.7*	45.8	10.6	51.5	42.4	37.7
NuSky (HWW)++	68.8	46.1	63.4	63.9	36.8	60.9	56.8*	67.7*
NuWest (P,HWW)+	65.0	42.3	62.0	57.0	34.2	59.6	54.0	65.2
Paul ++	69.9	45.1	72.1*	64.7	38.5*	66.7*	59.8*	60.5
Promontory ^{1/}	74.2*	41.6	65.9	63.3	30.4	58.2	56.1*	51.5
Prowers 99 +	50.7	31.3	53.8	46.4	19.1	55.2	43.2	45.8
Pryor (P)++	69.9	44.7	75.4**	60.5	32.1	68.3*	58.7*	58.2
Quantum 542 (P)	69.3	41.0	67.7*	52.7	24.0	58.8	52.1	55.4
Rampart ^{2/}	50.5	-	60.8	47.4	-	50.4		
Rocky (P)	69.6	39.8	69.1*	57.3	29.7	59.6	54.0	56.3
Tiber	61.0	39.2	67.1*	60.3	28.4	59.0	52.1	60.9
Vanguard	57.0	24.5	59.7	49.8	20.8	53.9	44.1	39.6
Wahoo +	68.3	46.1		59.2	34.3			
Average	63.9	40.7	65.1	57.3	31.0	59.3	53.1	57.9
LSD (0.05)	7.3	6.1	9.4	5.8	7.4	11.6	4.5	10.8
C.V.	6.6	9.1	8.8	6.3	15.0	11.9	7.0	16.4

** = indicates highest yielding variety within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = 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

^{2/} = Rampart not planted in 2002

Table 12. HARD WINTER WHEAT: Yield Performance under Sawfly Pressure (1997-2003)

Variety/Line	Yield (bushels per acre)												Average 13 Locs w/Rmp
	Havre 1997	Big Sandy 1997	The Knees 1997	Highwood 1997	Broadview 1997	Loma 1999	Loma 2000	Loma 2001	The Knees 2001	Ft Benton 2002	Havre 2003	N. Havre 2003	
Bighorn (P)+	49.6	40.8	37.5	55.0	25.2	37.3	34.2	10.7	20.2	31.0	31.6	49.5	35.6*
BigSky ++	45.5	46.1	44.9	52.4	29.4	39.6	38.5	11.4	18.0	31.3	27.8	45.9	
CDC Falcon (P) + Jerry										32.4	28.8	54.1	
Judith	47.7	38.4	38.2	50.6	23.9	43.7	36.1	12.4	19.5	30.3	30.5	50.3	35.6*
Morgan (P)+	49.6					40.6	37.2	10.9	21.4	30.5	25.4	56.4	
MT00159											31.2	58.8	
MT0097											31.5	48.5	
MT9982								12.0	23.4	28.3	29.3	60.3	
MT9989											30.7	53.5	
MTI01158 (IMI)											28.1	55.9	
MTR9997										32.7	31.5	55.9	
MTS0031 (Genou)										31.8	30.2	55	
Neeley	42.6	41.7	34.3	51.1	27.3	34.9	39.5	12.3	16.5	29.7	30.3	59.2	35.4*
Norstar	41.3	47.8	34.4	45.2	25.5	35.8	36.5	9.2	18.0	28.1	18.9	46.7	
NuSky (HWW) ++	52.7					35.8	27.5	13.2	19.3	32.5	28.4	55.9	
NuWest (HWW) +	49.8	41.6	43.5	48.8	26.3	32.8	34.0	8.8	20.7	31.7	22.8	58.9	35.3*
Paul ++							33.5	8.5	19.6	30.3	34.0	48.2	
Promontory + ^{1/}	43.1	33.0	34.8	55.2	20.6	35.8	39.7	9.3	16.2	34.4	30.3	56.2	34.0
Pryor (P)++											37.3	48.6	
Rampart ^{2/}	45.2	47.9	39.5	52.3	28.8	35.9	42.7	16.4	23.0	-	30.5	54.8	37.9**
Rocky (P)	50.2	43.8	41.7	55.9	24.2	33.2	47.0	13.3	21.2	37.1	29.6	51.7	37.4*
Tiber	47.1	36.9	42.8	54.5	26.4	36.7	44.9	13.1	18.3	32.6	26.9	45.0	35.7*
Vanguard	48.3	45.9	41.4	50.5	31.0	32.6	41.4	15.7	24.4	33.7	32.1	46.8	37.3*
Average	47.1	42.2	39.4	52.0	26.2	36.5	38.0	11.8	20.0	31.7	29.3	53.2	35.7
LSD (0.05)													3.0
C.V.													10.0

** = 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

2/ = Rampart not planted in 2002

Table 13. Precipitation Data for Crop Year 2002-2003 (inches)

Agricultural Research Center	Sept. 2002	Oct. 2002	Nov. 2002	Dec. 2002	Jan. 2003	Feb. 2003	Mar. 2003	Apr. 2003	May 2003	June 2003	July 2003	Aug 2003	Total
Western Triangle, Conrad	2.00	0.68	0.18	0.07	0.05	0.22	0.31	1.96	1.52	2.40	0.12	0.18	9.69
					1984-2003 Average = 11.52								
Northern, Havre	1.35	0.62	0.57	0.09	0.37	0.44	0.47	1.69	1.92	3.05	0.41	0.56	11.54
					1916-2003 Average = 11.99								
Northwestern, Kalispell	1.18	0.25	0.87	1.67	1.63	1.01	2.32	2.23	1.78	1.57	0.05	0.35	14.91
					1949-2003 Average = 19.67								
Central, Moccasin	1.63	0.62	0.06	0.31	0.62	0.44	0.56	3.68	2.25	1.84	0.40	0.56	12.97
					1909-2003 Average = 15.36								
Southern, Huntley	1.36	0.74	0.10	0.24	0.68	0.74	0.82	1.04	2.75	2.38	0.00	0.12	10.97
					1911-2002 Average = 13.18								
Northeastern, Sidney	0.41	0.05	0.40	0.47	0.16	2.37	0.55	3.68	3.23	1.42	1.56	0.27	14.57
					1949-2003 Average = 13.86								
Williston, N. Dakota	0.36	0.99	0.13	0.46	2.32			1.21	2.95	2.45	1.63	1.22	13.72
					1957-2003 Average = 14.57								
Post Farm, Bozeman	1.29	0.12	0.03	0.19	1.17	1.19	1.10	2.94	2.18	2.41	0.16	0.54	13.32
					1958-2003 Average = 16.01								

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

Variety	Coleoptile length (inches)				
	2003	2002-2003	2000//2003	1999//2003	
		2 yr	3 yr	4 yr	
Rampart	4.1**	4.4**	4.5**	4.6*	long coleoptile
Vanguard	4.0*	4.4*	4.5*	4.6**	
MTS0031 (Genou)	3.9*	4.1*			
MTS0125	3.9*				
MTS0131	3.9*				
Prowers 99 + Above (CL)++	3.8 3.7	3.9 3.8	4.0		
Tiber	3.5	3.4	3.6	3.8	
BigSky ++	3.4	3.6	3.7	3.8	
MTR9997	3.4	3.5			
Norstar	3.4	3.6	3.6	3.6	
AP 502CL (P,CL)++	3.3				
BZ9W96-788 (P)	3.3				
Quantum 542 (P)	3.3	3.4	3.5	3.6	
Elkhorn +	3.2	3.4	3.3	3.4	
Gary (HWW)+	3.2	3.3	3.2		
Neeley	3.2	3.4	3.4	3.6	
NuHorizon (P,HWW)++	3.2	3.2	3.2		
Rocky (P)	3.2	3.2	3.7	3.6	
Bighorn (P)+	3.1	3.2	3.2	3.3	
GM10004 (P, HWW)	3.1	3.1	3.3		
MT0177	3.1				
MTW01143	3.0				medium coleoptile
CDC Falcon (P)+	2.9	2.9	2.8		
Expedition ++	2.9	3.0			
Golden Spike (HWW)+	2.9	3.1	3.0		
Jerry	2.9	3.1			
MTI01158 (IMI)	2.9				
MTW01132	2.9				
MTW01146	2.9				
Jagalene (P)++	2.8				
MT0097	2.8	2.9			
MT01148	2.8				
NuFrontier (P,HWW)++	2.8	3.0	3.2		
Paul ++	2.8	3.0	2.9	3.1	
Erhardt	2.7	2.9	2.9	3.1	
MTR01108	2.7				
Promontory	2.7	2.8	2.7	2.8	
Wahoo +	2.7	2.8			
Judith	2.6	3.0	2.9	3.0	
Millennium +	2.6				short coleoptile
NuSky (HWW)++	2.6	2.8	2.8	2.9	
NuWest (P,HWW)+	2.6	2.8	2.7	2.9	
Pryor (P)++	2.6	2.9	2.9		
MT00159	2.5	2.9			
MT9982	2.5	2.9			
MT9989	2.5	2.6			
MTW01133	2.5				
Morgan (P)+	2.3	2.5	2.4	2.5	
	3.0 0.2 4.1	3.2 0.3 5.0	3.3 0.3 6.2	3.4 0.3 5.2	

** = indicates longest coleoptile within a column

CL = CLEARFIELD wheat tolerant to imidazolinone (IMI) herbicides

* = indicates varieties equal to longest coleoptile 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
Above	E	White	2	S	-	3	2	S	-	MR	-
AP 502CL	E	Brown	2	-	-	-	-	S	-	-	-
Bighorn	M	White	3	MS	-	5	3	S	MS	R	MS
BigSky	M	White	4	S	-	4	3	S	MS	R	MR
CDC Falcon	M-L	White	4	MS	-	3	3	S	-	MR	S
Elkhorn	M-L	White	4	MW	-	4	3	S	MS	R	MR
Erhardt	M	White	4	MS	MS	4	4	S	S	R	R
Expedition	E	White	3	S	-	5	3	S	-	R	-
Gary	M-L	White	3	MW	-	3	2	R	MR	S	M
Genou(MTS0031)	M	White	2	MS	-	4	4	S	-	-	-
Golden Spike	M	Brown	3	M	-	3	3	R	S	S	M
Jagalene	E	White	2	-	-	-	-	S	-	-	-
Jerry	M-L	White	5	MS	-	3	3	S	-	R	MR
Judith	M-E	White	3	S	M	4	5	S	VS	R	MS
Millennium	E	White	2	M	-	-	-	S	-	MR	-
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
NuFrontier	E	White	3	S	-	3	2	S	-	R	S
NuHorizon	E	White	3	S	-	3	3	S	-	R	MS
NuSky	M	White	4	M	R	5	4	S	MS	R	MR
NuWest	M	White	4	S	R	5	4	S	MS	R	MR
Paul	M	White	4	M	-	4	4	S	S	R	MS
Promontory	E	Brown	2	MS	-	5	4	R	R	S	MS
Prowers 99	M	White	3	M	-	4	3	S	-	M	M
Pryor	M-L	White	3	S	-	3	3	S	-	S	MR
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
Rocky	E	White	2	MW	S	3	3	S	S	R	S
Tiber	M	Brown	3	S	VR	3	3	S	VS	S	MR
Vanguard	M	White	2	MS	M	4	4	S	S	S	S
Wahoo	E	White	3	S	-	3	2	S	-	R	-

1/ E = Early; M = Medium, L = Late classification of AP 502CL, Jagalene, and Millennium based on limited data

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

3/ W = Weak

4/ VR = Very Resistant

5/ 5 = Superior

MW = Medium Weak

R = Resistant

4

M = Medium

MR = Moderately Resistant

3

MS = Medium Strong

M = Moderate

2

S = Strong

MS = Moderately Susceptible

1 = Inferior

S = Susceptible

- = no information

Table 16. List of soft white winter wheat varieties.

Cultivar	Origin	Release Year	Pedigree
Public Varieties			
Bruehl (SWW Club)	Washington	1999	UNA (NS 1971)/3/Oasis//WA6362/WA6242/4/Tres/Eltan
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)

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)

Cultivar/Line	Grain Yield (bushels/acre)				2003 Data				
	2003	2002-2003	2001-2003	2000-2003	Test weight lb/bu	Heading Date		Plant height in	Protein %
						Julian	Calendar		
		2 yr	3 yr	4 yr					
Bruehl (Club) +	60.1	92.7	86.7		54.5	162.7	12-Jun	25.3	12.3
Cashup (P) +	58.3	85.6	78.7	86.6	58.1	156.7	6-Jun	25.6	12.5
Daws	69.1	92.7	81.1	90.7	58.0	154.0	3-Jun	25.2	12.3
R Eltan	71.3	101.9*	92.3*	101.2**	55.2	162.3	11-Jun	26.8	13.0
R Hill 81	65.0	95.1	83.0	93.0	56.0	159.7	9-Jun	27.4	13.8
Kmor	65.2	94.9	88.2	94.4	53.3	158.7	8-Jun	26.4	13.4
KW960195p 7005 (P)	59.8	88.9			59.4	153.3	2-Jun	24.0	13.2
Lambert	60.1	92.6	83.3	96.9*	58.6	155.0	4-Jun	27.6	13.0
R Lewjain	67.5	97.0*	89.6*	96.9*	56.4	162.3	11-Jun	25.1	12.1
MAC-1 (P) +	70.8	99.4*	86.8	96.3	57.5	156.3	5-Jun	28.4	12.7
MacVicar	70.2	94.7	84.7	93.1	57.6	156.7	6-Jun	26.4	11.7
Madsen	65.7	91.1	82.6	90.9	57.0	157.3	6-Jun	24.9	12.8
R Malcolm	73.1	93.7	83.8	92.4	55.6	156.0	5-Jun	26.5	13.1
Neeley (HRW)	76.3	101.8*	89.2*	95.4	60.1	154.3	3-Jun	31.5	13.5
Rod	70.2	95.6*	89.7*	99.6*	51.9	160.0	9-Jun	25.7	12.4
Stephens	70.4	102.2**	94.1**	95.0	57.1	157.3	6-Jun	26.0	11.7
Average	67.1	95.0	86.3	94.5	56.6	157.7	7-Jun	26.4	12.7
LSD (0.05)	ns	6.6	5.2	4.6		1.6		2.4	
C.V.	10.0	6.0	6.5	6.0		0.6		5.4	

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

Cultivar/Line	Grain Yield (bushels/acre)				2003 Data				
	2003	2002-2003	2001-2003	2000-2003	Test weight lb/bu	Heading Date		Plant height in	Protein %
						Julian	Calendar		
Bruehl (Club) +	91.2	86.5	94.4		50.8	174.7	24-Jun	33.6	13.3
Cashup (P) +	86.2	80.0	85.3	89.5	54.4	170.0	19-Jun	30.6	11.8
Daws	91.9	84.2	87.5	91.5	56.9	169.7	19-Jun	31.8	12.0
R Eltan	106.1**	95.0**	101.2**	107.0**	56.7	174.3	23-Jun	34.9	11.6
R Hill 81	85.4	85.1	88.4	94.2	55.2	172.3	21-Jun	35.3	14.0
Kmor	90.9	85.7	91.2	96.4	52.1	172.0	21-Jun	33.3	12.8
KW960195p 7005 (P)	92.1	92.6*			57.0	167.3	16-Jun	30.7	13.0
Lambert	92.2	89.0*	90.1	96.3	54.6	168.7	18-Jun	35.8	13.1
Lewjain	86.6	82.3	87.0	93.2	54.0	174.7	24-Jun	31.5	13.8
MAC-1 (P) +	100.3*	92.8*	96.1*	101.9	56.8	169.3	18-Jun	37.0	13.5
MacVicar	84.7	83.3	89.2	94.7	51.9	169.7	19-Jun	33.0	13.3
Madsen	86.6	85.0	89.6	94.8	54.4	172.0	21-Jun	33.9	14.0
R Malcolm	86.6	84.4	88.7	95.7	53.1	168.3	17-Jun	32.2	13.0
Neeley (HRW)	92.1	89.5*	94.2	99.3	59.7	168.7	18-Jun	37.5	13.6
Rod	93.1	89.0*	93.6	99.4	53.2	172.0	21-Jun	31.5	12.7
Stephens	88.5	83.1	88.0	94.5	54.7	174.3	23-Jun	34.2	13.4
Average	90.9	86.7	91.0	96.3	54.7	171.1	20-Jun	33.5	13.1
LSD (0.05)	10.8	6.8	5.6	4.5	1.5	1.8		1.9	
C.V.	7.1	6.8	6.6	5.8	1.6	0.6		3.4	

** = 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 19. SOFT WHITE WINTER WHEAT: Moccasin - Dryland

Cultivar/Line	Grain Yield (bushels/acre) ^{1/}			2003 Data				
	2003	2002-2003	2001-2003	Test weight lb/bu	Heading Date		Plant height in	Protein %
					Julian	Calendar		
		2 yr	3 yr					
Bruehl (Club) +	32.1	38.1	42.6	43.9	174.0	23-Jun	30.3	18.8
Cashup (P) +	33.2	40.6	42.7	46.7	171.5	21-Jun	31.7	17.5
Daws	39.1	45.7	46.9	47.5	171.5	21-Jun	33.0	16.7
Eltan	36.1	42.7	47.6	46.1	174.0	23-Jun	34.3	19.1
Hill 81	39.9	43.9	45.8	49.1	173.0	22-Jun	35.7	17.8
Kmor	41.3	44.4	46.1	48.5	172.5	22-Jun	31.0	16.2
KW960195p 7005 (P)	48.9	46.3		49.4	168.5	18-Jun	31.7	17.7
Lambert	36.4	44.2	46.5	46.4	169.5	19-Jun	37.0	16.8
Lewjain	37.7	41.7	46.2	47.5	174.0	23-Jun	31.3	18.0
MAC-1 (P) +	36.4	40.9	42.7	50.2	170.5	20-Jun	36.3	16.9
MacVicar	38.4	43.5	44.7	48.0	172.0	21-Jun	30.7	17.1
Madsen	38.6	43.8	45.4	47.7	171.0	20-Jun	34.3	17.9
Malcolm	31.0	39.7	43.1	48.8	170.5	20-Jun	33.7	17.4
Neeley (HRW)	37.1	44.3	48.4	51.9	171.0	20-Jun	39.3	17.0
Rod	36.1	42.9	44.7	48.7	171.5	21-Jun	29.0	15.9
Stephens	31.4	40.5	44.0	48.4	172.5	22-Jun	32.3	15.7
Average	36.7	42.7	45.2	48.1	171.7	21-Jun	33.2	17.3
LSD (0.05)	ns	ns	ns	3.5	2.3		3.5	
C.V.	13.9	9.6	9.5	4.4	0.6		6.4	

** = indicates highest yielding variety within a column

ns = no significant differences among varieties

* = 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/} = 2000 Crop destroyed by hail

Table 20. 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
Bruehl (Club) +	L	-	-	-	R	MS	R
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

(P) = Private Variety; + = Protected Variety

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

2/ 5 = Best Winter survival (over several years at Moccasin)

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 2004 Bulletin:

AP 502CL – a CLEARFIELD (CL) wheat with imidazolinone tolerance, developed by AgriPro Seeds in 2001. AP 502CL is an awned, brown-chaffed, early maturing, semidwarf hard red winter wheat. In Montana tests, in 2003, AP 502CL had average yields across all locations except Sidney and Williston where low winterhardiness put this variety at the bottom. It had below average test weight and average protein. 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. Additionally, the CLEARFIELD gene is patented.

Genou (MTS0031) – a solid-stem hard red winter wheat with improved yield potential and cold tolerance relative to Rampart. Stem solidness is relatively good, although not as good as Rampart. Test weight, maturity, plant height, grain protein, and end-use qualities are similar to those of Rampart and Vanguard. Foundation seed will be available in fall of 2004. Genou (French for knee) is named after a school house in The Knees area of Chouteau County. PVP, Title V will be applied for.

Jagalene – an awned, white-chaffed, early maturing, semidwarf hard red winter wheat developed by AgriPro Seeds in 2002. In Montana tests, in 2003, Jagalene had high yield, high test weight, and average protein. Winter hardiness of Jagalene was less than Rocky. PVP, Title V will be applied for.

Millennium – a hard red winter wheat developed cooperatively by the Nebraska Agricultural Experiment Station and USDA-ARS and released in 2000 by the developing institutions and the South Dakota Agricultural Experiment Station. It is an awned, white-glumed cultivar with early maturity and average plant height under Montana conditions. In Montana tests, in 2003, Millennium had above average yield, above average test weight, and average protein. Winter hardiness of Millennium was less than Rocky. Millennium is moderately resistant to stem rust and leaf rust and has exhibited a low level of tolerance to wheat streak mosaic virus. Nebraska has determined that

the overall end-use characteristics for Millennium should be acceptable to the milling and baking industries. 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:

Above – a CLEARFIELD (CL) wheat with imidazolinone tolerance, developed by the Colorado Agricultural Experiment Station in 2001. Above is an awned, white-chaffed, early maturing, semidwarf hard red winter wheat. It has good straw strength. In Montana tests, in 2002, Above had below average yield at all locations except Bozeman, while in 2003, it was an average variety across the 8 locations tested. It had low winter survival. Above has average test weight and below average protein. Above is resistant to stem rust, susceptible to leaf rust and moderately susceptible to both wheat streak mosaic virus and barley yellow dwarf virus. Above had average milling results and poor baking from samples in the 2002 tests. 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. Additionally, the CLEARFIELD gene is patented.

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 was 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.

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. It is rated as having acceptable milling and baking quality. This variety is protected under the Plant Variety Protection Act.

Elkorn - released by the North Dakota Agricultural Experiment Station in 1995. It is a hard red winter wheat. Elkorn is an awned, white chaffed, tall variety, with a lax, tapering spike. Elkorn 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 Elkorn 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.

Expedition – hard red winter wheat released by the South Dakota Agricultural Experiment Station in 2002. Expedition is an early maturing variety with white chaff color and good winter hardiness. It had average yield, above average test weight, short stature and average protein in Montana testing. According to South Dakota St. Univ. it has fair lodging and excellent baking quality. PVP, Title V is pending

Gary – hard white winter wheat was released in 2001 by the Idaho Agricultural Experiment Station. Gary is a semidwarf with white chaff, medium to late maturity, and medium to weak straw strength. Yields are above average across Montana testing sites, but with lower than average test weight and protein. Gary is highly resistant to dwarf bunt, has adult plant resistance to stripe rust, moderate tolerance to snow mold and susceptible to stem rust. Gary has average milling and only fair baking

characteristics, with lower than average loaf volume. PVP, Title V is pending

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. Golden Spike is licensed to General Mills for production outside Utah.

Jerry – hard red winter wheat released by North Dakota State University in 2001. It is white-chaffed and awned and similar in maturity to Roughrider. Jerry has good winter hardiness and is a top yielder in areas where winterkill can occur. Jerry has average test weight and protein under Montana conditions. It has good resistance to prevalent races of stem and leaf rust. Mixing properties and baking performance are equal to Roughrider.

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.

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.

NuFrontier – hard white winter wheat marketed by General Mills, released in 2001. Average yielding variety with excellent test weight, but low protein under Montana conditions. NuFrontier is early maturing, short, with good straw strength. Limited quality data shows average milling and fair baking characteristics, with lower than average loaf volume. PVP, Title V is pending

NuHorizon - hard white winter wheat marketed by General Mills, released in 2001. Average yielding variety with excellent test weight, but low protein under Montana conditions. NuHorizon is early maturing, short, with good straw strength. Limited quality data shows good milling, with above average flour extraction and average baking characteristics. PVP, Title V is pending

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.

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.

Paul – a hollow-stemmed, winter-hardy, high quality hard red winter wheat with yield potential similar to Judith and Neeley. Has improved winter hardiness and baking quality relative to Neeley. Test weight of Paul is low but slightly higher than that of Judith. Paul is of medium to late maturity, relatively short, with straw strength similar to Neeley. Paul is resistant to stem rust, but susceptible to leaf and stripe rust. Foundation seed was available in fall of 2003. ‘Paul’ is named in honor of Paul L. Brown’s long-term contributions to Montana dryland agriculture. PVP, Title V will be applied for.

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.

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.

Pryor (BZ9W96-919) – hard red winter wheat released by Western Plant Breeders in 2002. Pryor is a white chaffed, awned variety with short stature and medium winter hardiness. Good yielding

variety with average test weight and below average protein. It is susceptible to stem rust and moderately resistant to leaf spot complex. Pryor has average milling and baking characteristics.

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.

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.

Wahoo – hard red winter wheat released jointly by Nebraska and Wyoming in 2000. Wahoo is a semidwarf, early maturing white chaffed variety. It has above average yield, below average test weight, and average protein under Montana conditions. Wahoo is moderately resistant to stem rust and leaf rust and susceptible to wheat streak and barley yellow dwarf viruses. Milling and baking characteristics are acceptable. 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.

Soft White Winter Wheat

Bruehl – club type soft white winter wheat developed by Washington State University and released in 1999. Semi-dwarf, awned, late season maturity. Superior yield to Eltan, especially under snow mold pressure. Test weights similar to Eltan. Good resistance to snow mold and stripe rust. Moderately susceptible to leaf rust, stem rust, Cephalosporium stripe, and eyespot.

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.

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.

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.

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.

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.

Publication reviewed and/or data supplied by the following Montana research staff:

Mr. Jim Berg, Research Associate, Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, Montana.

Dr. Phil Bruckner, Associate Professor, Winter Wheat Breeding, Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, Montana.

Mr. Gregg Carlson, Associate Professor of Agronomy, Northern Agricultural Research Center, Havre, Montana.

Dr. Joyce Eckhoff, Associate Professor of Agronomy, Eastern Agricultural Research Center, Sidney, Montana.

Dr. Bill Grey, Adjunct Assistant Professor and Montana Foundation Seed Stocks Manager, Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, Montana.

Mr. Robert Johnston, Research Associate, Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, Montana.

Dr. Ken Kephart, Superintendent and Associate Professor of Agronomy, Southern Agricultural Research Center, Huntley, Montana

Dr. Gregory D. Kushnak, Superintendent and Associate Professor of Agronomy, Western Triangle Research Center, Conrad, Montana.

Mr. Ron Larson, Manager, Montana Seed Growers Association, Montana State University, Bozeman, Montana.

Ms. Deanna Nash, Cereal Quality Laboratory Manager, Plant Sciences and Plant Pathology Department, Montana State University, Bozeman, Montana.

Mr. Neal Riveland, Agronomist, Williston Research and Extension Center, North Dakota State University, Williston, ND

Dr. Robert Stougaard, Assistant Professor of Weed Science, Northwestern Agricultural Research Center, Kalispell, Montana.

Mr. Dave Wichman, Superintendent and Assistant Professor of Agronomy, Central Agricultural Research Center, Moccasin, Montana.

Note: Information in this article is available on the web at:

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