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of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

2004

Submitted by

Dr. Gregory D. Kushnak, Superintendent & Crop Scientist

and

Dr. Grant D. Jackson, Soil Scientist

Montana State University

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Soils Research

Summary of climatic data by month for the '03-'04 crop year (September - August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (19 yr)	Current Year	Average (19 yr)
September, 2003	1.01	1.08	55.9	57.4
October, 2003	1.15	0.54	49.2	45.4
November, 2003	0.25	0.35	25.4	31.8
December, 2003	0.17	0.16	28.5	24.9
January, 2004	0.25	0.19	18.0	23.0
February, 2004	0.03	0.21	26.8	24.7
March, 2004	0.08	0.44	36.7	33.3
April, 2004	0.53	0.89	45.8	43.8
May, 2004	2.99	1.83	47.3	52.4
June, 2004	1.83	2.84	56.2	59.9
July, 2004	0.58	1.47	66.2	66.5
August, 2004	1.99	1.30	64.0	66.4
Total	10.86	--	--	--
Average	--	11.30	43.3	44.1

Last killing frost in Spring

2004---------- May 15 (25°F)
Average---------- May 18

First killing frost in Fall

2004---------- Oct 2 (26°F)
Average---------- Sept. 23

Frost free period (days)

2004---------- 139
Average---------- 129

Maximum summer temperature------- 97°F (July 19, 2004)

Minimum winter temperature------- -23°F (Jan 27, 2004)

2004 Winter Wheat Variety Evaluations in the Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak, Conrad, MT; and Dr. Phil Bruckner, MSU Plant Science Dept.

Winter wheat variety trials were grown on station at Conrad, and off-station at the Knees area east of Brady. The Conrad trials were planted on reduced-tillage fallow, and the Knees trial was no-till planted on chemical fallow.

Results: Data for 2004 are presented in Tables 1 and 2 for Conrad, and the Knees location in Tables 3 and 4. Winter injury at Conrad was evident in most of the less hardy lines, favoring the more hardy lines in the yield ranking.

At the Knees, 'Rocky' had the highest average yield and test weight (Table 4). 'Genou', a new sawfly resistant variety, averaged 2 bu/acre higher than sawfly-resistant 'Vanguard'. Genou had good stem solidness, although not quite as solid as Rampart. Winterhardiness of Genou has been slightly higher than Vanguard and Rampart, and similar to Rocky. Test weight and percent protein of Genou were above average. At Conrad, yield of Genou was 4 bu/acre higher than for Vanguard (Table 2).

In the hard white varieties, 'NuHorizon' had the highest yield and test weight. 'NuSky' had above average yield and protein (Table 2).

Detailed descriptions of most of the varieties tested are included in Extension Bulletin 1098 "Performance Summary of Winter Wheat Varieties in Montana", available at County Agent Offices. Additional observations concerning the varieties are presented in the following pages.

Winter Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

Winterhardiness ratings: 5 = very good; 1 = poor.
Coleoptile length: Long = 3.4" or more; Short = 3" or less.

Above (CO, 2001): IMI resistant (imazamox or 'Beyond' herbicide), as part of American Cyanimid's Clearfield System. 'Beyond' controls cheatgrass, goatgrass and wild oats. (MSU has IMI resistant lines of Tiber, Rampart, Big Sky and NuWest currently being evaluated). 'Above' has stiff straw, medium coleoptile, WH=2, early maturity, medium yield and protein, poor quality.

AP502 CL (AgriPro, 2001): Clearfield system IMI resistant. Semidwarf height, early maturity. Low yield & test weight. Medium protein.

Archer (NAPB): Winterhardiness less than Centurk, but greater than Vona (probably should classify as a 2). Not widely adapted for Montana. Short straw and good lodging resistance. Early maturity. Good shatter resistance. Sometimes can have test weight problems due to its massive tillering. Low protein.

Big Sky (MT9432, 2001): Nuwest/Tiber cross, hard red kernels, white chaff. Good winterhardiness (4), greater than Judith, and equal or slightly better than Tiber, and slightly less than Morgan. Strong, stiff straw, very good lodging resistance, height equal to Tiber. Long coleoptile. Medium maturity, heading 1-2 days later than Rocky, but 2 days earlier than Neeley, Tiber and Morgan. Yield about equal to Rocky and Neeley, and 2-3 bu higher than Tiber. High test wt and protein, protein = Tiber. Post-harvest seed dormancy is high, like Tiber. Septoria and tan spot resistance is good. A good alternative to Tiber.

Bighorn (WPB, 1985): Winterhardiness somewhat tender in Triangle area tests, but others rate it a 3. Short straw, medium stiff. Medium coleoptile. Medium maturity. Susceptible to stem rust but resistant to dwarf smut. Above average yield. Protein is medium.

Elkhorn (ND, 1994): Good winter hardiness (4). Medium height and medium-weak straw strength. Long coleoptile. Medium-late maturity. Low yield. Above average protein. Recommended only for eastern Montana, not competitive in other areas. Average quality.

Erhardt (MT8719, MSU, 1996): White chaff. Good winterhardiness (4), equal to Roughrider. Five inches shorter than Roughrider and 3 inches shorter than Rocky. Strong straw, much better lodging resistance than Roughrider, and somewhat better than Rocky & Neeley, but not as strong as McGuire or Tiber. Medium coleoptile. Medium maturity, 2 days later than Judith & Rocky, one day earlier than Tiber, 2 days earlier than Neeley. Resistant to stem rust & leaf spot complex. Susceptible to WSMV, stripe rust, dwarf bunt, RWA & sawfly. Hetero (mixed) resist to GP Hessian fly. Yield 19% higher than Roughrider, and 5% lower than Tiber, Neeley & Rocky unless the latter three suffer winter injury. Moderately suscept to shatter. Higher test wt than Roughrider, Judith & Neeley, and similar to Tiber & Rocky. High protein (similar to Redwin) & excellent quality. Intended to replace Roughrider in NE Montana.

Expedition (SD, 2002): Winterhardiness 3. Semidwarf, stiff straw, medium coleoptile. Early maturity. Average yield & test weight. Average protein & good quality.

Falcon (CDC, WPB, Sask. 1999): Good winterhardiness (4), similar to Morgan and greater than Tiber. Semidwarf, medium-stiff straw 4" shorter than Rocky. Short coleoptile. The first true winterhardy semidwarf available for irrigated conditions in Montana. Heading 1 day later than Rocky, 2 days earlier than Neeley & Tiber. Average to above average yield on dryland, good performance for irrigated or high rainfall conditions. Test wt =Neeley, and 2# less than Rocky. Protein similar to Rocky & Neeley, and 1% less than Tiber.

Fidel (Amer Cyanamid). IMI herbicide resistant (see 'Above').

Genou (MTS 0031, MSU 2004): Sawfly resistant. Stem solidness is relatively good, although not as solid as Rampart; and may be more sensitive to environmental factors than that of Rampart. Sawfly resistance comparison (max rating = 25): Rampart = 22, Genou = 20. Winterhardiness higher than Vanguard and Rampart, equal to Rocky, and less than Neeley and Tiber. Height similar to Vanguard, 2" shorter than Rocky, and 3" shorter than Tiber. Long coleoptile. Maturity half-day earlier than Vanguard, one day later than Rocky, one day earlier than Tiber. Yield 5-10% (2-3 bu) higher than Vanguard & Rampart, 3 bu less than Tiber, 4.5 bu less than Rocky. Test weight equal to Vanguard, 1.5 lb less than Tiber and Rocky. Protein is high and equal to Vanguard & Big Sky, 0.5% higher than Tiber, 1.0% higher than Rocky & Neeley.

Jagalene (AgriPro, 2002): Winterhardiness=2 or less. Semidwarf, stiff straw, medium coleoptile. Early maturity. Shatter resistant. Yield above avg, slightly less than Rocky. High test weight. Avg protein and good milling quality.

Jerry (ND, 2001): Winterhardiness high (5). Medium-stiff straw, medium coleoptile. Medium-late maturity. Yield is average, except in winterkill areas where it's above average. Average protein.

Judith (MT 8039, MSU, 1989): Winterhardiness = 3, higher than Rocky. Low vernalization requirement. Medium short straw; straw less stiff than Neeley, Tiber and Redwin; but stiffer than Rocky. Medium-short coleoptile. Heading slightly later than Rocky, but earlier than Tiber. Stripe and stem rust resistant. Yields fair to good, sometimes equal to Rocky and Tiber. Medium shatter resistance. Test weight is sometimes low, and may be a problem. Judith represents the lower limit for test weight check. Protein is medium, equal to Tiber. Average quality.

Ledger (WestBred, 2005). BZ9W96-788. Winterhardiness = 4. Semidwarf height, 4" less than Rocky. Medium coleoptile. Early heading, 1 day later than Rocky. Above avg yield & test wt. Avg protein. Partial sawfly tolerance.

Millenium (Nebr, 1999): Winterhardiness = 2 or less. Height slightly shorter than Rocky. Short coleoptile. Early heading, average yield. Below average protein.

Morgan (Sask & WPB, S89-142, 1996): Norstar/Archer. Excellent winterhardiness (5). Semidwarf , medium-stiff straw, 2-3" shorter than Rocky. Very short coleoptile. Three days later to head and slightly later maturity than Rocky; heading similar to Neeley. Average yield. Test wt 1 lb less than Rocky or Tiber. Protein equal or slightly higher than Rocky, similar to Neeley, and about 1% less than Tiber and Rampart. Milling and baking acceptable, about equal to Neeley. Recommended for areas needing high levels of winterhardiness.

MT1159CL (WestBred, MSU MTCL01159, 2004): Clearfield system IMI resistant. (Resistance to imazamox or 'Beyond' herbicide, which controls cheatgrass, goatgrass and wild oats). Crop tolerance to Beyond herbicide is equal or superior to 'Above' winter wheat, and approved by BASF. Winterhardiness is marginal, similar to Promontory and Rampart, and production should be restricted to areas where winterkill risk is moderate. Semidwarf height and good lodging resistance. Long coleoptile. Medium maturity, 2 days earlier than Neeley, and 5 days later than Above. Low yield and below average test weight. Protein level is acceptable. Milling and baking quality is marginal, but better than the cultivar 'Above'. Useful in the short term as a weed management tool in problem fields.

Neeley (Idaho, 1980): Winterhardiness medium (3). Medium short straw, slightly less stiff than Tiber. Medium coleoptile. Medium-late maturity, making it highly vulnerable to sawfly. Susceptible to stem rust. Very high yielder in good years, but does poor if stressed for moisture. Good shatter resistance. Protein & quality are erratic, ranging from low to high; apparently more sensitive to Nitrogen deficiency.

Norstar (Canada, 1977): Maximum Winterhardiness (5). Very tall straw, poor lodging resistance. Long coleoptile. Late maturity. Susceptible to leaf spot. Low yield. Medium shatter resistance. Protein medium-low. Average quality.

Paul (MT 9426, MSU, 2003): Winterhardiness = 4. Height 2" shorter than Neeley, 3" shorter than Tiber & Big Sky. Medium-stiff straw. Medium coleoptile length, shorter than Tiber & Big Sky. Heading 0.5 day earlier than Neeley, Tiber & Big Sky. Yield similar to Neeley, and slightly higher than Tiber & Big Sky. Test weight similar to Neeley, and 1 pound lower than Tiber & Big Sky. Protein equal to Neeley, 0.5% less than Tiber, and 1% less than Big Sky.

Promontory (Utah, 1990): Red head. Winter hardiness poor (2 or less). Medium short, strong straw, good lodging resistance. Short coleoptile. Medium-late maturity. Excellent stripe rust & dwarf smut resistance; susceptible to stem rust. Below average yield and above average test weight. Protein medium low.

Pryor (WPB, 2002): (BZ9w96-919): Winterhardiness 3 = Neeley. Short stiff straw, 4" shorter than Neeley. Medium coleoptile. Medium late maturity similar to Neeley & Tiber, 3 days later than Rocky. Average to above average yield. Below average test weight. Below average protein, good quality. Intended mainly for Central Montana as a replacement for Neeley.

Quantum 542 (WPB/Hybritech): An F_1 hybrid; needs new seed each year. Planting F_2 (second generation) seed may result in yield reduction and developement of ergot due to sterility in a small percentage of florets (ms ratio less than 3:1). F_1 vs F_2 tests in 1992 indicated a 12% yield reduction from planting 2nd generation seed. Winterhardiness is fairly good (3), but less than Winalta. Medium short height, but taller than 547, giving an advantage in dry conditions. Lodging resistance equal to Rocky. Med-long coleoptile. Early maturity like Rocky. Susceptible to stem rust. Medium shatter resistance. High yield. Below average protein.

Rampart (MTS92042, MSU, 1996): Sawfly resistant (sister line to Vanguard). Red chaff, upright head. May have some improvements over Vanguard for yield, stem solidness, and quality. Equal or marginally better winterhardiness than Vanguard (2) but slightly less than Rocky. Should not be grown in areas where high levels of winterhardiness are needed, unless protected by stubble. Height 1 inch shorter than Judith & Neeley, med-stiff straw. Very long coleoptile. Matures 1 day later than Judith & Rocky, 2 days earlier than Neeley. Some resistance to stem rust, and some tolerance to wheat streak mv. Medium shatter resistance. Yield is below average, but is above average under heavy sawfly conditions. Does not seem as prone to shatter as Vanguard. Good test weight, protein and quality.

Rocky (Agripro, 1978): A selection from Centurk for soil borne mosaic resistance. Medium low winterhardiness (2), less than Redwin and Tiber. Medium stiff straw, medium height. Long coleoptile. Early maturity, which sometimes allows escape from sawfly. High yield. Very susceptible to yellow berry expression under low nitrogen conditions. Rocky is lower quality than Centurk. Medium protein.

Tiber (MSU, 1988): Dark Red head, (darker than redwin); blackish red in years of favorable moisture. This trait makes Tiber popular for wheat weaving and other crafts. Winterhardiness = 3. Medium height with good lodging resistance. Stiff straw, which may cause it to thresh a little harder than weaker-strawed varieties. Tiber straw seems to persist longer after tillage, thus may enhance conservation compliance. Med-long coleoptile. Very resistant to sprouting, causing some dormancy problems. Medium maturity, but late enough to be sawfly vulnerable. Susceptible to stem rust. Very resistant to shatter. Below average yield. Protein is above average. Good milling and baking quality. See Big Sky for alternative.

Vanguard (MTSE2238) (MSU, 1995): Sawfly resistant. (Lew/Tiber//Redwin cross). Good stem solidness. White chaff, nodding head. Winterhardiness slightly less than Rocky (2, marginal to poor). Straw slightly stiffer and 1 inch shorter than Rocky, but moderately susceptible to lodging under high-yield conditions. Heterogeneous for height. Long coleoptile. Medium head date, 1 day later than Rocky, 3 days earlier than Neeley. Good wheat streak mv tolerance. Susceptible to stem & stripe rust. Yield is above average; but under heavy sawfly infestation, yield is above average. Medium shatter resistance. Good test weight. Protein high; quality adequate. Not a satisfactory variety for non-sawfly areas, and should not be grown where high levels of winterhardiness are needed unless protected by stubble.

Wahoo (Nebr & Wyo, 2000): Winterhardiness = 3. Semidwarf, 2" shorter than Rocky, stiff straw. Medium coleoptile. Early maturity. High yield. Average test weight & protein, acceptable quality.

Hard White Winter Wheat

Gary (Idaho 550, 2001): Hard white. Winterhardiness 3. Semidwarf, med-weak straw. Med-late maturity. High yield, low test wt & protein.

Golden Spike (UT, Gen Mills, 1998): Hard white. Winterhardiness 3. Height similar to Rocky, med-stiff straw. Medium coleoptile. Medium maturity. Below average yield. Low test weight & protein.

NuFrontier (Gen Mills, 2001): Hard white. Winterhardiness 3. Stiff straw, medium coleoptile. Early maturity. Above average yield and test wt, low protein.

NuPlains (Nebr, Gen Mills, 1998): Hard white. Winterhardiness 2-3. Stiff straw, 5" shorter than Rocky, Medium coleoptile. Medium maturity. Yield slightly lower than Nuwest. High test wt & protein.

NuHorizon (Gen Mills, 2001): Hard white. Winterhardiness 2-3. Stiff straw, medium coleoptile. Early maturity. Above average yield. High test weight, low protein.

Nuwest (MT 7811) (MSU, General Mills, 1994): Hard white winter wheat for specialty markets. Dual purpose, noodle and bread. Winterhardiness = 4, slightly more than Tiber. 1 or 2 inches shorter than Rocky. Stiffer strawed than Neeley & Rocky. Very short coleoptile, 30% shorter than Rocky & Neeley. Two days later than Rocky, 3 days earlier than Neeley. Resistant to stem rust but susceptible to stripe rust, dwarf bunt, and WSMV. Susceptible to sawfly, RWA, and Hessian fly. Average yield and well adapted to Montana. Medium test weight and protein. Good resistance to preharvest sprouting – Many hard whites tend to sprout as they lack the polyphenolic cpds that occur in the bran of red wheat. But sprouting is usually not a problem for hard whites in Montana (In 1993, everything sprouted - red or white). Contains 1 red kernal/1000. Protein medium to high, about 0.5% less than Redwin. Good quality.

NuSky (MTW 9441) (MSU, 2001): Nuwest/Tiber, hard white. (Sister line to the hard red var BigSky). Good dual purpose quality for noodles & bread. Winterhardiness 4, slightly greater than Tiber. Height and straw strength similar to Nuwest & Rocky, med-stiff. Short coleoptile. Heading similar to Nuwest, Tiber & Neeley; and 3 days later than Rocky. Shatter resistant. Average yield. Test weight similar to Nuwest, and higher than Neeley. Medium to high protein. Quality similar to Nuwest. High level of post-harvest dormancy (similar to Tiber), and thus does not have the sprouting problems common to other hard white wheats. NuSky is a public release.

Table 1. 2004 Intrastate Winter Wheat Test (Exp. 3518): Conrad

Cultivar/Line	Yield bu/ac	Test weight lb/bu	Winter survival %	Heading date Julian	Plant height in	Protein %
MT02113	82.4	61.6	54	168	38	11.3
BigSky	78.6	63.0	62	170	43	12.2
MTW02111 (HWW)	78.3	61.3	54	174	38	11.4
MT0097	77.4	62.7	61	171	40	12.7
Ledger BZ9W96-788	77.2	63.8	50	168	36	11.9
Millenium	76.9	63.6	57	166	41	12.3
MT9982-65	76.9	61.8	49	170	41	12.1
NuHorizon (HWW)	76.7	65.1	58	165	33	12.2
Rocky	76.3	63.7	57	167	45	11.0
Quantum 542	75.3	63.3	45	168	43	11.6
MT01148	75.3	62.7	63	172	41	11.6
Expedition	74.7	63.4	60	165	37	12.0
MT9982-53	74.6	60.9	47	175	38	12.2
NuWest (HWW)	72.8	60.2	48	170	40	11.5
MTW01133	72.1	61.7	52	166	33	12.0
CDC Falcon	72.0	63.7	60	168	35	12.7
NuFrontier (HWW)	71.9	64.2	49	165	35	12.0
Bighorn	71.7	61.8	54	169	35	12.4
Neeley	71.7	62.8	54	172	41	12.1
Paul	71.7	61.3	59	171	37	11.3
MT00159	71.4	60.6	45	172	41	12.8
Wahoo	71.2	62.4	70	167	34	12.9
Jerry	70.9	62.5	58	169	45	12.4
Pryor (BZ9w96-919)	70.8	61.4	56	171	36	11.9
Judith	70.3	61.4	58	168	40	12.5
MT02136	70.2	60.0	51	169	37	11.4
Genou (MTS0031) ++	69.9	62.7	51	172	40	12.8
NuSky (HWW)	69.8	61.0	49	172	42	12.2
Morgan	69.3	62.6	63	173	41	11.4
Jagalene	69.0	64.9	51	166	33	13.2
Above (IMI)	68.7	62.7	55	164	32	12.8
MTW01143	68.6	62.0	58	173	40	12.2
Promontory	67.9	63.2	46	168	35	12.8
Golden Spike (HWW)	66.8	61.1	51	174	38	11.6
WA7936 (HWW)	66.6	56.3	45	172	37	11.4
MT0245	66.1	62.4	58	170	37	12.7
Vanguard ++	65.8	62.7	53	169	43	12.7
MT0277	65.7	61.4	45	167	39	12.0
MT0177	65.4	61.9	54	169	39	12.8
MTS0222	65.2	61.8	45	167	37	14.1
Tiber	64.9	62.0	53	171	45	13.1
MTW02115 (HWW)	64.6	62.9	59	170	40	12.1
WA7939	63.3	55.1	46	175	37	11.6
MTS0023-58	63.2	60.1	40	173	45	12.4
Rampart ++	62.9	62.5	52	169	40	14.2
GM10004 (bz9w797761)	61.5	61.7	51	168	41	12.4
MTCL01159 (IMI)	60.3	59.4	44	169	36	13.2
Elkhorn	56.8	61.5	55	175	48	12.7
Norstar	56.4	61.7	53	174	50	12.3
Average	70.0	61.9	53	170	39	12.3
LSD (0.05); CV	9.6; 7.8		12.6; 13.8			
P-value (Varieties)	0.0010		0.0082			

Location: MSU Western Triangle Agri Research Center, Conrad, MT.
Planted Sept 10, 2003 on fallow. Fertilizer, actual: 11-52-0 with seed + 50 N topdress.
Harvested Aug 12, 2004. Sawfly resistant ++

Table 2. 2004 Intrastate Winter Wheat Varieties (Condensed List): Conrad

Cultivar/Line	Yield bu/ac	Test weight lb/bu	Winter survival %	Heading date Julian	Plant height in	Protein %
BigSky	78.6	63.0	62	170	43	12.2
MT0097	77.4	62.7	61	171	40	12.7
Ledger BZ9W96-788	77.2	63.8	50	168	36	11.9
Millenium	76.9	63.6	57	166	41	12.3
NuHorizon (HWW)	76.7	65.1	58	165	33	12.2
Rocky	76.3	63.7	57	167	45	11.0
Quantum 542	75.3	63.3	45	168	43	11.6
MT01148	75.3	62.7	63	172	41	11.6
Expedition	74.7	63.4	60	165	37	12.0
NuWest (HWW)	72.8	60.2	48	170	40	11.5
MTW01133	72.1	61.7	52	166	33	12.0
Falcon	72.0	63.7	60	168	35	12.7
NuFrontier (HWW)	71.9	64.2	49	165	35	12.0
Bighorn	71.7	61.8	54	169	35	12.4
Neeley	71.7	62.8	54	172	41	12.1
Paul	71.7	61.3	59	171	37	11.3
MT00159	71.4	60.6	45	172	41	12.8
Wahoo	71.2	62.4	70	167	34	12.9
Jerry	70.9	62.5	58	169	45	12.4
Pryor (BZ9w96-919)	70.8	61.4	56	171	36	11.9
Judith	70.3	61.4	58	168	40	12.5
Genou (MTS0031) ++	69.9	62.7	51	172	40	12.8
NuSky (HWW)	69.8	61.0	49	172	42	12.2
Morgan	69.3	62.6	63	173	41	11.4
Jagalene	69.0	64.9	51	166	33	13.2
Above (IMI)	68.7	62.7	55	164	32	12.8
Promontory	67.9	63.2	46	168	35	12.8
Golden Spike (HWW)	66.8	61.1	51	174	38	11.6
Vanguard ++	65.8	62.7	53	169	43	12.7
Tiber	64.9	62.0	53	171	45	13.1
Rampart ++	62.9	62.5	52	169	40	14.2
MTCL01159 (IMI)	60.3	59.4	44	169	36	13.2
Elkhorn	56.8	61.5	55	175	48	12.7
Norstar	56.4	61.7	53	174	50	12.3
LSD; CV	9.6 bu; 7.8%		12.6; 13.8			
P-value	0.001		0.008			

Sawfly resistant ++
Planted Sept 10, 2003, fallow. Fertilizer, actual: 11-52-0 with seed + 50 N topdress.
Harvest date: Aug 12, 2004.
Location: MSU Western Triangle Agri Research Center, Conrad, MT.

Table 3. 2004 Off-Station **Winter Wheat** Test: The Knees Area.

Cultivar/Line	Yield bu/ac	Test weight lb/bu	Plant height	Protein %
Millenium	71.7	61.1	39	12.9
MT0097	66.0	59.9	38	12.9
CDC Falcon	65.1	61.3	37	11.8
Paul	65.1	58.2	36	11.9
Rocky	64.9	61.6	41	12.0
Jerry	64.7	59.9	42	13.2
Pryor	62.1	58.0	36	11.7
MT00159	61.9	55.8	38	12.7
MT0177	61.9	58.7	40	13.3
Wahoo	61.5	58.4	34	12.7
Promontory	61.3	60.1	37	12.7
Morgan	61.1	59.1	39	12.7
Jagalene	60.5	60.8	38	13.8
Neeley	59.1	57.8	38	13.7
Genou (MTS0031) ++	57.8	60.0	41	12.3
MTW01133 (HWW)	57.0	59.7	34	12.0
Vanguard ++	55.9	59.6	40	13.7
NuSky (HWW)	55.8	58.7	40	11.9
Rampart ++	55.3	59.1	40	13.6
NuWest (HWW)	54.9	58.1	38	13.3
MTCL01159	53.6	58.2	36	12.7
BigSky	53.4	58.9	42	14.4
MT01148	53.1	59.9	40	13.3
Tiber	52.0	59.8	45	13.6
Average	59.8	59.3	39	12.9

LSD (0.05) n.s. CV = 11.5%. P = 0.0926
Sawfly resistant ++

Planted Sept 10, 2003; no-till chem- fallow. Harvested Aug 6, 2005.
Cooperator & Location: Dan Picard, Knees area east of Brady, MT.
Fertilizer, actual: 11-52-0 with seed + 50 N topdress.
Conducted by Western Triangle Research Center, MSU Montana Agr Expt Sta.

Table 4. Three-year averages for **Winter Wheat** varieties, Knees Area, 2002-04

Variety	3-Year Average Yield bu/a	Test weight	Height in.	Protein %	Winter survival class *
Rocky	59.6	60.5	37.7	11.8	2
Paul (MT9426)	55.8	56.7	32.3	12.3	4
MT0097	55.5	59.2	34.4	12.4	
CDC Falcon	55.2	60.0	31.7	11.9	4
MT00159	55.1	56.3	34.8	11.9	
Jerry	54.6	59.0	37.8	12.9	5
Pryor	53.8	57.7	33.4	11.6	3
Genou (MTS0031) ++	52.8	59.2	36.7	12.7	2
Promontory	52.6	59.6	34.0	12.0	2-
NuWest (HWW)	52.0	58.3	36.0	12.3	4
BigSky	51.9	59.3	37.3	13.4	4
Morgan	51.4	58.1	35.3	12.0	5
Tiber	51.3	58.8	40.0	13.1	3
Vanguard ++	50.5	59.5	36.3	13.0	2-
NuSky (HWW) 9411	50.1	58.5	36.7	11.7	4
Neeley	49.7	57.3	35.3	12.2	3
Rampart ++	47.4	59.0	35.7	12.8	2-
Nursery mean	52.9	58.7	35.2	12.4	

Sawfly resistant ++

* High winterhardiness = 5. Low = 1.

Cooperator & Location: Dan Picard, Knees area east of Brady, MT.

Conducted by MSU Western Triangle Agri Research Center.

2004 Spring Wheat & Durum Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak, Conrad, MT; and Dr. Luther Talbert, MSU Plant Science Dept.

Off-station spring wheat variety trials were grown in Teton County near Choteau, Glacier County near Cut Bank, and Chouteau County at the "Knees". On-station trials at Conrad were grown on both dryland and irrigated conditions. The Choteau, Cut Bank, and Knees trials were no-till planted on chem-fallow. Trials at the Knees and Conrad included both spring wheat and durum.

Results: Data for the spring wheat trials are presented in Tables 5-16, and include the 2004 data and multi-year averages. Table 16 is a summary of all the Western Triangle area tests over the past five years, and is equivalent to 20 tests on each variety. Durum data are presented in Tables 17-22.

Due to unusual circumstances, nitrogen fertilizer was not applied to the dryland spring wheat trials at Conrad and Cut Bank, as well as for the dryland and irrigated durum trials at Conrad. Consequently, protein levels for these four trials were very low in 2004.

Averaged across all of the Western Triangle area tests over the past five years, the top yielding spring wheat varieties were 'Choteau', 'Hank', 'Reeder', 'McNeal', 'Outlook' and 'HiLine' (Table 16). Choteau and Reeder had above average test weight, and average protein. Choteau had the highest stem-solidness (sawfly resistance) rating of 22, compared to 20 for Fortuna, and 16 for Ernest. (Maximum rating = 25). Choteau averaged 5 bu/acre higher yield than Fortuna and Ernest. Heading date for 'Choteau' was slightly earlier than McNeal and Ernest, and slightly later than Fortuna. Choteau is bearded and has a semidwarf height.

Among the durum varieties, 'Avonlea', 'Alzada', 'Maier', and 'Mountrail' were the highest yielders on dryland. Avonlea and Maier had above average test weight and protein (Table 18). Test weights at the Knees averaged 57.4 lbs/bu, indicating this area may have a higher risk of failure to produce market quality durum (Table 22). For irrigated durum, Mountrail, 'Munich', Alzada and 'Plaza' were the highest yielding varieties (Table 20).

Additional comments on spring wheat and durum varieties are presented in the following pages. Also refer to MSU Extension Bulletin 1093 for descriptions of many of the varieties tested.

Spring Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad MT

Far-Go herbicide tolerance:

Most Tolerant: Argent, Bergen, Bronze Chief, Butte-86, Dalen, Ernest, Fortuna, Glenman, Grandin, Gus, Hank, Kodiak, Len, Marshall, McNeal, NK 751, Pioneer 2398, Pioneer 2731, Rambo, Stoa, Vanna, Westbred 926 & 936.

Least Tolerant: Alex, Amidon, Borah, Border, Centennial, Ellar, Era, Erik, Express, Fergus, Fremont, Hiline, Kulm, Lew, Newana, Pondera, Pioneer 2375, Russ, Scholar, Sharp, Sonja, Sprite, Teal, Waldron.

How to plant is just as important as what to plant. For best results plant with a hoe drill rather than a double-disc drill. A hoe drill moves the Far-Go treated soil out and away from the seed row so at normal planting depths the seed will go under the treated layer, where it's less susceptible to injury. If using a disc drill, choose tolerant varieties. Seeding depth should be 1.5 to 2 inches. Run tillage equipment 3" deep or less which will incorporate Far-Go at 1.5" deep. Weather and soil type are also important. Cold, wet weather can delay the wheat's emergence and increase its chance of damage from the Far-Go in the soil. Wait until soil temps are warmer and increase seeding rate by 10% if planting less tolerant varieties. If the soil is light and has little organic matter, injury to the spring wheat is more likely.

Cereal Qaulity Ratings: 5 = superior; 3 = average; 2 = poor; 1 = very poor.

Sawfly Resistant Hard Red Spring Wheat Varieties

Resistance among varieties ranges from low to high and varies with yearly climate differences; none have total resistance.

Abby (Canada): Stems not completely solid. Standard height, similar to Fortuna. Low yield. Good test weight.

Amidon (ND606, ND, 1988): Bearded. Medium tall; lodges worse than Fortuna; weak broken stems. Partial sawfly resistance (30% less solid than Fortuna); sawfly resistance not sufficient for severely infested areas. Medium-late; same maturity as Lew. Some tolerance to dryland root rot. Moderately susceptible to septoria. Has shown good tolerance to wheat streak mv (3 on scale of 1-3). Susceptible to Septoria. Below average yield. Average test weight. High protein like Fortuna. Quality = 4.5.

Border, Westbred (WPB, 1994): Bearded semidwarf. Solid stem in some years, moderate sawfly resistance (about like Rambo). Early maturity (4 days earlier than Fortuna). Too tough to thresh, resulting in dockage discounts. Susceptible to leaf rust. Medium yield and protein. Quality = 5.

Choteau (MSU, 2004) MT9929: Semidwarf with good straw strength. Height = HiLine, 2" shorter than McNeal, 4" shorter than Ernest & Fortuna. Stems very solid with good sawfly resistance (more solid than Fortuna). Sawfly resistance comparisons (max rating = 25): Choteau =22, Fortuna = 20, Ernest = 16. Medium-early, 2 days later than Hank, 0.5 day later than Ernest & Fortuna, 2 days earlier than McNeal. High yield, similar to McNeal on both dryland and irrigated. Yields substantially higher than Ernest and Fortuna. Above average test wt (similar to Ernest & Fortuna, and 0.5# higher than McNeal). Moderate resistance to Septoria, and good resistance to most stem rust races. Protein slightly higher than Fortuna & McNeal (0.5%), and slightly less than Ernest. Normal gluten strength and acceptable quality.

Conan (BZ992598; WPB, 1998): Rambo/906R cross. Semidwarf. Sawfly resistance slightly better than Rambo, and Scholar, greater than Amidon, and less than Fortuna. Low level of sawfly-attractant cis-3-hexenylacetate. Similar in yield and appearance to Rambo. Two days earlier than Rambo. Some tolerance to Wheat Streak M V. Protein 0.5-0.9% higher than Rambo, and better protein quality than Rambo.

Ernest (ND677) (ND, 1995): Bearded. Tall, weak straw. Sawfly resistance varies from medium to good (slightly less than Lew, Fortuna & Cutless). High level of sawfly-attractant cis-3-hexenylacetate. Moderately late maturing (like Amidon), slightly earlier than McNeal. Poor threshability, similar to Amidon. Tolerant to Far-go. Resistant to prevalent races of leaf & stem rust. Yield similar to Amidon, Lew, and Fortuna. High protein and test weight. Quality = 4.5.

Fortuna (ND): Beardless, tall straw. Too tall for irrigated conditions, where it becomes vulnerable to lodging. Solid stemmed and has very good sawfly resistance. Early maturing. Tolerant to Fargo. Very susceptible to Septoria. Medium to low yield except under severe sawfly conditions, where Fortuna often ranks high for yield. Somewhat susceptible to shattering, especially in conditions favoring development of large kernels. High test weight and protein. Quality = 4.5.

Lew (MSU, 1976): Beardless. Tall; medium weak straw. Good sawfly resistance (10 to 15% less than Fortuna, but 22% more resistant than Amidon). Medium late mat. 3 days later than Fortuna. Susceptible to Fargo. Avenge herbicide cannot be used. Septoria tolerance moderate. Average yield similar to Fortuna. Better shatter resistance than Fortuna. Medium to high test weight. Medium protein, less than fortuna. Quality = 5.

Rambo, Westbred (WPB, 1986): Bearded. Semidwarf; short stiff straw, but medium lodging resistance. Partial sawfly resistance (36% less solid than Fortuna). Threshes easily. Some tolerance to dryland root rot. May have more tolerance to septoria than Fortuna, but is still moderately susceptible. Above average yield and test weight. Medium-low protein .

Scholar (MT9433; MSU, 1999): Bearded. Medium tall, but slightly shorter than Fortuna, 1 inch shorter than Amidon. Moderate lodging resistance. Partial resistance to sawfly (semi-solid stem), slightly better than Amidon and Rambo. High level of cis-3-hexenylacetate. Maturity medium-late, like McNeal and Amidon. Above average yield, agronomics and quality; higher yield than Amidon. Intended to replace Amidon. Good resistance to Septoria & tan spot.

Hollow-Stem, Sawfly Susceptible Hard Red Spring Wheat Varieties

Alsen (ND, 2004). Scab resistant. Semidwarf height. Medium maturity. Above average yield and test weight. High protein.

Express, Westbred (WPB, 1991): Bearded semidwarf with very strong straw. 6" shorter than McNeal. Medium maturity, 1 day earlier than McNeal. Reported to be tolerant to Avenge herbicide, but very susceptible to FarGo. Resistant to Septoria. High yield. For irrigated conditions. Medium protein, similar to Glenman. Quality = 4.

Freyr (AgriPro, 2004): Semidwarf height. Medium maturity. Above average yield, test weight and protein.

Hank (WPB): Shatter resistant line from 926/936 cross, and may replace WB-926. Semidwarf height similar to 926, and 3" shorter than McNeal & Reeder. Medium lodging resistance. Early maturing, heading date 4 days earlier than McNeal, 3 days earlier than Reeder, 1 day later than 926. High yield, similar to Reeder and McNeal, and higher than 926. Better shatter resistance than 926. Test weight 1 pound lower than 926 & McNeal, 2# lower than Reeder. Good tolerance to dryland root rot, tolerant to Far-go. Protein 0.3% higher than McNeal, equal to Reeder, and 0.2% less than 926. Good quality.

Hi-Line (MT8402) (MSU, 1991): Bearded. Semidwarf; strong straw; better lodging resistance than McNeal. Height is 1 inch shorter than Pondera & McNeal. Hi-Line contains a small percentage of tall plants, giving the variety a ragged appearance. This trait is probably due to an unstable chromosome carrying the semidwarf gene, and it may not be possible to purify the variety for uniform height. Medium maturity; 3 days earlier than McNeal (maturity similar to Lew & Pondera). Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Somewhat susceptible to dryland root rot, more so than McNeal. Susceptible to leaf rust. Above average yield. High protein. Quality = 4.

Knudson (AgriPro): Semidwarf, strong straw. Medium maturity, similar to Reeder. Average yield. High test weight, low protein.

McNeal (MT8849, MSU, 1994): Red chaffed. Bearded semidwarf but slightly taller and more uniform height than Hiline. Good lodging resistance, but lodged more than Hiline in the high rainfall year of 1995. Straw is less resilient, and is prone to breaking over in strong wind. Medium-late maturity 3 days later than Hiline. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Some tolerance to dryland root rot, more so than Hiline. High yield, similar to Reeder and Choteau. Average test weight. Very good quality with high protein and loaf volume. Quality = 4.

Newana (MSU, 1976) - Bearded semidwarf. Good lodging resistance. Medium-late maturity, 3 days later than Pondera and Hi-Line. Very susceptible to sawfly. Tolerant to septoria. Very Good yield on irrigation; medium on dryland. Yields similar to Hi-Line on irrigation, but has less protein than Hi-Line. Yields lower than Hi-Line on dryland. Good shatter resistance. Protein medium. Quality = 3.

Norpro (AgriPro): Semidwarf, strong straw. Medium-late maturity. Above average yield. Average test weight and protein.

Outlook (MT 9874; MSU, 2002): Russian Wheat Aphid resistant, but susceptible to new biotype in 2004. Stiff straw, semidwarf, height equal to McNeal & Reeder. Maturity = McNeal. Yield similar to McNeal and Reeder. Test weight slightly lower than McNeal. Protein 0.2% lower than McNeal, and 0.5% lower than Reeder. Protein & quality acceptable.

Reeder (ND, 1999): Bearded semidwarf. Head date = McNeal, but maturity slightly later than McNeal. The "stay-green" trait provides a longer grain-fill period and higher yield, as long as moisture is available. Similar to McNeal for agronomics and quality. High protein. Susceptible to Everest W.O. herbicide.

Westbred - See also Border, Conan, Express, Fergus, Hank, Nomad, Pristine, Rambo, Zeke.

Westbred 926R (WPB, 1987): Bearded semidwarf. Good straw strength; 4 inches shorter than McNeal. Maturity equal to Hiline, and 3 days earlier than McNeal. Susceptible to Avenge herbicide; good tolerance to FarGo. Has some resistance to Washington race of Hessian fly. Fairly good tolerance to dryland root rot. Among highest yielders. Tendency to shatter. Test weight similar to McNeal. Protein similar to McNeal. See also Fergus, Hank, & WB-936. Quality = 4.5.

Westbred 936 (WPB): Bearded semidwarf for irrigated only. 936 is stiffer strawed than 926; 5 inches shorter than McNeal. Maturity 3 days earlier than McNeal. Reportedly tolerant to Avenge herbicide; fairly good tolerance to FarGo. Does not have dryland root rot resistance. More susceptible to dryland root rot than 926 and Fergus (although IMZ helps to control root rot). Moderate resistance to stem rust, resistant to stripe rust. Susceptible to leaf rust and Septoria. Shatter resistant. Superior to 926 as an irrigated variety. (Tested as ph986-61 in 1992). Has low test weight on dryland. Protein 0.4% higher than McNeal. Quality = 4.

Hard White Spring Wheat

Protein of hard white will probably need to be at least 14% to meet market standards for bread baking, but lower protein is required for noodle markets. Some contracts accept 11 to 14%. Many hard white varieties sprout more readily than hard reds, especially those developed from Australian germ plasm. The pure white trait is difficult to maintain, as pollen from red wheats may pollinate a white variety, causing a mixture of red kernels. It is very important to clean the combine, storage bins and other grain handling equipment prior to harvest to avoid mixing white wheat with other wheats. Seeding equipment and seedbed must also be free of red wheats. Seeding rate should be 10% higher than for red wheat to reduce late tillers and thereby reduce green kernels.

Agawam (WestBred, 2005. bz996472): Hard White. Semidwarf height. Early heading, similar to Explorer. High yield and test weight. Protein 1% lower than Explorer.

Argent (ND, 1998): Hard white. Semidwarf, lodging resistant. Early maturity. Fargo tolerant. High protein.

Blanca Grande (Gen Mills): Hard white. Short stiff straw. Early maturity. Medium high yield. High test weight and low protein.

Explorer (MTHW 9710). (MSU 2002). Hard white, bread-baking type. Semidwarf, 2 inches shorter than McNeal. Slightly solid-stem, but not sufficient for sawfly resistance. Early maturing, two days earlier than HiLine, 3-5 days earlier than McNeal. Yield is similar to HiLine, and 2 bu less than McNeal. Very susceptible to Septoria, thus not recommended for far eastern Montana. Good test weight. High protein, similar to HiLine & McNeal; and probably too high for noodles. Excellent bread baking quality.

Golden 86 (GP Seed & Research Inc, 1986): Hard white. Used by a commercial milling and baking firm north of Three Forks, Montana. A high quality hard white for specialty markets.

Idaho 377S (ID, Pro-Mar, General Mills, 1997): Hard white. Grown under contract with General Mills. Agronomically similar to well-adapted hard red check varieties in Montana trials in 1977-1988. Taller than most irrigated varieties, and therefore is more prone to lodging. Susceptible to Avenge herbicide.

MTHW 9420 (MSU, 1999): Experimental for exclusive release. Agronomically similar to Hiline. Maturity equal to Hiline. Very susceptible to wheat streak mosaic virus. Excellent bread quality, but too high in protein for noodles.

Plata (Gen Mills): Hard white. Short stiff straw. Medium maturity. Medium yield & test wt. Med-low protein.

Durum

Durum is generally much more susceptible to wheat streak mv and Fusarium crown rot than spring wheat.

Durum quality scale: 4 = good; 3 = average; 2 = poor. Quality durum has strong gluten. Growers who plan to grow weak-gluten varieties need to have a marketing organization identified that will purchase those varieties. Cool-climate areas are traditionally the good quality durum areas, as durum kernels tend to get flinty in hot areas. Kernel color is a very important quality trait. Rainfall or irrigation after heading causes color loss, but some varieties are less prone to color loss. Such varieties are the preferred choice in areas of late-season rainfall. Varieties that lose color more readily may be fine for drier areas of Montana. Varieties developed for the arid southwestern U.S. could be at high risk for color loss in moister climates. Seeding rate for durum should be 30% higher than for spring wheat due to the larger durum kernel (fewer kernels per bushel). An additional seed-rate increase may be desirable to suppress late tillers and thereby decrease green kernels. Color score is important, and green kernels contribute to poor color and dockage. 23 to 29 seeds per square foot (approx 1.0 to 1.26 million seeds per acre) has normally been a good seeding rate for durum.

Alzada (WestBred, 2005. YU 894-75): Semidwarf height, stiff straw. Early maturing. High yield, average test weight. Medium protein. Good quality, semolina color and gluten strength.

Avonlea (Can, 1997): Medium tall. Medium straw strength and lodging resistance. Early maturity. High yield and test weight. Good quality and protein. Intended to replace Kyle in Canada.

Belzer (ND, 1997): Medium-tall, moderate suscept to lodging. Late maturity. Moderate scab resistance. Large kernels, low test weight, medium protein. Quality = 4.

Ben (ND, 1997): Medium height, medium strong straw. Medium maturity. Medium yield. Large kernel size, high test weight & protein. Quality = 4.

Command (ND): Semidwarf. High irrigated yield, medium dryland yield. Severe leaf spots in 1999.

Dilse (ND): Medium height, late maturity. Medium yield. High test weight & protein, excellent quality.

Kari (AgriPro): Medium height and lodging resistance. Medium maturity. High test weight & protein, good quality.

Kyle (Canada, 1984): Very tall weak straw, poor lodging resistance. Very late maturing. Medium yield. Medium test weight, large kernel size. High protein. Strong gluten; quality = 4.

Lebsock (ND): Medium-short height, stiff straw. Late maturing. Medium yield and protein. High test weight. Quality = 4.

Maier (ND, 1998): Medium height, stiff straw, good lodging resistance. Medium-late maturity. High yield. Medium large kernels, very high test weight. High protein. The best milling quality of any durum so far.

Melita (Canada, 1995): Tall straw, moderately suscept to lodging. Medium maturity. Large kernels, medium protein. Quality = 4.

Monroe (ND, 1985): Tall, medium lodging resistance for dryland. Early maturity. Low yield, average test weight. Above average protein, strong gluten; quality = 4.

Mountrail (ND,1998): Medium-tall, but stiff straw and fair lodging resistance. Medium-late maturity. High yield. Average test weight. Medium large kernel and medium protein. Good quality, but kernel color more sensitive to late rain than some other varieties. (All durums are sensitive to late rain/irrigation relative to color loss).

Munich (ND, 1995): Medium-short, slightly taller than Laker. Strong straw, good lodging resistance. Med-late maturity. Medium yield. Medium kernel size and protein. Strong gluten; quality = 4.

Napolean (Can): Tall, but med lodging resistance. Low test weight and protein.

Navigator (Can): Med short, but weak straw. Med late maturity. Medium test weight & protein, good quality.

Pathfinder (Can): Med tall, weak straw. Med late maturity. Med test weight. Med low protein, good quality.

Pierce (ND): Medium height and lodging resistance. Average yield. High test weight. Medium protein, good quality.

Plaza (ND): Med-short straw, med lodging resistance. Late maturity. Med test weight. Low protein, medium quality.

Plenty (Canada, 1990): Very tall weak straw; lodges easily. Late maturing. High yield. Medium test weight, large kernel size, high protein. Strong gluten; quality = 4.

Utopia (Private, General Mills, 1997): 933, DU2. Black awns. Awn color may not fully express under stress conditions. Short semidwarf, shorter than McNeal spring wheat. Stiff straw. Early maturity. High yield. Sensitive to Avenge herbicide.

Vic (ND, 1979): Tall weak straw. Medium-early maturity. Susceptible to leaf rust and leaf spotting diseases; highly susceptible to WSMV. Low to medium yield. Good shatter resistance. High test weight, large kernel size, medium high protein. Strong gluten; quality = 4.

Voss (Agripro, 1994): Short semidwarf, shorter than McNeal spring wheat. Stiff straw. Latest maturing of all entries in 1995 at Conrad. Medium kernel size, low protein. Quality = 3.

Table 5. 2004 ADVANCED **SPRING WHEAT** NURSERY, CONRAD DRYLAND.

VARIETY	YIELD BU/AC	TESTWT LB/BU	HEAD DATE	Height In.	% Protein
Agawam HW (bz996472)	69.7	63.8	182	33	10.9
MT 0354	67.2	61.7	185	34	10.2
MT 0260	66.0	59.4	186	35	10.9
MT 0205	65.6	58.9	185	34	10.0
MT 0307	65.4	63.1	185	37	11.3
MT 0352	65.1	60.7	186	33	10.2
ALSEN	65.1	60.7	185	36	12.3
MT 0336	64.6	62.3	185	33	10.3
MTHW0362	64.4	62.3	184	35	9.9
MT 0339	64.3	60.7	185	35	11.1
CHOTEAU ++	63.8	63.9	185	34	10.8
MT 0245	63.6	60.2	185	35	10.2
MT 0351	63.1	61.7	184	35	10.7
MT 0247	63.0	63.1	185	37	12.1
MT 0249	62.8	61.7	184	33	11.1
McNeal/906 (bz999592)	62.6	59.8	185	36	11.7
Border/Conan (bz996434)	62.4	63.1	184	37	10.6
FREYR	62.0	62.0	185	35	12.0
MT 0342	61.8	62.8	185	33	11.4
WESTBRED 926	61.5	60.8	182	32	11.4
MT 0315	61.2	60.5	185	33	11.9
MTHW0361	61.0	61.4	183	32	10.2
Reeder	60.7	60.2	185	37	10.9
MT 0266	60.3	61.1	183	34	12.2
MT 0338	60.2	60.7	186	35	11.5
KNUDSON	60.2	61.9	185	35	10.4
OUTLOOK	60.2	60.2	186	34	11.7
MT 0319	60.1	62.6	184	34	10.5
MT 0311	60.1	62.2	185	34	11.5
HANK	60.1	59.5	183	34	10.9
NORPRO	59.9	61.6	185	29	10.5
MTHW0357	59.8	62.6	185	35	10.5
MTHW0202	59.8	64.3	181	34	11.0
MT 0326	59.7	61.2	184	36	10.9

continued		Yield	TW	Head	Hgt	Prot
MT 0261		59.6	59.9	185	39	10.6
MT 0255		59.5	60.5	184	34	9.3
MT 0318		59.2	62.7	184	36	11.3
MT 0346		58.9	61.6	186	35	11.8
MTHW9420		58.8	60.6	184	34	9.5
MT 0345		58.8	62.2	186	33	11.9
MTHW0002		58.4	61.4	185	36	9.1
MTHW0204		58.3	61.3	185	32	10.0
HI-LINE		58.2	62.9	183	31	11.0
FORTUNA	++	58.0	62.9	183	38	10.3
Conan	+	58.0	60.2	185	34	11.7
MT 0305		58.0	63.4	185	35	10.9
MT 0313		58.0	62.4	185	37	11.6
MTHW0366		57.5	63.7	183	32	9.9
MCNEAL		57.5	61.8	185	34	11.2
MT 0220		57.2	62.5	183	32	11.8
MT 0306		56.7	64.5	182	33	11.6
ERNEST	+	56.7	62.9	184	39	11.5
MT 0325		56.4	61.2	185	38	11.9
MT 0234		55.8	62.7	182	32	12.0
EXPLORER	HW	55.8	62.1	182	32	11.9
NEWANA		55.3	60.7	185	30	10.6
AGRIPRO4		54.3	64.2	184	34	11.2
AGRIPRO5		54.2	64.7	183	38	10.6
MT 0317		54.1	62.4	185	34	12.2
MT 0228		54.1	58.8	185	33	11.2
SCHOLAR	+	52.8	61.1	186	38	12.0
AGRIPRO6		50.9	64.2	184	34	12.8
AMIDON	+	50.8	61.2	185	40	11.3
THATCHER		44.6	59.8	186	42	10.9
ABBEY	+	44.9	60.1	---	39	- - -

LSD(.05) IN SAME BLOCK = 7.18 bu. LSD(.05) DIFFERENT BLOCKS = 7.34 bu.
COEFFICIENT OF VARIATION 7.09
++ Sawfly resistant.
+ Partial sawfly resistance.
Location: MSU Western Triangle Ag Research Center, Conrad, MT
Planted Apr 20, 2004 on fallow. Harvested Aug 18, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 6. 2004 ADVANCED **SPRING WHEAT** NURSERY, CONRAD DRYLAND.

(Condensed List)

VARIETY	YIELD BU/AC	TESTWT LB/BU	HEAD DATE	Height In.	% Protein
Agawam HW (bz996472)	69.7	63.8	182	33	10.9
ALSEN	65.1	60.7	185	36	12.3
CHOTEAU ++	63.8	63.9	185	34	10.8
MT 0245	63.6	60.2	185	35	10.2
MT 0249	62.8	61.7	184	33	11.1
Bz996434 Border/Conan	62.4	63.1	184	37	10.6
FREYR	62.0	62.0	185	35	12.0
WESTBRED 926	61.5	60.8	182	32	11.4
Reeder	60.7	60.2	185	37	10.9
MT 0266	60.3	61.1	183	34	12.2
KNUDSON	60.2	61.9	185	35	10.4
OUTLOOK	60.2	60.2	186	34	11.7
HANK	60.1	59.5	183	34	10.9
NORPRO	59.9	61.6	185	29	10.5
MTHW 0202	59.8	64.3	181	34	11.0
MTHW 9420	58.8	60.6	184	34	9.5
HI-LINE	58.2	62.9	183	31	11.0
FORTUNA ++	58.0	62.9	183	38	10.3
Conan +	58.0	60.2	185	34	11.7
MCNEAL	57.5	61.8	185	34	11.2
ERNEST +	56.7	62.9	184	39	11.5
EXPLORER HW	55.8	62.1	182	32	11.9
SCHOLAR +	52.8	61.1	186	38	12.0
AMIDON +	50.8	61.2	185	40	11.3
THATCHER	44.6	59.8	186	42	10.9
ABBEY +	44.9	60.1	-	39	- - -

LSD(.05) IN SAME BLOCK 7.18 bu
LSD(.05) DIFFERENT BLOCKS 7.34 bu
COEFFICIENT OF VARIATION 7.09
++ Sawfly resistant.
+ Partial sawfly resistance.
Location: MSU Western Triangle Ag Research Center, Conrad, MT
Planted Apr 20, 2004 on fallow. Harvested Aug 18, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 7. Five-year averages, dryland **Spring Wheat** varieties, Conrad, 2000-04.

Variety	5-Year Average				
	Yield bu/a	Test weight	Height in.	Head date	Protein %
Agawam HW	47.3	62.8	28.0	178.8	13.3
Reeder	46.1	60.2	29.8	180.0	14.0
Choteau ++	44.2	60.5	28.0	181.0	14.7
Norpro	42.9	59.7	26.1	181.0	14.1
WB 926	42.8	59.7	28.0	178.2	14.9
Hank	42.8	58.8	29.2	179.4	14.4
Outlook	41.7	58.7	29.2	182.0	14.4
McNeal	41.1	59.8	29.2	181.8	14.1
Knudson	41.1	60.8	28.9	181.3	13.9
Mt 9420 HW	40.7	59.4	28.0	180.0	13.7
HiLine	40.2	60.1	27.2	179.2	15.0
Scholar +	40.2	60.4	32.2	182.8	14.8
Conan +	40.2	59.8	27.8	180.6	14.7
Fortuna ++	40.2	60.6	34.2	180.8	14.2
Explorer HW	39.5	60.2	27.0	178.8	14.6
Ernest +	38.2	60.5	33.4	181.4	15.2
Amidon +	37.3	59.3	33.4	181.2	14.6
nursery mean	41.2	59.9	29.6	180.6	14.5

Sawfly resistant ++
Partial sawfly reistance +
HW = hard white
Location: MSU Western Triangle Agr Research Center, Conrad, MT

Table 8. 2004 **IRRIGATED SPRING WHEAT** VARIETIES, CONRAD.

VARIETY		YIELD BU/AC	TESTWT LB/BU	HEAD DATE	Height In.	% Protein
CHOTEAU	++	105.7	63.5	184	35	12.6
HANK		104.5	61.6	183	36	13.4
MT 0249		101.7	62.1	184	35	14.1
WESTBRED 926		100.8	61.2	182	36	13.8
MCNEAL		99.4	62.7	184	37	13.3
MT 0245		96.8	62.2	185	37	13.8
MTHW 0202		96.1	64.1	181	36	11.7
HI-LINE		95.9	63.3	183	34	12.8
RAMBO	+	95.5	62.6	185	35	12.9
MTHW 9420		95.5	61.9	183	35	12.1
Reeder		95.4	62.2	184	39	14.6
MT 0266		94.6	61.4	182	37	12.8
OUTLOOK		93.0	61.5	185	35	12.9
EXPLORER HW		89.1	62.5	182	35	12.7
ALSEN		88.0	63.0	183	37	13.9
SCHOLAR	+	86.2	62.8	185	42	14.5
Conan	+	86.1	62.7	183	38	12.9
ERNEST	+	86.1	62.4	184	44	14.6
AMIDON	+	84.2	62.0	184	45	14.3
ABBEY	+	68.5	62.8	-	41	-
FORTUNA	++	67.5	62.6	183	41	14.3

Yield MEAN 93.1 bu C.V.1 = 7.89
LSD (0.05) 12.15 bu C.V.2 = 4.56

++ Sawfly resistant.
+ Partial sawfly resistance.

Location: MSU Western Triangle Ag Research Center, Conrad, MT
Planted Apr 21, 2004 on fallow. Harvested Sept 5, 2004.
Fertilizer, actual: 11-52-0 with seed + 60 N topdress.

Table 17. 2004 **DURUM** VARIETIES, CONRAD DRYLAND.

VARIETY	YIELD BU/AC	TESTWT LB/BU	HEAD DATE	Height In.	% Protein
Alzada (WPB YU 894-75)	64.6	63.1	183	34	9.7
AC AVONLEA	62.3	63.3	185	38	10.4
DILSE	62.2	63.6	187	36	10.2
MCNEAL (spr wht)	62.0	61.7	186	35	10.7
MOUNTRAIL	61.8	63.0	186	38	9.7
PLAZA	60.7	62.6	185	32	9.9
Munich	59.4	63.1	184	39	10.5
MAIER	57.8	63.8	185	35	10.4
LEBSOCK	57.4	64.1	185	36	9.6
KYLE	57.1	62.8	186	40	10.4
PIERCE	56.7	63.3	185	38	10.4
BEN	54.5	64.1	185	37	10.5
MONROE	53.8	63.5	182	37	10.8
VIC	52.5	63.6	184	39	10.9
Yield MEAN	58.8 bu	C.V.1 = 7.08			
LSD (0.05)	6.98 bu	C.V.2 = 4.09			

Location: MSU Western Triangle Ag Research Center, Conrad, MT
Planted Apr 20, 2004 on fallow. Harvested Aug 18, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 18. Five-year averages, dryland **Durum** varieties, Conrad, 2000-04.

	5-Year Average				
Variety	Yield bu/a	Test weight	Height in.	Head date	Prot %
Avonlea	42.1	60.1	32.2	180.8	14.9
McNeal (spr wht)	41.8	58.7	30.4	182.2	14.0
Alzada yu894-75	41.4	59.8	28.5	179.7	14.0
Mountrail	40.4	59.4	31.8	182.8	14.0
Maier	40.0	60.7	30.2	182.6	14.6
Plaza	38.5	59.4	27.4	182.2	14.0
Kyle	38.4	60.0	35.8	184.0	14.8
Munich	37.9	59.7	30.0	180.8	14.7
Pierce	37.3	60.6	32.4	182.0	14.6
Lebsock	37.1	60.9	30.8	182.0	14.0
Dilse	37.1	60.2	30.7	183.5	14.8
Ben	35.4	60.7	32.6	182.2	14.7
Monroe	34.1	59.6	31.8	178.2	15.1
Vic	33.5	60.3	32.6	181.2	14.6
nursery mean	38.2	60.0	31.2	181.7	14.5

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

Table 19. 2004 **Irrigated DURUM** VARIETIES, CONRAD.

VARIETY	YIELD BU/AC	TESTWT LB/BU	HEAD DATE	Height In.	% Protein
PLAZA	101.8	64.3	185	32	9.6
MOUNTRAIL	98.5	63.9	185	40	9.8
Munich	97.3	63.2	184	39	10.2
AC AVONLEA	95.1	64.2	183	40	11.1
MCNEAL (spr wht)	92.3	63.4	184	38	11.0
MAIER	91.8	64.6	185	37	10.2
Alzada (WPB YU 894-75)	91.2	64.1	182	34	10.8
LEBSOCK	90.7	63.9	184	38	10.6
PIERCE	89.7	64.3	185	42	10.1
DILSE	87.3	64.3	185	40	10.4
KYLE	84.9	63.9	186	45	10.4
BEN	84.4	63.6	184	41	10.3
VIC	80.1	63.8	184	44	10.4
MONROE	51.8	62.6	180	43	10.9

Yield MEAN	88.3 bu	C.V.1 = 7.17
LSD (0.05)	10.6 bu	C.V.2 = 4.14

Location: MSU Western Triangle Ag Research Center, Conrad, MT
Planted Apr 21, 2004 on fallow. Harvested Sept 5, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 20. Five-year averages, **irrigated Durum** varieties, Conrad, 2000-04

	5-Year Average				
Variety	Yield bu/a	Test weight	Height in.	Head date	Prot %
Mountrail	77.7	62.5	35.8	182.5	11.3
Munich	75.5	62.1	34.2	181.3	12.1
Alzada yu894-75	75.3	63.3	31.1	179.8	12.1
McNeal (spr wht)	75.2	61.9	33.6	182.3	12.4
Plaza	74.9	63.0	30.2	182.8	11.6
Avonlea	74.3	62.8	35.8	180.8	12.6
Maier	73.0	63.3	33.4	181.3	12.0
Pierce	72.3	63.3	37.1	182.9	11.2
Dilse	69.8	63.3	35.7	182.9	11.9
Lebsock	69.5	62.8	34.4	181.8	12.3
Ben	66.8	63.3	36.2	182.0	12.1
Kyle	63.3	62.4	40.2	184.3	12.6
Vic	59.9	63.0	37.8	182.3	12.2
Monroe	54.2	62.5	36.0	179.3	12.5
nursery mean	69.6	62.7	34.4	181.6	12.1

Location: MSU Western Triangle Agr Research Center, Conrad, MT.

Table 21. 2004 OFFSTATION **DURUM** VARIETIES, The "KNEES" area.

VARIETY	YIELD BU/AC	TESTWT LB/BU	Height In.	% Protein
MCNEAL (spr wht)	57.2	55.7	37	15.9
MOUNTRAIL	53.1	57.3	38	15.8
LEBSOCK	52.7	60.5	39	15.9
MAIER	52.2	59.5	37	17.0
MONROE	51.7	58.6	42	16.4
Munich	50.5	58.1	38	15.8
AC AVONLEA	50.4	57.4	42	16.8
DILSE	50.1	58.2	40	17.3
BEN	49.1	59.1	42	16.8
VIC	47.6	59.5	43	15.9
KYLE	47.4	58.5	41	15.7
PIERCE	46.5	58.6	41	16.7
PLAZA	45.3	58.3	32	14.2

Yield MEAN	50.3 bu	C.V.1 = 5.25
LSD (0.05)	4.45 bu	C.V.2 = 3.03

Cooperator & Location: Dan Picard, Knees area east of Brady, MT.
Planted Apr 13, 2004 on chem. fallow. Harvested Aug 10, 2004.
Fertilizer, actual: 11-52-0 with seed + 50 N topdress.
Conducted by MSU Western Triangle Ag Research Center.

Table 22. Four-year averages, **Durum** varieties, Knees area, 2001-04.

Variety	4-Year Average Yield bu/a	Test weight	Height in.	Prot %
Mountrail	34.0	56.9	32.3	16.5
Monroe	34.0	57.6	35.0	16.7
McNeal (spr wht)	33.9	55.0	30.8	16.1
Maier	33.2	57.5	31.0	17.2
Avonlea	32.8	57.5	33.7	17.1
Lebsock	32.7	59.3	32.0	16.1
Munich	31.1	56.9	30.9	16.6
Kyle	31.1	57.6	35.2	16.6
Ben	31.1	58.0	34.0	17.0
Plaza	30.8	57.2	26.9	15.8
Vic	30.7	59.5	35.1	16.6
nursery mean	32.0	57.4	32.6	16.6

Cooperator & Location: Dan Picard, Knees area, Chouteau County.
Conducted by MSU Western Triangle Agr Research Center.

2004 Barley Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak and Ron Thaut, Research Center, Conrad; and Dr. Tom Blake and Pat Hensleigh, MSU Plant Science Dept.

Dryland off-station barley variety trials were grown in Teton County near Choteau, Glacier County near Cut Bank, and Chouteau County at the Knees Area. At Conrad, both dryland and irrigated trials were grown. These four locations represent diverse environments with Teton having deep soil and typically favorable moisture; the Knees with deep soil, intermediate moisture and warmer temperatures; and Cut Bank with short, cool growing season. The Cut Bank, Knees and Choteau trials were no-till planted on chem-fallow.

Results: Data for the 2004 trials and 5-year averages at Conrad are presented in Tables 23-30, and include two separate irrigated trials. The irrigated trial in Tables 29-30 is more specific to malt varieties. Data for the off-station locations are presented in Tables 31-36, and include the 2004 data and five-year averages. Table 37 is a summary of all the Western Triangle area dryland barley tests over the past five years, and is equivalent to 19 tests on each variety.

Averaged across all dryland locations over the past five years, the feed barley 'Haxby' had the highest yield and test weight (Table 37). Dryland multi-year averages for some of the newer malt varieties are limited, but in 2004, the 2-row 'Metcalfe' averaged 4 bu/a higher yield than 'Copeland' and 'Harrington'; and the 6-row 'Tradition' averaged 3 bu/a higher than 'Lacey' across all locations.

Under irrigation, 'Merit' and Metcalfe averaged higher yields over the past four years than other 2-row malt varieties; and Lacey and Tradition were the highest yielding 6-row malt varieties (Table 30).

Comments on barley varieties are presented in the following pages. Also refer to MSU Extension Bulletin 1094.

Barley Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

BA 1202 (Busch Ag): 2-row malt. Stiffer strawed & higher yield than Klages. Requires good rainfall or irrigation. Maturity 2 days later than Harrington. Average yield.

Baronesse (Ackermann-Germany): Seed produced in USA by Western Plant Breeders. 2-row feed. Short straw and good lodging resistance; 2.5" & 3" shorter than Harrington & Gallatin, respectively. One to four days later maturity than Gallatin; equal or slightly later maturity than Harrington. Among highest yielders when tested in favorable moisture conditions. Test weight is 1 lb less than Gallatin, but % plump is higher. Recommended list for irrigated and dryland.

Boulder (WestBred, 2005. BZ596117): 2-row feed. Height similar to Haxby. Heading 1 day later than Haxby, and 1 day earlier than Baronesse. High yield, similar to Haxby. High test weight, 0.5 lb less than Haxby.

Calgary (Ariz Plt Br): 2-row feed for irrigated conditions. Stiff straw 2" shorter than Baronesse, stiffer than Baronesse, Haxby & Gallatin. Head date = Baronesse. Irrigated yield greater than Baronesse. Test wt = Baronesse.

Conlon (ND, 1996): 2-row malt. Medium height, weak straw, slightly weaker than Bowman. Early maturity, 1-2 days earlier and higher test weight than Bowman. Developed for areas of heat & drought stress. High resistance to net blotch; susceptible to spot blotch & Fusarium head blight.

Conrad (BA 5057): 2-row malt, Busch Agr Resources. Similar height and lodging resistance as BA1202, 2-3 inches shorter than Harrington. Similar maturity and plump as BA1202 and Harrington. Higher yield than BA 1202 and Harrington.

Coors 37 (Moravian 37): Currently the main variety contracted by Coors in 2004.

Copeland (Sask. Canada, 1999): 2-row malt. Better straw strength and earlier maturity than Harrington. Higher yield, test weight, and plump than Harrington. Net blotch resistant. Scald & Septoria susceptible.

Drummond (ND 15477): 6-row malt. Height similar to Stander, stronger straw than other 6-row malt types. Improved yield over Morex, Robust and Foster. Plump higher than Morex.

Eslick (MT960228, MSU, 2005): 2-row feed. (Stark/Baron cross). Height = Harrington, 1" taller than Baronesse, 1" shorter than Haxby & Gallatin. Heading date similar to Harrington, and 1-2 days later than Haxby & Gallatin. Yield similar to Baronesse and Haxby, and higher than Gallatin & Valier. Test wt = Baronesse, greater than Harrington, and 2# less than Haxby. Eslick has superior performance in areas of ample moisture, while Haxby is preferred where lower moisture conditions are expected.

Excel (Minn, 1990): 6-row malt for upper Midwest. Combines the superior agronomics of Robust and the malt quality of Morex. Good alternative to Robust and Morex. Stiff straw. Later maturity and higher yield than Morex.

Foster (ND, 1995): 6-row malt for North Dakota. Med-short; stiff straw. Medium maturity. Medium yield.

Gallatin (MSU, 1986): 2-row feed. Med-short height; stiff straw and good lodging resistance (more than Hector, Klages, Lewis, and Clark). Medium maturity, slightly earlier than Hector, and earlier than Bearpaw. Yields high in both dry and wet conditions; thus a broadly adapted feed barley. Good drought tolerance.

Garnet (ID, 1998): 2-row malt. Similar to Harrington.

Harrington (Sask. Can): 2-row malt. Medium height; medium weak straw. Late maturity. Sensitive to hot dry areas; yields good in moist areas. Can sprout or germinate (internal falling number) at a lower moisture content than other varieties. Sweating in the bin can be enough to ruin germination. Susceptible to skinning unless carefully threshed.

Haxby (MSU 2002, MT950186): 2-row feed. 3 inches taller and two days earlier than Baronesse. Yield is equal to Baronesse, and is among highest yielders in Triangle Area. Highest test weight of all varieties. Non-Baronesse derived, providing good diversity. Haxby has superior performance in lower moisture conditions, while Eslick is the preferred choice for high moisture conditions.

Haybet (MSU): 2-row, hooded hay barley. Later to mature than Horsford, and higher forage yield. Similar to Horsford for grain yield, which is low. Harvest at soft dough stage. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting.

Hays (MSU, 2004): MT981060. Hooded 2-row. Shorter than Haybet and more resistant to lodging. Higher grain yield than Haybet (similar to Harrington). Test wt = Haybet, and 2# less than Harrington. Higher forage yield than Haybet and Westford (8%). Harvest at soft dough stage. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting.

Kendall (Can): 2-row malt. High irrigated yield.

Lacey (M98, MN 1999): 6-row malt. Intended to replace Robust. Height intermediate between Robust & Stander. Lodging resistance greater than Robust, but less than Stander.

Legacy (Busch Ag 2978; 6B932978): 6-row malt. 2 to 4 inches taller than Harrington. Higher yield than Morex and Robust, but lower than Harrington. Has 30% resistance to vomatoxin.

Manley (TR 409) (Canada): 2-row. Slightly stiffer strawed and three days later than Harrington, (approx. Klages maturity); longer shelf life than Harrington - does not lose its germination as bad. May replace Harrington in Canada; but only in high rainfall, stripe rust areas.

Merit (Busch Ag): 2-row malt. Late maturing, too late for dryland. Lodges easier than 1202 and Harrington, but yields higher. Net blotch resistance, and moderate Scald resistance.

Merlin, Westbred (WPB): Waxy seed, semidwarf. Better yield and lodging resistance than Waxbar, but quality not accepted by Japan markets yet.

Metcalfe (Manitoba Canada, 1994): 2-row malt. Possible replacement for Harrington. Higher yield, test weight and plump than Harrington. Slightly earlier to head than Harrington. Moderate resistance to spot-form net blotch. Susceptible to scald and Septoria.

Morex (Minn, 1978): 6-row malt. Tall; medium straw strength. Early maturity. Shatters readily - swathing advised. Agronomically the worst malting barley on the list. Excel may be a better choice.

MT910189 : Experimental 2-row malt for dryland. 4 days earlier than Harrington, and retains plump on dryland much better than Harrington. 5 bu/a higher yield than Harrington. Plant-scale test planned for 2005.

Prowashonupana (line 3) (MSU): 2-row hulless. Does not have soluble B-glucan unless they can find a way to steam process it out. Potential specialty market.

Robust (Mn, 1983): 6-row malt. Tall; medium straw strength. Medium maturity. The 1992 Robust crop in Minnesota did not malt due to dormancy for unknown reasons. Growers therefore switched to 'Stander' in 1993.

Shonkin (MSU): Waxy 2-row hulless. Stands up better than Wanubet, but has weak straw and low yield. Heads slightly later than Hector. Up to 10% or more of the grain may not thresh free from the hulls. Shonkin is LR 247 from Wanubet (a separate variety from Wanubet) and is a "clean seed" source of Wanubet to allow a more pure line. Special use, with no recommendation.

Stander (M-64, Minn, 1993): 6-row malt for upper Midwest. Med-short straw, stiffer than other 6-row malt types. Medium-late maturity. Better yield stability and kernel-plump than Excel, but Excel seems to be preferred by growers.

Steptoe (Wash): 6-row feed. Among the highest yielders on irrigation or dryland. Very low test weight dryland.

Stockford (WestBred, 2005). 2-row hooded hay barley. Height is 2" taller than Hays. Heading is 2 days earlier than Hays. Forage yield is similar to Hays and Haybet. Harvest at soft dough stage. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting.

Tradition (Busch Ag, BA6B95-2482): 6-row malt. Stiffer straw than Legacy, good lodging resistance. Higher yield than Legacy.

Valier (MSU 1999): 2-row feed. Lewis/Baroness cross 10% better feed efficiency (rumenal digestibility) and 10% better ADG in cattle. Agronomically superior to Gallatin and Lewis, but less than Baroness. Better head extension out of boot than Baroness. H 3860224 (MSU): Released as a germplasm. Slightly higher feed value than Valier.

Wanubet (MSU, 1990): Waxy 2-row hulless. The B-glucan line that will most likely be industrialized. Weak straw and low yield (70% of Hector or Gallatin). Med-late mat. Up to 10% or more of the seed may not thresh free from the hulls.

Waxbar, Westbred (WPB): Waxy barley grown under contract in 1994 & 1995 for export to Japan. Standard height and fairly late to mature. See Merlin.

Westford, Westbred (WPB): 6-row hooded hay barley. Maturity considerably later than Horsford and Whitford, allowing for greater forage production. Seed yield low (similar to Horsford). Hay yields considerably higher than Horsford. Harvest at soft dough stage. Hooded barleys are sometimes vulnerable to ergot, but the amount is slight. Caution should be taken to avoid high nitrate levels when using any small grain as a forage. Test forage for nitrate before the crop is harvested.

Westbred 501 (WPB): 6-row feed. Very stiff straw (supposedly doesn't lodge). Marketed mainly in Idaho.

Xena (WPB bz594-19): baroness/stark cross. 2-row feed. Two inches taller and better boot emergence than Baroness. Lodging resistance equal to Baroness. Late maturity, similar to Baroness. Better adapted to dryland than Baroness, (higher test wt and plump than Baroness on dryland). Equal or better yield than Baroness on dryland.

Table 23. **Dryland Intrastate Barley** varieties, Conrad 2004.

Variety	Yield bu/a	Head date	Plant height in.	Test weight lb/bu	Plump %	Thin %	Protein %
MT000125	101.1	183	36	53.2	92	2	13.0
MT020155	100.5	180	35	52.1	94	1	13.0
MT020075	99.4	185	32	49.8	90	2	11.0
MT000153	99.2	182	35	54.2	95	1	11.7
MT020064	98.0	183	35	53.9	98	1	12.2
MT000045	97.3	183	34	51.9	98	1	12.5
MT000047	97.0	182	35	51.6	89	2	12.7
Boulder, bz596-117	96.6	182	39	54.7	98	1	12.7
WPB Xena	95.5	183	37	51.6	94	1	11.2
MT020166	95.5	182	33	50.8	95	1	10.5
MT010155	95.2	182	39	53.1	98	1	14.1
Gallatin	94.8	182	35	52.7	91	2	12.4
MT010191	94.6	186	31	51.4	91	3	10.6
MT000040	94.0	183	36	52.6	92	3	12.4
APB B99AL-616	93.7	183	34	47.6	86	3	12.1
MT020037	93.4	182	37	53.4	94	1	12.4
Valier	93.3	183	34	49.7	97	2	13.4
Auriga	92.9	183	29	51.1	89	3	12.6
MT020167	92.6	182	33	54.5	95	1	12.4
MT010080	92.6	183	39	51.2	76	6	13.6
MT010160	91.8	183	36	50.9	73	7	13.0
MT020204	91.7	182	33	51.1	93	2	11.9
MT970229	91.0	183	33	53.6	98	1	12.0
Haxby	91.0	182	32	55.2	91	2	10.9
Conrad, 2B965057	90.8	184	32	50.9	87	4	13.0
Baronesse	90.5	183	31	51.8	93	1	11.8
Metcalfe	89.7	182	38	52.2	83	3	11.7
MT910189	89.3	182	32	52.1	98	1	10.6
MT010158	89.3	183	30	53.8	97	1	13.3
MT010213	89.1	183	35	53.2	98	1	12.4
MT981004	88.2	183	33	50.0	87	2	10.2
Eslick, MT960228	87.2	184	33	52.8	93	1	11.4
MT020072	86.9	184	34	50.2	97	1	11.7
MT981006	86.7	182	33	51.0	94	2	12.9

Continued

Table 23 continued.

Variety	Yield	Head	Height	TW	Plump	Thin	Prot
Copeland	86.3	184	39	49.3	87	2	12.8
MT010156	86.3	182	36	53.3	98	1	13.4
MT020205	86.3	182	32	51.7	92	2	11.9
MT010205	86.1	185	34	49.7	79	4	12.1
Tradition	86.0	181	39	50.4	92	1	11.3
MT010081	85.9	184	32	51.8	92	2	12.2
MT000138	85.2	182	37	52.0	96	2	13.7
MT020162	85.2	183	34	52.6	96	1	11.5
MT010177	84.9	182	32	53.8	97	1	11.7
MT000092	84.4	183	38	50.9	97	1	10.9
MT981238	84.4	182	38	52.0	98	1	13.0
MT010162	84.3	184	32	51.6	92	2	11.2
MT970116	83.8	182	40	53.5	98	1	11.6
MT020080	83.4	184	32	48.3	90	3	11.6
APB SR-6608	82.1	186	25	47.0	75	5	12.5
Legacy	81.1	181	39	48.6	60	6	11.4
MT020139	80.5	183	33	50.9	97	1	12.7
MT020090	80.1	184	26	47.4	61	3	11.0
Harrington	80.0	184	36	52.0	91	2	12.1
Lacey	79.1	180	35	51.3	87	2	11.6
Merit	79.0	184	33	48.6	94	2	11.7
MT010212	78.9	183	36	50.6	93	2	12.0
MT981210	78.4	184	31	53.5	96	1	11.2
Morex	77.4	180	42	49.9	67	5	11.8
MT020085	76.7	184	27	45.2	78	3	11.2
MT020246	76.3	185	30	49.9	91	2	11.4
Conlon	73.5	180	35	49.7	98	1	12.9
MT020120	70.8	184	32	49.4	96	1	12.4
Mean	88.0	182.8	34.2	51.4	90.7	2	12.1
LSD (0.05) =	13.9						
C.V.1 =	9.8						
C.V.2 =	5.7						

Location: MSU Western Triangle Ag Research Center, Conrad, MT.
Planted Apr 20, 2004. Harvested Aug 12, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 24. **Dryland Intrastate Barley** varieties, Conrad 2004.

Condensed List

Variety	Yield bu/a	Head date	Plant height in.	Test weight lb/bu	Plump %	Thin %	Protein %
Boulder, bz596-117	96.6	182	39	54.7	98	1	12.7
WPB Xena	95.5	183	37	51.6	94	1	11.2
Gallatin	94.8	182	35	52.7	91	2	12.4
Valier	93.3	183	34	49.7	97	2	13.4
Auriga	92.9	183	29	51.1	89	3	12.6
MT970229	91.0	183	33	53.6	98	1	12.0
Haxby	91.0	182	32	55.2	91	2	10.9
Conrad, 2B965057	90.8	184	32	50.9	87	4	13.0
Baronesse	90.5	183	31	51.8	93	1	11.8
Metcalfe	89.7	182	38	52.2	83	3	11.7
MT910189	89.3	182	32	52.1	98	1	10.6
Eslick, MT960228	87.2	184	33	52.8	93	1	11.4
Copeland	86.3	184	39	49.3	87	2	12.8
Tradition	86.0	181	39	50.4	92	1	11.3
MT970116	83.8	182	40	53.5	98	1	11.6
Legacy	81.1	181	39	48.6	60	6	11.4
Harrington	80.0	184	36	52.0	91	2	12.1
Lacey	79.1	180	35	51.3	87	2	11.6
Merit	79.0	184	33	48.6	94	2	11.7
Morex	77.4	180	42	49.9	67	5	11.8
Conlon	73.5	180	35	49.7	98	1	12.9
Mean	88.0	182.8	34.2	51.4	90.7	2	12.1
LSD (0.05) =	13.9						
C.V.1 =	9.8						
C.V.2 =	5.7						

Location: MSU Western Triangle Ag Research Center, Conrad, MT.
Planted Apr 20, 2004. Harvested Aug 12, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 25. Five-year averages, dryland **Barley** varieties. Conrad 2000 - 2004.

Variety	5-Year Average						
	Yield bu/a	Head date	Height in.	Test weight	Plump %	Thin %	Protein %
Baronesse, WB	72.2	183	26	49.9	74	8	14.1
MT910189	71.6	180	28	51.1	76	9	13.6
Valier	70.0	183	28	51.0	64	14	15.3
MT970229	69.9	182	28	52.3	81	7	14.5
Boulder, WB	69.8	182	28	52.3	74	6	14.9
Eslick	69.3	183	28	50.3	68	12	13.9
Haxby	68.9	181	28	53.2	68	10	13.7
MT970116	68.3	180	32	52.6	87	4	13.7
Tradition, BA, 6-row	65.9	181	30	48.9	63	5	14.4
Gallatin	64.7	182	29	49.2	60	15	14.5
Harrington	64.3	183	29	49.4	74	9	14.4
Xena, WB	63.2	182	29	49.8	67	13	14.0
Merit, BA	59.9	183	27	47.7	76	8	14.4
Morex, 6-row	57.8	179	33	46.6	40	26	14.6
Legacy, BA, 6-row	57.7	180	32	47.1	56	14	14.1
Conlon	57.7	179	27	50.2	80	6	14.5
Nursery Mean	65.1	182.0	28.1	49.7	66.0	12.6	14.5

BA = Busch Ag; WB = WestBred.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 26. **Irrigated Intrastate Barley** varieties, Conrad 2004.

Variety	Yield bu/a	Head date	Plant height in.	Test weight lb/bu	Plump %	Thin %	Protein %
Calgary	124.3	183	31	55.1	95	1	12.7
Merit	124.0	185	36	50.3	91	2	11.5
WPB Xena	123.8	183	37	55.1	98	0	12.4
Baronesse	123.5	183	36	52.9	95	2	12.2
MT020162	119.2	183	37	53.9	99	0	13.5
MT970229	118.1	183	38	55.0	98	1	12.9
MT981004	117.6	183	34	51.5	92	2	12.0
Conrad, 2B965057	116.4	183	34	54.1	99	1	13.3
MT020166	116.3	182	33	53.3	98	1	12.3
MT010205	116.3	185	35	53.8	99	0	12.3
MT020246	116.1	186	35	53.6	97	1	10.6
MT010158	115.9	182	32	54.6	99	0	14.0
MT000125	114.6	182	34	55.0	99	0	13.1
Copeland	114.5	184	38	52.9	99	0	11.8
MT000153	112.7	180	35	54.1	97	1	13.6
APB B99AL-616	112.3	183	33	53.2	98	1	12.4
MT000138	112.1	181	38	55.2	99	0	14.0
MT020075	112.0	184	30	52.8	98	1	12.3
Auriga	111.7	183	31	55.0	99	1	12.0
MT020080	109.6	182	30	51.1	99	1	12.3
MT010162	109.0	183	33	54.5	99	1	12.4
MT981006	107.9	182	33	52.5	97	1	12.5
MT020085	106.0	184	30	50.8	90	3	11.7
MT010080	106.0	181	33	51.9	98	1	13.3
Haxby	105.9	183	36	55.7	99	1	12.5
Tradition	105.2	182	40	51.6	97	1	12.8
MT010213	104.4	183	34	54.3	98	1	14.2
MT020155	104.2	179	35	52.2	95	1	13.9
Lacey	103.8	180	39	52.1	98	1	12.7
MT010160	103.6	182	36	54.9	99	0	13.2
Metcalfe	103.1	182	36	53.1	96	1	12.8
MT010212	103.0	182	33	53.0	96	1	13.1
MT010177	102.9	181	32	53.1	94	2	13.9
MT020072	102.9	184	36	54.6	99	0	13.6

Continued

Table 26 continued.

Variety	Yield	Head	Height	TW	Plump	Thin	Prot
Eslick	102.6	183	29	53.4	99	0	12.4
MT020204	102.0	182	33	54.8	98	0	14.4
Boulder, bz596-117	101.9	182	37	55.1	97	1	13.9
MT000047	101.7	181	35	54.0	99	1	13.3
Valier	101.3	184	34	54.3	98	0	13.4
MT020139	101.1	183	37	54.0	99	0	14.4
MT010081	100.9	183	38	54.0	99	1	13.0
MT981210	100.6	183	37	54.0	98	1	14.2
MT020090	99.5	183	32	53.1	97	1	12.2
MT020064	99.4	182	37	55.8	99	0	14.3
MT000040	99.1	182	33	55.5	99	0	13.6
MT981238	98.9	181	37	54.2	99	0	14.8
MT010191	98.8	184	37	55.1	97	1	13.2
MT010155	97.6	182	37	54.3	99	0	13.5
MT020205	97.2	180	35	54.0	97	1	14.1
MT020167	96.6	182	33	54.2	96	2	13.5
MT910189	96.2	182	35	54.8	98	1	12.8
MT010156	96.0	180	33	53.6	99	1	14.1
Gallatin	95.9	181	38	55.5	98	1	12.9
MT020037	95.1	182	40	53.9	93	2	14.4
Conlon	95.1	179	37	53.9	99	1	13.8
MT020120	94.8	183	34	53.5	99	0	12.4
MT000045	94.6	182	35	53.3	97	1	13.4
MT970116	92.4	181	39	55.5	99	0	13.1
Legacy	91.9	181	37	48.8	84	3	12.9
Harrington	90.5	183	35	53.0	98	1	12.4
MT000092	77.7	181	34	53.4	97	1	13.2
Morex	69.8	181	43	48.8	93	2	14.0
Mean	104.7	182.3	35.1	53.6	97.2	1	13.1
LSD (0.05) =	15.8						
C.V.1 =	9.4						
C.V.2 =	5.4						

Location: MSU Western Triangle Ag Research Center, Conrad, MT.
Planted Apr 21, 2004 on fallow. Harvested Aug 17, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 27. **Irrigated Intrastate Barley** varieties, Conrad 2004.
Condensed List

Variety	Yield bu/a	Head date	Plant height in.	Test weight lb/bu	Plump %	Thin %	Protein %
Calgary	124.3	183	31	55.1	95	1	12.7
Merit	124.0	185	36	50.3	91	2	11.5
Xena, WPB	123.8	183	37	55.1	98	0	12.4
Baronesse	123.5	183	36	52.9	95	2	12.2
MT970229	118.1	183	38	55.0	98	1	12.9
Conrad, 2B965057	116.4	183	34	54.1	99	1	13.3
Copeland	114.5	184	38	52.9	99	0	11.8
Auriga	111.7	183	31	55.0	99	1	12.0
Haxby	105.9	183	36	55.7	99	1	12.5
Tradition	105.2	182	40	51.6	97	1	12.8
Lacey	103.8	180	39	52.1	98	1	12.7
Metcalfe	103.1	182	36	53.1	96	1	12.8
Eslick	102.6	183	29	53.4	99	0	12.4
Boulder, bz596-117	101.9	182	37	55.1	97	1	13.9
Valier	101.3	184	34	54.3	98	0	13.4
MT910189	96.2	182	35	54.8	98	1	12.8
Gallatin	95.9	181	38	55.5	98	1	12.9
Conlon	95.1	179	37	53.9	99	1	13.8
MT970116	92.4	181	39	55.5	99	0	13.1
Legacy	91.9	181	37	48.8	84	3	12.9
Harrington	90.5	183	35	53.0	98	1	12.4
Morex	69.8	181	43	48.8	93	2	14.0
Mean	104.7	182.3	35.1	53.6	97.2	1	13.1
LSD (0.05) =	15.8						
C.V.1 =	9.4						
C.V.2 =	5.4						

Location: MSU Western Triangle Ag Research Center, Conrad, MT.
Planted Apr 21, 2004 on fallow. Harvested Aug 17, 2004.
Fertilizer, actual: 11-52-0 with seed.

Table 28. Five-year averages, **Irrigated Barley** varieties. Conrad 2000 -2004.

Variety	5-Year Average						
	Yield bu/a	Head date	Height in.	Test weight	Plump %	Thin %	Protein %
Xena, WB	111.1	182	33	53.8	94	2	11.5
Baronesse, WB	111.0	182	30	53.3	94	2	11.4
Eslick	111.0	183	29	53.5	94	1	11.2
MT970229	110.5	182	32	54.2	97	1	12.5
Calgary	109.5	182	27	53.7	93	1	12.2
Merit, BA	106.2	183	31	51.0	95	1	11.9
Haxby	104.7	182	31	55.0	95	1	11.9
Boulder, WB	104.0	181	31	54.5	94	1	12.2
Valier	103.5	183	32	53.5	94	1	12.2
Lacey, 6-row	101.3	178	31	52.0	95	1	11.7
Metcalfe	99.7	181	31	52.8	94	1	11.9
Gallatin	99.7	180	34	54.3	94	2	11.3
Conlon	98.6	179	30	53.6	96	1	12.5
Tradition, BA, 6-row	98.0	181	31	51.2	95	1	12.1
MT970116	97.1	181	34	53.8	95	2	12.3
MT910189	96.2	181	30	53.4	94	2	11.7
Harrington	92.6	183	30	52.2	94	2	11.6
Legacy, BA, 6-row	89.8	181	33	49.6	89	3	12.5
Morex, 6-row	68.6	180	34	50.0	85	3	12.8
Mean	101.4	181.8	30.9	52.8	92.3	2.1	12.0

BA = Busch Ag; WB = WestBred

Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 29. Irrigated **Malt Barley** varieties, Conrad 2004.

Variety	Yield bu/a	Head date	Plant height	Lodge 0-9	Test weight lb/bu	Plump %	Thin %	Protein %
Merit	111.6	184	32	5.0	50.9	90	3	12.1
Baronesse	109.2	182	33	3.0	52.8	91	4	13.0
Coors 37	108.2	184	26	0.0	52.9	91	3	12.3
Lacey	107.4	179	38	5.7	51.9	91	3	13.6
Tradition	105.6	181	39	6.7	51.7	94	2	13.7
Drummond	104.1	181	41	5.3	51.4	91	2	13.8
Gallatin	102.4	181	36	4.3	54.2	92	3	13.6
MT981238	98.7	181	36	1.7	54.9	97	2	15.0
Stander	97.9	180	39	5.3	52.3	90	3	13.3
Copeland	97.5	184	39	4.3	52.1	93	2	12.8
MT981210	97.4	182	34	4.0	54.3	97	1	14.0
Metcalfe	97.3	182	32	4.7	53.5	93	3	13.0
Haxby	96.7	181	37	4.3	55.7	95	2	13.2
MT970116	96.4	180	39	4.0	55.1	95	2	13.2
BA1202	96.3	183	33	5.0	52.5	94	2	12.9
Legacy	95.3	181	39	7.7	50.9	87	4	13.2
Foster	92.9	179	39	7.0	50.9	96	1	12.8
Conlon	91.6	178	35	1.3	53.8	96	1	13.3
Excel	89.8	180	40	5.7	50.2	79	7	13.1
Harrington	89.2	183	35	5.0	51.9	87	6	12.4
MT910189	88.2	180	35	7.3	54.2	92	3	13.8
Kendall	85.5	183	36	7.3	52.4	90	4	13.6
Robust	77.7	179	40	7.3	51.0	85	4	14.2
Morex	72.4	180	43	5.7	49.0	74	9	14.2
Mean	96.2	181.2	36.5	4.9	52.5	91	3	13.3
LSD (0.05) =	14.6			3.4	1.1	5	2	
C.V.1 =	9.3							
C.V.2 =	5.4							

Location: MSU Western Triangle Ag Research Center, Conrad, MT.
Planted Apr 21, 2004 on fallow. Harvested Aug 17, 2004.
Fertilizer, actual: 11-52-0 with seed. Lodging: 0 = none, 9 = flat.

Table 30. Four-year averages **Irrigated Malt Barley** varieties. Conrad 2001 2004.

Variety	4-Year Average						
	Yield bu/a	Head date	Height in.	Test weight	Plump %	Thin %	Protein %
Haxby +	104.4	181	31	54.2	96	2	12.7
Lacey, 6-row	104.0	178	33	51.2	94	3	12.0
Baronesse, WB +	103.4	181	28	53.0	95	2	11.8
MT970116	100.5	180	34	53.4	96	2	12.8
Merit, BA	99.1	184	29	50.0	92	3	11.8
Tradition, BA, 6-row	99.1	181	32	50.4	95	1	12.4
Metcalfe	97.5	182	31	52.2	94	2	12.0
MT981210	97.2	183	30	53.1	96	1	12.6
Foster, 6-row	96.9	178	33	49.8	96	1	11.9
MT981238	96.8	180	31	53.0	94	2	13.7
Gallatin +	96.4	180	32	53.5	95	1	12.2
MT910189	95.9	180	30	52.6	95	2	12.3
Kendall	95.2	183	30	51.9	95	2	12.4
Coors 37	94.8	182	25	52.1	94	2	12.1
BA1202	94.7	182	28	51.0	95	1	12.3
Drummond, 6-row	92.6	180	35	50.1	93	2	12.4
Excel, 6-row	92.3	180	34	49.2	86	4	11.7
Legacy, BA, 6-row	91.7	181	34	49.3	86	4	11.8
Conlon	89.0	178	30	52.9	96	2	12.1
Stander, 6-row	88.8	181	33	50.6	92	2	12.0
Harrington	87.4	182	30	50.6	91	3	11.8
Robust, 6-row	80.2	179	35	49.9	87	3	12.4
Morex, 6-row	69.8	180	35	49.1	83	5	12.9
Mean	94.4	180.8	31.1	51.5	92.9	2.1	12.1

BA = Busch Ag; WB = WestBred; + = feed barley.
Location: MSU Western Triangle Ag Research Center, Conrad, MT.

Table 31. Off-station **Barley** varieties. Cut Bank, 2004.

VARIETY	Yield bu/ac	Height in.	Test wt.	Plump %	Thin %	Protein %
Hays ++	87.9	35	47.8	90	3	9.6
Valier	87.3	35	52.2	97	1	9.6
Eslick	86.1	35	51.5	98	1	9.2
Baronesse	85.7	35	51.7	97	1	9.0
Haxby	83.4	34	53.0	98	1	9.6
MT970116	82.3	37	52.5	98	1	10.0
Metcalfe	82.3	36	52.3	98	1	9.5
Gallatin	82.1	36	52.7	98	1	10.3
Tradition, BA, 6-row	80.7	38	48.9	97	1	9.7
MT910189	79.5	33	53.4	98	1	9.9
MT970229	78.9	33	52.8	99	1	9.5
Lacey, 6-row	78.6	38	48.3	98	1	9.8
Harrington	77.8	34	51.8	98	1	9.5
Copeland	77.7	37	50.1	98	1	9.4
Conlon	70.1	36	51.6	99	1	10.7
Haybet ++	68.6	39	47.7	78	6	11.2
MEANS	80.6		51.2	96.3	1.4	9.8
C.V.1 =	5.99					
C.V.2 =	3.46					
LSD (0.05) =	8.05 bu		1.49	6.65	2.05	

++ Awnless Hay Barley. BA = Busch Ag.

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT.
Conducted by MSU Western Triangle Ag Research Center.
Planted Apr 19, 2004, no-till chem. fallow. Harvested Sept 4, 2004.
Fertilizer, actual: 11-52-0 with seed.