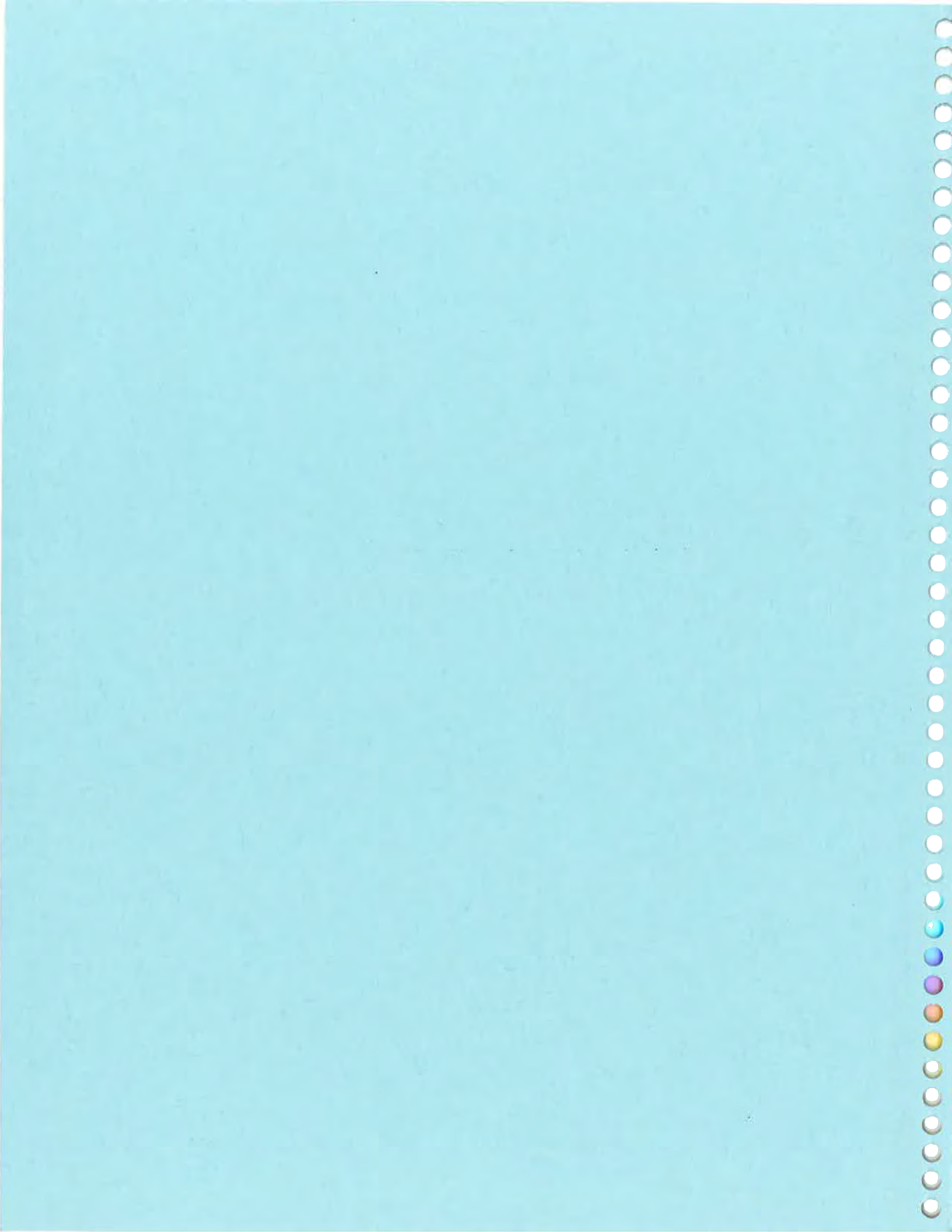


The 29th
ANNUAL RESEARCH REPORT
of the
WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER
Montana Agricultural Experiment Station
Conrad, Montana
2006 Crop Year

Submitted by
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Summary of climatic data by month for the '05-'06 crop year (September - August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (21-yr)	Current Year	Average (21-yr)
September, 2005	1.19	1.09	54.6	57.1
October, 2005	1.48	0.61	46.4	45.4
November, 2005	0.31	0.31	36.4	32.3
December, 2005	0.16	0.17	23.9	25.1
January, 2006	0.00	0.18	34.4	23.3
February, 2006	0.11	0.19	24.5	25.1
March, 2006	0.88	0.47	29.1	33.1
April, 2006	1.17	0.91	45.8	43.9
May, 2006	1.72	1.77	54.5	52.5
June, 2006	3.67	2.99	61.8	59.9
July, 2006	0.92	1.38	71.4	66.8
August, 2006	1.82	1.34	65.6	66.3
Total	13.43	--	--	--
Average	--	11.41	45.7	44.2

Last killing frost in Spring (32°F)

2006----- May 9

Average 1986-2006----- May 17

First killing frost in Fall (32°F)

2006----- Sept 23

Average 1986-2006----- Sept 23

Frost free period (days)

2006----- 137

Average----- 129

Maximum summer temperature----- 97°F (July 29, 2006)

Minimum winter temperature----- -29°F (Feb 17, 2006)

2006 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 and Jim Berg, 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 all entries at Conrad 2006 are presented in Table 1. A condensed version in Table 2 lists only the varieties and a few potential-release lines. The Knees 2006 results are in Table 4. The Knees harvest was delayed one week due to combine repairs, resulting in shatter losses for some varieties as noted in Table 4. Multi-year averages for the respective locations are listed in Tables 3 and 5.

Paul and Yellowstone were among the high yield-ranking varieties, but both were below average for test weight.

Among the sawfly resistant varieties, Genou was consistently higher yielding than Vanguard, Rampart and Bynum, and also had a moderately higher level of winter survival.

The tests included several varieties designed for Clearfield's 'Beyond' herbicide system. These varieties offer choices for various uses and conditions, with Hyalite being a hollow-stem hard white, and Bynum a solid-stem hard red for sawfly resistance. The others are of the hollow-stem hard-red class.

Among the hard white varieties, the experimental MTW01133 had higher yield and test weight than NuSky, and appears to have low PPO levels.

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.

Stem solidness scores of 19 or higher are generally required for reliable sawfly resistance.

Above (CO, 2001): IMI resistant (imazamox or 'Beyond' herbicide), as part of American Cyanamid's Clearfield System. 'Beyond' controls cheatgrass, goatgrass and wild oats. 'Above' has stiff straw, medium coleoptile, Winterhardiness = 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.

Bauermeister (WA7939, 2005): Winterhardiness = 2. Medium height, med-strong straw. Very late maturity. Very low test weight.

Big Sky (MT9432, 2001): Nuwest/Tiber cross, hard red kernels, white chaff. Good winterhardiness (4). 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 weight and protein, protein. Post-harvest seed dormancy is high, like Tiber. Septoria and tan spot resistance is good. A good alternative to Tiber.

Bond (CO 2004): Winterhardiness = 2. Clearfield system IMI resistant. Stiff straw, medium height, early maturity. Resistant to biotype 1 Russian wheat aphid.

Buteo (CDC, WPB, Sask., 2006): Standard height. Medium maturity. Below average yield. Above average test wt.

Bynum, MTCL0318 (MSU & WPB, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardiness = 2. Medium strong straw. Stem solidness = 20 (compared to 22 for Rampart), which typically provides a reliable level of sawfly tolerance. Similar in yield and other characteristics to Rampart. Sawfly resistant, low yield, high protein, and excellent baking quality.

Carter (WestBred, bzw02-2060, 2007): Semidwarf height. Stem solidness score = 14.4. Medium early heading. Below average yield. Above average test weight.

Falcon (CDC, WPB, Sask. 1999): Good winterhardiness (4), similar to Morgan and greater than Tiber. Semidwarf, 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. Not for stripe rust areas.

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. Medium stiff straw. 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. Yield 5-10% (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, 1.0% higher than Rocky.

Hatcher (CO 2004): Winterhardness = 2. Strong straw, medium height. Early maturity. Low protein. Resistant to biotype 1 Russian wheat aphid and Great Plains biotype Hessian fly.

Jagalene (AgriPro, 2002): Winterhardness = 2. Semidwarf, stiff straw, medium coleoptile. Early maturity, 1 day earlier than Rocky. Shatter resistant. Yield above avg, slightly less than Rocky. High test weight, higher than Rocky. Avg protein, but higher than Rocky. Good milling quality. Good disease resistance package (stem & stripe rust, tan spot and Septoria).

Jerry (ND, 2001): Winterhardness high (5). Medium-stiff straw, medium coleoptile. Medium-late maturity. Yield is below average, except in winterkill areas where it's above average. Average protein. Has one of the worst sawfly stem-cutting ratings. Shatter susceptible.

Ledger (WestBred, 2005). BZ9W96-788. Winterhardness = 2. Semidwarf height & stiff straw, 4" less than Rocky. Medium coleoptile. Stem solidness = 12 and highly variable & sensitive to cloudy conditions, which does not provide a reliable level of sawfly tolerance. Early heading, 1 day later than Rocky. Above avg yield & test wt. Avg protein and acceptable quality. Moderate stripe rust resistance.

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

Morgan (Sask & WPB, S89-142, 1996): Norstar/Archer. Excellent winterhardness (5). Standard height. Medium stiff straw. 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 winterhardness. Has one of the worst sawfly stem-cutting ratings.

MT1159CL (WestBred, MSU MTCL01159, 2004): Clearfield system single-gene 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. Winterhardness is marginal (2-), and production should be restricted to areas where winterkill risk is moderate. Semidwarf height and good lodging resistance. Long coleoptile. Stem solidness = 13, which does not provide a reliable level of sawfly tolerance. 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. To be discontinued and replaced by Norris.

Neeley (Idaho, 1980): Winterhardness medium (3). Medium short straw. Medium coleoptile. Medium-late maturity. 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. Not for stripe rust areas.

Norris, MTCL 0316 (MSU & WPB, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide (which controls cheatgrass, goatgrass and wild oats). Winterhardness = 3. Stiff straw, medium height, 3" taller than MT1159CL. Earlier maturity (2 days) and much higher yield than MT1159CL. High test weight. Low to average protein, good quality. Replaces MT1159CL.

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

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

Pryor (WPB, 2002): Winterhardiness 3 = Neeley. Short stiff straw, 4" shorter than Neeley. Medium coleoptile. Medium late maturity similar to Neeley & Tiber, 3 days later than Rocky. Above average yield. Average test weight and protein, good quality. Intended mainly for Central Montana as a replacement for Neeley. Not for stripe rust areas.

Rampart (MSU, 1996): Sawfly resistant (sister line to Vanguard). Solid stem rating = 22. Red chaff, upright head. Winterhardiness is marginal (2-). Should not be grown in areas where high levels of winterhardiness are needed, unless protected by stubble. Height 1 inch shorter than Neeley, med-stiff straw. Very long coleoptile. Matures 1 day later than 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. Winterhardiness = 2. Medium weak straw, medium height. Long coleoptile. Early maturity. High yield. Very susceptible to yellow berry expression under low nitrogen conditions. Medium protein. See Jagalene for alternative.

Tiber (MSU, 1988): Dark Red head, (darker than redwin); blackish red in years of favorable moisture. 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. Fdn seed being discontinued. See Big Sky for alternative.

Vanguard (MSU, 1995): Sawfly resistant. (Lew/Tiber/Redwin cross). Good stem solidness. White chaff, nodding head. Winterhardiness marginal (2-). 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 below 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.

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

Willow Creek (MSU 2005): Beardless forage winter wheat for hay. HRW class. Very tall straw, lodging susceptible. High forage yield. Tends to be safer than barley for nitrates, because earlier seasonal development escapes heat stress better.

Yellowstone (MT00159, MSU, 2005): Winterhardiness = 4. Height similar to Neeley, and taller than Falcon, Paul & Pryor. Straw strength is excellent. Coleoptile length is medium. Medium maturity, similar to Paul. Broadly adapted state-wide, but is stem-rust susceptible. Very high-yielding, 4% higher than Pryor and 9% higher than Falcon. Below average test weight. Protein is medium, similar to Paul & Morgan, and lower than Rampart & Genou. Excellent baking quality and good Asian noodle quality.

Hard White Class listed on next page:

Hard White Winter Wheat

Protein of hard white wheat for bread baking needs to be higher than required for noodle markets. Some varieties are dual-purpose and can be used for both bread and noodles. Although not a concern for bread baking quality, varieties with low levels of polyphenol oxidase (PPO) are desirable for noodles, since high PPO levels are associated with noodle discoloration. Some 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.

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, low PPO. Winterhardiness 3. Height similar to Rocky, med-stiff straw. Medium coleoptile. Medium maturity. Below average yield. Low test weight & protein.

Hyalite MTCL0306 (MSU & WPB, 2005): Hard White, low PPO. Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardiness = 3. Height similar to Neeley. Good yield, similar to Neeley. Red kernel occurrence is 0.7% (high, but still acceptable). Dual-purpose quality similar to NuWest & NuSky. Good milling & baking quality.

MDM WA7936 (Wash., 2006): Hard white. Winterhardiness = 2. Medium stiff straw. Very late maturity. Yield similar to NuWest. Low test weight.

NuDakota (AgriPro, 2005): Hard white. Semidwarf height. Early heading. Above average yield, average test wt.

NuFrontier (Gen Mills, 2001): Hard white, high PPO, but still used by GM. 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, high PPO. Winterhardiness = 3. Stiff straw, medium coleoptile. Early maturity. Above average yield. High test weight, low protein. Discontinued.

Nuwest (MT 7811) (MSU, General Mills, 1994): Hard white, low PPO. Dual purpose, noodle and bread. Winterhardiness = 4. 1 or 2 inches shorter than Rocky. Stiff straw. Very short coleoptile. Two days later than Rocky. 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 kernel/1000. Protein medium to high. Good quality.

NuSky (MTW 9441) (MSU, 2001): (Nuwest/Tiber). Hard white, low PPO. (Sister line to the hard red var BigSky). Good dual purpose quality for noodles & bread. Winterhardiness 4. 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.

Wendy (SD, 2004): Hard white. Semidwarf height. Early heading. Below average yield and test weight.

Table 1. 2006 Intrastate **Winter Wheat** Variety Test (Exp. 3518), Conrad, MT.

Variety	Source	Class**	Solid stem score*	Yield bu/ac	Test Wt lb/bu	Head date	Height in.	Protein %	1/ Stripe rust
Bond	Colorado	CL		88.5	62.8	151	33	12.4	VS
Paul	MSU			86.6	62.8	156	35	12.5	VS
Bauermeister	Wash.			86.5	61.2	159	36	11.3	MR
MTCL0486		CL		85.6	63.2	154	31	13.1	S
MT0495				85.4	62.3	156	33	13.2	R
NuFrontier	Gen Mills	HW		84.9	60.9	154	30	12.2	R
MT0419				84.9	63.1	155	32	12.9	R
Pryor	WestBred			84.7	63.9	156	30	11.4	MR
Norris CL0316	WestBred	CL		84.0	63.0	153	34	13.4	S
Yellowstone	MSU			83.7	62.2	155	34	12.4	R
MTW01133		HW		83.3	62.5	153	29	13.7	VS
Above	Colorado	CL		83.2	62.3	151	28	13.2	VS
Hyalite CL0306	WestBred	HW,CL		82.6	63.2	153	33	13.5	VS
MTCL0477		CL		82.5	62.3	154	37	12.4	MR
MT02113				82.1	62.7	156	35	11.8	VS
Hatcher	Colorado			81.7	63.2	155	29	12.8	MR
NuDakota	AgriPro	HW		81.0	62.0	152	29	13.3	R
Falcon	WestBred			80.4	63.7	156	28	12.4	S
Wahoo	Nebr.			80.3	62.6	152	32	13.2	S
Ledger	WestBred		11.6	78.1	63.7	156	32	13.6	MR
MTS04120			19.2	77.9	63.0	155	35	13.2	MR
Genou	MSU		19.4	77.0	63.5	155	35	13.6	S
Rocky	AgriPro			76.5	63.9	153	35	13.3	S
Neeley	Idaho			76.5	63.2	156	35	12.5	VS
Promontory	Utah			76.3	63.6	156	36	12.3	R
BigSky	MSU			75.6	63.2	155	36	13.6	VS
MDM	Wash.	HW		75.4	62.5	158	35	11.1	R
MT03176				74.9	61.6	153	34	13.3	R
Golden Spike	Gen Mills	HW		74.8	63.2	158	37	11.9	R
MT0403				74.7	62.1	153	32	13.7	S

Continued

Table 1 continued. (2006 Intrastate winter wheat).

Variety		Class	Solid stem*	Yield	Test Wt	Head date	Height	Protein %	<u>1/</u> Stripe rust
MTR0441				74.3	63.2	154	30	13.5	R
MT01148				74.2	63.2	159	37	13.3	R
MTS04114		HW	19.2	73.0	63.6	155	32	14.4	R
Rampart	MSU		22.7	71.1	64.4	155	35	14.5	R
Wendy	S. Dakota	HW		71.0	61.9	151	28	14.6	R
Bynum CL0318	WestBred	CL	19.8	70.9	62.7	154	31	14.9	R
MT1159CL	WestBred	CL	14.6	70.6	61.1	155	30	13.5	MR
Jagalene	AgriPro			70.3	64.7	155	32	13.5	R
Carter 22060	Westbred		14.4	69.5	63.0	154	28	13.3	MR
Tiber	MSU			69.4	63.0	155	36	13.1	S
MT0423				69.1	63.4	155	36	12.4	MR
Millenium	Nebr.			68.4	62.4	153	30	14.1	MR
Vanguard	MSU		20.3	68.0	62.8	156	36	14.2	MR
Buteo	WestBred			67.2	64.4	155	39	12.5	S
NuSky	MSU	HW		65.7	62.4	156	39	12.5	VS
NuWest	Gen Mills	HW		65.5	62.3	155	36	13.0	VS
Morgan	WestBred			60.2	62.7	157	37	13.0	VS
Jerry	N. Dakota			54.1	62.0	155	40	13.3	MR
Willow Creek	MSU	forage		50.0	61.2	161	51	14.2	R
Average				75.8	62.8	154.9	33.7	13.1	
LSD (0.05)				9.5 bu.					
C.V. (%)				7.7					
P-value				<.0001					

* Solid stem score of 19 or higher is generally required for reliable sawfly resistance.

** Classes: HW = hard white; CL = Clearfield System; Forage is awnless.

1/ Stripe rust data from several Montana locations: R=resistant, MR=mod res, S=susceptible, VS=very susc.

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

Planted Sept 20, 2005 on fallow. Fertilizer, actual: 71-52-0

Table 2. 2006 Intrastate **Winter Wheat Variety Test (Condensed list)**, Conrad, MT.

Variety	Source	Class**	Solid stem score*	Yield bu/ac	Test Wt lb/bu	Head date	Height in.	Protein %	<u>1/</u> Stripe rust
Bond	Colorado	CL		88.5	62.8	151	33	12.4	VS
Paul	MSU			86.6	62.8	156	35	12.5	VS
Bauermeister	Wash.			86.5	61.2	159	36	11.3	MR
MT0495				85.4	62.3	156	33	13.2	R
NuFrontier	Gen Mills	HW		84.9	60.9	154	30	12.2	R
Pryor	WestBred			84.7	63.9	156	30	11.4	MR
Norris CL0316	WestBred	CL		84.0	63.0	153	34	13.4	S
Yellowstone	MSU			83.7	62.2	155	34	12.4	R
MTW01133		HW		83.3	62.5	153	29	13.7	VS
Above	Colorado	CL		83.2	62.3	151	28	13.2	VS
Hyalite CL0306	WestBred	HW,CL		82.6	63.2	153	33	13.5	VS
MTCL0477		CL		82.5	62.3	154	37	12.4	MR
MT02113				82.1	62.7	156	35	11.8	VS
Hatcher	Colorado			81.7	63.2	155	29	12.8	MR
NuDakota	AgriPro	HW		81.0	62.0	152	29	13.3	R
Falcon	WestBred			80.4	63.7	156	28	12.4	S
Wahoo	Nebr.			80.3	62.6	152	32	13.2	S
Ledger	WestBred		11.6	78.1	63.7	156	32	13.6	MR
MTS04120			19.2	77.9	63.0	155	35	13.2	MR
Genou	MSU		19.4	77.0	63.5	155	35	13.6	S
Rocky	AgriPro			76.5	63.9	153	35	13.3	S
Neeley	Idaho			76.5	63.2	156	35	12.5	VS
Promontory	Utah			76.3	63.6	156	36	12.3	R
BigSky	MSU			75.6	63.2	155	36	13.6	VS
MDM	Wash.	HW		75.4	62.5	158	35	11.1	R
Golden Spike	Gen Mills	HW		74.8	63.2	158	37	11.9	R
MT01148				74.2	63.2	159	37	13.3	R
MTS04114		HW	19.2	73.0	63.6	155	32	14.4	R
Rampart	MSU		22.7	71.1	64.4	155	35	14.5	R
Wendy	S. Dakota	HW		71.0	61.9	151	28	14.6	R

Continued

Table 2 continued. (Condensed list, 2006 Winter Wheat varieties, Conrad).

Variety	Source	Class**	Solid stem*	Yield	Test Wt	Head	Height	Protein	Stripe rust 1/
Bynum CL0318	WestBred	CL	19.8	70.9	62.7	154	31	14.9	R
MT1159CL	WestBred	CL	14.6	70.6	61.1	155	30	13.5	MR
Jagalene	AgriPro			70.3	64.7	155	32	13.5	R
Carter 02-2060	Westbred		14.4	69.5	63.0	154	28	13.3	MR
Tiber	MSU			69.4	63.0	155	36	13.1	S
Millenium	Nebr.			68.4	62.4	153	30	14.1	MR
Vanguard	MSU		20.3	68.0	62.8	156	36	14.2	MR
Buteo	WestBred			67.2	64.4	155	39	12.5	S
NuSky	MSU	HW		65.7	62.4	156	39	12.5	VS
NuWest	Gen Mills	HW		65.5	62.3	155	36	13.0	VS
Morgan	WestBred			60.2	62.7	157	37	13.0	VS
Jerry	N. Dakota			54.1	62.0	155	40	13.3	MR
Willow Creek	MSU	forage		50.0	61.2	161	51	14.2	R
Average				75.8	62.8	154.9	33.7	13.1	
LSD (0.05)				9.5					
C.V. (%)				7.7					
P-value				<.0001					

* **Solid stem score of 19 or higher is generally required for reliable sawfly resistance.**

** Classes: HW = hard white; CL = Clearfield System; Forage is awnless.

1/ Stripe rust data from several Montana locations: R=resistant, MR=mod res, S=susceptible, VS=very susc.

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

Planted Sept 20, 2005 on fallow. Fertilizer, actual: 71-52-0

Table 3. Four-year averages, Winter wheat varieties, WTARC, Conrad 2003 - 06.

Variety	4-Year Average					Winter survival class ①						
	Yield bu/a	Test wt	Height in.	Head date	Protein %							
Yellowstone	MSU						79.8	61.6	37	165	12.9	4
Pryor	WestBred						78.5	62.4	34	165	12.2	3
Wahoo	Nebr.						78.4	62.4	34	161	13.2	3
Norris CL0316	WestBred	CL					78.0	62.9	37	162	13.3	3
Ledger	WestBred						77.4	63.9	34	163	13.0	2
MTW 01133		HW					77.4	62.0	32	161	13.4	
Paul	MSU						77.3	61.7	36	166	12.6	4
Hatcher	Colorado						77.0	63.3	34	162	12.6	2
NuFrontier	Gen Mills	HW					76.7	63.4	34	162	12.4	3
Falcon	WestBred						76.5	63.5	32	164	12.8	4
Rocky	AgriPro						76.3	64.1	40	163	12.7	2
Hyalite CL0306	WestBred	HW	CL				76.1	62.7	37	162	13.1	3
Bond CL	Colorado		CL				76.1	62.4	36	160	12.5	2
Above	Colorado		CL				75.1	62.6	32	160	13.3	2
Promontory	Utah						74.5	63.8	36	164	12.7	2-
Neeley	Idaho						73.7	62.4	39	167	12.9	3
BigSky	MSU						73.0	62.7	40	165	13.6	4
Genou	MSU	++					72.9	63.0	39	165	13.2	2
MTS 04120		++					72.8	62.9	38	165	13.2	
Millenium	Nebr.						72.3	63.3	37	161	13.4	2
Bauermeister	Wash.						72.0	58.2	37	169	11.8	2
Jagalene	AgriPro						71.6	64.8	33	162	13.8	2
NuSky	MSU	HW					71.5	61.5	40	166	12.9	4
NuWest	Gen Mills	HW					71.1	61.2	39	165	13.1	4
MDM	Wash.	HW					70.0	59.2	37	168	11.6	2
Morgan	WestBred						68.6	62.1	39	167	12.9	5
Vanguard	MSU	++					68.2	62.6	40	164	13.8	2-
Tiber	MSU						68.0	62.6	42	165	13.5	3
Golden Spike	Gen Mills	HW					68.0	61.0	39	167	12.6	3
MTS 04114		++	HW				67.6	62.7	36	164	14.2	
Carter	WestBred						67.4	63.0	32	163	13.5	
Bynum CL0318	WestBred	++	CL				65.5	62.8	36	163	14.5	2
Rampart	MSU	++					65.5	62.9	38	165	14.0	2-
Jerry	N. Dak.						65.4	61.9	42	164	13.5	5
MT1159CL	WestBred		CL				64.3	60.5	35	164	13.6	2-
nursery mean							73.6	62.4	36.8	164.0	13.1	

++ sawfly resistant. HW = hard white. CL = Clearfield herbicide system.

① Winterhardness: 5 = high, 1 = low.

Table 4. 2006 Off-station **Winter Wheat Variety Test**, Knees Area.

Variety			Yield bu/ac	Test Wt lb/bu	Height in.	Protein %
Paul	MSU		84.3	63.2	35	10.4
Pryor	WestBred		83.5	63.4	33	11.4
Neeley	Idaho		76.2	63.1	38	11.1
Wahoo	Nebr.		71.6	63.0	34	12.0
BigSky	MSU		70.8	63.3	41	11.7
Falcon	WestBred		70.6	63.0	33	12.7
MT01148			69.7	62.7	40	11.7
Genou	MSU	++	69.4	63.2	39	13.7
NuSky	MSU	HW	69.2	61.6	38	12.1
Tiber	MSU		67.7	63.2	42	12.6
Ledger	WestBred		67.4	64.3	34	11.8
Jagalene	AgriPro		66.3	64.5	35	13.6
Norris (0316)	WestBred	CL	66.2	63.3	37	13.1
Promontory	Utah		64.9	63.8	39	11.7
Yellowstone (shatter)	MSU		63.8	61.8	39	11.2
Rampart	MSU	++	61.4	62.7	37	12.9
Rocky (shatter)	AgriPro		60.6	63.5	38	11.5
Morgan	WestBred		59.4	62.1	38	10.8
Bynum (0318)	WestBred	++ CL	55.4	62.8	36	13.6
MT02113 (shatter)			54.7	62.3	39	10.7
Hyalite (0306) (shatter)	WestBred	HW CL	54.6	63.0	37	12.0
Vanguard	MSU	++	52.8	63.0	40	12.7
Millenium	Nebr.		51.5	63.0	35	12.3
Jerry (severe shatter)	N.Dak.		35.9	61.8	41	12.2
Average			64.5	63.0	37.4	12.06
LSD (0.05)			14.5			
C.V. (%)			13.7			
P-value (Varieties)			<.0001			

++ = Sawfly resistant (stem-solid rating of 19 or higher).

HW = Hard white. CL = Clearfield system.

Planted Sept 8, 2005, no-till chem-fallow. Fertilizer, actual: 71-52-0.

Harvested July 27, 2006: 1-week late, shatter loss for entries marked '**shatter**'

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

Conducted by MSU Western Triangle Ag Research Center.

Table 5. Five-year averages, **Winter Wheat** varieties, Knees area, Chouteau Co. 2002 - 06.

Variety	5-Year Average				Winter survival class ①	
	Yield bu/a	Test wt.	Height in.	Protein %		
Paul	63.3	57.8	34	12.8	4	
Pryor	62.8	59.2	35	12.3	3	
Wahoo	61.1	58.8	33	12.8	3	
Falcon	61.0	59.8	33	12.9	4	
Rocky	60.8	61.0	39	12.5	2	
Yellowstone	60.6	57.8	38	12.2	4	
Jagalene	60.3	61.7	35	13.5	2	
Norris CL0316	CL	59.1	59.8	37	13.0	3
Genou	++	58.3	60.1	38	13.4	2
BigSky		57.7	60.2	39	13.5	4
Promontory		57.7	60.7	36	12.4	2-
Neeley		56.8	58.0	37	13.0	3
Millenium		56.8	60.4	36	12.9	2
Tiber		56.4	60.0	41	13.5	3
NuSky	HW	55.6	58.6	37	12.8	4
MT01148		55.1	58.8	38	13.1	
Morgan		54.7	58.9	37	12.2	5
Hyalite CL0306	HW, CL	52.8	59.6	36	12.3	3
Jerry		52.5	59.7	41	12.9	5
Vanguard	++	52.3	59.9	38	13.7	2-
Rampart	++	51.5	59.9	37	13.5	2-
Bynum CL0318	++, CL	50.4	60.2	36	14.0	2
nursery mean		57.4	59.5	36.6	12.9	

++ = Sawfly resistant (stem-solid rating of 19 or higher).

HW = hard white. CL = Clearfield herbicide system.

① Winterhardiness: 5 = high, 1 = low.

Location: Dan Picard farm, east of Brady (Chouteau County).

Conducted by MSU Western Triangle Agr Research Center, Conrad, MT.

2006 Spring Wheat & Durum Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory Kushnak, Conrad, MT; Dr. Luther Talbert and Susan Lanning, MSU Plant Science Dept; and Dr. Joyce Eckhoff, EARC, Sidney, MT.

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

Results: Data for the spring wheat trials are presented in Tables 6-19, and include the 2006 and multi-year averages. All entries of the Advanced Yield trial at Conrad are listed in Table 6, with a condensed version in Table 7 showing only named varieties and a few potential-release lines. Table 19 is a summary of all the Western Triangle area tests over the past five years, and is equivalent to 25 tests on each variety. Durum data are presented in Tables 20-23.

Moisture conditions were favorable for spring wheat at Conrad, Knees and Cut Bank in 2006, while the Choteau and Oilmont locations suffered considerable lack-of-moisture stress.

'Agawam', 'Vida' and 'Choteau' were the top-ranking varieties for yield across all locations over the past five years (Table 19). Other varieties with above-average yield included 'Outlook', 'Hank', 'Reeder' and 'McNeal'. In addition to ranking high for yield, Agawam, Choteau and Reeder also had above-average test weight. Agawam is in the Hard White class, and had the highest test weight of the varieties tested. Vida exhibits a "stay-green" trait, in which the plant has a longer period of time after heading to develop grain yield. Moisture depletion before completion of grain filling could affect test weight, but it is not certain if Vida's below-average test weight is due to the stay-green trait or to some other factor.

Agawam and Choteau exhibited good sawfly tolerance, and had stem-solidness ratings slightly higher than 'Fortuna'.

Among the durum varieties, 'Alzada', 'Avonlea', 'Maier', and 'Strongfield' had above-average yield in the dryland trials over the past five years (Table 21). Maier, 'Pierce' and 'Dilse' had above-average average test weight. Strongfield and Avonlea had the highest protein. In the irrigated trial, Alzada, Avonlea, Mountrail, Pierce and 'Plaza' ranked above average for yield (Table 23). Avonlea and Dilse had the highest protein.

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

Sawfly Resistant Hard Red Spring Wheat Varieties:

Resistance (stem-solidness) among varieties ranges from low to high and varies with yearly climate differences; none have total resistance. Stem-solidness scores range from 5 (hollow) to 25 (completely solid). Solidness needs to be at least 19 to provide a reliable level of sawfly tolerance.

Agawam: See Hard White Spring Wheat. (Solid stem score = 23).

Choteau (MSU, 2004) MT9929: Semidwarf with good straw strength. Height is 2" shorter than McNeal and 4" shorter than Fortuna. Stems very solid with good sawfly resistance (more solid than Fortuna). Sawfly resistance comparisons (max rating = 25): Choteau = 21, Fortuna = 19, 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 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%). Normal gluten strength and good milling and baking quality. Fair Hessian fly tolerance.

Conan (BZ992598; WPB, 1998): Rambo/906R cross. Semidwarf. Solid stem score is low (10), but has low levels of sawfly-attractant cis-3-hexenylacetate, which increases sawfly resistance to medium. 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 is medium (solid stem score = 16). High level of sawfly-attractant cis-3-hexenylacetate. Moderately late maturing, slightly earlier than McNeal. Poor threshability. Tolerant to Far-go. Resistant to prevalent races of leaf & stem rust. Yield similar to Fortuna. High protein and test weight. Good quality.

Fortuna (ND): Beardless, tall straw. Too tall for irrigated conditions, where it becomes vulnerable to lodging. Good sawfly resistance (solid stem score = 19). 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. Fair Hessian fly tolerance.

Scholar (MT9433; MSU, 1999): Bearded. Medium tall, but slightly shorter than Fortuna. Moderate lodging resistance. Medium solid stem score (13) combined with high levels of cis-3-hexenylacetate result in medium-low sawfly resistance. Maturity medium-late, like McNeal. Average yield. Good quality. Good resistance to Septoria & tan spot.

Hollow-Stem, Sawfly Susceptible Hard Red Spring Wheat Varieties:

Alsen (ND, 2004). Moderate Fusarium scab resistance (MR). Semidwarf height. Medium maturity. Average yield. High test weight. High protein. Very poor Hessian fly tolerance.

AP603CL (AgriPro): Two-gene IMI resistance for Clearfield System.

Buck Pronto (Trigen Seeds, 2000): Semidwarf, stiff straw. Early maturity. Average yield. Below average test weight. Adapted to dryland and irrigated areas of Washington.

Corbin (WPB, 2006, BZ996434): Semidwarf height, stem-solidness score = 13. Medium maturity. Average yield. Above-average test weight. Average protein.

Freyr (AgriPro, 2004): Semidwarf height. Good lodging resistance, but less than Norpro. Medium maturity, 2 days earlier than McNeal. Above average yield, test weight and protein. Fusarium Scab resistance slightly lower than for Alsen (MR). Stripe rust MR. Acceptable quality.

Glenn (ND, 2006, ND747): Fusarium Scab tolerance slightly better than Alsen (MR).

Hank (WestBred): 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 3 days earlier than McNeal. Above average yield, similar to Reeder and McNeal, and higher than 926. Better shatter resistance than 926. Test weight 1 pound lower than McNeal. 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. Hessian fly tolerant (similar to Choteau).

Hanna (AgriPro): Fusarium Scab tolerant.

Jedd (WestBred, 2007, BZ9m03-1044): Clearfield System hard red with 2-gene resistance. Semidwarf height. Above average yield and test weight. Medium-late heading. Average protein.

Kelby (AgriPro, 2006, AP06): Scab tolerant, semidwarf height. Early heading. Below average yield. Above average test weight and protein.

Knudson (AgriPro): Semidwarf, strong straw. Medium maturity, similar to Reeder. Average yield. High test weight, low protein. Not well-adapted for District 5 (Triangle Area). Intermediate scab tolerance.

McNeal (MSU, 1994): Red chaffed. Semidwarf height. Good lodging resistance, but straw is less resilient, and is prone to breaking over in strong wind. Medium-late maturity. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Some tolerance to dryland root rot. Above average yield, similar to Reeder and Choteau. Average test weight. Very good quality with high protein and loaf volume. Medium-low Hessian fly tolerance.

Norpro (AgriPro): Semidwarf, strong straw. Medium-late maturity. Average yield. Average test weight and protein. Low flour yield and high ash. Not well-adapted for dryland in District 5 (Triangle), but suitable for irrigated.

Outlook (MSU, 2002): Russian Wheat Aphid resistant, but susceptible to new biotype in 2004. Stiff straw, semidwarf, height equal to McNeal & Reeder. Med-late maturity = McNeal. Above average 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; quality superior to Reeder.

Polaris (N. Star Genetics): Not tested. Very late maturity, med stiff straw, med test wt, low protein.

Reeder (ND, 1999): Semidwarf height. Medium head date, slightly earlier than 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. High protein. Quality is below average. Susceptible to Everest W.O. herbicide. Very poor Hessian fly tolerance.

Satum (N. Star Genetics): Not tested. Very late maturity, med height, stiff straw, med-low test wt, high protein.

Vida (MT 0245): Semidwarf height, medium straw strength. Med-late maturity, heading = McNeal, but stays green 3 to 4 days later than McNeal. High yield, 4 bu over McNeal. Average test weight and protein, acceptable quality. Possible replacement for Outlook and Reeder (except Outlook would remain in use for RWA resistance). MR stripe rust and Septoria. Partially-solid stem (stem score = 11), similar to Conan & Ernest for sawfly tolerance.

WestBred - See also Agawam, Conan, Corbin, Hank, Jedd.

WestBred 926R (WPB, 1987): Semidwarf. Good straw strength; 4 inches shorter than McNeal. Maturity 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. Average yield. Tendency to shatter. Average test weight. Above average protein. See also Hank.

Hard White Spring Wheat

Protein of hard white wheat for bread baking needs to be higher than wheat required for noodle markets. Some varieties are dual-purpose and can be used for both bread and noodles. Although not a concern for bread baking quality, varieties with low levels of polyphenol oxidase (PPO) are desirable for noodles, since high PPO levels are associated with noodle discoloration. At present, all Montana hard white spring varieties are high PPO, and thus better suited for bread baking. 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. Sawfly resistant: solid stem score = 22, similar to that of Choteau, and has a low level of sawfly-attractant cis-3-hexenylacetate. Early heading, similar to Explorer. Very high yield and test weight. Protein 1.4% lower than Explorer. Fair Hessian fly tolerance.

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 (MSU 2002). Hard white, bread-baking type. Semidwarf, 2 inches shorter than McNeal. Slightly solid-stem, but not sufficient for sawfly resistance. Early maturing, 3 days earlier than McNeal. Yield is 2 bu less than McNeal and 6 bu less than Agawam. Very susceptible to Septoria, thus not recommended for far eastern Montana. Average test weight. High protein, 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. High quality.

Idaho 377S (ID, Pro-Mar, General Mills, 1997): Hard white. Taller than most irrigated varieties, and therefore is more prone to lodging. Susceptible to Avenge herbicide.

MTHW 0202 (MSU exper line): Hard white. Sawfly resistant (solid stem score = 20). Semidwarf. Early maturity. Average yield. Above average test weight. Protein 0.5% less than Explorer, and 0.9% higher than Agawam. Being re-selected for purity, and will be re-tested as a new line (0202 essentially no longer exists).

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.

Pristine (WPB): Hard white. Semidwarf. 3 days earlier than McNeal. Yield = McNeal. Protein 0.5% < McNeal. Very high quality, and used for bread baking by industry in Mid-west.

Durum

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

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. Kernel color is a very important quality trait. Rainfall or irrigation after heading causes color loss (bleaching), but some varieties are less prone to color loss. Canadian varieties are screened for bleaching resistance. Such varieties are the preferred choice in areas of late-season rainfall. Varieties that lose color more readily may be okay for drier areas of Montana. Varieties developed for the arid southwestern U.S. could be at higher 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.

Alkabo (ND, 2006): Medium-tall height, very stiff straw. Medium maturity. Above average yield and test wt. Good quality.

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

Avonlea (Can, 1997): Medium tall. Medium straw strength and lodging resistance. Early maturity. High yield and average test weight. Good quality and protein.

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

Ben (ND, 1997): Medium height, medium strong straw. Medium maturity. Below average yield. Large kernel size, high test weight & average protein. Good quality.

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

Dilse (ND): Medium height, late maturity. Below average yield. Average weight. High protein, excellent quality.

Divide: (ND, 2006): Medium-tall height, stiff straw. Medium maturity. Average yield. Above average test wt. Excellent quality.

Grenora (ND, 2006): Medium-tall height, stiff straw. Medium maturity. Average yield and test wt. Good quality.

Kyle (Canada, 1984): Very tall weak straw, poor lodging resistance. Very late maturing. Average yield and test weight, large kernel size. Kyle has the highest tolerance to color-loss (rain-bleaching). Above average protein. Strong gluten; good quality.

Lebsock (ND): Medium-short height, stiff straw. Late maturing. Below average yield and protein. Above average test weight. Good quality.

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

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

Mountrail (ND, 1998): Medium-tall, but stiff straw and fair lodging resistance. Medium-late maturity. Above average yield. Average test weight. Medium large kernel and average protein. Medium 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. Average yield, test weight and protein. Medium kernel size. Strong gluten, good quality.

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-tall height and lodging resistance. Average yield. High test weight. Average protein, good quality.

Plaza (ND): Med-short straw, med lodging resistance. Late maturity. Below-average yield on dryland; above-average yield on irrigated. Below average test weight. Low protein, medium quality.

Strongfield (Can, 2005): Medium tall, med-late maturity. Above average yield. Average test weight. Above-average protein. Good color and quality. Low Cadmium uptake.

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

Table 6. 2006 Advanced **Spring Wheat** variety nursery, Conrad Dryland.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0249		70.6	59.5	32	176	14.1
MT 0416		68.8	59.1	33	177	13.4
BZ902413		68.5	60.4	32	175	13.6
MT 0515		68.3	60.7	34	178	13.7
MT 0266		67.9	58.5	34	175	14.1
AGAWAM	++ HW	67.7	62.9	31	172	12.7
CHOTEAU	++	67.3	59.6	33	177	13.9
MT 0413		65.4	61.3	32	175	13.6
MT 0539		65.2	58.5	32	176	13.7
BZ999592		64.7	59.2	33	178	13.9
MT 0540		64.7	59.1	32	173	13.9
VIDA MT 0245		64.7	58.3	34	178	13.1
MT 0336		63.8	59.3	35	177	12.9
OUTLOOK		63.8	56.9	34	179	13.5
MT 0519		63.6	61.4	34	175	14.0
MT 0405		63.5	59.3	31	176	13.9
MT 0516		62.9	60.4	34	175	14.3
MTHW0202	HW	62.7	61.1	32	171	13.7
MT 0260		62.1	59.2	34	178	13.4
Reeder		62.0	60.0	35	176	13.7
MT 0414		61.5	60.0	36	176	14.1
Jedd BZ9M1044	CL	61.2	60.0	28	177	13.2
BW781		61.0	58.6	36	173	14.6
SCHOLAR	+	60.8	59.8	38	179	14.1
MT 0550		60.5	60.3	34	174	13.1
MT 0412		60.4	61.0	32	171	12.8
MT 0415		59.7	60.2	36	177	14.4
HANK		59.6	58.0	33	175	13.6
EXPLORER	HW	59.0	59.0	30	174	14.1
GLENN		58.8	63.3	39	176	14.5
KELBY		58.8	61.9	30	174	14.4
BZ9M1024		58.7	59.1	32	175	13.6
MT 0544		58.4	58.5	34	176	13.9
WPB GERMANY		58.3	61.6	31	178	13.2
NORPRO		58.0	56.8	29	176	14.2

Table 7. 2006 Advanced **Spring Wheat** variety nursery, Conrad Dryland.**Condensed List**

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0249		70.6	59.5	32	176	14.1
MT 0266		67.9	58.5	34	175	14.1
AGAWAM	++ HW	67.7	62.9	31	172	12.7
CHOTEAU	++	67.3	59.6	33	177	13.9
BZ999592		64.7	59.2	33	178	13.9
VIDA MT 0245		64.7	58.3	34	178	13.1
MT 0336		63.8	59.3	35	177	12.9
OUTLOOK		63.8	56.9	34	179	13.5
MTHW0202	HW	62.7	61.1	32	171	13.7
MT 0260		62.1	59.2	34	178	13.4
Reeder		62.0	60.0	35	176	13.7
Jedd BZ9M1044	CL	61.2	60.0	28	177	13.2
SCHOLAR	+	60.8	59.8	38	179	14.1
HANK		59.6	58.0	33	175	13.6
EXPLORER	HW	59.0	59.0	30	174	14.1
GLENN		58.8	63.3	39	176	14.5
KELBY		58.8	61.9	30	174	14.4
BZ9M1024		58.7	59.1	32	175	13.6
WPB GERMANY		58.3	61.6	31	178	13.2
NORPRO		58.0	56.8	29	176	14.2
KNUDSON		56.9	58.9	31	178	13.1
CORBIN BZ996434		56.2	59.3	33	175	14.1
FREYR		55.6	60.5	35	175	14.1
ERNEST	+	54.7	58.7	39	177	14.5
Conan	+	53.1	59.1	33	175	13.8
MCNEAL		51.3	58.9	33	178	13.1
FORTUNA	++	43.7	60.2	42	176	14.2
THATCHER		42.9	57.6	43	180	14.1
nursery mean		58.8	59.4	33.7	176.1	13.8

LSD (.05) = 7.41 bu in same block; 7.57 bu for different blocks.

C.V. = 7.46

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white. CL = Clearfield System.

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

Planted April 19, 2006 on fallow. Harvested Aug 14, 2006.

Fertilizer, actual: 71-52-0

Table 8. Five-year averages, dryland Spring Wheat varieties,
Conrad area, Pondera Co. 2002 - 2006.

Variety	Source	Class	5-Year Average				
			Yield bu/a	Test weight	Height in.	Head date	Protein %
Agawam	WestBred	++ HW	60.2	62.5	30	180	13.1
Choteau	MSU	++	56.4	59.8	32	182	14.3
Vida MT 0245	MSU		55.9	58.5	33	184	13.6
Reeder	ND		55.8	59.5	34	181	14.1
Jedd bz9m1044	WestBred	CL	55.0	60.3	28	183	13.7
Freyr	AgriPro		53.5	60.7	34	182	14.3
Outlook	MSU		52.9	57.9	32	184	14.3
Norpro	AgriPro		52.8	58.0	29	182	14.1
Hank	WestBred		52.4	57.7	32	181	14.3
Corbin bz996434	WestBred		52.2	60.0	33	182	14.3
Knudson	AgriPro		51.9	59.9	32	183	13.7
McNeal	MSU		51.6	59.7	32	183	13.8
Explorer	MSU	HW	51.2	59.6	30	180	14.4
Scholar	MSU	+	49.6	59.9	37	184	14.8
Kelby	AgriPro		49.6	61.7	32	181	15.1
Conan	WestBred	+	49.1	59.1	31	182	14.6
Fortuna	ND	++	48.5	60.5	39	182	13.9
Ernest	ND	+	46.0	59.2	38	183	15.2
Nursery Mean			53.3	59.5	32.8	182.0	14.2

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

CL = Clearfield System (2-gene). HW = Hard White

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

Table 9. 2006 Irrigated Spring Wheat variety trial, Conrad, MT.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
AGAWAM	++ HW	90.6	64.2	32	172	13.0
MT 0515		89.0	62.5	33	176	13.6
CHOTEAU	++	87.6	61.4	31	176	13.9
MTHW0202	++ HW	84.0	63.0	30	171	13.7
HANK		81.0	60.4	31	174	13.8
Vida MT0245		80.3	59.1	33	176	13.8
MT 0564		77.5	61.0	32	174	13.6
Conan	+	76.8	60.0	33	173	13.8
OUTLOOK		76.5	58.6	35	176	13.8
Reeder		75.2	61.7	35	173	14.0
FREYR		75.0	61.5	36	174	14.0
GLENN		74.9	63.7	37	172	14.5
NORPRO		74.8	60.3	31	175	13.5
WB 926		74.7	59.9	32	172	14.2
FORTUNA	++	71.2	61.7	41	175	13.9
SCHOLAR	+	70.4	60.8	37	176	15.2
ERNEST	+	69.1	61.1	39	174	14.4
MCNEAL		67.2	59.5	36	176	13.8
KNUDSON		67.0	60.5	33	175	13.0
EXPLORER	HW	64.3	60.0	32	172	14.6
mean		76.4	61.1	34.0	174.1	13.9

LSD (.05) = 11.6 bu. C.V.1&2 = 9.2 & 5.3

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

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

Planted April 19, 2006 on fallow. Harvested Aug 14, 2006.

Fertilizer, actual: 100-52-0

Table 10. Five-year averages, irrigated Spring Wheat varieties,
Conrad area, Pondera Co. 2002 - 06.

Variety	Source	Class	5-Year Average				
			Yield bu/a	Test wt.	Height in.	Head date	Protein %
Agawam	WestBred	++ HW	85.0	63.6	34	179.2	13.5
Vida MT 0245	MSU		83.6	60.7	35	182.9	14.6
Hank	WestBred		83.2	60.2	33	180.8	14.7
MTHW 0202		HW	82.1	62.5	33	178.5	13.7
Choteau	MSU	++	81.5	61.5	33	182.0	14.7
WB 926	WestBred		80.3	60.7	33	180.0	14.6
Outlook	MSU		77.7	59.7	35	182.8	14.2
Reeder	ND		77.1	61.9	36	181.0	15.0
McNeal	MSU		77.0	60.4	35	182.8	14.4
Norpro	AgriPro		76.7	60.8	32	181.7	14.3
Explorer	MSU	HW	76.3	61.4	33	179.8	14.6
Scholar	MSU	+	73.1	61.5	40	183.2	15.4
Conan	WestBred	+	72.8	60.9	34	181.6	14.4
Knudson	AgriPro		72.3	61.5	36	182.2	13.9
Ernest	ND	+	68.4	61.5	42	181.8	15.4
Fortuna	ND	++	65.9	61.8	41	181.2	14.8
nursery mean			76.5	61.2	35.4	181.4	14.6

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

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

Table 11. 2006 Spring Wheat variety trial, Cut Bank.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
AGAWAM	++ HW	104.2	63.8	31	12.3
MT 0515		103.4	61.9	37	13.0
CHOTEAU	++	93.5	61.5	32	12.8
Vida MT0245		88.9	60.0	37	13.2
HANK		87.8	59.8	32	12.5
FORTUNA	++	87.8	62.9	44	13.4
WB 926		86.3	60.0	33	12.7
MTHW0202	++ HW	85.9	62.4	32	12.7
SCHOLAR	+	85.3	61.1	42	13.9
KNUDSON		81.7	60.5	34	11.9
Conan	+	80.3	58.9	33	13.7
EXPLORER	HW	78.8	60.5	34	13.5
FREYR		78.1	61.5	35	12.7
MT 0564		78.0	61.5	35	12.5
Reeder		77.7	60.4	36	13.2
OUTLOOK		76.8	58.7	35	12.6
ERNEST	+	75.5	62.4	43	12.4
GLENN		72.4	64.7	40	13.8
NORPRO		69.8	57.6	32	13.0
MCNEAL		65.3	59.0	36	12.7
mean		82.9	61.0	35.7	12.9
LSD (.05) = 10.4 bu. C.V.1&2 = 7.6 & 4.4					

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

Cooperator & location: Kevin Bradley, north of Cut Bank, MT
Planted April 18, 2006 on chem-fallow.

Fertilizer, actual: 81-52-0

Harvested Aug 22, 2006.

Conducted by MSU Western Triangle Ag Research Center.

Table 12. Four-year averages, **Spring Wheat** varieties,
Cut Bank area, Glacier Co. 2003 - 06.

Variety	Source	Class	4-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Agawam	WestBred	++ HW	58.8	63.9	31	11.5
Vida MT 0245	MSU		55.1	60.5	34	11.9
Choteau	MSU	++	54.6	61.9	31	11.9
Fortuna	ND	++	53.5	62.1	41	12.6
Hank	WestBred		52.5	59.8	32	11.7
Outlook	MSU		51.7	59.4	34	11.4
MTHW 0202		HW	51.5	62.8	32	11.6
Explorer	MSU	HW	49.5	61.0	33	11.9
Knudson	AgriPro		48.9	61.3	34	11.7
WB 926	WestBred		48.7	60.2	31	12.2
Reeder	ND		48.7	60.8	34	12.1
McNeal	MSU		48.1	60.4	34	12.1
Conan	WestBred	+	47.5	59.9	31	12.5
Scholar	MSU	+	46.1	61.0	40	12.3
Ernest	ND	+	45.9	62.0	39	11.9
Norpro	AgriPro		45.4	58.9	32	11.7
nursery mean			50.2	61.0	34.1	12.0

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT

Conducted by MSU Western Triangle Agr Research Center.

Table 13. 2006 **Spring Wheat** variety trial, Choteau, MT.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
OUTLOOK		39.4	54.0	31	16.4
Vida MT0245		38.9	54.9	28	16.5
CHOTEAU	++	37.0	55.5	29	16.9
MCNEAL		36.1	52.3	30	17.5
MT 0564		35.2	55.4	28	17.1
ERNEST	+	34.7	56.9	34	17.4
GLENN		33.4	58.4	38	16.6
Reeder		33.4	55.1	31	16.8
Conan	+	33.2	54.8	27	16.9
AGAWAM	++ HW	33.1	57.4	28	16.4
MTHW0202	++ HW	32.9	54.5	28	16.8
MT 0515		32.5	55.8	28	17.0
WB 926		32.0	52.7	28	17.8
EXPLORER	HW	31.4	54.5	29	17.2
SCHOLAR	+	31.1	55.7	33	17.5
NORPRO		30.7	53.1	28	17.0
FREYR		29.8	54.8	30	16.3
FORTUNA	++	29.4	57.4	35	16.6
HANK		28.8	51.4	28	17.8
KNUDSON		24.3	53.8	30	17.7
mean		32.9	54.9	30.1	17.0
LSD (.05) = 6.1 bu. C.V.1&2 = 11.2 & 6.5					

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

Cooperator & location: Roy Inbody, east of Choteau, MT

Planted April 20, 2006 on recrop.

Fertilizer, actual: 100-52-0

Harvested Aug 8, 2006.

Conducted by MSU Western Triangle Ag Research Center.

Table 14. Four-year averages, **Spring Wheat** varieties,
Choteau area, Teton Co. 2003 - 06.

Variety	Source	Class	4-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Vida MT 0245	MSU		52.0	56.7	34	16.2
Outlook	MSU		50.3	55.9	33	16.2
Agawam	WestBred	++ HW	49.2	60.3	32	15.4
Choteau	MSU	++	47.4	57.6	32	16.7
McNeal	MSU		47.3	55.7	34	17.0
Reeder	ND		45.8	57.3	34	16.9
Conan	WestBred	+	45.1	57.5	30	16.4
Hank	WestBred		44.6	54.5	31	17.5
WB 926	WestBred		44.5	55.2	31	17.3
Fortuna	ND	++	43.1	59.5	41	16.5
Explorer	MSU	HW	42.9	57.1	32	16.4
Ernest	ND	+	42.8	58.7	40	17.1
Norpro	AgriPro		42.5	54.2	32	16.8
MTHW 0202		HW	42.4	57.7	32	16.2
Knudson	AgriPro		40.6	57.6	35	16.9
Scholar	MSU	+	39.8	57.8	38	17.4
nursery mean			45.1	57.0	33.8	16.8

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

Cooperator & Location: Roy Inbody, Choteau, MT. Teton Co.

Conducted by MSU Western Triangle Agr Research Center.

Table 15. 2006 **Spring Wheat** variety trial, Oilmont.

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
OUTLOOK		38.5	48.3	37	16.9
AGAWAM	++ HW	37.9	52.3	32	16.6
MT 0515		37.6	49.9	34	17.1
Vida MT0245		36.7	47.8	34	18.1
MT 0564		36.0	49.2	34	18.1
CHOTEAU	++	35.6	49.2	31	17.2
Reeder		34.3	49.2	40	17.6
Conan	+	33.0	49.7	33	18.1
MCNEAL		32.6	46.5	36	18.3
MTHW0202	++ HW	31.6	49.0	33	16.9
WB 926		31.4	46.8	33	18.9
HANK		31.0	46.0	30	18.7
EXPLORER	HW	29.6	47.8	30	18.3
ERNEST	+	29.4	48.5	41	18.0
NORPRO		29.2	45.6	32	18.0
FREYR		28.6	49.9	35	17.2
FORTUNA	++	27.6	50.5	40	17.1
SCHOLAR	+	27.3	48.0	43	19.2
GLENN		25.0	50.3	40	17.5
KNUDSON		24.6	49.5	35	17.8
mean		31.9	48.7	35.2	17.8
LSD (.05) = 5.8 bu. C.V.1&2 = 11.1 & 6.4					

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

Cooperator & location: Terry Alme, east of Oilmont, MT.

Planted April 17, 2006 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 6, 2006.

Conducted by MSU Western Triangle Ag Research Center.

Table 16. Two-year averages, **Spring Wheat** varieties,
Oilmont area, Toole Co. 2003 & 2006.

Variety	Source	Class	5-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Outlook	MSU		29.7	46.6	34	18.2
Reeder	ND		28.2	48.2	35	18.4
Choteau	MSU	++	27.6	50.0	30	18.1
Hank	WestBred		26.9	46.3	29	19.6
McNeal	MSU		26.0	45.0	31	19.3
WB 926	WestBred		25.9	45.9	30	19.6
Conan	WestBred	+	25.8	48.7	30	18.7
Explorer	MSU	HW	25.7	47.6	30	19.0
Ernest	ND	+	25.1	49.7	37	19.1
Fortuna	ND	++	25.0	49.5	38	17.9
Scholar	MSU	+	22.9	47.8	38	19.8
nursery mean			26.3	47.7	32.7	18.9

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

Cooperator & Location: Terry Alme, Oilmont, Toole Co. MT

Conducted by MSU Western Triangle Agr Research Center.

Table 17. 2006 **Spring Wheat** variety trial, Knees area, MT

Variety	Class	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
AGAWAM	++ HW	76.9	59.9	30	14.6
Vida MT0245		76.6	55.7	34	15.2
HANK		76.5	53.8	33	15.1
CHOTEAU	++	76.4	57.8	32	15.4
MT 0515		74.9	57.6	34	14.9
WB 926		73.4	53.5	33	15.9
MTHW0202	++ HW	73.0	56.3	32	15.3
OUTLOOK		72.7	53.2	33	15.4
MCNEAL		71.6	55.3	34	15.8
NORPRO		70.6	53.8	32	14.8
EXPLORER	HW	69.6	54.5	33	15.6
Reeder		69.3	55.7	35	15.7
FREYR		68.8	56.6	36	15.0
MT 0564		68.2	55.7	32	16.2
KNUDSON		66.5	57.3	36	15.0
SCHOLAR	+	65.2	56.5	38	15.8
GLENN		64.1	59.3	42	15.6
Conan	+	61.4	55.5	30	15.4
FORTUNA	++	61.0	59.0	42	15.8
ERNEST	+	59.7	57.1	40	16.3
mean		69.8	56.2	34.6	15.4
LSD (.05) = 9.5 bu. C.V.1&2 = 8.2 & 4.8					

++ = sawfly resistant (solid stem score 19 or higher).

+ = partial sawfly resistance.

HW = hard white.

Cooperator & location: Dan Picard, western Chouteau Co.

Planted April 21, 2006 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 8, 2006.

Conducted by MSU Western Triangle Ag Research Center.

Table 18. Five-year averages, **Spring Wheat** varieties,
Knees area, Chouteau Co. 2002 - 06.

Variety	Source	Class	5-Year Average			
			Yield bu/a	Test weight	Height in.	Protein %
Agawam	WestBred	++ HW	50.4	59.5	31	14.7
Vida MT 0245	MSU		49.9	56.1	33	15.3
Hank	WestBred		49.0	54.0	32	16.2
McNeal	MSU		48.9	55.3	33	15.8
Choteau	MSU	++	48.6	57.1	31	15.6
MTHW 0202		HW	47.5	57.5	31	15.4
WB 926	WestBred		47.3	54.2	31	16.8
Reeder	ND		47.0	56.2	33	16.1
Outlook	MSU		46.7	54.3	33	15.3
Explorer	MSU	HW	46.3	55.8	32	15.6
Norpro	AgriPro		46.3	54.0	31	15.3
Knudson	AgriPro		44.5	57.8	34	15.5
Fortuna	ND	++	44.2	58.1	39	15.8
Scholar	MSU	+	43.9	57.7	36	16.4
Conan	WestBred	+	41.9	56.0	30	15.8
Ernest	ND	+	40.6	57.4	37	16.1
nursery mean			46.3	56.1	33.2	15.8

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

Cooperator & Location: Dan Picard, Knees area, Chouteau Co. MT

Conducted by MSU Western Triangle Agr Research Center.

Table 19. Multi-Year x Location Averages - **Spring Wheat Varieties.**
Western Triangle Area

Variety	Source	Class	25-Year x Location Average ^①				
			Yield bu/a	Test weight	Height in.	Protein %	Head date ^②
Agawam	WestBred	++ HW	55.5	60.1	31.4	14.1	179.2
Vida MT 0245	MSU		54.3	56.7	33.7	14.8	182.9
Choteau	MSU	++	52.7	58.0	31.4	15.1	182.0
Outlook	MSU		51.5	55.6	33.5	14.7	182.8
Hank	WestBred		51.4	55.4	31.5	15.5	180.8
Reeder	ND		50.4	57.3	34.3	15.3	181.0
McNeal	MSU		49.8	56.1	33.2	15.2	182.8
WB 926	WestBred		49.4	55.7	31.4	15.7	180.0
Explorer	MSU	HW	48.7	57.1	31.5	15.2	179.8
Norpro	AgriPro		48.2	55.5	31.0	14.9	181.7
Knudson	AgriPro		47.2	57.8	34.0	14.8	182.2
Conan	WestBred	+	47.0	57.0	31.0	15.3	181.6
Fortuna	ND	++	46.7	58.6	39.6	15.1	181.2
Scholar	MSU	+	45.9	57.6	38.0	15.9	183.2
Ernest	ND	+	44.8	58.1	38.6	15.6	181.8
nursery mean			49.5	57.1	33.7	15.2	181.4

++ Sawfly resistant (solid stem score of 19 or higher).

+ Partial sawfly resistance

HW = Hard White

① Conrad 5-yr, Conrad Irr 5-yr, Choteau 4-yr, Knees 5-yr, Cut Bank 4-yr, Oilmont 2-yr.
Years included are 2002 to 2006.

② Head date, Conrad only.

Conducted by MSU Western Triangle Agr Research Center.

Table 20. 2006 dryland Durum variety trial, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %	HAVC	Color	100-seed wt, gm
MT01695	71.9	63.0	26	176	12.2	94.3	18.1	3.39
MT01649	69.9	58.6	25	174	13.8	93.6	20.0	3.54
Avonlea	65.9	60.2	37	178	13.9	100.0	19.8	3.68
MT02525	65.8	61.8	26	175	12.9	91.0	18.9	3.41
MT03012	65.0	61.9	27	172	13.4	97.5	19.1	3.36
Strongfield	64.8	60.5	38	180	14.9	92.2	20.1	3.23
Alzada	64.2	60.1	29	175	12.4	91.1	19.2	4.53
Alkabo	64.1	61.1	36	178	13.2	97.9	18.0	3.42
MT02DH82	63.6	62.1	38	177	12.7	92.0	17.5	4.08
Pierce	63.4	61.1	39	178	12.9	97.0	17.8	3.72
Mountrail	63.2	59.4	38	179	14.4	82.7	22.0	3.12
Grenora	63.0	59.9	36	178	13.4	100.0	17.8	4.04
Divide	62.7	60.9	37	179	13.1	93.3	19.1	3.69
MT02302	62.3	57.9	28	177	13.7	92.7	20.7	3.30
MT02DH32	61.7	61.3	37	175	14.0	87.6	19.3	3.34
Kyle	61.1	60.3	45	180	14.1	93.2	19.7	3.44
Dilse	60.7	61.3	36	179	12.9	89.2	19.4	3.87
MT02DH71	60.6	60.3	37	178	14.1	92.5	18.8	3.24
MT02DH55	60.3	58.9	36	178	13.0	92.7	20.3	3.21
Maier	60.1	60.6	35	178	14.0	89.5	20.1	3.21
MT01617	60.0	57.0	28	179	13.3	76.8	21.3	2.85
Plaza	58.3	58.0	28	179	13.1	81.0	19.8	3.14
MT02298	58.1	58.5	26	178	13.4	88.5	19.2	3.33
MT03108	53.5	55.7	27	178	14.9	82.9	21.1	3.17
Mean	62.7	60.0	33.1	177.4	13.5	91.2	19.5	3.47

LSD (.05) = 10.8 bu. C.V.1&2 = 10.5 & 6.1

Planted April 19, 2006 on fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 9, 2006.

Location: MSU Western Triangle Ag Research Ctr, Conrad, MT

Table 21. Five-year averages, dryland Durum varieties, Conrad area, Pondera Co. 2002 - 06.

Variety	Source	5-Year Average				Protein %
		Yield bu/a	Test weight	Height in.	Head date	
Alzada	WestBred	55.1	60.2	31	181	13.6
Avonlea	Can	54.8	60.2	37	183	14.9
Strongfield	Can	54.7	60.1	37	185	15.0
Maier	ND	52.4	61.0	34	183	14.3
Mountrail	ND	52.3	59.7	36	184	14.2
McNeal Wheat	MSU	52.3	59.0	34	183	13.9
Pierce	ND	50.8	61.0	37	183	14.1
Kyle	Can	50.5	60.1	41	185	14.7
Plaza	ND	50.3	59.0	29	184	13.8
Dilse	ND	49.2	60.9	35	184	14.6
nursery mean		52.2	60.1	34.8	183.4	14.3

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

Table 22. 2006 Irrigated Durum variety trial, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %	HAVC	Color	100-seed wt, gm
MT01695	101.9	64.8	30	174	11.7	89.1	15.9	4.23
MT02525	90.4	63.1	28	173	12.5	87.1	18.1	4.12
MT01649	87.7	59.8	28	173	13.3	77.5	19.1	4.17
MT02298	87.0	61.6	28	175	12.1	87.0	17.3	4.44
Plaza	85.7	59.2	30	176	12.6	85.4	18.7	3.78
Avonlea	85.1	61.6	37	175	12.8	96.0	18.4	4.51
Pierce	84.9	62.6	40	177	13.4	90.7	20.0	3.64
Grenora	83.7	60.4	36	176	13.6	82.8	20.4	3.78
Divide	83.0	61.6	39	176	13.5	82.8	20.1	4.14
MT02DH55	82.8	60.1	34	177	13.6	83.4	19.2	3.35
MT02DH71	81.9	61.3	33	175	13.4	82.5	18.0	4.17
MT02DH82	81.5	61.3	39	176	13.7	81.1	17.9	4.10
Alzada	81.1	61.5	31	173	12.7	85.3	20.4	4.50
MT03108	81.1	59.5	30	176	13.4	90.5	19.5	4.15
MT02302	81.0	60.0	28	175	13.0	84.6	19.9	4.32
MT01617	80.4	58.3	30	176	12.8	77.6	20.2	3.27
MT02DH32	79.5	61.8	37	174	13.3	91.3	16.0	4.24
Mountrail	79.3	60.3	39	176	12.9	87.4	20.6	3.79
Kyle	79.1	61.5	40	177	12.6	91.7	17.3	4.21
Maier	78.2	61.9	35	174	13.5	87.8	18.1	4.02
MT03012	77.5	62.7	29	172	12.0	94.6	18.8	4.08
Strongfield	76.6	61.1	39	178	13.5	93.2	20.0	3.83
Dilse	75.9	61.1	37	177	13.9	85.7	19.9	3.68
Alkabo	75.1	61.3	37	177	13.2	83.9	19.2	3.86
Mean	82.5	61.2	33.9	175.3	13.0	86.6	18.9	4.02

LSD (.05) = 9.8 bu. C.V.1&2 = 7.2 & 4.2

Planted April 19, 2006 on fallow.

Fertilizer, actual: 100-52-0

Harvested Aug 14, 2006.

Location: MSU Western Triangle Ag Research Ctr, Conrad, MT

Table 23. Five-year average, irrigated Durum varieties,
Conrad area, Pondera Co. 2002 - 06.

Variety	Source	5-Year Average				
		Yield bu/a	Test weight	Height in.	Head date	Protein %
Plaza	ND	81.3	61.1	31	183	13.4
Mountrail	ND	81.0	61.7	38	183	13.1
Alzada	WestBred	80.7	62.3	33	180	13.6
Avonlea	Can	79.7	61.8	38	181	14.2
Pierce	ND	79.7	62.6	40	184	13.4
Maier	ND	77.3	62.5	36	182	13.9
McNeal Wheat	MSU	75.1	60.4	36	183	13.5
Dilse	ND	74.6	62.2	38	184	14.1
Kyle	Can	68.8	61.4	43	184	13.9
nursery mean		77.6	61.7	36.8	182.5	13.7

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

2006 Barley Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak, Research Center, Conrad; and
Dr. Tom Blake and Stan Bates, MSU Plant Science Dept.

Dryland off-station barley variety trials were grown in Teton County near Choteau, Glacier County near Cut Bank, Toole County near Oilmont and western Chouteau County at the "Knees". On-station trials at Conrad were grown on both dryland and irrigated conditions. The Cut Bank, Oilmont and Knees trials were no-till planted on chem-fallow, while the Choteau trial was recrop.

Results: Data for the various locations are presented in Tables 24-40, and include the 2006 and multi-year averages. All entries of the dryland and irrigated Intrastate trials at Conrad are listed in Tables 24 and 27, respectively, with a condensed version of each in Tables 25 and 28 showing only named varieties and a few potential-release lines. The irrigated trial in Tables 30-31 is more specific to malt varieties. Table 40 is a summary of all the Western Triangle area dryland barley tests over the past few years, and is equivalent to 22 tests on each variety.

Moisture conditions were exceptionally favorable for dryland yield and malt quality traits at Conrad, Cut Bank and Knees in 2006, while the Choteau and Oilmont locations experienced low-moisture conditions. The irrigated trials at Conrad sustained substantial lodging due to a severe storm during irrigation.

Averaged across all dryland locations over the past several years, the feed barley 'Haxby' had the highest yield and test weight. The 2-row malt varieties 'Conrad', 'Craft' and 'Hockett' had above-average yield, test weight and percent plump. Hockett (MT910189) and Craft (MT970116) averaged substantially higher dryland yield, test weight, and plump than 'Metcalfe' and 'Harrington', and were 2 to 4 days earlier to head. Malt status of Hockett and Craft is pending. If approved, the two lines would be intended for use in dryland malt barley production.

Additional 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

Baroness (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. Stripe rust resistant.

Boulder (WestBred, 2005. BZ596117): 2-row feed. Composite-cross, non-Baroness derived. Height similar to Haxby. Heading 1 day later than Haxby, and 1 day earlier than Baroness. High yield, similar to Haxby. High test weight, 0.5 lb less than Haxby. Replacement for Baroness and Xena.

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

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. About 2 inches shorter than Harrington. Similar maturity as Harrington. Higher yield than Harrington. Slightly higher test weight and plump than Harrington.

Coors 37 (Moravian 37): Currently the main variety contracted by Coors in 2006.

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.

Craft (MT970116; MSU & Sierra Malting): 2-row malt for Sierra Malting Co. Released 2006, but not recommended yet. Taller than Harrington & Merit. 2 days earlier heading date than Harrington, but later heading than Hockett. High yield, test wt, & plump. Moderate stripe rust resistance. Susceptible to net blotch. European style of malt enzyme activity for microbrew market. Needs one more year plant-scale tests for AMBA approval.

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 Baroness, 1" shorter than Haxby & Gallatin. Heading date similar to Harrington, and 1-2 days later than Haxby & Gallatin. Yield similar to Baroness and Haxby, and higher than Gallatin & Valier. Test wt = Baroness, 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.

Geraldine (MT960101; MSU, Miller Brewing): 2-row malt for Miller Brewing Co. Possible release date 2008, pending plant-scale tests. About 1 day later heading than Harrington. Moderate stripe rust resistance.

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 Baroness. Yield is equal to Baroness, and is among highest yielders in Triangle Area. Highest test weight of all varieties. High feed quality. Non-Baroness derived, providing good diversity. Haxby has superior yield performance in lower moisture conditions, while Eslick has a yield advantage in 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 between heading stage and 5 days post-heading for highest protein. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting. 1/ see footnote.

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 between heading stage and 5 days post-heading for highest protein. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting. 1/ see footnote.

Hockett (MSU, MT910189): 2-row dryland malt. Possible release date 2008, pending plant-scale test results. 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. Very susceptible to stripe rust.

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. Very susceptible to stripe rust.

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. Very high diastatic power for excellent malting ability. 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. Medium straw strength. Higher yield, test weight and plump than Harrington. Similar protein as Harrington. Medium-late, 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.

Rawson (ND19119 ???): 2-row feed. Medium height & straw strength. Higher yield and 20% larger seed than Conlon. MR to spot & net blotch. Adapted to western N Dakota.

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.

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.

Stellar (ND16301, 2005): 6-row malt. Medium-short. Good straw strength and widely adapted across North Dakota. Medium maturity. High plump and low protein. Excellent malt quality. Moderate spot-blotch resistance. Net-blotch susceptible.

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 between heading stage and 5 days post-heading for highest protein. Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting. 1/ see footnote.

Tradition (Busch Ag, BA6B95-2482): 6-row malt. Stiffer straw than Legacy, good lodging resistance. Higher yield than Legacy. Higher test weight and plump than Legacy. Very susceptible to stripe rust.

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.

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 between heading stage and 5 days post-heading for highest protein. 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. 1/ see footnote.

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.

1/ Nitrates in hay: Oats have the highest nitrate levels, 6-row barleys have the next highest, and 2-row barleys rank lower nitrates. Winter wheat hay tends to be safer than spring grains for nitrates because the earlier seasonal development allows the winter wheat to escape heat stress better. Nitrates decrease during grain filling, but in drought conditions, nitrates in spring grains may be high all season, unless irrigation is available.

Table 24. Dryland Intrastate Barley variety trial, Conrad 2006.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT040204	116.1	55.4	86	2.2	9.2	179	32
MT040209	115.7	55.3	95	0.9	9.7	178	30
YU501385 <i>Champion</i>	114.2	55.9	93	0.8	9.6	179	32
Conrad	113.9	54.1	96	0.7	9.8	178	30
Baronesse	113.7	54.6	94	0.9	10.1	178	31
MT040114	112.6	54.5	95	0.7	9.2	179	33
Xena	112.6	54.2	86	1.4	9.4	178	31
Haxby	111.7	57.4	94	1.0	10.0	175	34
MT020064	111.5	55.9	99	0.2	11.1	178	36
MT040013	111.2	55.4	95	0.9	9.5	179	36
Geraldine ⁹⁶⁰¹⁰¹	110.3	55.5	83	2.2	9.4	179	31
Eslick	110.0	56.3	92	0.9	8.7	177	33
MT040181	109.9	56.8	89	1.9	9.3	178	30
MT040130	109.2	55.8	89	2.5	10.5	178	32
MT040134	109.0	55.3	95	0.9	10.1	180	29
MT010162	108.5	54.7	93	1.1	9.3	179	34
MT040129	108.5	56.4	91	1.2	8.8	179	32
MT040110	108.1	55.3	95	1.0	10.3	179	33
MT040216	107.9	58.0	95	0.6	10.2	178	30
MT020167	107.6	55.2	97	0.7	10.3	177	34
MT040107	107.5	58.0	95	1.0	9.4	180	31
MT040105	107.1	54.7	96	1.0	10.9	179	31
MT030137	106.9	56.8	96	0.8	10.4	177	31
MT970229	106.7	55.9	97	0.5	10.5	179	32
MT040021	105.6	55.9	95	0.9	9.9	177	35
MT040024	105.5	56.4	78	2.6	9.5	177	30
MT030042	105.5	57.6	95	1.0	8.9	178	31
MT010160	105.4	54.6	96	0.9	10.2	178	33
MT040058	105.1	56.5	95	0.6	9.7	175	32
MT000040	104.9	56.4	96	0.8	10.7	178	32
2B992316	104.8	53.8	87	2.1	9.4	178	33
MT020162	104.7	54.6	95	1.0	10.3	179	34
MT020155 →	104.5	56.4	95	0.8	10.1	172	36
MT030079	104.4	57.5	96	0.4	10.3	177	34
Hockett ^{MT910189}	104.1	55.4	96	0.6	9.6	173	29

continued

<i>continued</i>	Yield	TW	Plump	Thin	Prot	Head	Height
MT040220	104.1	55.3	96	0.7	9.9	180	30
MT000047	103.7	55.7	95	1.1	10.3	177	32
MT040073	103.4	57.0	93	1.7	10.1	178	32
MT960101-30	103.2	54.5	88	1.5	9.1	180	30
MT960101-21	103.1	54.6	90	1.8	10.3	180	30
MT040226	102.8	58.1	93	1.4	9.9	179	31
MT040136	102.4	58.3	96	0.7	10.1	178	33
2B992657	102.4	49.6	84	3.0	9.4	179	33
Harrington	102.1	53.7	96	0.6	9.9	178	32
MT040106	101.9	55.1	97	0.7	9.7	179	31
Boulder	101.2	57.0	97	0.7	11.4	177	33
MT010081	100.2	55.6	96	0.8	10.2	177	33
MT000138	99.5	56.7	99	0.3	11.1	175	36
Craft MT970116	99.4	56.1	95	0.9	10.0	177	33
MT030144	99.1	55.3	95	0.7	10.5	178	32
MT030063	99.1	57.0	96	0.6	9.5	177	34
MT000125	98.6	54.1	98	0.4	9.9	178	33
MT010158 —	98.2	55.7	97	0.6	10.6	177	31
MT040104	97.3	56.3	97	0.8	9.8	177	30
MT040231	97.2	57.0	95	0.6	9.9	177	32
MT970116-6	97.2	56.3	97	0.4	10.3	175	33
Metcalfe	97.2	54.4	94	1.3	10.5	175	34
MT020204 —	97.0	57.5	95	1.1	9.8	177	32
MT010080	94.9	55.1	97	0.6	10.1	177	34
MT970116-5	94.5	56.8	95	0.8	9.9	177	36
MT020205	93.3	56.2	96	0.6	11.0	177	32
MT040223	93.2	56.8	95	0.9	10.0	178	32
MT040093	92.8	55.4	93	1.1	10.3	179	30
Tradition	81.9	53.9	89	0.8	10.1	176	35
Means	104.1	55.7	93.8	1.0	10.0	177.7	32.3

LSD (.05) = 11.8 bu in same block.

C.V. = 6.60

Planted April 19, 2006 on fallow. Harvested Aug 1, 2006.

Fertilizer, actual: 11-52-0

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

Table 25. **Dryland Intrastate Barley** variety trial, Conrad 2006.**Condensed List**

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Conrad BuschAg	113.9	54.1	96	0.7	9.8	178	30
Baronesse	113.7	54.6	94	0.9	10.1	178	31
Xena WestBred	112.6	54.2	86	1.4	9.4	178	31
Haxby MSU	111.7	57.4	94	1.0	10.0	175	34
Geraldine 960101	110.3	55.5	83	2.2	9.4	179	31
Eslick MSU	110.0	56.3	92	0.9	8.7	177	33
MT970229	106.7	55.9	97	0.5	10.5	179	32
Hockett 910189	104.1	55.4	96	0.6	9.6	173	29
Harrington	102.1	53.7	96	0.6	9.9	178	32
Boulder WestBred	101.2	57.0	97	0.7	11.4	177	33
Craft 970116	99.4	56.1	95	0.9	10.0	177	33
Metcalfe	97.2	54.4	94	1.3	10.5	175	34
Tradition BuschAg	81.9	53.9	89	0.8	10.1	176	35
Means	104.1	55.7	93.8	1.0	10.0	177.7	32.3

LSD (.05) = 11.8 bu in same block.

C.V. = 6.60

Planted April 19, 2006 on fallow. Harvested Aug 1, 2006.

Fertilizer, actual: 11-52-0

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

Table 26. 7-year averages, dryland Barley varieties, Conrad, MT, 2000 - 2006.

Variety ①	7-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Baronesse	80.4	50.5	78	6.7	13.3	182	27
Hockett 910189	80.1	51.6	82	6.7	13.0	178	29
Haxby MSU	78.7	53.8	75	7.3	12.9	180	29
MT970229	77.8	52.4	86	5.2	13.6	182	29
Conrad BuschAg	77.5	50.1	79	6.3	13.6	182	28
Eslick MSU	77.4	51.0	73	9.0	12.8	182	29
Boulder WestBred	76.8	53.1	80	6.6	13.9	181	30
Craft 970116	75.6	52.8	89	3.7	13.0	180	32
Xena WestBred	74.6	50.6	73	9.8	13.0	182	30
Metcalfe	73.5	50.2	74	9.7	13.7	181	31
Geraldine 960101	73.2	50.8	58	14.6	13.1	183	29
Harrington	73.1	49.5	76	8.1	13.6	182	30
Tradition BuschAg	72.5	49.2	67	11.9	13.3	180	32
Merit BuschAg	68.7	48.1	64	7.6	13.4	183	29
Legacy BuschAg	68.4	47.3	59	11.2	13.3	180	33
Mean	75.2	50.9	75.2	8.3	13.3	181.1	29.8

① Tradition & Legacy are 6-row; all others are 2-row.

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

Table 27. Irrigated Intrastate Barley variety trial, Conrad 2006.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT040024	129.0	55.1	93	2.0	12.3	177	30
MT040114	128.6	54.3	95	1.7	12.7	178	31
MT030079	128.6	56.9	94	1.7	12.4	178	32
MT040209	126.4	54.4	86	4.2	11.9	178	31
MT000047	125.4	54.4	94	1.7	13.3	176	33
MT970229	125.4	55.1	93	1.6	12.5	178	33
Calgary	125.3	54.4	88	3.9	12.4	178	28
YU501385 <i>Champion</i>	125.3	56.0	96	0.8	11.7	176	31
Geraldine ⁹⁶⁰¹⁰¹	123.3	53.7	90	2.6	12.5	179	32
MT040226	123.3	58.0	96	1.1	12.1	175	30
MT960101-30	123.0	52.8	84	4.7	12.5	179	30
MT040181	121.8	54.4	90	4.1	12.6	178	30
Haxby	119.2	56.5	91	3.2	12.6	175	32
MT020162	118.8	55.4	95	1.5	13.1	177	34
MT040021	118.6	54.6	92	2.3	13.3	175	31
MT040216	118.5	56.7	91	3.4	13.0	177	32
MT010160	118.5	54.0	89	2.7	13.0	178	34
MT020155	118.2	53.9	90	3.0	13.3	172	35
MT020204	117.8	55.3	88	3.1	13.2	175	32
MT040105	117.5	55.3	94	1.8	11.4	180	30
MT020064	117.0	54.8	97	0.9	13.2	177	31
Baronesse	116.9	53.8	86	5.4	11.8	178	30
MT020205	116.6	54.8	95	1.4	13.8	175	35
MT040107	115.8	54.4	91	3.5	11.9	180	29
MT040130	115.1	54.5	88	3.8	12.7	178	29
MT040231	115.0	55.4	90	3.2	13.6	177	35
Boulder	114.0	57.2	94	2.0	13.6	175	31
MT000138	113.9	55.9	95	1.6	13.4	175	36
MT040129	113.6	53.9	88	3.1	12.7	178	29
MT970116-6	113.4	55.1	90	3.3	12.8	174	35
MT030063	113.0	55.6	96	1.5	12.6	178	37
MT960101-21	113.0	54.0	85	4.7	12.4	181	30
MT040134	112.7	54.1	82	5.1	12.6	180	31
MT970116-5	112.5	54.4	86	5.1	12.6	175	35
2B992316	111.9	52.9	85	3.7	12.7	178	30

continued

<i>continued</i>	Yield	TW	Plump	Thin	Prot	Head	Height
MT040220	111.8	55.1	87	3.4	12.0	178	28
MT030137	111.1	55.1	90	3.0	13.5	176	30
MT020167	110.6	54.1	94	1.8	13.2	178	31
Eslick	110.1	54.1	86	4.3	11.9	177	31
MT010158	109.3	54.8	95	1.3	12.5	178	31
MT030144	109.0	56.0	91	2.4	12.9	176	32
MT000125	108.7	54.7	96	1.3	12.2	179	33
MT040136	108.4	56.3	93	2.1	12.9	177	31
MT040058	108.0	55.3	94	2.1	12.4	177	32
Craft 970116	108.0	55.8	91	2.5	12.3	175	33
MT030042	107.9	55.1	87	4.6	12.2	178	30
Conrad	107.8	52.3	89	2.5	13.7	179	28
2B992657	107.3	50.3	76	7.0	11.4	178	31
MT040073	106.9	55.7	89	3.5	13.7	177	31
Tradition	106.8	53.2	88	1.9	12.2	175	36
MT040013	105.4	53.9	87	4.6	11.3	180	35
MT010080	105.2	54.6	91	2.1	13.1	176	32
MT000040	104.7	55.6	92	2.5	13.5	176	30
MT010081	104.5	54.0	87	4.0	14.3	177	32
MT010162	104.5	54.8	87	3.1	12.4	179	31
Xena	102.7	54.4	85	4.3	12.6	177	33
MT040110	102.3	52.6	77	9.4	13.4	179	31
MT040106	101.4	52.9	88	4.6	13.6	179	31
Metcalfe	100.8	53.9	93	2.0	12.6	178	32
MT040104	98.4	54.4	90	3.3	12.9	175	31
MT040204	97.4	53.2	86	4.1	12.1	180	30
MT040093	96.3	54.4	89	4.0	13.5	175	32
Hockett 910189	94.2	53.2	91	2.8	12.5	175	32
Harrington	91.7	52.0	78	7.4	12.9	177	31
Mean	112.6	54.6	89.8	3.1	12.7	177.2	31.6

LSD (.05) = 12.9 bu in same block.

C.V. = 6.73

Planted April 19, 2006 on fallow. Harvested Aug 1, 2006.

Fertilizer, actual: 71-52-0

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

Table 28. Irrigated Intrastate Barley variety trial, Conrad 2006.

Condensed List

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT970229	125.4	55.1	93	1.6	12.5	178	33
Calgary	125.3	54.4	88	3.9	12.4	178	28
Geraldine 960101	123.3	53.7	90	2.6	12.5	179	32
Haxby MSU	119.2	56.5	91	3.2	12.6	175	32
Baronesse	116.9	53.8	86	5.4	11.8	178	30
Boulder WestBred	114.0	57.2	94	2.0	13.6	175	31
Eslick MSU	110.1	54.1	86	4.3	11.9	177	31
Craft 970116	108.0	55.8	91	2.5	12.3	175	33
Conrad BuschAg	107.8	52.3	89	2.5	13.7	179	28
Tradition BuschAg	106.8	53.2	88	1.9	12.2	175	36
Xena WestBred	102.7	54.4	85	4.3	12.6	177	33
Metcalfe	100.8	53.9	93	2.0	12.6	178	32
Hockett 910189	94.2	53.2	91	2.8	12.5	175	32
Harrington	91.7	52.0	78	7.4	12.9	177	31
Mean	112.6	54.6	89.8	3.1	12.7	177.2	31.6

LSD (.05) = 12.9 bu in same block.

C.V. = 6.73

Planted April 19, 2006 on fallow. Harvested Aug 1, 2006.

Fertilizer, actual: 71-52-0

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

Table 29. 7-year averages, irrigated Barley varieties, Conrad, MT, 2000 - 2006.

Variety ①	7-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT970229	112.5	54.4	96.6	0.9	12.4	181	32
Geraldine ⁹⁶⁰¹⁰¹	112.2	53.1	91.0	2.5	11.7	183	30
Eslick ^{MSU}	111.9	53.6	93.4	1.8	11.3	182	29
Calgary	111.4	53.7	92.2	1.4	12.1	182	27
Baronesse	110.4	53.2	91.6	2.6	11.6	182	31
Xena ^{WestBred}	110.0	53.8	92.7	2.0	11.6	181	33
Conrad ^{BuschAg}	108.4	52.9	95.6	1.3	12.3	182	29
Haxby ^{MSU}	108.3	55.1	94.7	1.6	12.0	181	32
Merit ^{BuschAg}	107.8	50.9	93.3	1.9	12.0	183	32
Boulder ^{WestBred}	104.9	55.2	95.2	1.3	12.6	180	32
Copeland	103.4	51.5	90.6	2.5	11.7	183	35
Tradition ^{BuschAg}	101.8	51.7	93.9	1.3	12.0	180	34
Craft ⁹⁷⁰¹¹⁶	99.9	54.1	94.4	1.9	12.3	180	34
Metcalfe	98.8	52.7	93.4	1.7	12.1	182	32
Hockett ⁹¹⁰¹⁸⁹	96.9	53.3	94.1	2.1	11.9	180	31
Harrington	93.1	52.0	91.4	2.5	11.8	182	31
Legacy ^{BuschAg}	92.3	49.6	83.9	4.2	12.4	180	34
Morex	72.0	50.3	83.9	3.5	12.6	179	36
mean	102.9	52.9	92.2	2.1	12.0	181.1	31.9

① Tradition, Legacy & Morex are 6-row; all others are 2-row.

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

Table 30. Irrigated Malt Barley variety trial, Conrad 2006.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT970229	2	129.1	54.3	91	2.6		176	30
Boulder	2	122.1	56.0	95	1.9		175	30
Craft MT970116	2	116.8	54.3	90	3.5		172	36
Haxby	2	114.1	54.4	93	1.9		174	31
Merit	2	113.8	51.7	90	3.2		178	35
Geraldine 960101	2	111.8	54.2	85	4.2		179	31
Stellar	6	110.1	52.6	91	2.7		173	31
Calgary	2	107.7	52.6	81	6.2		179	29
Eslick	2	106.0	53.4	84	5.0		177	31
Conrad	2	102.8	52.6	89	3.3		176	36
Copeland	2	100.6	50.8	79	6.3		179	38
Legacy	6	100.3	49.9	59	13.1		176	34
Tradition	6	100.0	53.3	90	1.4		173	31
Xena	2	95.5	52.6	78	6.1		178	30
Metcalfe	2	95.0	53.4	88	3.9		175	34
Kendall	2	92.2	52.6	83	5.6		177	38
Hockett MT910189	2	91.1	53.8	90	3.3		174	35
Drummond	6	89.9	51.4	79	5.3		172	36
Harrington	2	88.5	48.4	77	7.5		177	36
Robust	6	80.0	53.1	79	5.4		174	34
Morex	6	67.7	51.5	72	6.6		173	35
Hays forage	2	67.1	49.7	65	14.8		179	29
average		100.1	52.6	83.1	5.2		175.7	33.2

LSD (.05) = 16.9 bu.

C.V. 1&2 = 10.1 & 5.8

Planted April 19, 2006 on fallow. Harvested Aug 1, 2006.

Fertilizer, actual: 71-52-0

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

Table 31. Six-year averages, irrigated Malt Barley varieties, Conrad 2001 - 06.

Variety	Spike	6-Year Average						Head date	Height in.
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %			
Geraldine ⁹⁶⁰¹⁰¹	2	107.7	52.5	91	2.7		183	29	
Haxby ^{MSU}	2	107.0	54.4	96	1.5		180	32	
Baronesse	2	104.4	52.9	93	2.7		181	29	
Craft ⁹⁷⁰¹¹⁶	2	104.4	53.6	95	1.9		179	35	
Tradition ^{BuschAg}	6	102.1	51.0	94	1.2		179	32	
Merit ^{BuschAg}	2	101.8	50.2	92	2.7		183	31	
Conrad ^{BuschAg}	2	101.7	52.2	95	1.9		181	32	
Coors 37	2	100.9	51.7	92	2.3		182	25	
Copeland	2	99.3	51.1	91	2.7		183	35	
Metcalf	2	97.6	52.3	93	2.1		181	32	
Kendall	2	96.0	52.1	92	2.7		182	32	
Hockett ⁹¹⁰¹⁸⁹	2	96.0	53.0	94	2.1		179	31	
Drummond	6	95.4	50.7	91	2.1		179	36	
Legacy ^{BuschAg}	6	93.8	49.6	82	4.7		180	35	
Harrington	2	89.9	49.9	86	4.0		182	31	
Robust	6	84.6	50.9	87	3.3		179	35	
Morex	6	74.5	49.7	81	4.8		179	37	
Mean		97.3	51.7	90.6	2.7		180.5	32.2	

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

Table 32. 2006 Barley variety trial, Cut Bank.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Legacy	6	111.1	49.6	91	2.6	13.1	37
Copeland	2	107.8	50.9	94	1.6	11.8	36
Harrington	2	107.0	51.0	92	2.4	12.1	35
Eslick	2	106.9	53.5	92	3.0	12.2	34
Xena	2	105.7	52.6	92	2.9	12.5	33
Stellar	6	105.6	51.3	96	1.1	12.4	36
Geraldine ⁹⁶⁰¹⁰¹	2	105.0	53.2	92	3.0	12.0	33
Tradition	6	104.6	51.1	95	0.9	12.7	37
Drummond	6	102.6	50.1	94	1.2	12.7	37
Metcalfe	2	101.1	52.8	92	2.5	13.2	34
MT970229	2	100.9	53.4	93	2.2	12.9	33
Robust	6	100.2	50.8	94	1.0	13.2	38
Conrad	2	99.8	51.2	94	1.9	13.4	34
Hays ^{forage}	2	98.9	48.6	80	11.0	12.8	32
Hockett ⁹¹⁰¹⁸⁹	2	98.2	53.8	93	2.5	12.7	33
Boulder	2	98.2	53.6	92	3.6	13.3	34
Craft ⁹⁷⁰¹¹⁶	2	96.0	52.9	94	2.0	13.1	36
Kendall	2	95.6	52.4	93	2.4	13.2	35
Haxby	2	93.9	54.6	92	3.0	12.8	34
Merit	2	93.7	49.7	92	2.5	12.8	33
mean		101.6	51.9	92.4	2.7	12.8	34.7
LSD (.05) =		5.3 bu					
C.V. =		8.3%					

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT.

Planted April 18, 2006 on chem-fallow. Harvested Aug 10, 2006.

Fertilizer, actual: 81-52-0

Conducted by MSU Western Triangle Ag Research Center.

Table 33. Four-year averages, **Barley** varieties, Cut Bank area, 2003 - 06.

Variety	Spike	4-Year Average					
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Eslick MSU	2	70.8	49.9	72	15	11.0	31
Hockett 910189	2	70.5	51.2	77	8	11.4	30
MT970229	2	69.2	51.9	85	5	11.3	30
Baronesse	2	69.0	49.3	71	17	11.6	30
Haxby MSU	2	69.0	52.3	71	13	11.1	32
Legacy BuschAg	6	68.9	47.6	74	10	11.8	35
Xena WestBred	2	68.9	50.1	71	13	11.4	31
Copeland	2	68.9	48.3	77	7	11.1	32
Metcalfe	2	68.9	50.2	76	10	11.4	32
Boulder WestBred	2	68.8	52.1	76	13	11.1	31
Hays forage	2	68.7	45.3	68	16	11.5	30
Tradition BuschAg	6	68.7	48.2	76	7	11.6	34
Craft 970116	2	68.0	51.2	81	8	11.6	34
Geraldine 960101	2	67.9	50.1	71	15	11.0	30
Conrad BuschAg	2	67.9	49.3	78	7	11.8	31
Drummond	6	67.7	48.0	76	9	11.8	36
Robust	6	67.5	48.7	76	7	12.4	36
Harrington	2	67.2	49.0	76	11	11.2	31
Merit BuschAg	2	65.1	47.6	76	10	11.5	31
Kendall	2	65.0	49.5	76	8	11.4	31
Mean		68.3	49.6	75.0	12.1	11.4	31.6

Cooperator & Location: Kevin Bradley, north of Cut Bank, MT.
 Conducted by MSU Western Triangle Agr Research Center.

Table 34. 2006 Barley variety trial, Choteau.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Craft MT970116	2	64.2	49.5	53	14	14.8	33
Haxby	2	63.0	51.1	34	29	15.6	29
Hockett 910189	2	57.1	48.3	41	30	15.4	31
Xena	2	56.9	46.4	29	38	15.0	28
Kendall	2	56.4	46.2	47	26	17.1	29
Boulder	2	54.5	46.6	22	50	17.6	25
Eslick	2	54.1	46.8	15	49	16.5	26
Conrad	2	52.6	45.8	30	39	16.1	29
Drummond	6	52.4	42.0	16	60	15.8	33
MT970229	2	52.3	46.4	23	40	17.5	26
Legacy	6	51.2	44.5	20	46	15.6	32
Harrington	2	49.6	45.9	31	33	15.9	29
Tradition	6	49.4	43.1	13	59	16.2	32
Metcalfe	2	48.7	47.1	37	27	16.8	30
Hays forage	2	47.1	44.2	24	37	15.9	28
Copeland	2	44.6	45.6	44	21	16.0	32
Merit	2	43.6	42.8	24	48	16.8	28
Stellar	6	41.8	41.9	24	46	15.3	32
Robust	6	39.3	42.8	18	52	15.7	35
Geraldine 960101	2	37.9	46.2	15	58	17.5	26
mean		50.8	45.7	28.0	40.1	16.1	29.7
LSD (.05) =		7.0 bu					
C.V. =		4.9					

Cooperator & Location: Roy Inbody, east of Choteau, MT.
 Planted April 20, 2006 on recrop. Harvested July 31, 2006.
 Fertilizer, actual: 100-52-0
 Conducted by MSU Western Triangle Ag Research Center.

Table 35. Four-year averages, **Barley** varieties, Choteau area, 2003 - 06.

Variety	Spike	4-Year Average					
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Haxby MSU	2	82.5	51.5	47	19	16.3	36
Hockett 910189	2	81.6	49.6	55	16	16.2	36
Craft 970116	2	79.9	49.8	59	14	16.6	39
Boulder WestBred	2	79.9	48.7	47	27	17.6	32
MT970229	2	79.4	48.8	57	18	17.0	34
Xena Westbred	2	76.4	46.3	38	25	16.8	34
Tradition BuschAg	6	75.5	43.8	24	38	17.5	38
Drummond	6	74.6	43.1	21	43	16.7	40
Eslick MSU	2	74.3	47.1	40	22	16.7	34
Conrad BuschAg	2	74.2	46.4	41	26	17.5	34
Kendall	2	73.7	46.2	51	21	18.1	35
Hays ①	2	73.1	42.5	28	35	16.7	34
Baronesse	2	68.7	45.2	28	34	17.5	32
Harrington	2	67.9	44.8	31	30	17.4	36
Metcalfe	2	67.8	45.8	39	26	17.8	37
Geraldine 960101	2	66.7	45.6	22	44	17.6	34
Copeland	2	65.4	45.3	37	24	17.6	36
Robust	6	64.9	43.2	28	36	16.4	42
Merit BuschAg	2	64.5	43.6	33	34	17.6	35
Legacy BuschAg	6	62.2	43.5	21	43	16.9	39
Mean		73.2	46.3	38.0	28.0	17.1	35.6

① Hays = awnless forage-hay variety.

Cooperator & Location: Roy and Scot Inbody, east of Choteau, MT.
Conducted by MSU Western Triangle Agr Research Center.

Table 36. 2006 Barley variety trial, Oilmont.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Haxby	2	69.6	46.6	28	35	15.8	36
Tradition	6	62.4	41.1	20	55	15.1	41
MT970229	2	61.7	45.2	27	39	16.1	33
Kendall	2	59.6	40.8	24	46	16.6	38
Craft 970116	2	58.9	43.8	22	49	15.1	39
Xena	2	58.1	43.1	18	50	13.9	34
Hockett 910189	2	56.5	41.2	17	56	15.2	36
Stellar	6	55.7	38.8	22	53	14.3	35
Harrington	2	54.6	40.0	17	53	15.6	34
Conrad	2	53.5	42.8	26	42	15.5	34
Drummond	6	53.1	39.6	16	63	14.8	38
Metcalfe	2	50.7	41.5	18	54	16.3	36
Boulder	2	50.7	46.0	34	32	16.0	32
Eslick	2	48.5	42.0	17	57	14.6	34
Robust	6	46.8	40.4	23	53	15.0	39
Hays	2	46.5	39.6	7	77	16.6	31
Copeland	2	44.6	40.8	17	58	16.3	38
Legacy	6	42.6	38.0	13	65	15.1	35
Merit	2	41.5	38.2	13	61	15.9	36
Geraldine 960101	2	34.0	41.1	12	72	16.8	33
		52.5	41.5	19.6	53.5	15.5	35.6
LSD (.05) =		5.3 bu					
C.V. =		8.3%					

Cooperator & Location: Terry Alme, east of Oilmont, MT.
 Planted April 17, 2006 on chem-fallow. Harvested July 28, 2006.
 Fertilizer, actual: 71-52-0
 Conducted by MSU Western Triangle Ag Research Center.

Table 37. Two-year averages, **Barley** varieties, Oilmont, 2003 & 2006.

Variety	Spike	2-Year Average					
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Haxby MSU	2	56.0	45.4	21	38	17.1	31
MT970229	2	54.0	45.6	18	45	17.8	30
Craft 970116	2	51.2	44.7	18	49	16.7	34
Baronesse	2	50.3	42.8	8	67	17.3	29
Xena WestBred	2	44.9	44.0	15	49	15.7	30
Eslick MSU	2	44.5	42.6	10	64	16.4	29
Metcalfe	2	42.3	42.4	20	43	17.2	31
Harrington	2	41.7	41.7	20	44	16.8	30
Hays ①	2	39.3	40.3	7	66	17.0	27
Geraldine 960101	2	31.2	41.5	8	71	18.0	28
mean		45.6	43.3	14.3	53.3	17.0	29.7

① Hays = awnless forage-hay variety.

Cooperator & Location: Terry Alme, east of Oilmont, MT.
 Conducted by MSU Western Triangle Agr Research Center.

Table 38. 2006 Barley variety trial, Knees area MT.

Variety	Spike	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Hockett ⁹¹⁰¹⁸⁹	2	85.5	52.9	93	1.6	11.3	31
Legacy	6	85.3	49.8	59	5.6	10.2	38
Eslick	2	84.6	51.9	86	1.4	10.2	32
Metcalfe	2	83.6	52.5	90	2.1	11.6	35
MT970229	2	83.1	53.5	94	0.9	11.7	30
Haxby	2	82.8	55.2	89	1.4	10.1	32
Tradition	6	80.4	51.3	81	1.7	11.1	33
Boulder	2	79.9	54.3	93	1.3	11.9	32
Conrad	2	79.9	51.1	93	1.6	11.1	29
Stellar	6	79.3	50.4	86	2.0	10.8	31
Craft ⁹⁷⁰¹¹⁶	2	77.8	53.3	95	0.8	11.1	37
Merit	2	75.9	47.6	77	5.5	12.4	31
Drummond	6	75.8	50.6	80	2.7	11.7	38
Copeland	2	75.5	49.9	93	1.3	10.9	32
Geraldine ⁹⁶⁰¹⁰¹	2	75.3	52.0	70	4.8	10.9	30
Harrington	2	74.0	50.3	91	1.6	11.0	29
Hays ^{forage}	2	71.4	51.0	80	5.3	10.7	31
Xena	2	71.1	51.2	85	1.9	10.0	28
Robust	6	70.9	50.4	73	3.9	11.4	37
Kendall	2	69.1	51.0	90	2.0	11.5	31
		78.1	51.5	84.9	2.5	11.1	32.4
LSD (.05) =		12.6 bu					
C.V. =		10.8					

Cooperator & Location: Dan Picard, western Chouteau county.

Planted April 21, 2006 on chem-fallow. Harvested July 27, 2006.

Fertilizer, actual: 11-52-0

Conducted by MSU Western Triangle Ag Research Center.

Table 39. Five-year averages, **Barley** varieties, Knees area, 2002 - 06.

Variety	Spike	5-Year Average					
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Boulder WestBred	2	72.0	50.3	64	16	14.8	32
Eslick MSU	2	71.6	48.3	58	14	13.4	31
MT970229	2	70.8	49.5	79	6	14.5	31
Haxby MSU	2	70.3	52.6	67	9	13.2	32
Hockett 910189	2	69.4	50.3	76	6	13.8	31
Metcalfe	2	68.9	48.3	63	13	14.5	33
Conrad BuschAg	2	68.0	48.7	69	10	13.7	29
Craft 970116	2	67.2	50.5	76	8	13.7	34
Merit BuschAg	2	67.2	45.2	56	20	14.8	31
Xena WestBred	2	66.7	47.8	60	15	13.2	30
Baronesse	2	66.7	47.4	52	22	14.4	31
Hays ①	2	66.2	46.1	52	21	13.9	30
Copeland	2	66.1	46.7	59	20	14.4	31
Legacy BuschAg	6	65.8	46.1	45	19	13.0	33
Drummond	6	64.4	47.8	60	13	14.0	33
Harrington	2	63.6	46.9	66	13	14.2	31
Geraldine 960101	2	63.1	47.7	49	28	14.2	29
Kendall	2	61.8	47.7	68	11	14.7	31
Tradition BuschAg	6	61.3	47.7	58	12	14.0	30
Robust	6	57.3	47.2	62	9	14.0	32
Mean		66.8	48.3	62.2	14.5	14.0	31.1

① Hays = awnless forage-hay variety.

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

Table 40. Multi-Year x Location Averages - **Barley** varieties, Western Triangle Area.

Variety	Spike	22-Year x Location Dryland Average ①						
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.	Head date ②
Haxby MSU	2	71.3	51.1	56	17	14.1	32	180
MT970229	2	70.4	49.6	65	15	14.8	31	182
Hockett 910189	2	69.8	49.1	61	18	14.3	31	178
Boulder Westbred	2	68.7	50.1	59	19	15.0	30	181
Craft 970116	2	68.4	49.8	64	16	14.3	34	180
Eslick MSU	2	67.6	47.8	51	25	14.1	31	182
Baronesse	2	67.1	47.0	48	29	14.8	30	182
Conrad BuschAg	2	66.8	47.7	57	18	14.7	30	182
Xena Westbred	2	66.2	47.8	51	22	14.0	31	182
Drummond	6	65.3	45.6	47	27	14.4	35	180
Tradition BuschAg	6	64.9	46.2	48	25	14.6	34	180
Kendall	2	64.7	47.1	59	18	15.1	32	183
Metcalfe	2	64.4	47.4	54	20	14.9	33	181
Hays forage MSU	2	64.2	44.2	43	30	14.4	30	183
Harrington	2	62.7	46.4	54	21	14.6	31	182
Copeland	2	61.9	46.3	52	23	14.8	33	183
Geraldine 960101	2	60.3	47.1	41	34	14.8	30	183
Legacy BuschAg	6	60.1	44.7	42	29	14.3	34	180
Merit BuschAg	2	60.1	44.7	48	26	14.9	31	183
Robust	6	59.6	45.8	51	22	14.5	35	180
Mean		65.2	47.3	52.6	22.8	14.6	31.9	181.4

① Conrad dryland 7-yr + Choteau 4-yr + Cut Bank 4-yr + Oilmont 2yr + Knees 5-yr.
Years included thru 2006. Comparable average calculations.

② Head date, Conrad only.

Conducted by MSU Western Triangle Agr Research Center.

Title: Cultural practices for producing dryland malt barley

Year: 2006

Locations: Western Triangle Ag. Research Center
Knees area east of Brady (Killon farm)
Ethridge area (Griffin farm)
Sunburst area (Karst farm)
Joplin area (Moog farm)
Cut Bank area (Bradley farm)

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425;

Objectives: To determine the planting rate for optimum, dryland malt barley yield and quality; and to evaluate the effects of nitrogen (N) and sulfur (S) fertilization on yield and quality of malt barley.

Procedures: Planting rates of 10, 15, and 20 seeds/ft², N rates of 0, 30, and 60 lbs N/acre, and S rates of 0, 10, and 20 lbs/acre were applied to Hockett barley at the following locations: Cut Bank, Ethridge, Joplin, Knees, Sunburst, and WTARC. Nitrogen as urea, 25 lbs/acre of potassium (K) as KCl, and S as potassium sulfate was applied while seeding in a band approximately one inch above and to the side of the seed row. All plots received 30 lbs P₂O₅/ acre as 0-45-0 applied with seed as well as KCl. Soils were sampled initially for water, nitrate-N, and sulfate-S in one foot increments to a depth of three feet. Surface soil samples (0-6") were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Results are shown in Table 1b along with other site characteristics. Plots were harvested with a small plot combine, and the grain weighed and tested for protein and S content, percent plump and thins, and test weight. Plot size was 5 rows wide (12 inch spacing) and 25 feet long.

Results:

Summary: Grain yield, kernel plumpness, grain protein, and grain S content data are tabulated in Tables 2b, 3b, 4b, and 5b. Average grain yields ranged from 40 to 89 bu/ac, and grain plumpness at all locations exceeded 75% except Joplin. Joplin was the only location that experienced severe drought stress. Yields at Sunburst were reduced by the leaf disease complex (net blotch, scald, etc.) Optimum yields were achieved with a planting rate of 20 seeds/ft², and average grain protein levels ranged from 8.3 to 11.1%.

Planting rate: Increasing planting rate increased grain yields all locations except Joplin. Kernel plumpness declined with increasing planting rate at all locations except Cut Bank and Joplin. Protein and seed S content declined with increasing planting rate at three locations.

Nitrogen rate: Nitrogen increased yields at all locations except Joplin. Kernel plumpness declined with increasing N at all locations except Sunburst. Grain protein and S content increased with increasing N rate.

Sulfur rate: Grain yield at Cut Bank declined with increasing fertilizer S; yields were not affected at the other locations. Kernel plumpness was unaffected by S; however, grain protein decreased with increasing S rate at only one location, Ethridge. Grain S content was unaffected by S fertilization.

Three year summary: Under dryland conditions and typical starter fertilizer programs of 60 lbs of 11-52-0, most fallow fields will have enough N for malt barley production. Fields should be soil tested for nitrate N and additional N fertilizer added to correspond to 1 to 1.2 lbs N/bu yield goal. Optimum seeding rate for yield, plump, and protein content appears to be around 15 pure live seeds per square foot. Sulfur fertilizers should not be used.

Table 1b. Site characteristics and soil test results by location. Western Triangle Ag. Research Center. 2006.

Site Characteristics						
Character	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Date	4/25	4/18	4/14	4/28	4/20	4/19
Harvest Date	8/21	8/8	8/1	8/7	8/14	8/16
Previous Crop	Chem. Fallow	Chem. Fallow	Chem. Fallow	Chem. Fallow	Chem. Fallow	Conv. Fallow
Growing Season Precipitation (inches)	4.10	4.27	3.64	4.00	6.05	6.89
Spray Date	6/6	6/7	6/6	None	ND	6/2
Soil Test Results						
Test	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
pH	8.8	8.0	8.0	8.0	7.9	7.9
O.M. (%)	0.7	1.8	2.0	2.7	1.7	2.4
P (ppm)	5	24	21	11	14	22
K (ppm)	174	540	369	621	271	376
EC (mmhos/cm)	0.42	0.41	0.33	0.51	0.40	0.28
NO ₃ -N (0-3', lb/ac)	67.5	67.3	125.2	97.5	41.5	62.5
SO ₄ -S (0-3', lb/ac)	94	152	352.8	125	82	319

ND=Not determined. **=Bronate Advanced @ 1.6 pt/a tank mixed with Achieve SC @ 8oz/a. *=Soil sample to two feet depth.

Table 2b. Effect of nitrogen, sulfur, and planting rate on yield of dryland malt barley. Western Triangle Ag. Research Center. 2006.

Treatment		Location					
Plant rate	N-S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seed/ft ²	lb/ac	-----bu/ac-----					
10	0 - 0	71.2	70.1	41.5	67.9	41.8	72.5
15	0 - 0	83.5	70.8	41.1	71.4	48.1	79.9
20	0 - 0	86.6	75.1	36.8	74.1	51.9	73.7
10	30 - 0	83.2	73.6	39.7	75.2	50.5	73.6
15	30 - 0	94.1	76.5	34.8	73.7	49.8	81.5
20	30 - 0	94.9	74.9	42.9	76.0	57.2	82.2
10	60 - 0	93.1	75.2	38.5	76.8	50.3	74.8
15	60 - 0	98.5	73.0	40.6	79.5	59.7	79.6
20	60 - 0	103.5	78.6	40.5	76.7	59.8	79.6
10	0 - 10	79.3	65.6	39.6	68.1	45.0	69.4
15	0 - 10	81.2	73.6	39.9	75.0	50.2	71.6
20	0 - 10	83.5	70.9	40.6	77.5	52.3	74.3
10	30 - 10	88.5	70.2	41.4	70.5	50.3	78.6
15	30 - 10	92.1	75.6	44.2	76.0	55.7	80.6
20	30 - 10	93.0	78.3	40.4	77.4	64.5	80.8
10	60 - 10	90.0	70.9	38.5	78.6	57.5	76.5
15	60 - 10	100.7	77.3	41.6	81.2	64.2	81.6
20	60 - 10	102.2	75.8	40.1	80.7	63.1	80.5
10	0 - 20	71.8	69.9	44.7	67.3	42.4	75.3
15	0 - 20	79.4	67.9	44.4	73.7	46.5	75.5
20	0 - 20	84.5	72.1	40.7	73.8	51.7	70.4
10	30 - 20	80.3	74.1	43.4	77.1	49.8	77.1
15	30 - 20	85.4	79.4	40.0	79.1	55.8	78.0
20	30 - 20	95.8	76.6	40.5	77.7	56.4	83.5
10	60 - 20	85.9	66.7	37.3	72.6	59.5	71.7
15	60 - 20	91.1	78.0	38.0	77.7	61.5	78.0
20	60 - 20	97.8	73.2	39.2	78.3	61.3	81.9

Table 2b. Continued						
Treatment	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Rate Summary						
10 seeds/ft ²	82.6 a	70.7 a	40.5 a	72.7 a	49.7 a	74.4 a
15 seeds/ft ²	89.6 b	74.7 b	40.5 a	76.4 b	54.6 b	78.5 b
20 seeds/ft ²	93.5 c	75.1 b	40.2 a	76.9 b	57.6 b	78.5 b
P-value, Linear contrast	0.001	0.468	0.823	0.001	0.001	0.001
P-value, Quad. contrast	0.271	0.690	0.888	0.090	0.465	0.029
Nitrogen Summary						
0 lbs/ac	80.1 a	70.7 a	41.1 a	72.1 a	47.8 a	73.6 a
30 lbs/ac	89.7 b	75.5 b	40.8 a	75.9 b	54.4 b	79.5 b
60 lbs/ac	95.8 c	74.3 b	39.3 a	78.0 c	59.7 c	78.2 b
P-value, Linear contrast	0.001	0.019	0.224	0.001	0.001	0.001
P-value, Quad. contrast	0.213	0.026	0.595	0.388	0.589	0.001
Sulfur Summary						
0 lbs/ac	89.8 a	74.2 a	39.6 a	74.6 a	52.1 a	77.5 a
10 lbs/ac	90.1 a	73.1 a	40.7 a	76.1 a	55.9 a	77.1 a
20 lbs/ac	85.8 b	73.1 a	40.9 a	75.3 a	53.9 a	76.8 a
P-value, Linear contrast	0.011	0.468	0.350	0.532	0.260	0.530
P-value, Quad. contrast	0.099	0.690	0.709	0.206	0.036	0.956
Statistical Summary						
Mean	88.5	73.5	40.4	75.3	54.0	77.1
CV (%)	7.5	8.7	14.5	6.1	12.3	5.7
Interaction		Interaction p-values				
Plt Rate x N Rate	0.999	0.922	0.576	0.314	0.608	0.113
Plt Rate x S Rate	0.322	0.511	0.809	0.575	0.928	0.489
N Rate x S Rate	0.786	0.708	0.423	0.091	0.803	0.240
N Rate x S Rate x Plt rate	0.786	0.619	0.766	0.890	0.816	0.164

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

Table 3b. Effect of nitrogen, sulfur, and planting rate on kernel plumpness of dryland malt barley. Western Triangle Ag. Research Center. 2006.

Treatment		Location					
Plant. rate	N-S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seed/ft ²	lb/ac	-----%					
10	0 - 0	93.9	91.8	18.2	95.0	95.5	96.0
15	0 - 0	95.7	90.6	23.0	94.0	95.7	96.3
20	0 - 0	95.2	91.4	13.3	90.2	94.8	94.9
10	30 - 0	94.0	90.7	14.6	92.2	95.4	97.0
15	30 - 0	93.9	83.2	6.2	89.3	95.1	96.6
20	30 - 0	95.1	76.9	15.5	88.7	94.4	94.3
10	60 - 0	93.2	89.2	8.1	86.6	94.7	95.0
15	60 - 0	94.4	73.4	11.6	85.2	94.7	95.1
20	60 - 0	94.0	74.9	13.5	80.3	93.7	93.8
10	0 - 10	95.4	95.9	16.3	92.6	93.9	97.0
15	0 - 10	94.4	92.2	27.4	94.9	94.9	96.3
20	0 - 10	95.5	89.3	20.2	90.1	95.3	94.8
10	30 - 10	94.8	90.4	18.4	94.7	95.0	97.1
15	30 - 10	95.1	88.5	20.2	92.4	95.3	96.0
20	30 - 10	96.0	82.5	12.2	88.3	93.9	95.0
10	60 - 10	93.9	90.8	11.3	88.4	96.0	96.4
15	60 - 10	94.5	77.7	15.1	83.3	95.3	94.1
20	60 - 10	94.7	78.3	9.9	78.2	94.6	92.5
10	0 - 20	95.9	93.1	30.0	96.2	95.4	95.4
15	0 - 20	95.4	91.9	28.3	92.9	94.9	94.4
20	0 - 20	95.0	93.3	20.9	89.5	94.2	94.2
10	30 - 20	94.6	89.6	20.6	93.1	95.7	96.2
15	30 - 20	95.3	84.8	15.7	91.8	94.8	94.6
20	30 - 20	94.3	89.0	11.3	88.8	94.0	94.1
10	60 - 20	93.6	87.4	9.3	89.0	95.8	95.4
15	60 - 20	93.4	82.1	7.7	83.5	95.3	94.3
20	60 - 20	93.8	71.6	8	81.3	94.8	92.2

Table 3b. Continued						
Treatment	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Rate Summary						
10 seeds/ft ²	94.4 a	91.0 a	16.3 a	92.0 a	95.3 a	96.2 a
15 seeds/ft ²	94.7 a	84.9 b	17.2 a	89.7 b	95.1 a	95.3 a
20 seeds/ft ²	94.8 a	83.0 b	13.9 a	86.2 c	94.4 b	94.0 b
P-value, Linear contrast	0.146	0.159	0.349	0.001	0.003	0.001
P-value, Quad. contrast	0.789	0.310	0.324	0.568	0.336	0.455
Nitrogen Summary						
0 lbs/ac	95.1 a	92.2 a	22.0 a	92.8 a	94.9 a	95.5 a
30 lbs/ac	94.8 a	86.2 b	15.0 b	91.0 a	94.8 a	95.6 a
60 lbs/ac	93.9 b	80.6 c	10.5 b	84.0 b	95.0 a	94.3 b
P-value, Linear contrast	0.001	0.001	0.001	0.001	0.922	0.005
P-value, Quad. contrast	0.399	0.848	0.576	0.010	0.691	0.099
Sulfur Summary						
0 lbs/ac	94.4 a	84.7 a	13.8 a	89.0 a	94.9 a	95.4 a
10 lbs/ac	94.9 a	87.3 a	16.8 a	89.2 a	94.9 a	95.4 a
20 lbs/ac	94.6 a	87.0 a	16.8 a	89.6 a	95.0 a	94.5 a
P-value, Linear contrast	0.457	0.159	0.250	0.563	0.768	0.048
P-value, Quad. contrast	0.118	0.310	0.514	0.956	0.955	0.176
Statistical Summary						
Mean	94.6	86.3	15.8	89.3	94.9	95.1
CV (%)	1.4	7.8	68.7	5.4	1.2	2.1
Interaction		Interaction p-values				
Plt Rate x N Rate	0.943	0.036	0.555	0.645	0.543	0.846
Plt Rate x S Rate	0.293	0.762	0.555	0.926	0.652	0.730
N Rate x S Rate	0.593	0.892	0.453	0.893	0.152	0.941
N Rate x S Rate x Plt rate	0.647	0.341	0.936	0.951	0.762	0.971

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

Table 4b. Effect of nitrogen, sulfur, and planting rate on grain protein content of dryland malt barley. Western Triangle Ag. Research Center. 2006.

Treatment		Location					
Plant. rate	N-S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seed/ft ²	lb/ac	-----%-----					
10	0 - 0	10.00	10.31	ND	10.78	8.90	8.59
15	0 - 0	9.84	10.47	ND	11.09	7.97	9.38
20	0 - 0	9.84	10.31	ND	10.78	8.13	9.06
10	30 - 0	9.53	11.41	ND	11.09	9.06	9.69
15	30 - 0	9.53	10.63	ND	10.78	8.28	9.53
20	30 - 0	9.38	10.94	ND	11.09	7.81	9.53
10	60 - 0	10.31	10.94	ND	11.41	8.75	10.00
15	60 - 0	10.16	10.94	ND	10.94	8.44	9.69
20	60 - 0	10.00	10.94	ND	11.72	8.28	9.84
10	0 - 10	9.84	10.47	ND	11.09	9.69	8.28
15	0 - 10	9.53	10.31	ND	10.94	7.81	8.44
20	0 - 10	9.38	10.00	ND	11.25	7.50	8.28
10	30 - 10	9.53	10.78	ND	10.63	8.44	9.69
15	30 - 10	9.69	10.31	ND	10.78	7.97	9.38
20	30 - 10	9.69	10.47	ND	10.78	8.13	9.06
10	60 - 10	10.94	10.94	ND	11.25	9.38	10.16
15	60 - 10	10.31	10.78	ND	11.25	8.44	9.84
20	60 - 10	10.00	10.78	ND	11.56	8.59	9.53
10	0 - 20	9.38	10.16	ND	11.25	8.13	8.75
15	0 - 20	9.22	10.16	ND	10.78	8.13	8.44
20	0 - 20	9.22	9.53	ND	10.78	7.66	8.75
10	30 - 20	9.69	10.78	ND	11.41	8.28	9.38
15	30 - 20	9.38	10.16	ND	11.09	7.97	9.22
20	30 - 20	10.00	9.69	ND	11.56	7.97	8.91
10	60 - 20	10.94	10.94	ND	11.41	8.75	10.00
15	60 - 20	9.38	10.94	ND	11.09	8.59	9.84
20	60 - 20	10.00	10.31	ND	11.09	8.13	10.16

Table 4b. Continued						
Treatment	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Rate Summary						
10 seeds/ft ²	10.02 a	10.75 a	ND	11.15 a	8.82 a	9.39 a
15 seeds/ft ²	9.67 b	10.52 ab	ND	10.97 a	8.18 b	9.31 a
20 seeds/ft ²	9.72 b	10.33 b	ND	11.18 a	8.02 b	9.24 a
P-value, Linear contrast	0.283	0.002	ND	0.843	0.001	0.319
P-value, Quad. contrast	0.375	0.914	ND	0.088	0.098	0.942
Nitrogen Summary						
0 lbs/ac	9.58 b	10.19 b	ND	10.97 b	8.21 b	8.66 c
30 lbs/ac	9.60 b	10.57 a	ND	11.02 b	8.21 b	9.38 b
60 lbs/ac	10.23 a	10.83 a	ND	11.30 a	8.59 a	9.90 a
P-value, Linear contrast	0.001	0.001	ND	0.011	0.019	0.001
P-value, Quad. contrast	0.016	0.620	ND	0.286	0.170	0.439
Sulfur Summary						
0 lbs/ac	9.84 a	10.76 a	ND	11.08 a	8.40 a	9.48 a
10 lbs/ac	9.88 a	10.54 ab	ND	11.06 a	8.44 a	9.27 a
20 lbs/ac	9.69 a	10.30 b	ND	11.16 a	8.18 a	9.18 a
P-value, Linear contrast	0.283	0.002	ND	0.508	0.176	0.176
P-value, Quad. contrast	0.375	0.914	ND	0.593	0.302	0.148
Statistical Summary						
Mean	9.80	10.53	ND	11.10	8.34	9.31
CV (%)	6.32	5.91	ND	4.76	8.35	6.93
Interaction	Interaction p-values					
Plt Rate x N Rate	0.150	0.426	ND	0.807	0.624	0.527
Plt Rate x S Rate	0.391	0.349	ND	0.667	0.236	0.686
N Rate x S Rate	0.167	0.569	ND	0.062	0.719	0.241
N Rate x S Rate x Plt rate	0.817	0.998	ND	0.688	0.399	0.922

Yield means with the same letter are not significantly different accord to the LSD ($p=0.05$).

ND=Not Determined.

Table 5b. Effect of nitrogen, sulfur, and planting rate on grain sulfur content of dryland malt barley. Western Triangle Ag. Research Center. 2006.

Treatment		Location					
Plant. rate	N-S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seed/ft ²	lb/ac	-----%-----					
10	0 - 0	0.110	0.115	ND	0.115	0.108	0.113
15	0 - 0	0.103	0.118	ND	0.115	0.100	0.113
20	0 - 0	0.105	0.115	ND	0.118	0.105	0.108
10	30 - 0	0.108	0.128	ND	0.118	0.108	0.118
15	30 - 0	0.110	0.120	ND	0.120	0.103	0.115
20	30 - 0	0.103	0.125	ND	0.118	0.100	0.113
10	60 - 0	0.113	0.120	ND	0.125	0.113	0.120
15	60 - 0	0.113	0.123	ND	0.120	0.105	0.125
20	60 - 0	0.108	0.123	ND	0.123	0.103	0.120
10	0 - 10	0.105	0.110	ND	0.125	0.105	0.113
15	0 - 10	0.105	0.115	ND	0.118	0.103	0.115
20	0 - 10	0.105	0.115	ND	0.120	0.103	0.108
10	30 - 10	0.110	0.113	ND	0.123	0.113	0.118
15	30 - 10	0.100	0.118	ND	0.120	0.103	0.113
20	30 - 10	0.108	0.113	ND	0.118	0.100	0.115
10	60 - 10	0.115	0.118	ND	0.125	0.110	0.120
15	60 - 10	0.108	0.118	ND	0.123	0.110	0.120
20	60 - 10	0.110	0.120	ND	0.123	0.108	0.120
10	0 - 20	0.108	0.110	ND	0.120	0.108	0.113
15	0 - 20	0.105	0.118	ND	0.120	0.108	0.110
20	0 - 20	0.108	0.113	ND	0.118	0.105	0.110
10	30 - 20	0.113	0.120	ND	0.120	0.105	0.115
15	30 - 20	0.103	0.123	ND	0.118	0.100	0.118
20	30 - 20	0.108	0.110	ND	0.118	0.105	0.113
10	60 - 20	0.115	0.123	ND	0.123	0.115	0.123
15	60 - 20	0.110	0.120	ND	0.115	0.105	0.120
20	60 - 20	0.110	0.120	ND	0.118	0.103	0.125

Table 5b. Continued						
Treatment	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Rate Summary						
10 seeds/ft ²	0.111 a	0.117 a	ND	0.121 a	0.109 a	0.117 a
15 seeds/ft ²	0.106 b	0.119 a	ND	0.119 b	0.104 b	0.116 a
20 seeds/ft ²	0.107 b	0.117 a	ND	0.119 b	0.103 b	0.114 a
P-value, Linear contrast	0.616	0.038	ND	0.066	0.001	0.097
P-value, Quad. contrast	0.499	0.010	ND	0.193	0.082	0.469
Nitrogen Summary						
0 lbs/ac	0.106 b	0.114 b	ND	0.119 a	0.105 ab	0.111 c
30 lbs/ac	0.107 b	0.119 a	ND	0.119 a	0.104 b	0.115 b
60 lbs/ac	0.111 a	0.120 a	ND	0.121 b	0.108 a	0.121 a
P-value, Linear contrast	0.002	0.001	ND	0.042	0.052	0.001
P-value, Quad. contrast	0.211	0.313	ND	0.342	0.082	0.278
Sulfur Summary						
0 lbs/ac	0.108 a	0.121 a	ND	0.119 a	0.105 a	0.116 a
10 lbs/ac	0.107 a	0.115 b	ND	0.121 a	0.106 a	0.115 a
20 lbs/ac	0.109 a	0.117 b	ND	0.119 b	0.106 a	0.116 a
P-value, Linear contrast	0.616	0.038	ND	0.837	0.475	0.834
P-value, Quad. contrast	0.499	0.010	ND	0.026	0.679	0.717
Statistical Summary						
Mean	0.108	0.118	ND	0.120	0.105	0.116
CV (%)	6.51	5.69	ND	4.76	6.22	4.84
Interaction						
Interaction p-values						
Plt Rate x N Rate	0.895	0.318	ND	0.736	0.595	0.505
Plt Rate x S Rate	0.506	0.346	ND	0.736	0.962	0.778
N Rate x S Rate	0.999	0.281	ND	0.243	0.662	0.871
N Rate x S Rate x Plt rate	0.646	0.608	ND	0.883	0.382	0.609

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

ND=Not Determined.

Title: Effect of nitrogen (N), phosphorus (P), and sulfur (S) on camelina yield, oil content, oil quality, and nutrient content.

Year: 2006

Locations: Cut Bank area (Bradley farm)

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425

Objectives: To determine the optimum rate of N, P, and S fertilizers for producing high quality camelina oil.

Procedures: Nitrogen rates of 0, 30, and 60 lbs N/acre, P_2O_5 rates of 0, 15, and 30 lbs/acre, and a S rate of 15 lbs/acre were applied to Camelina (variety Celine) at the following locations: WTARC, Cut Bank, and Joplin. WTARC and Joplin locations were lost due to poor stands as the result of drought at Joplin and N fertilizer damage at WTARC. Nitrogen as urea, 25 lbs/acre of potassium (K) as KCl, and S as potassium sulfate were applied while seeding in a band approximately one inch above and to the side of the seed row. Phosphorus fertilizer as 0-45-0 was applied with seed. Soils were sampled initially for water, nitrate-N, and sulfate-S in one foot increments to a depth of three feet. Surface soil samples (0-6") were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Results are shown in Table 1c. Plants were sampled (1 ft²) at maturity for N, P, K and S content. Plots were swathed when pods turned yellow and threshed with small plot equipment, and the seed weighed and tested for N, P, K, and S content, oil content, and fatty acid composition. Plot size was 5 rows wide with 12 inch row spacing and 25 feet long.

Results: Nitrogen and P both increased camelina seed yields again this year as shown in Table 2c. The P response is not surprising since camelina grows rapidly during the cool portion of the growing season when soil P is the least soluble. As expected seed oil content declined slightly with N fertilization but increased slightly with P fertilization. Sulfur fertilization had no effect on seed yield or oil content. Also oil quality (Table 3c) was essentially unaffected by fertilization. Nitrogen was the only fertilizer element that affected seed nutrient content. Seed N and P content declined with increasing N while K and S increased with increasing N. Whole plant nutrient content (Table 4c) was basically unaffected by fertilization.

Table 1c. Site characteristics and soil test results: Cut Bank location. Western Triangle Ag. Research Center. 2006.

Character	
Planting Date	4/25
Swathing Date	7/31
Threshing Date	8/10
Previous Crop	Chemical Fallow
Growing Season Precipitation(inches)	4.10
Spray Date*	6/7
Test	
pH	8.8
O.M. (%)	0.7
P (ppm)	5
K (ppm)	174
EC (mmhos/cm)	0.42
NO ₃ -N (0-3', lb/ac)	68
SO ₄ -S (0-3', lb/ac)	94

* = Poast @ 2 pt/a.

Table 2c. Effect of nitrogen, phosphorus, and sulfur on camelina seed yield, oil, and nutrient content. Cut Bank Location. Western Triangle Ag. Research Center. 2006.

Treatment N-P ₂ O ₅ -S	Yield	Oil Content	N Content	P Content	K Content	S Content
-----lbs/acre-----		-----%-----				
0 - 0 - 0	1421	40.6	3.56	0.593	0.78	0.560
0 - 15 - 0	1644	40.4	3.75	0.578	0.80	0.558
0 - 30 - 0	1540	39.3	3.68	0.588	0.80	0.545
30 - 0 - 0	1648	39.6	3.93	0.553	0.80	0.570
30 - 15 - 0	1741	40.3	3.78	0.548	0.78	0.548
30 - 30 - 0	1529	39.4	3.95	0.550	0.78	0.583
60 - 0 - 0	1670	36.6	4.00	0.523	0.80	0.588
60 - 15 - 0	1722	38.2	4.10	0.518	0.75	0.580
60 - 30 - 0	1882	37.4	3.85	0.503	0.78	0.600
0 - 0 - 15	1389	38.3	3.83	0.560	0.80	0.580
0 - 15 - 15	1735	40.3	3.68	0.585	0.78	0.553
0 - 30 - 15	1647	39.2	3.78	0.570	0.80	0.573
30 - 0 - 15	1647	40.2	3.83	0.533	0.73	0.568
30 - 15 - 15	1847	40.2	3.90	0.550	0.73	0.578
30 - 30 - 15	1744	40.3	3.90	0.535	0.75	0.603
60 - 0 - 15	1716	38.4	3.90	0.543	0.80	0.610
60 - 15 - 15	1850	40.0	4.05	0.530	0.75	0.613
60 - 30 - 15	1677	37.9	4.05	0.530	0.73	0.595
Nitrogen Summary						
0	1563 a	39.7 a	3.71 a	0.579 a	0.79 a	0.561 a
30	1693 b	40.0 a	3.88 b	0.545 b	0.76 b	0.575 a
60	1753 b	37.9 b	3.99 b	0.524 c	0.77 b	0.598 b
P-value, Linear contrast	0.004	0.001	0.001	0.001	0.045	0.036
P-value Quadratic contrast	0.521	0.0023	0.628	0.323	0.056	0.452
Phosphorus Summary						
0	1582 a	38.9 a	3.84 a	0.550 a	0.78 a	0.579 a
15	1757 b	39.7 a	3.88 a	0.551 a	0.76 a	0.571 a
30	1670 ab	38.9 a	3.87 a	0.546 a	0.77 a	0.583 a
P-value, Linear contrast	0.168	0.975	0.699	0.567	0.313	0.250
P-value Quadratic contrast	0.019	0.037	0.709	0.652	0.176	0.230
Sulfur Summary						
0	1644 a	39.1 a	3.84 a	0.550 a	0.78 a	0.570 a
15	1695 a	39.3 a	3.88 a	0.548 a	0.76 b	0.586 a
Statistical Summary						
Mean	1669	39.2	3.86	0.549	0.77	0.578
CV (%)	13.0	3.8	5.76	5.01	5.5	6.30

	Seed Yield	Oil Content	N Content	P Content	K Content	S Content
Interaction	Interaction P-value					
N rate X P rate	0.583	0.932	0.724	0.866	0.266	0.648
N rate x S rate	0.646	0.093	0.722	0.070	0.127	0.993
P rate x S rate	0.704	0.918	0.791	0.519	0.926	0.956
N rate x P rate x S rate	0.514	0.402	0.313	0.761	0.3600	0.603

Yield means with the same letter are not significantly different according to the LSD (p=0.05).

ND = Not Determined.

Table 3c. Effect of nitrogen, phosphorus, and sulfur on camelina oil quality. Cut Bank Location. Western Triangle Ag. Research Center. 2006.

Treatment N-P ₂ O ₅ -S lbs/acre	Fatty Acid						
	Stearic C18:0	Oleic C18:1	Linoleic C18:2	Linolenic C18:3	Arachidic C20:1	EPA C20:5	DHA C22:6
	-----% of Oil Content-----						
0 - 0 - 0	2.34	16.75	18.91	35.03	13.38	2.02	0.55
0 - 15 - 0	2.32	16.47	19.06	35.71	13.18	1.94	0.49
0 - 30 - 0	2.36	16.38	19.32	34.65	13.57	2.05	0.54
30 - 0 - 0	2.44	16.44	19.07	34.89	13.52	2.06	0.58
30 - 15 - 0	2.41	16.71	18.99	35.04	13.50	1.87	0.56
30 - 30 - 0	2.42	16.70	18.98	34.79	13.58	2.11	0.55
60 - 0 - 0	2.60	16.21	19.55	33.97	13.61	2.16	0.60
60 - 15 - 0	2.51	16.09	19.31	34.67	13.49	2.10	0.62
60 - 30 - 0	2.44	15.95	19.17	35.63	13.32	2.05	0.52
0 - 0 - 15	2.48	16.16	19.23	34.02	13.97	2.23	0.60
0 - 15 - 15	2.32	16.31	18.88	35.09	13.45	2.08	0.71
0 - 30 - 15	2.36	16.27	19.10	35.05	13.48	2.07	0.66
30 - 0 - 15	2.42	16.24	19.16	34.87	13.52	2.08	0.55
30 - 15 - 15	2.28	16.78	18.85	36.21	12.99	1.89	0.50
30 - 30 - 15	2.40	16.48	18.76	35.40	13.61	2.07	0.54
60 - 0 - 15	2.50	16.14	19.15	34.60	13.70	2.14	0.56
60 - 15 - 15	2.47	15.89	18.89	35.10	13.77	2.17	0.58
60 - 30 - 15	2.48	15.81	19.42	34.98	13.35	2.09	0.54
Nitrogen Summary							
0	2.38 a	16.39 a	19.08 a	34.92 a	13.51 a	2.05 a	0.59 a
30	2.40 a	16.56 a	18.96 a	35.17 a	13.47 a	2.01 a	0.55 a
60	2.50 b	16.11 b	19.25 a	34.83 a	13.54 a	2.12 a	0.57 a
P-value, Linear contrast	0.002	0.019	0.158	0.758	0.727	0.205	0.494
P-value Quadratic contrast	0.182	0.005	0.051	0.282	0.590	0.119	0.175
Phosphorus Summary							
0	2.46 a	16.33 a	19.18 a	34.55 a	13.62 a	2.11 a	0.57 a
15	2.42 a	16.37 a	19.12 a	35.29 a	13.41 a	2.00 a	0.58 a
30	2.39 a	16.26 a	18.99 a	35.08 a	13.49 a	2.07 a	0.56 a
P-value, Linear contrast	0.247	0.493	0.617	0.089	0.356	0.448	0.666
P-value Quadratic contrast	0.151	0.650	0.072	0.086	0.303	0.099	0.674
Sulfur Summary							
0	2.44 a	16.42 a	19.14 a	34.94 a	13.46 a	2.04 a	0.55 a
15	2.41 a	16.21 a	19.05 a	35.01 a	13.56 a	2.09 a	0.59 a
Statistical Summary							
Mean	2.43	16.32	19.10	34.97	13.51	2.06	0.57
CV (%)	5.21	3.17	1.83	3.00	3.59	9.01	18.7

Table 3c. Continued.							
	Stearic C18:0	Oleic C18:1	Linoleic C18:2	Linolenic C18:3	Arachidic	EPA C20:5	DHA C22:5
Interaction	Interaction P-value						
N rate X P rate	0.844	0.407	0.453	0.695	0.393	0.428	0.703
N rate x S rate	0.678	0.281	0.835	0.3339	0.402	0.650	0.017
P rate x S rate	0.385	0.017	0.729	0.824	0.670	0.803	0.584
N rate x P rate x S rate	1.077	0.364	0.164	0.406	0.701	0.840	0.713

Yield means with the same letter are not significantly different according to the LSD (p=0.05).

ND = Not Determined.

Table 4c. Effect of nitrogen, phosphorus, and sulfur on camelina whole plant nutrient content. Cut Bank Location. Western Triangle Ag. Research Center.2006.

Treatment N-P ₂ O ₅ -S lbs/acre	N Content	P Content	K Content	S Content
	-----%-----			
0 - 0 - 0	1.33	0.16	1.43	0.26
0 - 15 - 0	1.33	0.18	1.40	0.26
0 - 30 - 0	1.27	0.18	1.33	0.23
30 - 0 - 0	1.37	0.18	1.47	0.26
30 - 15 - 0	1.40	0.18	1.40	0.27
30 - 30 - 0	1.43	0.18	1.50	0.27
60 - 0 - 0	1.33	0.16	1.57	0.27
60 - 15 - 0	1.53	0.17	1.87	0.26
60 - 30 - 0	1.40	0.16	1.57	0.26
0 - 0 - 15	1.33	0.18	1.50	0.27
0 - 15 - 15	1.37	0.20	1.40	0.28
0 - 30 - 15	1.40	0.18	1.37	0.28
30 - 0 - 15	1.37	0.17	1.53	0.27
30 - 15 - 15	1.33	0.19	1.47	0.27
30 - 30 - 15	1.47	0.17	1.57	0.30
60 - 0 - 15	1.30	0.16	1.73	0.26
60 - 15 - 15	1.70	0.17	1.77	0.33
60 - 30 - 15	1.47	0.20	1.70	0.28
Nitrogen Summary				
0	1.34 a	0.18 a	1.41 a	0.26 a
30	1.69 a	0.17 a	1.49 a	0.37 a
60	1.46 a	0.17 a	1.70 b	0.28 a
P-value, Linear contrast	0.038	0.184	0.001	0.099
P-value Quadratic contrast	0.953	0.891	0.252	0.909
Phosphorus Summary				
0	1.34 a	0.17 a	1.54 a	0.26 a
15	1.44 a	0.18 a	1.55 a	0.28 a
30	1.41 a	0.18 a	1.51 a	0.27 a
P-value, Linear contrast	0.225	0.240	0.602	0.587
P-value Quadratic contrast	0.131	0.223	0.616	0.224
Sulfur Summary				
0	1.38 a	0.17 a	1.50 a	0.26 a
15	1.42 a	0.18 a	1.56 a	0.27 b
Statistical Summary				
Mean	1.40	0.18	1.53	0.27
CV (%)	11.6	11.8	12.4	12.4

Table 4c. Continued.				
	N Content	P Content	K Content	S Content
Interaction	Interaction p-value			
N rate X P rate	0.130	.0785	0.321	0.459
N rate x S rate	0.740	0.683	0.955	0.803
P rate x S rate	0.710	0.683	0.654	0.425
N rate x P rate x S rate	0.859	0.417	0.910	0.502

Yield means with the same letter are not significantly different according to the LSD ($p=0.05$).

ND = Not Determined.

Title: Evaluation of Camelina and Safflower varieties as potential feed stock for biofuels or lubricants.

Year: 2006

Locations: Western Triangle Ag. Research Center (WTARC)
Knees area east of Brady (Picard farm)
Sunburst area (Karst farm)

Personnel: Grant Jackson and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425

Objectives: To determine the adaptation and suitability of camellina and safflower as a potential source of biofuel and lubricants.

Procedures: Varieties of camelina were planted with a 5-row, 12-inch spaced planter at three locations. Safflower was only planted at WTARC utilizing the same planter. Plot size was 5 by 25 feet, and all locations except WTARC were planted no-till into previously fallowed land (WTARC was planted in to conventional fallow). All locations except WTARC were fertilized with 30 lbs/acre of 11-52-0 applied with the seed and 30 lbs/acre of 0-0-60 applied broadcast while planting. At WTARC, 30 lbs/acre of 11-52-0 was applied with the seed and 44 lbs N/acre as urea, 20 lbs of K as KCl, and 24 lbs of S as ammonium sulfate was applied topdress. Weeds were controlled with Poast herbicide.

Results: Seed yields are shown in Table 2o and 3o, and individual site characteristics are shown in Table 1o.

Table 1o. Site Characteristics of oilseed trials. Western Triangle Ag. Research Center, Conrad. 2006.

Crop	Knees	Sunburst	WTARC
	Planting Date		
Camelina	4/21	4/20	4/26
Safflower	NA	NA	4/26
Swathing Date			
Camelina	7/19	7/18	4/24
Thrashing Date			
Camelina	7/27	7/27	8/8
Safflower	NA	NA	10/2
Growing Season Precipitation			
Camelina	2.75	7.60	6.31
Safflower	NA	NA	9.55

Table 2o. Camelina variety trial: Seed yield and oil content data. Western Triangle Ag. Research Center, Conrad, MT. 2006.

Variety or Line	Location					
	Knees	Sunburst	WTARC	Knees	Sunburst	WTARC
	Seed Yield (lbs/acre)			Seed Oil Content (%)		
Celine	917 a	1102	1395	40.2	38.6	41.0
MT 1	939 a	1091	1304	40.5	39.6	41.2
MT 3	834 ab	1093	1363	41.1	38.2	41.0
MT 5	864 ab	1094	1404	42.0	40.7	40.7
MT 12	954 a	1196	1334	41.2	40.8	41.1
MT 15	667 b	1161	1286	41.0	41.3	40.7
C 32	739 ab	1178	1167	40.4	38.7	40.1
C 38	676 b	1088	1403	41.6	41.0	41.8
LSD (0.05)	237	NS	NS	ND	ND	ND
Mean	824	1125	1332	ND	ND	ND
CV %	19.6	18.1	16.5	ND	ND	ND

ND=Not Determined

Table 3o. Safflower variety trial: Seed yield and oil content data: Western Triangle Ag. Research Center, Conrad, MT. 2006.

Variety or Line	Seed Yield (lbs/acre)	Oil Content (%)
MT 2003	2229	37.4
Hybrid 90	2189	33.1
03 B 6748	2044	43.1
71 B 7113	1993	43.5
03B 1118	1929	44.4
Morlin	1777	39.6
02B 6655	1743	43.7
01B 2159	1661	42.0
Erlin	1611	41.9
Nutra Saf	1602	46.9
03B 5085	1587	44.2
Centennial	1511	42.9
LSD (0.05)	NS	1.2
Mean	1821	41.8
CV (%)	22.8	1.7