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WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

2005 Crop Year

Submitted by

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Summary of climatic data by month for the '04-'05 crop year (September - August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (20-yr)	Current Year	Average (20-yr)
September, 2004	1.01	1.08	55.3	57.3
October, 2004	1.13	0.57	43.8	45.3
November, 2004	0.00	0.33	36.9	32.1
December, 2004	0.14	0.16	30.4	25.2
January, 2005	0.18	0.19	18.2	22.8
February, 2005	0.00	0.20	31.8	25.1
March, 2005	0.69	0.45	34.5	33.4
April, 2005	0.89	0.89	43.5	43.8
May, 2005	0.58	1.77	50.7	52.3
June, 2005	5.16	2.96	57.4	59.8
July, 2005	0.12	1.40	68.6	66.6
August, 2005	1.66	1.32	64.6	66.3
Total	11.56	--	--	--
Average	--	11.32	44.6	44.2

Last killing frost in Spring

2005----- May 13 (32°F)

Average----- May 18

First killing frost in Fall

2005----- Sept 23 (32°F)

Average----- Sept 23

Frost free period (days)

2005----- 133

Average----- 129

Maximum summer temperature----- 95°F (August 1, 2005)

Minimum winter temperature----- -26°F (Jan 15, 2005)

2005 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 05 are presented in Table 1. A condensed version in Table 2 lists only the varieties and a few potential-release lines. The Knees 05 results are in Table 4. Multi-year averages for the respective locations are listed in Tables 3 and 5. Data from both locations combined over years are summarized in table 6.

Yellowstone, a new hard red variety, had the highest average yield across the Western Triangle area. Other high yielding varieties included Rocky, Jagalene, Falcon, Ledger and Pryor.

Among the sawfly resistant varieties, Genou was consistently higher yielding than Vanguard, Rampart and MTCL0318, and also had a moderately higher level of winter survival.

The tests included five varieties designed for Clearfield's 'Beyond' herbicide system. These five varieties offer choices for various uses and conditions, with MTCL0306 being a hollow-stem hard white, and MTCL0318 a solid-stem hard red for sawfly resistance. The other three, 'Above', MTCL0316 and MT1159CL are hollow-stem hard reds.

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.

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): 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.

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

Bond (CO 2004): Clearfield system IMI resistant. Medium height, early maturity.

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

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

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

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

Hatcher (CO 2004): Medium height. Early maturity. Low protein.

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

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

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

Ledger (WestBred, 2005). BZ9W96-788. Winterhardness = 2. Semidwarf height & stiff straw, 4" less than Rocky. Medium coleoptile. Stem solidness = 12, which does not provide a reliable level of sawfly tolerance. Early heading, 1 day later than Rocky. Above avg yield & test wt. Avg protein.

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

Morgan (Sask & WPB, S89-142, 1996): Norstar/Archer. Excellent winterhardness (5). 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.

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, similar to Promontory and Rampart, and production should be restricted to areas where winterkill risk is moderate. Semidwarf height and good lodging resistance. Long coleoptile. 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.

MTCL_0316 (MSU, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardness = 3. Medium height, 3" taller than MT1159CL. Earlier maturity (2 days) and higher yield than MT1159CL. High test weight. Low protein.

MTCL_0318 (MSU, 2005): Clearfield system single-gene resistance to imazamox or 'Beyond' herbicide. Winterhardness = 3. Stem solidness = 20, which typically provides a reliable level of sawfly tolerance. Similar in most characteristics to Rampart. Sawfly resistant, low yield, high protein, and excellent baking quality.

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.

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

Paul (MT 9426, MSU, 2003): Winterhardness = 4. Height 2" shorter than Neeley, 3" shorter than Tiber & Big Sky. Medium-stiff straw. Medium coleoptile length, shorter than Tiber & Big Sky. Heading 0.5 day earlier than Neeley, Tiber & Big Sky. Yield similar to Neeley, and slightly higher than Tiber & Big Sky. Very low test weight. Protein

equal to Neeley, 0.5% less than Tiber, and 1% less than Big Sky.

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

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

Quantum 542 (WPB/Hybritech): An F₁ hybrid; needs new seed each year. Planting F₂ (second generation) seed may result in yield reduction and development of ergot due to sterility in a small percentage of florets (ms ratio less than 3:1). F₁ vs F₂ tests in 1992 indicated a 12% yield reduction from planting 2nd generation seed. Winterhardiness = 3. Medium short height. Lodging resistance equal to Rocky. Med-long coleoptile. Early maturity like Rocky. Susceptible to stem rust. Medium shatter resistance. High yield. Below average protein.

Rampart (MTS92042, MSU, 1996): Sawfly resistant (sister line to Vanguard). Red chaff, upright head. Equal winterhardiness to Vanguard (2-) but slightly less than Rocky. Should not be grown in areas where high levels of winterhardiness are needed, unless protected by stubble. Height 1 inch shorter than 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 stiff straw, medium height. Long coleoptile. Early maturity, which sometimes allows escape from sawfly. High yield. Very susceptible to yellow berry expression under low nitrogen conditions. 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. See Big Sky for alternative.

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

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. 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. Medium test weight, similar to Falcon, Morgan, & Pryor; and higher than Paul. Protein is medium, similar to Paul & Morgan, and lower than Rampart & Genou. Excellent baking quality and good Asian noodle quality.

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.

MTCL 0306 (MSU, 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.

MTHW 01133 (MSU): Experimental, Hard white, low PPO.

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

Nuwest (MT 7811) (MSU, General Mills, 1994): Hard white, low PPO. Dual purpose, noodle and bread. Winterhardiness = 4. 1 or 2 inches shorter than Rocky. Stiffer strawed than Neeley & Rocky. 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.

Table 1. 2005 Intrastate Winter Wheat Variety Test (Exp. 3518), Conrad, MT.

Cultivar/Line		Yield bu/ac	Test Wt lb/bu	Heading date	Height in.	Protein %
MT02113		100.9	62.6	167	40	12.6
Hatcher		98.1	64.3	163	37	12.6
Pryor, WestBred		96.9	64.3	165	36	12.1
MTW02111	HW	96.8	62.7	170	39	11.8
Yellowstone (MT00159)		92.4	62.0	166	36	13.0
MT9982-65		91.7	61.5	166	39	13.0
MT9982-53		91.7	62.4	169	38	13.1
Promontory		91.5	64.2	166	38	12.7
MTCL0316	CL	90.7	63.4	163	39	12.9
MTW01133	HW	90.7	62.0	163	35	13.9
MT02136		89.3	62.3	165	36	12.1
MT01148		89.1	63.2	168	39	13.1
Wahoo		88.9	62.4	163	36	13.3
MT0383		88.8	63.2	166	35	13.6
Bond CL	CL	87.4	62.7	162	37	12.7
Paul		87.3	61.8	168	37	13.3
NuFrontier, GM	HW	86.4	65.1	164	36	12.2
Genou	++	86.0	64.5	167	42	12.3
MTCL0306, GM	HW, CL	85.5	62.8	164	38	14.3
Bauermeister		85.3	58.8	170	39	12.0
MT03176		85.0	61.8	163	39	13.7
Rocky		84.8	64.4	165	42	12.6
MT0097		84.7	61.5	168	41	13.5
NuSky	HW	84.6	61.7	168	41	12.8
Falcon, CDC, WestBred		84.4	63.6	165	34	12.7
Ledger, WestBred		84.3	64.2	165	35	13.1
Quantum 542, WestBred		84.3	62.9	164	42	13.7
Above	CL	84.1	63.2	162	36	13.4
WA7936	HW	84.0	59.4	172	39	11.8
NuWest, GM	HW	83.8	60.9	168	41	14.1
Morgan, WestBred		83.4	62.9	168	41	13.1
MT03177		83.3	60.1	165	42	13.3
BigSky		82.9	62.9	166	41	13.7
Jagalene, AgriPro		82.6	64.7	165	36	14.0
Neeley		82.4	62.2	168	42	13.2
GM10006	HW	81.7	65.3	164	33	14.3
NuHorizon, GM	HW	81.7	65.6	163	31	13.3
BZ9W02-2060		81.6	63.8	165	35	13.9
Bighorn, WestBred		80.5	64.2	166	35	13.0
Tiber		79.4	63.0	168	45	13.3
Millenium		79.4	63.5	163	40	13.7
Jerry		77.5	62.2	166	42	13.9
MTCL0318	++, CL	74.3	63.5	165	40	15.2
MTS0333	++	74.2	63.7	167	37	13.9
Vanguard	++	72.1	62.0	166	42	14.5
MTS0360	++	71.1	60.7	168	39	15.1
MT1159CL, WestBred	CL	70.7	61.6	166	38	13.4
Rampart	++	69.9	63.2	167	40	12.7
Norstar		62.8	59.7	172	54	14.5
Average		84.3	62.5	166.0	38.7	13.3
LSD (0.05); CV %		10.4; 7.2				
P-value (Varieties)		<.0001				

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

Planted Sept 23, 2004 on fallow. Fertilizer 72-52-0. Harvested Aug 8, 2005.

++ = sawfly resistant. HW = hard white. CL = Clearfield System.

Table 2. 2005 Intrastate Winter Wheat Variety Test (Condensed list), Conrad, MT.

Cultivar/Line		Yield bu/ac	Test Wt lb/bu	Heading date	Height in.	Protein %
MT 02113		100.9	62.6	167	40	12.6
Hatcher		98.1	64.3	163	37	12.6
Pryor, WestBred		96.9	64.3	165	36	12.1
Yellowstone (MT00159)		92.4	62.0	166	36	13.0
Promontory		91.5	64.2	166	38	12.7
MTCL 0316	CL	90.7	63.4	163	39	12.9
MTW 01133	HW	90.7	62.0	163	35	13.9
MT 01148		89.1	63.2	168	39	13.1
Wahoo		88.9	62.4	163	36	13.3
Bond CL	CL	87.4	62.7	162	37	12.7
Paul		87.3	61.8	168	37	13.3
NuFrontier, GM	HW	86.4	65.1	164	36	12.2
Genou	++	86.0	64.5	167	42	12.3
MTCL 0306, GM	HW, CL	85.5	62.8	164	38	14.3
Bauermeister		85.3	58.8	170	39	12.0
Rocky		84.8	64.4	165	42	12.6
NuSky	HW	84.6	61.7	168	41	12.8
Falcon, CDC, WestBred		84.4	63.6	165	34	12.7
Ledger, WestBred		84.3	64.2	165	35	13.1
Quantum 542, WestBred		84.3	62.9	164	42	13.7
Above	CL	84.1	63.2	162	36	13.4
NuWest, GM	HW	83.8	60.9	168	41	14.1
Morgan, WestBred		83.4	62.9	168	41	13.1
BigSky		82.9	62.9	166	41	13.7
Jagalene, AgriPro		82.6	64.7	165	36	14.0
Neeley		82.4	62.2	168	42	13.2
NuHorizon, GM	HW	81.7	65.6	163	31	13.3
Bighorn, WestBred		80.5	64.2	166	35	13.0
Tiber		79.4	63.0	168	45	13.3
Millenium		79.4	63.5	163	40	13.7
Jerry		77.5	62.2	166	42	13.9
MTCL 0318	++, CL	74.3	63.5	165	40	15.2
Vanguard	++	72.1	62.0	166	42	14.5
MT1159CL, WestBred	CL	70.7	61.6	166	38	13.4
Rampart	++	69.9	63.2	167	40	12.7
Norstar		62.8	59.7	172	54	14.5
Average		84.3	62.5	166.0	38.7	13.3
LSD (0.05); CV %		10.4; 7.2				
P-value (Varieties)		<.0001				

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

Planted Sept 23, 2004 on fallow. Fertilizer 72-52-0. Harvested Aug 8, 2005.

++ = sawfly resistant. HW = hard white. CL = Clearfield System.

Table 3. Three-year averages, Winter wheat varieties, Conrad 2003 - 05.

Variety	3-Year Average					Winter survival class ①
	Yield bu/a	Test wt	Height in.	Head date	Protein %	
MT 02113	83.9	60.8	38	168	12.5	
Yellowstone (MT00159)	78.5	61.4	38	169	13.0	4
Wahoo	77.8	62.3	35	164	13.2	3
MTCL 0316 CL	77.5	63.0	37	165	13.2	3
Ledger	77.2	63.9	34	165	12.8	2
Quantum 542	76.4	63.1	41	165	13.0	3
Pryor	76.4	61.9	35	168	12.4	3
Rocky	76.2	64.1	42	166	12.5	2
MTW 01133 HW	75.4	61.9	33	163	13.3	
NuHorizon HW	75.3	65.3	31	163	12.9	3
Falcon	75.1	63.4	33	166	12.9	4
MT 01148	74.4	62.2	39	169	12.9	
Paul	74.3	61.3	37	169	12.6	4
NuFrontier HW	73.9	64.2	35	164	12.4	3
Promontory	73.9	63.9	36	166	12.8	2-
Millenium	73.6	63.7	39	164	13.2	2
NuSky HW	73.4	61.2	40	169	13.0	4
NuWest HW	73.0	60.9	40	168	13.1	4
MTCL 0306 HW, CL	72.8	62.7	39	164	12.8	3
Bighorn	72.8	62.9	34	167	13.1	3
Neeley	72.8	62.1	41	170	13.0	3
Above CL	72.4	62.7	33	162	13.4	2
BigSky	72.2	62.6	41	168	13.5	4
Jagalene	72.0	64.8	34	164	13.9	2
Genou ++	71.5	62.8	40	168	13.0	2
Morgan	71.4	61.9	40	170	12.8	5
Bauermeister	69.5	56.8	37	172	12.1	2-
Jerry	69.1	61.9	42	167	13.5	5
Vanguard ++	68.2	62.5	41	166	13.7	2-
Tiber	67.5	62.4	43	169	13.6	3
Golden Spike HW	66.3	61.2	39	170	13.1	3
Rampart ++	63.6	62.5	39	168	13.9	2-
MTCL 0318 ++, CL	62.8	63.1	38	165	14.3	3
MT1159CL CL	61.3	60.3	36	167	13.6	2-
Norstar	54.8	59.9	51	172	13.9	5
nursery mean	72.3	62.3	38.1	166.9	13.1	

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

① Winterhardiness: 5 = high, 1 = low.

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

Table 4. 2005 Off-Station **Winter Wheat** Variety Test, Knees Area.

Variety		Yield bu/ac	Test Wt lb/bu	Height in.	Protein %
Yellowstone	MT00159	73.0	58.2	42	14.5
MT 0097		71.2	57.7	39	14.2
Jagalene	AgriPro	70.8	62.1	38	15.0
Wahoo		70.2	57.4	36	15.6
Falcon	CDC WestBred	68.9	56.0	37	15.9
MTW 01133	HW	67.7	58.5	33	15.5
Jerry		67.3	60.1	46	14.3
Promontory		66.0	60.7	39	14.2
MTCL 0316	CL	66.0	58.9	40	14.6
Pryor	WestBred	65.9	59.1	38	15.3
Rocky	AgriPro	64.8	59.9	43	15.3
Paul		64.7	55.6	36	16.6
Genou	++	63.4	59.6	40	15.2
BigSky		62.1	60.0	43	15.6
MTCL 0306	GM HW, CL	61.4	58.8	39	14.3
Tiber		60.3	60.6	44	15.4
Morgan	WestBred	59.6	58.2	41	14.5
Neeley		58.9	55.1	41	17.4
NuSky	HW	58.4	55.7	39	16.7
MT 01148		57.5	56.3	41	16.2
MT1159CL	WestBred CL	57.2	58.3	36	14.3
Vanguard	++	57.0	58.1	41	16.7
MTCL 0318	++, CL	56.9	60.2	40	16.7
Rampart	++	54.0	59.6	40	16.2
Average		63.5	58.5	39.7	15.4

LSD (0.05); CV % 7.7; 7.5

P-value (Varieties) <.0001

++ = sawfly resistant. HW = hard white. CL = Clearfield System.

Planted Sept 14, 2004, no-till chem-fallow. Harvested July 29, 2005.

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

Fertilizer, actual: 71-52-0.

Conducted by MSU Western Triangle Ag Research Center.

Table 5. Four-year averages, **Winter Wheat** varieties, Knees area, Chouteau Co. 2002 - 05.

Variety		4-Year Average				Winter survival class ①
		Yield bu/a	Test wt.	Height in.	Protein %	
Jagalene		61.3	61.3	35	13.7	2
Rocky		60.9	60.3	39	12.7	2
Yellowstone	MT00159	60.0	57.0	37	12.9	4
MT 0097		59.8	58.7	36	13.1	4
Wahoo		59.0	57.7	33	13.5	3
Falcon		58.7	59.0	33	12.9	4
Paul		58.0	56.4	33	13.4	4
Jerry		57.9	59.4	40	13.5	5
MTCL 0316	CL	57.8	59.1	37	12.8	3
Pryor		57.0	58.2	35	13.0	3
MTW 01133	HW	56.2	58.9	31	13.1	
Promontory		56.0	59.9	35	12.5	2-
Genou	++	55.5	59.3	38	13.3	2
BigSky		54.5	59.5	39	14.0	4
MTCL 0306	HW, CL	54.0	59.0	36	12.5	3
Tiber		53.5	59.2	41	13.7	3
Morgan		53.5	58.1	37	12.6	5
NuSky	HW	52.2	57.8	37	12.9	4
Vanguard	++	52.1	59.2	38	13.9	2-
Neeley		52.0	56.8	37	13.5	3
MT 1159CL	CL	49.9	58.0	33	12.9	2-
MT 01148		49.8	57.9	38	14.1	
MTCL 0318	++, CL	49.8	60.4	37	14.6	3
Rampart	++	49.0	59.1	37	13.7	2-
nursery mean		55.6	58.7	36.4	13.5	

++ sawfly resistant. 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.

Table 6. Two-location X multi-year Winter wheat varieties, thru 2005.

Variety		2-loc x multi-year Average				Winter survival class ①
		Yield bu/a	Test wt	Height in.	Protein %	
Yellowstone	MT00159	69.3	59.2	38	13.0	4
Rocky		68.5	62.2	41	12.6	2
Wahoo		68.4	60.0	34	13.4	3
MTCL0316	CL	67.7	61.1	37	13.0	3
MT0097		67.3	60.3	38	13.2	4
Falcon		66.9	61.2	33	12.9	4
Pryor		66.7	60.1	35	12.7	3
Jagalene		66.7	63.1	35	13.8	2
Paul		66.2	58.9	35	13.0	4
MTW01133	HW	65.8	60.4	32	13.2	
Promontory		64.9	61.9	36	12.7	2-
Jerry		63.5	60.7	41	13.5	5
Genou	++	63.5	61.1	39	13.2	2
MTCL0306	HW, CL	63.4	60.9	38	12.7	3
BigSky		63.3	61.1	40	13.8	4
NuSky	HW	62.8	59.5	39	13.0	4
Morgan		62.4	60.0	39	12.7	5
Neeley		62.4	59.5	39	13.3	3
MT01148		62.1	60.1	39	13.5	
Tiber		60.5	60.8	42	13.7	3
Vanguard	++	60.2	60.9	40	13.8	2-
Rampart	++	56.3	60.8	38	14.4	2-
MTCL0318	++, CL	56.3	61.8	38	14.5	3
MT1159CL	CL	55.6	59.2	35	13.3	2-
nursery mean		64.0	60.5	37	13.3	

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

① Winterhardiness: 5 = high, 1 = low.

Locations: Western Triangle Agr Research Center, Conrad, MT, and Knees area.

Years: Conrad 2003 - 2005, Knees 2002 -2005.

2005 Spring Wheat & Durum Variety Evaluations In The Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

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

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

Results: Data for the spring wheat trials are presented in Tables 7-18, and include the 2005 and multi-year averages. All entries of the Advanced Yield trial at Conrad are listed in Table 7, with a condensed version in Table 8 showing only named varieties and a few potential-release lines. Table 18 is a summary of all the Western Triangle area tests over the past five years, and is equivalent to 18 tests on each variety. Durum data are presented in Tables 19-24.

Although nitrogen fertilizer (71 lbs actual) was applied to all dryland spring wheat trials, the Cut Bank protein levels were very low in 2005.

Although the sawfly-resistant HRS 'Choteau' produced only average yields in 2005, it remained high in the yield ranking when averaged across all of the Western Triangle area tests over the past five years, yielding 5 bu higher than 'Fortuna'. Choteau had the highest stem-solidness (sawfly resistance) rating of 22, compared to 19 for Fortuna, and 16 for Ernest. (Maximum rating = 25). Heading date for 'Choteau' was slightly earlier than McNeal and slightly later than Fortuna.

High stem-solidness scores were also found in the hard white entries 'Agawam' (score = 22) and MTHW0202 (score = 20). The latter is an experimental with higher yield and test weight than 'Explorer'.

Among the durum varieties, 'Avonlea', 'Alzada', 'Maier', and 'Mountrail' were the highest yielders on dryland. Avonlea, Alzada and Maier had average or better test weights (Table 20). Test weights at the Knees averaged 57.6 lbs/bu, indicating this area may have a higher risk of failure to produce market quality durum (Table 24). For irrigated durum, Mountrail, Alzada and 'Plaza' were the highest yielding varieties (Table 22).

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.

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.

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.

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.

Waieka (bz998447; WestBred 2006): Hard white. Semidwarf height. Early maturity. Above average yield. Below average test weight. Average protein. Adapted to Washington state.

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.

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 susceptible 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.

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-late maturity. High 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 medium protein. Good quality, but kernel color more sensitive to late rain than some other varieties. (All durums are sensitive to late rain/irrigation relative to color loss).

Munich (ND, 1995): Medium-short, slightly taller than Laker. Strong straw, good lodging resistance. Med-late maturity. 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 height and lodging resistance. Average yield. High test weight. Average protein, good quality.

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

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

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

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

Table 7. 2005 Advanced Spring Wheat variety nursery, Conrad Dryland.

Variety		Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0411		61.7	60.3	34	181	13.6
MT 0431		60.0	60.0	31	179	14.4
MT 0421		58.9	57.6	32	184	14.7
MT 0460		57.0	60.7	34	183	15.2
MT 0423		56.6	59.7	33	182	15.0
MT 0405		56.2	57.3	34	182	15.8
MT 0260		55.9	59.9	34	185	14.1
Agawam	++ HW	55.8	61.1	31	182	13.3
Triple IV (bz996444)		55.5	58.6	34	181	14.1
MT 0413		55.5	58.8	33	182	15.2
MT 0425		55.4	57.9	33	182	13.9
MT 0417		55.3	60.0	36	182	15.3
MT 0245		55.0	59.1	32	184	14.7
Freyer		54.7	61.0	35	183	14.0
MT 0414		54.7	59.1	37	184	15.8
MT 0459		54.6	62.5	38	184	14.5
Alsen		54.6	59.3	34	183	15.2
McNeal		54.3	58.8	33	184	14.7
Explorer	HW	54.1	58.8	32	182	14.8
MT 0342		54.1	60.4	35	184	14.0
BZ9M1044		53.8	60.0	28	184	14.3
MT 0412		53.7	59.6	31	181	14.7
Reeder		53.3	59.1	35	183	15.3
MT 0266		53.1	56.4	36	182	15.1
MT 0345		53.0	59.3	33	184	14.9
Waieka (bz998447)	HW	52.9	54.9	35	182	15.1
MT 0415		52.8	59.8	36	184	15.3
BZ999592		52.6	58.2	37	185	15.7
MT 0249		52.4	58.4	35	184	15.6
Outlook		51.9	57.1	34	185	14.9
MT 0416		51.6	58.5	33	184	14.3
WPB Germany (acs52610)		51.5	61.3	34	186	14.9
Buck Pronto		51.2	57.9	33	182	15.6
Fortuna	++	51.0	60.1	42	184	14.5
MT 0401		51.0	59.5	34	182	15.4

<i>continued</i>		Yield	TW	Height	Head	Prot
Hank		51.0	56.7	32	183	15.3
MT 0408		50.9	56.9	39	186	15.0
Choteau	++	50.5	59.1	32	183	15.3
Banton		50.3	62.4	38	182	15.0
MT 0318		50.2	59.3	38	183	15.1
MT 0465		49.8	61.4	35	182	14.9
Conan	+	49.7	59.6	30	184	15.2
MT 0336		49.6	58.6	35	185	14.9
BZ9M1024		49.4	59.6	33	184	14.4
Norpro		49.0	55.0	31	184	15.2
MTHW0202	++ HW	48.9	58.1	34	181	14.9
MT 0418		48.8	57.6	36	182	15.0
MT 0313		48.8	58.3	36	185	15.3
MT 0464		48.6	58.9	39	182	14.5
Scholar	+	48.4	60.0	37	184	15.9
MT 0476		48.2	54.7	37	186	15.8
MT 0410		48.2	59.6	38	185	15.1
MT 0433		48.1	57.2	30	182	15.6
MT 0319		47.4	58.8	37	183	15.4
01II 27-20-1 CL (Agpro)		47.1	59.2	36	183	15.6
Knudson		47.0	59.4	35	185	14.7
MT 0461		46.0	59.5	37	185	15.0
SEEDDEX 1504B		45.9	58.5	27	184	14.5
MT 0432		45.7	56.9	35	184	15.6
MTHW0471	HW	45.6	59.6	40	186	16.7
MT 0325		42.9	59.0	36	184	15.8
MT 0315		40.8	57.3	36	184	16.5
Ernest	+	37.7	57.1	38	184	16.7
Thatcher		36.2	55.1	43	186	16.3
mean		51.2	58.8	34.7	183.4	15.0

LSD (.05) = 7.18 bu in same block; 7.34 bu for different blocks.

C.V. = 8.27

++ = 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 25, 2005 on fallow. Harvested Aug 22, 2005.

Fertilizer, actual: 71-52-0

Table 8. 2005 Advanced **Spring Wheat** variety nursery, Conrad Dryland.*(Condensed List)*

Variety		Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0260		55.9	59.9	34	185	14.1
Agawam	++ HW	55.8	61.1	31	182	13.3
Triple IV (bz996444)		55.5	58.6	34	181	14.1
MT 0245		55.0	59.1	32	184	14.7
Freyer		54.7	61.0	35	183	14.0
Alsen		54.6	59.3	34	183	15.2
McNeal		54.3	58.8	33	184	14.7
Explorer	HW	54.1	58.8	32	182	14.8
Reeder		53.3	59.1	35	183	15.3
MT 0266		53.1	56.4	36	182	15.1
Waieka (bz998447)	HW	52.9	54.9	35	182	15.1
MT 0249		52.4	58.4	35	184	15.6
Outlook		51.9	57.1	34	185	14.9
WPB Germany (acs52610)		51.5	61.3	34	186	14.9
Buck Pronto		51.2	57.9	33	182	15.6
Fortuna	++	51.0	60.1	42	184	14.5
Hank		51.0	56.7	32	183	15.3
Choteau	++	50.5	59.1	32	183	15.3
Banton		50.3	62.4	38	182	15.0
Conan	+	49.7	59.6	30	184	15.2
MT 0336		49.6	58.6	35	185	14.9
Norpro		49.0	55.0	31	184	15.2
MTHW0202	++ HW	48.9	58.1	34	181	14.9
Scholar	+	48.4	60.0	37	184	15.9
Knudson		47.0	59.4	35	185	14.7
Ernest	+	37.7	57.1	38	184	16.7
Thatcher		36.2	55.1	43	186	16.3
mean		51.2	58.8	34.7	183.4	15.0

LSD (.05) = 7.18 bu in same block; 7.34 bu for different blocks. C.V.=8.27

++ = 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 25, 2005 on fallow. Harvested Aug 22, 2005.

Fertilizer, actual: 71-52-0

Table 9. Four-year averages, dryland Spring Wheat varieties, Conrad area, Pondera Co. 2002 - 05.

Variety	4-Year Average						
	Yield bu/a	Test weight	Height in.	Head date	Protein %		
Agawam, WestBred	++	HW	58.4	62.4	30.3	181.5	13.2
MT 0249			54.6	59.6	32.5	183.5	14.7
Reeder			54.3	59.3	33.8	182.8	14.3
MT 0260			54.3	58.9	32.8	184.8	14.0
Alsen			54.0	59.3	33.3	183.6	15.2
Choteau	++		53.7	59.9	31.3	183.8	14.4
MT 0245			53.7	58.6	31.8	184.5	13.8
MT 0266			53.7	57.9	32.8	182.2	14.7
MT 0336			52.7	59.8	32.3	184.6	13.9
Waieka, WestBred		HW	52.7	57.1	33.5	181.8	14.1
MTHW 0202	++	HW	52.6	61.1	31.8	180.8	14.0
WB 926			52.1	59.0	31.1	181.4	14.7
Hank, WestBred			52.1	57.7	32.3	182.0	14.5
McNeal			51.7	59.9	32.3	184.5	14.0
Norpro, AgriPro			51.6	58.3	29.3	184.0	14.1
Knudson, AgriPro			50.6	60.2	32.5	184.5	13.9
Outlook			50.2	58.1	32.0	185.0	14.5
Fortuna	++		49.8	60.6	38.5	183.8	13.9
Explorer		HW	49.3	59.7	30.0	181.5	14.5
Conan, WestBred	+		48.1	59.1	30.0	183.8	14.8
Scholar	+		46.9	60.0	36.3	185.5	15.0
Ernest	+		43.8	59.3	37.3	184.3	15.4
nursery mean			51.7	59.3	32.7	183.4	14.4

++ 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 10. 2005 Irrigated Spring Wheat variety trial, Conrad, MT.

Variety			Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
MT 0260			69.1	62.0	35	185	13.7
MT 0245			68.8	61.2	35	184	14.4
Explorer		HW	67.7	61.0	33	182	14.3
Agawam	++	HW	66.7	62.2	34	181	13.1
MTHW0202	++	HW	66.2	61.2	34	180	14.0
Outlook			65.6	59.8	36	184	14.0
Alsen			65.0	62.2	36	183	15.1
WB 926			63.3	59.5	31	182	14.5
MT 0266			63.1	59.9	35	182	14.8
Norpro			62.3	60.4	31	183	14.2
McNeal			61.6	60.0	35	185	14.4
MT 0336			60.9	60.7	35	185	14.5
Choteau	++		59.8	61.1	34	184	15.1
Scholar	+		59.1	61.2	41	184	15.7
Knudson			58.5	61.4	36	184	13.9
Hank			58.2	57.6	33	183	15.4
Reeder			57.8	61.2	36	183	15.0
Conan	+		56.7	60.8	32	184	14.4
Fortuna	++		53.6	61.0	42	184	14.3
Ernest	+		51.8	60.5	42	184	15.3
mean			61.8	60.7	35.3	183.3	14.5
LSD (.05) = 10.5 bu. C.V.1&2 = 10.3 & 6.0							

++ = 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 25, 2005 on fallow. Harvested Aug 22, 2005.

Fertilizer, actual: 100-52-0

Table 11. Four-year averages, irrigated Spring Wheat varieties, Conrad area, Pondera Co. 2002 - 05.

Variety	4-Year Average					
	Yield bu/a	Test wt.	Height in.	Head date	Protein %	
Hank, WestBred	83.8	60.1	33.5	182.5	14.9	
MT 0245	82.5	61.5	35.2	184.4	14.9	
WB 926	81.7	60.9	33.0	182.0	14.7	
MTHW 0202	++ HW	80.8	62.4	34.2	180.4	13.6
Choteau	++	80.0	61.6	33.3	183.5	14.9
McNeal		79.5	60.7	35.3	184.5	14.6
Explorer	HW	79.3	61.8	33.0	181.8	14.6
MT 0266		78.7	60.5	35.2	182.0	14.5
Outlook		78.0	59.9	35.0	184.5	14.3
Reeder		77.6	61.9	36.0	183.0	15.2
Alsen		76.3	62.3	35.7	183.0	15.3
Scholar	+	73.8	61.7	40.5	185.0	15.5
Conan, WestBred	+	71.8	61.2	33.8	183.8	14.6
Ernest	+	68.3	61.6	42.3	183.8	15.7
Fortuna	++	64.6	61.9	40.5	182.8	15.0
nursery mean		76.7	61.3	35.9	183.2	14.9

++ 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 12. 2005 Spring Wheat variety trial, Cut Bank.

Variety			Yield bu/a	Test Wt lb/bu	Height in.	Protein %
Hank			51.0	56.7	34	10.4
Agawam	++	HW	50.2	61.4	33	10.0
MT 0245			49.4	57.3	36	9.9
Explorer		HW	48.1	59.4	36	10.5
MT 0266			47.6	57.9	36	10.6
Alsen			47.6	60.4	37	10.9
Outlook			46.6	57.1	35	9.8
Fortuna	++		46.2	59.6	41	11.0
MT 0336			45.8	59.2	37	9.6
Reeder			44.9	57.9	33	10.2
WB 926			44.1	58.3	33	10.6
McNeal			44.1	59.1	34	10.4
Choteau	++		43.9	60.0	31	10.9
MTHW0202	++	HW	43.9	61.2	33	10.2
Norpro			43.0	57.6	33	9.8
Knudson			42.3	59.4	35	10.8
MT 0260			42.2	56.5	35	9.7
Ernest	+		41.7	60.5	41	10.5
Conan	+		37.7	56.8	33	11.1
Scholar	+		33.6	58.1	42	10.1
mean			44.7	58.7	35.4	10.4
LSD (.05) = 4.9 bu. C.V.1&2 = 6.6 & 3.8						

++ = 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 12, 2005 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 22, 2005.

Conducted by MSU Western Triangle Ag Research Center.

Table 13. Three-year averages, **Spring Wheat** varieties, Cut Bank area, Glacier Co. 2003 - 05*.

Variety	3-Year Average				
	Yield bu/a	Test weight	Height in.	Protein %	
MT 0245	44.0	60.7	33.5	12.3	
Outlook	43.3	59.8	34.0	12.3	
McNeal	42.3	61.1	33.3	12.4	
Fortuna	++	42.1	61.7	39.7	13.1
Choteau	++	41.6	62.2	31.0	12.8
Hank, WestBred		40.7	59.8	32.0	12.4
Explorer	HW	39.7	61.3	32.3	12.4
MTHW 0202	++ HW	39.7	63.0	32.1	12.1
MT 0266		39.6	60.1	33.0	12.9
Reeder		39.0	61.0	33.0	12.6
Alsen		38.7	62.2	34.5	13.1
Conan, WestBred	+	36.5	60.5	30.7	12.8
WB 926		36.1	60.4	30.7	12.9
Ernest	+	36.0	61.8	38.0	12.9
Scholar	+	33.0	60.9	38.7	12.6
nursery mean		39.4	61.1	33.8	12.7

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

+ Partial sawfly resistance

HW = Hard White

* test wt is 2-year avg.

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

Table 14. 2005 Spring Wheat variety trial, Choteau, MT.

Variety			Yield bu/a	Test Wt lb/bu	Height in.	Protein %
MT 0266			55.6	54.4	36	15.9
Agawam	++	HW	53.7	60.1	31	13.9
Outlook			50.1	53.8	33	15.5
MT 0245			49.9	54.3	36	15.9
WB 926			49.7	54.2	30	17.2
McNeal			49.3	55.5	34	16.4
Fortuna	++		48.3	59.9	43	15.6
Alsen			47.8	56.9	36	16.0
Explorer		HW	47.6	56.7	33	15.9
Choteau	++		47.4	57.7	33	16.0
Knudson			47.3	58.6	35	15.7
Hank			46.7	53.5	32	16.9
Reeder			45.8	56.2	34	16.0
MT 0260			45.8	52.8	36	15.5
Norpro			44.3	52.7	32	16.1
Conan	+		43.7	56.9	30	15.8
MT 0336			43.1	55.6	33	15.7
Scholar	+		41.5	57.1	38	16.8
MTHW0202	++	HW	41.5	57.4	32	15.3
Ernest	+		40.9	59.1	41	16.2
mean			47.0	56.2	34.4	15.9
LSD (.05) = 6.5 bu. C.V.1&2 = 8.3 & 4.8						

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

+ = partial sawfly resistance.

HW = hard white.

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

Planted April 12, 2005 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 15, 2005.

Conducted by MSU Western Triangle Ag Research Center.

Table 15. Two-year averages, **Spring Wheat** varieties, Choteau area, Teton Co. 2004 - 05.

Variety	2-Year Average			
	Yield bu/a	Test weight	Height in.	Protein %
MT 0245	63.5	57.7	37.5	15.4
Outlook	62.5	56.9	36.0	15.3
MT 0266	60.2	56.3	36.5	15.9
McNeal	57.1	57.4	37.0	16.1
Hank, WestBred	56.7	56.0	34.0	16.3
Choteau ++	56.6	58.7	34.5	15.7
Alsen	56.5	58.8	36.5	16.0
Reeder	56.4	58.5	37.0	16.1
WB 926	55.5	56.4	33.0	16.5
Conan, Westbred +	54.6	58.8	32.5	15.4
Explorer HW	52.4	58.5	34.5	15.2
Fortuna ++	51.5	60.6	44.5	15.9
MTHW 0202 ++ HW	51.0	59.3	34.5	15.0
Ernest +	50.5	59.7	43.0	16.2
Scholar +	47.2	58.8	41.0	16.7
nursery mean	55.5	58.1	36.8	15.9

++ 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 16. 2005 Spring Wheat variety trial, Knees area, MT

Variety			Yield bu/a	Test Wt lb/bu	Height in.	Protein %
McNeal			55.8	56.1	34	15.2
Agawam	++	HW	55.3	59.0	33	13.8
MT 0266			54.0	53.8	37	15.0
Outlook			52.8	54.7	34	15.0
MTHW0202	++	HW	51.6	57.4	32	14.6
WB 926			51.6	53.3	33	16.0
MT 0245			51.6	55.9	36	14.9
Hank			50.9	52.3	35	16.3
Norpro			50.9	54.2	33	14.7
Explorer		HW	50.6	55.8	35	14.9
Alsen			49.6	57.5	36	14.3
Fortuna	++		49.1	59.5	41	15.1
Knudson			49.1	58.3	35	14.9
Choteau	++		48.5	56.4	35	15.7
Reeder			48.1	57.4	37	15.4
Scholar	+		48.0	59.3	39	15.8
Conan	+		47.4	57.8	34	15.0
MT 0260			46.9	55.5	35	14.7
MT 0336			46.7	55.9	35	14.3
Ernest	+		42.2	57.9	38	15.9
mean			50.0	56.4	35.4	15.1
LSD (.05) = 5.8 bu.			C.V.1&2 = 7.0 & 4.1			

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

+ = partial sawfly resistance.

HW = hard white.

Cooperator & location: Dan Picard, western Chouteau Co.

Planted April 11, 2005 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 9, 2005.

Conducted by MSU Western Triangle Ag Research Center.

Table 17. Five-year averages, **Spring Wheat** varieties, Knees area, Chouteau Co. 2001 - 05.

Variety	5-Year Average				
	Yield bu/a	Test weight	Height in.	Protein %	
MT 0266	38.9	54.3	32.2	15.3	
MT 0245	38.5	56.3	30.9	15.3	
McNeal	38.0	55.4	30.4	15.8	
Choteau	++	37.9	56.8	29.0	15.8
Hank, WestBred		37.7	54.4	29.6	16.4
Reeder		37.0	56.5	30.8	16.1
MTHW 0202	++ HW	36.9	58.1	28.8	15.4
Outlook		36.5	54.8	31.2	15.4
Explorer	HW	35.9	56.2	30.2	15.7
Fortuna	++	35.8	57.7	35.4	16.2
WB 926		35.8	54.7	29.0	16.9
Scholar	+	35.1	57.4	34.0	16.5
Alsen		35.0	56.8	31.8	16.0
Conan, WestBred	+	33.5	56.4	28.6	15.9
Ernest	+	33.1	57.3	34.0	16.2
nursery mean		36.2	56.2	31.1	16.0

++ 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 18. Multi-Year x Location Averages - **Spring Wheat Varieties**.
Western Triangle Area

Variety	18-Year x Location Average ^①					
	Yield bu/a	Test weight	Height in.	Protein %	Head date ^②	
MT 0245	56.4	59.0	33.8	14.3	184.5	
MT 0266	54.2	57.8	33.9	14.7	182.1	
Hank WestBred	54.2	57.6	32.3	14.9	182.3	
Outlook	54.1	57.9	33.6	14.3	184.8	
Choteau	++	54.0	59.8	31.8	14.7	183.6
McNeal		53.7	58.9	33.6	14.6	184.5
Reeder		52.8	59.4	34.1	14.8	182.9
MTHW 0202	++ HW	52.2	60.8	32.3	14.0	180.6
WB 926		52.2	58.3	31.4	15.1	181.7
Alsen		52.1	59.9	34.4	15.1	183.3
Explorer	HW	51.3	59.5	32.0	14.5	181.6
Conan WestBred	+	48.9	59.2	31.1	14.7	183.8
Fortuna	++	48.7	60.5	39.7	14.8	183.3
Scholar	+	47.2	59.7	38.1	15.2	185.3
Ernest	+	46.3	59.9	38.9	15.3	184.0
nursery mean		51.9	59.2	34.1	14.8	183.3

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

+ Partial sawfly resistance

HW = Hard White

① Conrad 4-yr + Conrad Irr 4-yr + Choteau 2-yr + Knees 5-yr + Cut Bank 3-yr.
Years included are 2001 to 2005.

② Head date, Conrad only.

Conducted by MSU Western Triangle Agr Research Center.

Table 19. 2005 dryland Durum variety trial, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Alzada	59.8	60.4	31	182	15.2
McNeal (spr wht)	57.4	58.8	36	184	15.6
Strongfield	55.5	59.0	39	185	16.4
Avonlea	55.4	59.3	39	184	16.8
Maier	54.5	60.5	34	184	16.2
Pierce	50.9	60.3	39	184	16.0
Vic	50.6	62.0	44	184	15.6
Lebsock	50.5	60.3	37	184	16.4
Plaza	50.2	58.1	29	185	16.2
Kyle	50.1	59.7	45	186	16.5
Monroe	49.3	58.8	40	182	16.7
Munich	49.1	59.1	36	184	16.9
Mountrail	47.9	58.3	39	185	16.6
Dilse	47.3	60.2	35	185	17.2
Ben	45.7	60.7	41	185	16.9
mean	51.6	59.7	37.6	184.2	16.3
LSD (.05) = 9.1 bu. C.V.1&2 = 10.6 & 6.1					

Planted April 25, 2005 on fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 22, 2005.

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

Table 20. Four-year averages, dryland Durum varieties,
Conrad area, Pondera Co. 2002 - 05.

Variety	4-Year Average				
	Yield bu/a	Test weight	Height in.	Head date	Protein %
Alzada, WestBred	52.8	60.3	31.0	182.0	13.9
McNeal (Spr Wheat)	52.6	59.0	33.8	184.8	14.2
Avonlea	52.0	60.2	36.5	184.0	15.2
Maier	50.4	61.1	33.3	184.8	14.4
Mountrail	49.6	59.8	36.0	185.3	14.1
Plaza	48.4	59.3	29.5	185.0	14.0
Kyle	47.8	60.0	40.5	186.3	14.8
Munich	47.8	59.8	33.8	183.5	14.6
Pierce	47.2	60.8	36.4	184.5	14.5
Lebsock	46.0	60.8	34.8	184.3	14.0
Dilse	45.8	60.5	34.0	185.8	15.2
Ben	44.1	61.2	37.3	184.5	14.6
Monroe	43.8	59.8	36.3	181.5	14.9
Vic	42.9	61.0	38.5	184.0	14.5
nursery mean	48.0	60.3	35.1	184.3	14.5

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

Table 21. 2005 irrigated Durum variety trial, Conrad, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Head date	Protein %
Alzada	55.3	60.7	31	182	15.8
Mountrail	54.5	60.8	35	185	15.7
Plaza	52.9	59.3	29	184	16.6
Maier	51.9	60.6	35	184	17.0
Pierce	51.8	60.7	39	185	16.6
McNeal (spr wheat)	51.8	58.6	35	184	15.0
Avonlea	50.3	59.6	39	182	17.4
Lebsock	50.1	60.4	37	183	16.7
Monroe	48.3	59.8	40	181	16.7
Munich	46.8	59.8	35	183	17.1
Dilse	46.6	60.5	36	185	17.8
Ben	46.4	61.1	39	184	17.2
Vic	44.1	61.4	40	183	16.8
Kyle	43.9	60.3	44	186	16.4
mean	49.6	60.3	36.7	183.6	16.6

LSD (.05) = 9.3 bu. C.V.1&2 = 11.2 & 6.5

Planted April 25, 2005 on fallow.

Fertilizer, actual: 100-52-0

Harvested Aug 22, 2005.

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

Table 22. Four-year average, irrigated Durum varieties,
Conrad area, Pondera Co. 2002 - 05.

Variety	4-Year Average				
	Yield bu/a	Test weight	Height in.	Head date	Protein %
Mountrail	81.5	62.0	37.5	184.8	13.2
Alzada, WestBred	80.6	62.6	33.3	182.0	13.8
Plaza	80.3	61.6	31.5	184.8	13.6
Avonlea	78.4	61.9	38.8	182.8	14.6
Munich	77.7	61.5	36.3	183.5	14.3
Maier	77.1	62.7	35.8	184.0	14.1
McNeal (Spr Wheat)	77.1	60.7	35.8	184.3	13.5
Pierce	76.6	62.4	40.2	185.2	13.4
Lebsock	74.2	62.1	37.8	183.8	14.3
Dilse	73.8	62.4	38.2	185.2	14.3
Ben	69.2	62.6	39.0	184.0	14.1
Kyle	66.3	61.4	43.3	185.8	14.2
Vic	65.1	62.3	41.3	183.8	14.4
Monroe	57.1	61.9	39.5	181.3	14.5
nursery mean	73.9	62.0	37.7	183.9	14.0

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

Table 23. 2005 Durum variety trial, Knees area, MT.

Variety	Yield bu/a	Test Wt lb/bu	Height in.	Protein %
McNeal (spr wheat)	53.4	56.4	34	15.7
Plaza	49.2	56.6	35	17.4
Alzada	48.3	55.5	32	17.4
Lebsock	47.9	58.2	41	17.7
Maier	47.6	56.7	38	18.2
Monroe	47.3	56.9	42	17.8
Avonlea	47.1	57.1	42	18.3
Mountrail	47.1	55.9	38	17.7
Dilse	47.1	57.9	38	17.6
Munich	45.5	56.2	39	18.8
Vic	45.0	58.6	42	17.9
Pierce	43.6	56.8	41	18.7
Ben	42.4	57.6	42	18.6
Kyle	41.7	57.4	46	18.2
mean	46.7	57.0	39.3	17.9

LSD (.05) = 6.7 bu. C.V.1&2 = 8.5 & 4.9

Cooperator/Location: Dan Picard, western Chouteau Co.

Planted April 11, 2005 on chem-fallow.

Fertilizer, actual: 71-52-0

Harvested Aug 9, 2005.

Conducted by MSU Western Triangle Ag Research Ctr.

Table 24. Four-year average, **Durum** varieties,
Knees area, Chouteau Co. 2002-05.

Variety	4-Year Average			
	Yield bu/a	Test weight	Height in.	Protein %
McNeal (Spr Wheat)	42.5	55.2	33.5	15.9
Monroe	41.4	57.7	39.3	17.0
Alzada, WestBred	40.5	56.7	30.0	16.4
Maier	40.4	57.5	35.0	17.5
Mountrail	40.3	56.7	35.8	16.8
Lebsock	39.9	59.5	36.0	16.4
Avonlea	39.7	57.6	38.0	17.3
Dilse	39.2	57.5	35.9	17.3
Plaza	38.5	57.3	30.8	16.1
Munich	37.9	57.0	35.0	17.1
Vic	37.5	59.5	39.2	16.9
Kyle	36.9	57.9	40.3	16.9
Ben	36.7	58.1	38.3	17.5
Pierce	36.5	57.1	37.8	17.5
nursery mean	39.2	57.6	36.3	16.9

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

2005 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 Pat Hensleigh, MSU Plant Science Dept.

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

Results: Data for the various locations are presented in Tables 25-38, and include the 2005 and multi-year averages. All entries of the dryland and irrigated intrastate trials at Conrad are listed in Tables 25 and 28, respectively, with a condensed version of each in Tables 26 and 29 showing only named varieties and a few potential-release lines. The irrigated trial in Tables 31-32 is more specific to malt varieties. Table 39 is a summary of all the Western Triangle area dryland barley tests over the past few years, and is equivalent to 17 tests on each variety.

Averaged across all dryland locations over the past five years, the feed barley 'Haxby' had the highest yield and test weight. The 2-row malt varieties 'Metcalf' and 'Conrad' had higher yields and test weights than 'Copeland' and 'Harrington' at most locations. The experimental 2-row malt lines Hockett (MT910189) and Craft (MT970116) averaged substantially higher dryland yields, test weights, and plumps than Metcalfe and Harrington, and were 3 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

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

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.

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. Similar height and lodging resistance as BA1202, 2-3 inches shorter than Harrington. Similar maturity and plump as BA1202 and Harrington. Higher yield than BA 1202 and Harrington.

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

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

Craft (MT970116; MSU & Sierra Malting): 2-row malt for Sierra Malting Co. Possible release date 2006. Earlier heading date than Harrington, and later heading than Hockett.

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 2007. About 1 day later heading than Harrington.

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 – decreased rumenal digestion rate for better feed efficiency and slightly lower risk of bloat and other digestive problems. 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 2007 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.

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

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

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

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

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

Metcalf (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 - swathng advised. Agronomically the worst malting barley on the list. Excel may be a better choice.

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

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

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

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

Stellar (ND16301, 2005): 6-row malt. Medium-short. Good straw strength and widely adapted across North Dakota. Medium maturity. High plump and low protein (in North Dakota). 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.

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.

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

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

Westford, Westbred (WPB): 6-row hooded hay barley. Maturity considerably later than Horsford and Whitford, allowing for greater forage production. Seed yield low (similar to Horsford). Hay yields considerably higher than Horsford. Harvest 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.

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

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

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 25. Dryland Intrastate Barley variety trial, Conrad 2005.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT020064	101.8	51.0	97.6	0.7	13.9	181	35
MT030035	99.0	46.6	90.0	3.8	11.6	182	34
MT020204	98.5	49.1	92.2	1.5	14.2	180	34
Hockett ⁹¹⁰¹⁸⁹	98.2	50.2	95.8	0.9	13.1	178	35
MT030168	98.2	51.2	71.5	10.1	12.3	183	32
MT020205	97.9	48.8	92.8	2.5	13.6	179	37
MT030107	97.7	50.2	73.5	7.7	12.1	181	29
MT010160	97.3	48.6	91.2	2.0	13.5	182	34
MT030063	96.3	51.4	77.8	4.8	12.5	182	34
MT020167	95.2	52.1	93.8	1.2	12.7	182	33
MT030144	95.1	51.3	91.9	1.7	12.9	181	32
MT000125	95.0	50.0	89.0	3.0	12.8	183	32
MT020166	94.7	47.3	83.1	5.1	12.5	183	31
MT020155	94.6	46.9	83.8	3.8	13.3	176	36
Haxby	94.5	53.1	93.2	1.5	12.0	182	32
MT030153	93.8	49.9	91.4	1.7	13.7	179	34
Boulder ^{WestBred}	93.5	52.9	92.9	1.2	12.5	182	32
MT030188	93.4	50.0	90.9	1.8	13.1	180	32
MT030051	93.4	49.6	93.0	1.8	12.5	180	33
Spaulding ^{Wstbred}	93.2	50.4	75.6	7.1	11.6	180	30
MT030079	92.4	52.9	92.7	0.9	12.1	183	34
YU501385	92.2	52.9	91.1	1.9	11.7	182	30
Xena ^{WestBred}	92.1	51.1	82.8	3.1	11.6	182	34
MT030042	91.9	51.9	74.5	4.8	12.0	179	31
MT010212	91.5	49.5	87.4	3.3	12.7	182	34
MT030152	91.4	49.3	90.6	1.6	12.2	182	33
MT030047	91.1	52.3	86.7	2.2	11.6	182	27
MT030036	90.8	46.8	93.2	1.4	12.8	180	34
MT010081	90.6	50.0	89.2	4.9	13.3	180	34
MT981210	90.5	49.5	92.5	1.4	13.1	183	36
Geraldine ⁹⁶⁰¹⁰¹	90.4	48.8	60.4	11.5	12.4	184	30
Gallatin	90.4	48.6	80.8	4.9	12.9	180	35
MT000047	90.2	50.3	93.1	1.5	13.2	180	33
MT030173	90.0	50.5	75.5	4.9	12.5	182	32
Conrad ^{Busch Ag}	90.0	48.9	92.0	2.1	12.6	182	31

continued

<i>continued</i>	Yield	TW	Plump	Thin	Prot	Head	Height
MT030182	89.3	51.1	90.2	1.8	13.5	182	30
MT030137	89.2	51.9	95.6	0.8	12.6	180	32
YU587432	89.2	48.3	82.4	3.0	12.6	180	31
Valier	89.1	50.4	55.1	12.7	14.2	183	32
Shakira	89.0	52.8	89.5	1.8	13.0	183	26
MT030003	88.7	49.9	96.3	0.9	12.6	178	34
Legacy Busch Ag	88.7	44.4	61.3	6.5	12.1	180	36
Craft 970116	88.4	50.2	89.8	3.7	12.5	180	36
Harrington	88.2	45.9	69.7	10.2	13.3	183	31
MT970229	88.0	49.7	96.8	0.8	12.6	182	32
Baronesse WB	88.0	49.3	82.8	5.2	12.5	182	31
MT030039	87.8	49.5	89.9	4.2	12.8	177	32
Tradition Busch Ag	87.7	47.1	53.6	10.4	12.3	181	36
MT000138	87.5	50.6	96.0	1.8	13.6	180	37
MT020162	87.4	48.9	92.4	1.4	13.0	183	34
MT000040	87.4	53.8	84.3	2.5	13.9	181	33
MT030046	86.8	49.9	77.0	4.4	12.7	184	33
MT010080	86.2	48.8	85.1	4.2	13.6	180	33
MT030081	86.2	48.8	84.0	4.2	11.9	180	31
Eslick	85.5	49.1	83.2	4.1	11.6	183	30
MT010162	85.3	47.3	61.6	9.4	12.5	183	31
Hays	85.2	44.0	68.0	11.0	12.9	183	34
Marthe	85.2	50.1	91.7	2.0	12.8	185	26
MT010213	84.9	50.8	95.6	0.9	13.6	183	32
Merit Busch Ag	83.8	45.2	63.5	14.0	12.1	184	34
MT030093	83.2	50.7	75.5	6.8	12.5	182	33
MT030160	82.5	49.7	64.8	10.4	12.6	183	33
MT010158	81.6	47.1	93.1	1.9	13.3	181	31
MT010191	80.7	48.9	81.7	5.0	13.1	184	33
means	90.6	49.7	84.3	4.1	12.7	181.4	32.6

LSD (.05) = 9.3 bu in same block; 9.6 bu for different blocks.

C.V. = 6.07

Planted April 25, 2005 on fallow. Harvested Aug 8, 2005.

Fertilizer, actual: 11-52-0

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

Table 26. Dryland Intrastate Barley variety trial, Conrad 2005.

(Condensed List)

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Hockett 910189	98.2	50.2	95.8	0.9	13.1	178	35
Haxby	94.5	53.1	93.2	1.5	12.0	182	32
Boulder WestBred	93.5	52.9	92.9	1.2	12.5	182	32
Spaulding Wstbred	93.2	50.4	75.6	7.1	11.6	180	30
Xena WestBred	92.1	51.1	82.8	3.1	11.6	182	34
MT981210	90.5	49.5	92.5	1.4	13.1	183	36
Geraldine 960101	90.4	48.8	60.4	11.5	12.4	184	30
Gallatin	90.4	48.6	80.8	4.9	12.9	180	35
Conrad Busch Ag	90.0	48.9	92.0	2.1	12.6	182	31
Valier	89.1	50.4	55.1	12.7	14.2	183	32
Shakira	89.0	52.8	89.5	1.8	13.0	183	26
Legacy Busch Ag	88.7	44.4	61.3	6.5	12.1	180	36
Craft 970116	88.4	50.2	89.8	3.7	12.5	180	36
Harrington	88.2	45.9	69.7	10.2	13.3	183	31
MT970229	88.0	49.7	96.8	0.8	12.6	182	32
Baronesse WB	88.0	49.3	82.8	5.2	12.5	182	31
Tradition Busch Ag	87.7	47.1	53.6	10.4	12.3	181	36
Eslick	85.5	49.1	83.2	4.1	11.6	183	30
Hays	85.2	44.0	68.0	11.0	12.9	183	34
Marthe	85.2	50.1	91.7	2.0	12.8	185	26
Merit Busch Ag	83.8	45.2	63.5	14.0	12.1	184	34
means	90.6	49.7	84.3	4.1	12.7	181.4	32.6

LSD (.05) = 9.3 bu in same block; 9.6 bu for different blocks.

C.V. = 6.07

Planted April 25, 2005 on fallow. Harvested Aug 8, 2005.

Fertilizer, actual: 11-52-0

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

Table 27. Six-year averages, dryland Barley varieties, Conrad, MT, 2000 - 2005.

Variety ①	6-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Hockett 910189	76.1	51.0	79.7	7.7	13.5	179	29
Baronesse WestBred	74.8	49.8	75.3	7.7	13.8	183	27
Boulder WestBred	73.5	52.6	77.7	4.1	14.4	182	30
Haxby	73.2	53.2	72.2	8.3	13.4	181	29
Valier	73.2	50.9	62.7	13.5	15.1	183	29
MT970229	73.0	51.9	83.8	6.0	14.2	182	29
Eslick	72.0	50.1	70.2	10.3	13.5	183	29
Craft 970116	71.7	52.2	87.8	4.2	13.5	180	32
Conrad Busch Ag	70.4	49.3	72.0	8.6	14.0	183	27
Tradition Busch Ag	69.5	48.5	60.0	13.6	14.0	181	31
Metcalfe	69.4	49.3	64.4	13.6	14.0	183	31
MT981210	69.3	50.8	83.5	5.7	14.1	183	29
Gallatin	69.0	49.1	63.8	13.3	14.2	181	30
Xena WestBred	68.3	50.0	70.5	11.2	13.6	182	30
Harrington	68.3	48.8	73.0	9.3	14.2	183	29
Hays ②	68.0	44.9	48.3	18.6	14.1	184	31
Geraldine 960101	67.1	50.0	53.8	16.7	13.7	183	28
Merit Busch Ag	63.9	47.3	74.2	8.7	14.0	183	28
Legacy Busch Ag	62.9	46.6	56.7	12.8	13.8	181	32
Mean	69.2	49.6	68.0	11.5	14.1	182	29

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

② Hays = awnless forage-hay variety.

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

Table 28. Irrigated Intrastate Barley variety trial, Conrad 2005.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
MT030173	122.1	53.9	97	1	12.1	182	34
MT020166	121.2	53.9	98	1	11.2	181	34
MT030042	120.9	55.5	96	2	11.0	179	33
MT030152	120.3	54.3	95	1	12.1	182	37
MT020064	118.8	54.4	98	1	12.6	180	35
Eslick ⁹⁶⁰²²⁸	118.6	53.8	97	1	11.3	183	28
MT030063	118.3	55.4	99	1	11.7	182	37
MT030081	116.9	54.2	98	1	12.3	182	37
MT000040	116.6	53.5	90	3	13.0	180	35
MT030079	116.4	54.8	94	1	11.6	183	36
MT010158	116.3	54.3	97	1	12.4	182	34
MT030137	116.3	53.9	97	2	13.5	180	33
Spaulding ^{WstBred}	116.2	54.4	94	1	11.2	181	33
Marthe	115.9	52.4	96	1	12.0	184	29
MT000047	115.8	53.8	96	1	12.6	180	35
YU501385	115.8	54.7	98	1	11.3	180	34
Haxby	115.4	54.4	99	2	12.3	182	36
MT020162	114.6	53.7	98	1	13.3	182	38
MT030144	114.3	54.9	98	1	12.8	179	36
Tradition ^{Busch Ag}	113.8	52.3	97	1	11.5	179	39
MT010081	113.7	54.4	95	2	12.9	181	35
Conrad ^{Busch Ag}	113.6	52.6	97	1	12.3	182	33
MT030168	113.5	54.7	93	2	11.8	182	35
Xena ^{WesrBred}	113.4	53.6	94	1	11.7	182	35
MT010191	113.2	52.8	92	2	11.8	184	34
MT030047	112.6	53.3	92	2	11.5	180	33
Geraldine ⁹⁶⁰¹⁰¹	112.0	54.0	94	2	11.5	183	32
MT030107	111.9	53.6	96	2	11.2	182	30
MT981210	111.9	55.1	99	1	12.2	181	34
MT020204	111.2	55.2	96	1	12.3	179	35
MT010080	110.1	53.5	96	1	13.2	179	37
MT020167	110.0	54.3	98	1	12.5	182	36
Calgary	110.0	53.5	94	1	11.7	183	27
MT010213	110.0	55.5	98	1	13.4	182	33
MT970229	109.8	55.0	98	1	12.1	182	34

continued

<i>continued</i>	Yield	TW	Plump	Thin	Prot	Head	Height
Merit Busch Ag	109.8	49.9	87	3	11.8	186	35
MT000125	109.0	53.2	97	1	12.5	181	37
YU587432	108.7	54.5	96	1	12.3	181	34
MT030160	107.9	52.3	95	1	12.2	183	32
Valier	107.8	53.8	95	1	13.9	183	36
MT010212	107.6	52.5	92	2	12.1	181	33
MT030035	107.3	52.2	96	2	11.8	183	36
MT030188	106.9	53.3	95	1	12.5	180	33
Gallatin	106.6	54.5	94	2	12.3	180	36
MT010162	106.5	52.6	92	3	12.6	182	32
MT030036	106.1	53.6	98	1	12.9	180	34
Craft 970116	105.9	54.0	97	1	12.7	180	38
MT020155	105.4	53.5	95	1	13.4	178	37
MT030051	105.3	54.7	97	1	13.7	180	35
MT010160	104.7	53.4	93	2	11.9	181	37
MT020205	104.6	52.8	94	2	13.1	181	36
MT030003	103.5	52.1	96	1	12.9	180	35
Hockett 910189	103.1	52.7	98	1	12.6	180	34
Boulder WestBred	102.8	55.2	97	1	12.5	181	36
Shakira	102.6	53.1	98	1	12.6	184	27
MT030039	102.2	54.3	97	1	12.5	177	35
MT030093	101.5	52.4	91	2	12.6	183	36
MT000138	101.5	55.5	98	1	13.8	181	35
MT030046	101.3	53.8	92	2	12.1	182	36
Baronesse WPB	100.5	51.6	84	5	12.1	182	32
Hays	97.7	50.6	86	5	12.1	183	35
Legacy Busch Ag	96.9	49.0	83	3	12.2	181	38
Harrington	96.8	51.4	90	2	12.0	183	34
Morex	93.0	50.4	88	2	11.8	180	42
means	109.9	53.5	94.9	1.5	12.3	181.3	34.6

LSD (.05) = 11.5 bu in same block; 11.7 bu for different blocks.

C.V. = 6.26

Planted April 25, 2005 on fallow. Harvested Aug 11, 2005.

Fertilizer, actual: 11-52-0

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

Table 29. Irrigated Intrastate Barley variety trial, Conrad 2005.

(Condensed List)

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Eslick 960228	118.6	53.8	97	1	11.3	183	28
Spaulding WstBred	116.2	54.4	94	1	11.2	181	33
Marthe	115.9	52.4	96	1	12.0	184	29
Haxby	115.4	54.4	99	2	12.3	182	36
Tradition Busch Ag	113.8	52.3	97	1	11.5	179	39
Conrad Busch Ag	113.6	52.6	97	1	12.3	182	33
Xena WestBred	113.4	53.6	94	1	11.7	182	35
Geraldine 960101	112.0	54.0	94	2	11.5	183	32
MT981210	111.9	55.1	99	1	12.2	181	34
Calgary	110.0	53.5	94	1	11.7	183	27
MT970229	109.8	55.0	98	1	12.1	182	34
Merit Busch Ag	109.8	49.9	87	3	11.8	186	35
Valier	107.8	53.8	95	1	13.9	183	36
Gallatin	106.6	54.5	94	2	12.3	180	36
Craft 970116	105.9	54.0	97	1	12.7	180	38
Hockett 910189	103.1	52.7	98	1	12.6	180	34
Boulder WestBred	102.8	55.2	97	1	12.5	181	36
Shakira	102.6	53.1	98	1	12.6	184	27
Baronesse WPB	100.5	51.6	84	5	12.1	182	32
Hays	97.7	50.6	86	5	12.1	183	35
Legacy Busch Ag	96.9	49.0	83	3	12.2	181	38
Harrington	96.8	51.4	90	2	12.0	183	34
Morex	93.0	50.4	88	2	11.8	180	42
means	109.9	53.5	94.9	1.5	12.3	181.3	34.6

LSD (.05) = 11.5 bu in same block; 11.7 bu for different blocks.

C.V. = 6.26

Planted April 25, 2005 on fallow. Harvested Aug 11, 2005.

Fertilizer, actual: 11-52-0

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

Table 30. Six-year averages, irrigated Barley varieties, Conrad, MT, 2000 - 2005.

Variety ①	6-Year Average						
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Eslick	112.2	53.5	94.7	1.3	11.2	183	29
Xena WestBred	111.2	53.7	94.0	1.7	11.4	182	33
MT970229	110.4	54.3	97.2	0.8	12.4	182	32
Geraldine 960101	110.4	52.9	91.2	2.5	11.6	184	30
Conrad Busch Ag	110.2	53.0	95.0	1.6	12.2	182	30
Calgary APB	109.4	52.9	92.9	1.7	12.0	182	27
Baronesse WestBred	109.3	53.1	92.5	2.2	11.6	182	31
Copeland	107.1	51.8	92.6	1.6	11.2	184	33
Merit Busch Ag	106.8	50.8	93.8	1.7	11.9	184	32
Haxby	106.5	54.9	95.3	1.3	11.9	182	32
Valier	104.2	53.5	94.5	1.2	12.5	183	32
Boulder WestBred	103.6	54.9	92.7	1.4	12.3	181	32
Tradition Busch Ag	101.2	51.5	95.2	1.2	12.0	181	33
Gallatin	100.8	54.3	94.0	1.8	11.5	180	34
MT981210	100.8	53.7	95.5	1.5	12.0	183	32
Metcalfe	98.8	52.5	93.2	1.8	12.2	183	32
Craft 970116	98.6	53.8	95.0	1.8	12.3	180	34
Hockett 910189	97.3	53.3	94.7	2.0	11.8	180	30
Harrington	93.3	52.0	93.7	1.7	11.6	183	31
Legacy Busch Ag	91.0	49.5	88.0	2.7	12.5	181	34
Hays ②	86.8	49.6	79.4	6.9	12.0	183	33
Morex	72.7	50.1	85.8	3.0	12.6	180	36
Mean	102.3	52.8	92.5	2.1	12.0	182	32

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

② Hays = awnless forage-hay variety.

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

Table 31. Irrigated Malt Barley variety trial, Conrad 2005.

Variety	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Tradition Busch Ag	111.6	50.5	93	1	12.0	180	37
Haxby	110.7	55.0	96	1	12.2	182	35
Xena WestBred	109.5	52.8	96	1	12.0	182	31
Eslick	108.9	51.7	84	4	12.3	184	31
Drummond	107.9	51.4	94	1	12.8	179	41
Craft 970116	107.3	53.6	94	2	13.7	181	36
Copeland	107.1	51.5	92	2	11.8	185	36
Geraldine 960101	105.7	51.7	84	4	13.5	184	29
Conrad Busch Ag	103.5	51.6	96	1	12.8	182	33
Hockett 910189	101.4	53.7	97	1	13.3	179	31
Robust	101.3	51.5	91	2	12.2	181	41
Harrington	101.0	48.5	76	5	12.9	184	31
Merit Busch Ag	100.6	49.4	92	2	13.1	184	33
Kendall	100.0	51.8	93	2	13.4	184	33
Morex	99.9	50.4	85	3	12.5	180	43
Metcalfe	97.6	51.5	92	2	13.5	185	34
Boulder WestBred	96.1	53.5	95	1	14.0	181	33
Legacy Busch Ag	95.4	50.7	90	1	13.1	182	41
Baronesse WPB	95.4	51.7	91	3	12.9	182	30
Hays	95.1	50.2	86	5	12.0	184	37
Calgary	92.8	50.0	85	3	13.6	184	28
MT970229	89.3	53.5	97	1	13.8	182	33
means	101.7	51.7	90.9	2.2	12.9	182.3	34.4

LSD (.05) = 16.9 bu.

C.V. 1&2 = 10.1 & 5.8

Planted April 25, 2005 on fallow. Harvested Aug 11, 2005.

Fertilizer, actual: 11-52-0

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

Table 32. Five-year averages, irrigated Malt Barley varieties, Conrad 2001 - 05.

Variety	Spike	5-Year Average						
		Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Head date	Height in.
Geraldine 960101	2	106.8	52.2	92	2.4	12.2	183	28
Haxby	2	105.6	54.4	96	1.4	12.6	181	32
Craft 970116	2	101.9	53.4	96	1.6	12.9	180	35
Baronesse WPB	2	101.8	52.8	94	2.1	12.0	181	29
Tradition Busch Ag	6	101.7	50.4	95	1.3	12.3	180	33
Conrad Busch Ag	2	101.3	52.2	95	1.7	12.3	182	30
Coors 37	2	100.7	51.5	94	2.0	12.8	183	25
Merit Busch Ag	2	99.4	49.9	92	2.6	12.0	184	30
Copeland	2	98.7	51.3	94	1.8	11.8	184	34
Metcalfe	2	97.3	52.0	94	1.9	12.4	182	32
Hockett 910189	2	97.0	52.8	95	1.8	12.5	180	30
BA1202 Busch Ag	2	96.4	50.8	94	1.5	12.4	182	29
Kendall	2	96.0	51.9	94	2.3	12.7	183	31
Drummond	6	95.8	50.4	93	1.6	12.6	180	36
Legacy Busch Ag	6	92.4	49.6	87	3.0	12.1	181	35
Harrington	2	90.1	50.2	88	3.3	12.0	182	30
Robust	6	85.0	50.3	88	3.0	12.4	180	36
Morex	6	75.8	49.4	83	4.5	12.8	180	37
Mean		96.1	51.5	93	2.1	12.3	181	32

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

Table 33. 2005 Barley variety trial, Cut Bank.

Variety ①	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Eslick	42.3	50.5	86	3	7.5	25
MT970229	42.0	52.1	95	1	8.3	24
Haxby	41.3	53.2	85	5	8.2	26
Baronesse WPB	41.0	51.0	89	3	8.4	24
Boulder WestBred	40.7	52.9	93	2	7.5	24
Geraldine 960101	40.4	51.4	83	4	7.5	24
Legacy Busch Ag	40.0	47.7	89	2	9.1	30
Merit Busch Ag	39.7	47.4	92	2	8.8	26
Hays ②	39.5	41.6	85	5	9.3	22
Conrad Busch Ag	39.1	49.5	96	1	8.9	25
Robust	38.9	48.7	91	2	10.1	31
Hockett 910189	38.7	50.7	94	1	8.4	25
Metcalfe	38.1	49.7	93	2	8.1	25
Craft 970116	37.9	51.1	92	3	9.3	27
Xena WestBred	37.7	50.7	82	4	7.7	24
Kendall	37.6	48.7	93	1	8.1	24
Harrington	37.5	49.2	93	1	7.5	25
Copeland	36.7	48.0	95	1	8.7	24
Drummond	36.3	48.0	90	3	9.4	31
Tradition Busch Ag	33.4	48.7	90	2	9.0	28
mean	38.9	49.8	89.4	2.7	8.3	24.8
LSD (.05) =	5.3 bu					
C.V. =	8.3%					

① Drummond, Legacy, Robust & Tradition are 6-row.

② Hays = awnless forage-hay variety.

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

Planted April 12, 2005 on chem-fallow. Harvested Aug 10, 2005.

Fertilizer, actual: 11-52-0

Conducted by MSU Western Triangle Ag Research Center.

Table 34. Four-year averages, Barley varieties, Cut Bank area, 2002 - 05.

Variety	4-Year Average					
	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Haxby	55.0	51.9	72	13	11.5	31
MT970229	54.1	51.4	86	5	11.5	29
Xena WestBred	54.0	49.8	70	14	11.6	31
Craft 970116	53.3	51.1	82	8	11.6	33
Metcalfe	53.2	49.9	78	8	11.3	31
Baronesse WPB	53.2	49.1	72	16	11.8	30
Hockett 910189	52.8	51.0	79	6	11.8	29
Eslick	52.8	49.4	73	15	11.2	30
Hays ①	52.5	44.7	70	14	11.8	29
Harrington	50.8	48.9	77	11	11.8	30
Copeland	50.5	48.0	79	6	11.7	31
Tradition 6-row, Busch Ag	50.4	47.7	77	8	12.1	33
Geraldine 960101	48.6	49.1	70	15	11.6	29
Mean	52.8	49.4	76.2	12	11.7	31

① Hays = awnless forage-hay variety.

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

Table 35. 2005 Barley variety trial, Choteau.

Variety ①	Yield bu/a	Test Wt lb/bu	Plump %	Thin %	Protein %	Height in.
Boulder WestBred	95.4	51.9	67	9	17.0	35
Hockett 910189	94.1	51.9	67	9	17.0	37
Tradition Busch Ag	93.8	45.5	30	23	18.0	40
Xena WestBred	93.3	48.9	49	13	15.8	36
Haxby	92.5	53.5	58	9	16.3	36
MT970229	92.1	51.4	79	7	17.3	35
Craft 970116	91.8	51.6	64	11	17.1	39
Eslick	88.3	49.4	37	18	17.1	35
Drummond	87.6	45.4	23	34	17.0	41
Conrad Busch Ag	86.5	48.1	47	18	18.2	34
Hays ②	85.3	43.6	31	30	17.2	35
Baronesse WPB	84.4	47.9	38	20	17.8	34
Geraldine 960101	84.1	46.9	25	31	17.6	36
Copeland	83.9	47.3	43	20	17.9	36
Robust	82.5	44.8	35	26	16.4	44
Metcalfe	82.3	47.8	47	20	18.0	40
Kendall	82.0	47.4	48	20	18.9	37
Harrington	80.5	45.8	31	27	17.8	36
Merit Busch Ag	77.3	45.5	38	26	17.7	37
Legacy Busch Ag	65.4	43.6	19	47	17.7	41
mean	86.2	48.6	46.1	18.3	17.3	36.5
LSD (.05) =	7.0 bu					
C.V. =	4.9					

① Drummond, Legacy, Robust & Tradition are 6-row.

② Hays = awnless forage-hay variety.

Cooperator & Location: Roy Inbody, east of Choteau, MT.

Planted April 12, 2005 on chem-fallow. Harvested Aug 9, 2005.

Fertilizer, actual: 11-52-0

Conducted by MSU Western Triangle Ag Research Center.

Table 2b. Effect of nitrogen, sulfur, and planting rate on yield of dryland malt barley.
Western Triangle Ag. Research Center. 2005.

Treatment		Location					
Plant. rate	N - S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seeds/ft ²	lb/acre	bu/acre					
10	0 - 0	45.0	51.8	77.2	68.1	76.7	76.3
15	0 - 0	41.3	58.6	79.3	73.8	82.6	83.7
20	0 - 0	36.3	73.6	79.6	79.2	89.0	83.1
10	30 - 0	59.2	65.2	80.6	78.5	80.2	76.5
15	30 - 0	66.2	75.7	86.6	86.2	87.0	84.2
20	30 - 0	68.2	70.7	91.3	93.5	88.0	81.5
10	60 - 0	77.7	94.8	82.4	86.3	84.1	79.7
15	60 - 0	81.3	75.9	90.8	89.6	85.1	78.1
20	60 - 0	83.6	89.0	84.3	90.9	100.1	83.3
10	0 - 10	34.7	56.2	77.4	73.2	82.0	79.0
15	0 - 10	38.6	58.4	77.6	76.1	82.8	85.1
20	0 - 10	40.4	57.1	78.4	85.1	86.7	81.7
10	30 - 10	61.2	80.7	83.7	83.1	88.4	81.6
15	30 - 10	62.5	75.7	85.8	89.5	92.1	83.0
20	30 - 10	61.6	76.5	84.8	92.8	92.4	89.2
10	60 - 10	71.2	91.5	82.6	84.1	87.6	80.4
15	60 - 10	75.4	95.3	88.3	90.5	97.5	81.4
20	60 - 10	72.7	100.7	89.3	92.6	98.3	85.8
10	0 - 20	39.4	48.2	74.2	69.2	77.7	75.4
15	0 - 20	34.4	64.8	83.3	74.7	83.3	81.8
20	0 - 20	33.6	62.3	79.6	83.2	85.1	79.3
10	30 - 20	55.3	79.2	83.1	80.5	85.4	73.1
15	30 - 20	64.7	78.6	87.5	86.2	88.7	89.9
20	30 - 20	62.3	90.2	86.2	90.2	99.5	94.5
10	60 - 20	65.2	96.1	84.8	87.8	91.4	81.7
15	60 - 20	73.1	86.1	90.3	90.6	94.4	85.6
20	60 - 20	80.9	90.4	88.2	94.3	98.9	87.8
Planting Rate Summary							
10		56.5 a	73.8 a	80.7 a	79.0 a	83.7 a	78.2 a
15		59.7 a	74.4 a	85.5 b	84.1 b	88.2 b	83.6 b
20		58.8 a	79.0 a	84.6 b	89.1 c	93.1 c	85.1 b
P-value, Linear contrast		0.373	0.135	0.005	0.001	0.001	0.001
P-value, Quad. contrast		0.362	0.504	0.020	0.925	0.878	0.256

Table 2b. Continued						
Nitrogen Summary						
0	38.2 a	59.0 a	78.5 a	75.8 a	82.9 a	80.6 a
30	61.2 b	77.0 b	85.5 b	86.7 b	89.1 b	83.7 a
60	75.7 c	91.1 c	86.8 b	89.6 c	93.0 c	82.6 a
P-value, Linear contrast	0.001	0.001	0.001	0.001	0.001	0.308
P-value, Quad. contrast	0.058	0.527	0.019	0.002	0.485	0.227
Sulfur Summary						
Treatment	Location					
lbs S/ ac	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
0	62.1 a	72.8 a	83.6 a	82.9 a	85.9 a	80.7 a
10	57.6 ab	76.9 a	83.1 a	85.2 a	89.7 a	83.0 a
20	55.4 b	77.3 a	84.1 a	84.1 a	89.4 a	83.2 a
P-value, Linear contrast	0.012	0.196	0.684	0.415	0.060	0.208
P-value, Quad. contrast	0.600	0.540	0.533	0.164	0.191	0.549
Statistical Summary						
Mean	58.4	75.7	83.6	84.1	88.3	82.3
CV (%)	18.8	16.7	7.0	7.2	8.9	10.2
Interaction	Interaction p-values					
Plt Rate x N Rate	0.447	0.341	0.844	0.418	0.945	0.348
Plt Rate x S Rate	0.999	0.949	0.826	0.999	0.703	0.685
N Rate x S Rate	0.915	0.300	0.947	0.573	0.591	0.550
N Rate x S Rate x Plt rate	0.601	0.456	0.651	0.968	0.652	0.812

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. 2005.

Treatment		Location					
Plant. rate	N - S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seeds/ft ²	lb/acre	bu/acre					
10	0 - 0	95.8	95.7	95.8	94.3	94.3	93.3
15	0 - 0	95.8	94.3	94.5	95.3	94.5	89.8
20	0 - 0	95.0	94.7	91.0	94.8	94.5	86.5
10	30 - 0	95.0	96.0	93.8	96.4	93.0	91.0
15	30 - 0	95.3	96.3	89.3	95.5	92.8	82.3
20	30 - 0	74.0	94.3	85.3	94.3	90.8	74.3
10	60 - 0	96.5	97.3	85.3	95.5	90.3	83.0
15	60 - 0	94.8	94.3	87.0	94.0	82.3	70.8
20	60 - 0	92.3	94.7	78.3	95.3	85.0	73.5
10	0 - 10	95.8	96.7	95.5	95.3	95.0	92.0
15	0 - 10	95.0	94.0	92.0	96.0	92.8	93.8
20	0 - 10	94.3	93.7	94.8	94.0	91.3	86.8
10	30 - 10	95.8	97.0	94.5	96.5	92.5	87.8
15	30 - 10	95.8	95.7	88.3	94.3	93.3	82.0
20	30 - 10	94.5	95.3	88.3	94.8	89.5	84.3
10	60 - 10	94.8	97.0	87.5	94.3	90.8	86.0
15	60 - 10	93.8	96.3	82.0	95.0	87.3	80.5
20	60 - 10	93.3	95.0	78.0	93.8	85.5	76.3
10	0 - 20	94.8	95.7	96.0	94.5	93.5	93.5
15	0 - 20	94.8	95.0	94.0	95.6	93.0	93.5
20	0 - 20	93.5	93.0	91.3	94.5	93.0	87.0
10	30 - 20	96.5	96.3	91.8	94.3	90.5	83.3
15	30 - 20	87.0	96.0	87.0	93.0	87.8	88.5
20	30 - 20	93.8	96.0	85.0	95.3	90.8	89.8
10	60 - 20	94.8	97.0	86.0	95.3	91.0	86.0
15	60 - 20	95.0	97.0	84.8	94.4	86.0	83.8
20	60 - 20	94.0	95.0	79.0	92.0	86.8	76.0
Planting Rate Summary							
10		95.5 a	96.5 a	91.8 a	95.1 a	92.3 a	88.4 a
15		94.1 a	95.4 b	88.7 b	94.8 ab	89.9 b	85.3 ab
20		91.6 a	94.6 c	85.6 c	94.3 b	89.7 b	81.6 b
P-value, Linear contrast		0.067	0.001	0.001	0.031	0.001	0.001
P-value, Quad. contrast		0.760	0.616	0.989	0.841	0.105	0.854

Table 3b. Continued						
Nitrogen Summary						
0	94.9 a	94.7 a	93.8 a	94.9 a	93.5 a	90.7 a
30	91.9 a	95.9 b	89.5 b	94.9 a	91.1 b	85.1 b
60	94.3 a	96.0 b	83.1 c	94.4 a	87.2 c	79.5 c
P-value, Linear contrast	0.771	0.001	0.001	0.177	0.001	0.001
P-value, Quad. contrast	0.141	0.041	0.442	0.425	0.194	0.993
Sulfur Summary						
Treatment	Location					
lbs S/ ac	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
0	92.7 a	95.3 a	88.9 a	95.0 a	90.8 a	83.0 a
10	94.8 a	95.6 a	89.0 a	94.9 a	90.9 a	85.5 a
20	93.8 a	95.7 a	88.3 a	94.3 a	90.3 a	86.8 a
P-value, Linear contrast	0.606	0.217	0.628	0.066	0.451	0.052
P-value, Quad. contrast	0.406	0.566	0.695	0.532	0.601	0.738
Statistical Summary						
Mean	93.7	95.5	88.7	94.7	90.6	85.1
CV (%)	9.5	1.1	5.5	1.7	3.4	9.5
Interaction	Interaction p-values					
Plt Rate x N Rate	0.675	0.489	0.240	0.118	0.052	0.664
Plt Rate x S Rate	0.346	0.462	0.494	0.947	0.357	0.425
N Rate x S Rate	0.523	0.546	0.833	0.623	0.085	0.831
N Rate x S Rate x Plt rate	0.458	0.125	0.988	0.081	0.357	0.430

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

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

Year: 2005

Locations: Cut Bank area (Bradley farm)
Joplin area (Moog farm)
Conrad area (Western Triangle Ag. Research Center)

Personnel:

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

Objectives:

To determine the optimum rate of N, S, and P 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 S rates of 0, 10, and 20 lbs/acre were applied to Camelina at the following locations: WTARC, Cut Bank, and Joplin. Nitrogen as urea, 25 lbs/acre of potassium (K) as KCl, and S as potassium sulfate were applied while seeding in a band (broadcast at Cut Bank) approximately one inch above and to the side of the seed row. Phosphorus fertilizer as 0-45-0 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. Plots were swathed and threshed with a 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 10 inch row spacing (at Cut Bank, plot size was 6 rows wide with a 12 inch row space) and 25 feet long.

Results:

Camelina yield data are recorded in table 2c. Only one location, Cut Bank, responded to N; however, all three locations responded to P, and no response to S was detected.

Table 1c. Site characteristics and soil test results by location. Western Triangle Ag. Research Center. 2005.

Site Characteristics			
Character	Cut Bank	Joplin	WTARC
Planting Date	April 25	April 19	April 26
Harvest Date	August 4	August 5	August 5
Previous Crop	Chem. Fallow	Chem. Fallow	Fallow
Growing Season Precipitation(inches)	7.66	5.30	6.00
Spray Date	June 15*	June 14*	
Soil Test Results			
Test	Cut Bank	Joplin	WTARC
pH	8.4	8.2	8.3
O.M. (%)	2.2	1.5	2.2
P (ppm)	7.4	10	12.1
K (ppm)	343	326	290
EC (mmhos/cm)	0.21	0.15	0.18
NO ₃ -N (0-3', lb/ac)	39	70	58
SO ₄ -S (0-3', lb/ac)	531	1476	2823

* = Poast @ 2 pt/a.

Table 2c. Effect of nitrogen, phosphorus, and sulfur on yield of camelina.
Western Triangle Ag. Research Center. 2005.

Treatment N - P ₂ O ₅ - S	Location		
	Cut Bank	Joplin	WTARC
-----lbs/acre-----			
0 - 0 - 0	230	1421	1078
0 - 15 - 0	251	1383	1011
0 - 30 - 0	258	1506	1110
30 - 0 - 0	505	1386	972
30 - 15 - 0	629	1505	1214
30 - 30 - 0	652	1576	962
60 - 0 - 0	693	1379	913
60 - 15 - 0	991	1274	1063
60 - 30 - 0	957	1444	1096
0 - 0 - 10	366	1289	998
0 - 15 - 10	295	1155	984
0 - 30 - 10	437	1428	956
30 - 0 - 10	575	1347	1033
30 - 15 - 10	539	1594	1031
30 - 30 - 10	629	1421	1113
60 - 0 - 10	843	1526	879
60 - 15 - 10	908	1404	1069
60 - 30 - 10	918	1771	1065
0 - 0 - 20	215	ND	1038
0 - 15 - 20	335	ND	1052
0 - 30 - 20	241	ND	983
30 - 0 - 20	525	ND	939
30 - 15 - 20	667	ND	1020
30 - 30 - 20	706	ND	1112
60 - 0 - 20	812	ND	779
60 - 15 - 20	909	ND	962
60 - 30 - 20	998	ND	1120
Nitrogen Summary			
0	295 a	1364 a	1023 a
30	603 b	1471 a	1044 a
60	892 c	1466 a	994 a
P-value, Linear contrast	0.001	0.139	0.360
P-value, Quad. contrast	0.726	0.342	0.203
Phosphorus Summary			
0	529 a	1391 ab	959 a
15	614 b	1386 a	1045 b
30	647 b	1524 b	1058 b
P-value, Linear contrast	0.001	0.058	0.003
P-value, Quad. contrast	0.339	0.228	0.185

Table 2c. Continued			
Treatment	Location		
N – P₂O₅ - S	Cut Bank	Joplin	WTARC
Sulfur Summary			
0	577 a	1430 a	1047 a
10	612 a	1437 a	1014 a
20	601 a	ND	1001 a
P-value, Linear contrast	0.434	ND	0.152
P-value, Quad. contrast	0.385	ND	0.736
Statistical Summary			
Mean	597	1434	1020
CV (%)	21.8	14.1	13.3
Interaction	Interaction p-values		
N rate X P rate	0.414	0.275	0.018
N rate x S rate	0.271	0.05	0.652
P rate x S rate	0.262	0.952	0.663
N rate x P rate x S rate	0.720	0.686	0.241

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

ND = Not Determined.

Title: Effect of nitrogen and phosphorus on flax seed yield and quality.

Year: 2005

Locations: Western Triangle Ag. Research Center (WTARC)
Cut Bank area (Bradley farm)
Sunburst area (Karst farm)
Joplin area (Moog farm)

Personnel:

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

Objectives: To evaluate the response of flax to nitrogen (N) and phosphorus (P) fertilization in North Central Montana.

Procedures:

Flax (variety indicated in site characteristics table) was planted in a RCB, factorial design with the following fertilizer treatments: 0, 30, and 60 lbs N/acre as urea applied broadcast or in a band to the side and about the seed while planting and 0, 15, and 30 lbs P₂O₅/acre as triple super phosphate applied with the seed. In addition all plots received 25 lbs/acre of K₂O as KCL. Plots were planted at Sunburst and Cut Bank locations with a six-row, 12-inch spaced planter. The other locations were planted with a 5-row, 10-inch spaced planter with a Conserv-a-pac opener that placed N fertilizer above and to the side of the seed. Plot length was 25 feet. All locations, except WTARC, were planted no-till into previously fallowed land or following barley. Site characteristics and soil test results are shown in Table 1f.

Results:

Results are presented in Table 2f through 8f. Average yields ranged from 792 to 1527 lbs seed/acre. All locations responded to N fertilization while only the Joplin responded to P fertilization. The WTARC location had excessive yield variability from poor stands due to a variation in planting depth. Average seed oil contents ranged for 40.1 to 41.6 %. Only two locations (Joplin and Sunburst) had oil content declines due to increasing N levels. Phosphorus did not affect seed oil content this year. Palmitic fatty acid levels averaged 4.8 to 5.1 % of the oil content, oleic averaged 15.5 to 17 %, stearic 2.7 to 3.4 %, linoleic 16.2 to 17.2 %, and linolenic 53.4 to 61.2 %. Palmitic and linoleic fatty acid content were unaffected by N fertilization; however, oleic levels increased with increasing N at Joplin, Sunburst, and WTARC. Stearic increased significantly at Sunburst with increasing N; however, the most important fatty acid, linolenic declined slightly with increasing N at Joplin and Sunburst. Phosphorus had no effect on any of the fatty acids. There was one significant N and P interaction with linoleic fatty acid at Cut Bank.

Table 1f. Site characteristics and soil test results of flax fertility trials. Western Triangle Ag. Research Center, Conrad. 2005.

Site Characteristics				
Character	Cut Bank	Joplin	Sunburst	WTARC
Variety	York	Neche	Carter	Omega
Planting Date	April 25	April 19	May 3	April 26
Harvest Date		Sept. 1	Sept. 8	Sept. 8
Previous Crop	Chem. Fall.	Chem. Fall.	Barley	Fallow
Precip. (inches)	8.45	5.30	8.50	7.66
Spray Date*	June 21		June 21	June 27
Soil test results by location				
Test	Cut Bank	Joplin	Sunburst	WTARC
pH	8.4	8.2	6.5	8.3
O.M. (%)	2.2	1.5	3.7	2.2
P (ppm)	7.4	10	27.5	12.1
K (ppm)	343	326	568	290
NO ₃ -N (0-3', lb/ac)	39	70	28	58
SO ₄ -S (0-3', lb/ac)	531	1476	153	5521

*=Bronate Advanced @ 1.0 pt/a

Table 2f. Effect of nitrogen and phosphorus on flax seed yield. Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N – P ₂ O ₅	Location			
	Cut Bank	Joplin	Sunburst	WTARC
-----lbs/acre-----				
0 – 0	665	819	1334	625
0 – 15	732	881	1193	618
0 – 30	813	868	1161	625
30 – 0	1098	861	1595	1088
30 – 15	1063	959	1636	886
30 – 30	1062	963	1623	657
60 – 0	1233	926	1714	808
60 – 15	1260	988	1783	788
60 – 30	1207	982	1701	1031
Nitrogen Summary				
0	737 a	856 a	1230 a	622 a
30	1074 b	928 b	1618 b	877 b
60	1233 c	965 b	1732 c	876 b
P-value, Linear contrast	0.001	0.001	0.001	0.019
P-value, Quad. contrast	0.004	0.515	0.001	0.155
Phosphorus Summary				
0	999 a	869 a	1548 a	840 a
15	1018 a	942 b	1537 a	764 a
30	1027 a	938 b	1495 a	771 a
P-value, Linear contrast	0.385	0.031	0.086	0.496
P-value, Quad. contrast	0.857	0.146	0.549	0.636
Summary Statistics				
NXP Interaction p-value	0.142	0.955	0.029	0.133
Mean	1015	916	1527	792
CV (%)	7.8	8.1	4.8	31.1

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

Table 3f . Effect of nitrogen and phosphorus on flax oil content. Western Triangle Ag. Research Center, Conrad. 2004.

Treatment N – P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	-----%-----			
0 – 0	40.3	41.7	41.2	40.5
0 – 15	40.8	41.7	41.2	40.4
0 – 30	40.5	41.4	41.2	40.3
30 – 0	40.3	40.7	41.4	40.3
30 – 15	40.5	41.2	41.1	40.1
30 – 30	40.8	41.2	41.1	40.1
60 – 0	40.5	40.9	40.5	40.2
60 – 15	40.5	40.5	40.8	40.0
60 – 30	40.8	40.5	40.4	40.2
Nitrogen Summary				
0	40.5 a	41.6 a	41.2 a	40.4 a
30	40.5 a	41.0 ab	41.2 b	40.2 a
60	40.6 a	40.6 b	40.6 b	40.1 a
P-value, Linear contrast	0.732	0.006	0.001	0.093
P-value, Quad. contrast	0.843	0.771	0.022	0.692
Phosphorus Summary				
0	40.3 a	41.1 a	41.1 a	40.3 a
15	40.6 a	41.1 a	41.0 a	40.2 a
30	40.7 a	41.0 a	40.9 a	40.2 a
P-value, Linear contrast	0.179	0.757	0.298	0.479
P-value, Quad. contrast	0.693	0.812	0.744	0.497
Summary Statistics				
NXP Interaction p-value	0.862	0.600	0.482	0.964
Mean	40.5	41.1	41.0	40.2
CV (%)	1.5	1.9	0.9	1.1

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

Table 4f. Effect of nitrogen and phosphorus on flax oil quality: Palmitic fatty acid.
Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N – P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	% of Oil Content			
0 – 0	4.91	4.94	5.02	4.79
0 – 15	4.97	4.98	5.05	4.77
0 – 30	4.97	5.10	5.03	4.75
30 – 0	4.93	5.06	5.05	4.83
30 – 15	4.87	4.89	5.08	4.84
30 – 30	4.88	4.98	5.04	4.88
60 – 0	4.96	4.97	5.06	4.71
60 – 15	4.93	4.98	5.08	4.82
60 – 30	4.89	5.01	5.05	4.88
Nitrogen Summary				
0	4.95 a	5.00 a	5.03 a	4.77 a
30	4.89 a	4.98 a	5.06 a	4.85 a
60	4.93 a	4.99 a	5.06 a	4.80 a
P-value, Linear contrast	0.577	0.738	0.184	0.428
P-value, Quad. contrast	0.273	0.674	0.668	0.070
Phosphorus Summary				
0	4.94 a	4.99 a	5.04 a	4.78 a
15	4.92 a	4.95 a	5.07 a	4.81 a
30	4.91 a	5.03 a	5.04 a	4.84 a
P-value, Linear contrast	0.613	0.468	0.946	0.118
P-value, Quad. contrast	0.992	0.196	0.264	0.917
Summary Statistics				
NXP Interaction p-value	0.754	0.371	0.997	0.246
Mean	4.92	4.99	5.05	4.81
CV (%)	2.3	2.6	1.2	1.9

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

Table 5f. Effect of nitrogen and phosphorus on flax oil quality: Oleic fatty acid.
Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N – P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	% of Oil Content			
0 – 0	14.5	17.0	16.0	20.6
0 – 15	14.3	16.5	16.0	20.7
0 – 30	14.2	17.1	16.0	21.1
30 – 0	14.3	17.5	16.8	21.5
30 – 15	14.1	17.3	16.5	21.1
30 – 30	13.8	17.1	16.4	21.1
60 – 0	14.6	17.5	16.9	20.7
60 – 15	14.4	17.7	17.3	21.4
60 – 30	13.8	17.7	17.2	21.7
Nitrogen Summary				
0	14.3 a	16.9 a	16.0 a	20.8 a
30	14.0 a	17.3 ab	16.6 b	21.2 a
60	14.3 a	17.6 b	17.1 c	21.3 a
P-value, Linear contrast	0.897	0.001	0.001	0.052
P-value, Quad. contrast	0.340	0.844	0.999	0.284
Phosphorus Summary				
0	14.5 a	17.3 a	16.5 a	20.9 a
15	14.2 a	17.2 a	16.6 a	21.1 a
30	13.9 a	17.3 a	16.6 a	21.3 a
P-value, Linear contrast	0.095	0.879	0.882	0.120
P-value, Quad. contrast	0.891	0.400	0.634	0.746
Summary Statistics				
NXP Interaction p-value	0.968	0.365	0.347	0.163
Mean	14.2	17.3	16.6	21.1
CV (%)	5.3	2.9	2.3	2.6

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

Table 6f. Effect of nitrogen and phosphorus on flax oil quality: Stearic fatty acid.
Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N – P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	% of Oil Content			
0 – 0	3.44	3.22	2.63	3.32
0 – 15	3.47	3.29	2.68	3.26
0 – 30	3.40	3.45	2.64	3.31
30 – 0	3.42	3.45	2.74	3.65
30 – 15	3.24	3.49	2.79	3.44
30 – 30	3.14	3.36	2.75	3.48
60 – 0	3.42	3.41	2.81	3.25
60 – 15	3.42	3.48	2.79	3.44
60 – 30	3.30	3.59	2.86	3.43
Nitrogen Summary				
0	3.44 a	3.32 a	2.65 a	3.30 a
30	3.27 b	3.44 a	2.76 b	3.53 b
60	3.38 ab	3.49 a	2.82 b	3.37 ab
P-value, Linear contrast	0.482	0.183	0.005	0.408
P-value, Quad. contrast	0.057	0.775	0.563	0.024
Phosphorus Summary				
0	3.43 a	3.36 a	2.73 a	3.41 a
15	3.38 a	3.41 a	2.75 a	3.38 a
30	3.28 a	3.47 a	2.75 a	3.40 a
P-value, Linear contrast	0.076	0.401	0.665	0.964
P-value, Quad. contrast	0.719	0.977	0.775	0.774
Summary Statistics				
NXP Interaction p-value	0.750	0.817	0.915	0.441
Mean	3.36	3.42	2.74	3.40
CV (%)	5.9	9.1	4.8	6.6

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

Table 7f. Effect of nitrogen and phosphorus on flax oil quality: Linoleic fatty acid.
Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N – P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	% of Oil Content			
0 – 0	16.2	16.3	17.2	17.0
0 – 15	16.1	16.5	17.3	17.0
0 – 30	16.5	16.3	17.2	17.3
30 – 0	16.3	16.4	17.3	16.9
30 – 15	16.2	16.3	17.2	17.1
30 – 30	16.1	16.3	17.2	16.8
60 – 0	16.5	16.3	17.3	17.0
60 – 15	16.2	16.4	17.1	17.1
60 – 30	16.2	16.0	17.2	16.8
Nitrogen Summary				
0	16.2 a	16.4 a	17.2 a	17.1 a
30	16.2 a	16.3 a	17.2 a	16.9 a
60	16.3 a	16.3 a	17.2 a	17.0 a
P-value, Linear contrast	0.540	0.514	0.562	0.541
P-value, Quad. contrast	0.402	0.996	0.918	0.417
Phosphorus Summary				
0	16.3 a	16.4 a	17.3 a	17.0 a
15	16.2 a	16.4 a	17.2 a	17.1 a
30	16.3 a	16.2 a	17.2 a	17.0 a
P-value, Linear contrast	0.658	0.470	0.265	0.884
P-value, Quad. contrast	0.092	0.516	0.394	0.484
Summary Statistics				
NXP Interaction p-value	0.036	0.946	0.645	0.419
Mean	16.2	16.3	17.2	17.0
CV (%)	1.2	2.9	1.1	2.0

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

Table 8f. Effect of nitrogen and phosphorus on flax oil quality: Linolenic fatty acid.
Western Triangle Ag. Research Center, Conrad. 2005.

Treatment N - P ₂ O ₅ lbs/acre	Location			
	Cut Bank	Joplin	Sunburst	WTARC
	% of Oil Content			
0 - 0	60.8	57.9	58.5	54.1
0 - 15	60.9	58.5	58.4	53.9
0 - 30	61.0	57.4	58.5	53.4
30 - 0	60.9	57.2	57.6	52.5
30 - 15	61.6	57.3	58.0	53.3
30 - 30	62.1	57.7	58.2	53.5
60 - 0	60.5	57.2	57.5	54.1
60 - 15	60.9	57.1	57.1	53.0
60 - 30	61.8	57.0	57.1	52.8
Nitrogen Summary				
0	60.9 a	58.0 a	58.5 a	53.8 a
30	61.6 a	57.4 ab	57.9 a	53.1 a
60	61.1 a	57.1 b	57.3 b	53.3 a
P-value, Linear contrast	0.677	0.011	0.001	0.248
P-value, Quad. contrast	0.153	0.606	0.714	0.235
Phosphorus Summary				
0	60.8 a	57.5 a	57.9 a	53.6 a
15	61.1 a	57.6 a	57.8 a	53.4 a
30	61.6 a	57.4 a	57.9 a	53.2 a
P-value, Linear contrast	0.066	0.745	0.839	0.369
P-value, Quad. contrast	0.867	0.432	0.778	0.931
Summary Statistics				
NXP Interaction p-value	0.855	0.347	0.521	0.175
Mean	61.2	57.5	57.9	53.4
CV (%)	1.8	1.3	1.1	1.8

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

Title: Effect of soil amendments and specialty fertilizer products on spring and winter wheat

Year: 2005

Location: Western Triangle Ag. Research Center, Conrad

Personnel: Grant Jackson and John Miller

Objectives: Evaluate plant growth enhancing products as requested by private industry.

Procedures: A dry, humic acid product, HM9754A, from Helena Chemical Co. (Experiment No. 05WK1) was applied to spring wheat. Six treatments shown in Table 1h were applied in a RCB field design with four replications. HM9754A treatments and 60 lbs per acre of monoammonium phosphate were applied with the seed, and N as urea (when N was included as a treatment) and potash were broadcast while planting.

Four Monty's Plant Food products (see Table 2h) used according to directions by sales representative or label were applied to winter wheat in a RCB field design with four replications. When applied monoammonium phosphate was seed placed while urea and potash fertilizers were broadcast while planting.

Results: Results for the humic acid product are shown in Table 1h, and the results for Monty's Plant Food products are shown in Table 2h.

Table 1h. Effect of humic acid (HM-9754-A) and fertilizer treatments on spring wheat yield and quality. Western Triangle Ag. Research Center, Conrad, MT. 2005.

Treatment	Grain Yield	Grain Protein	Test Weight	Final Stand Count
lbs N-P-K-HM9754A/acre	bu/acre	%	lb/bu	Tillers/3' of row
6-30-25-0	44.1 b	11.7 b	61.6 a	88 a
100-30-25-0	47.8 a	13.8 a	60.2 b	80 a
0-0-0-15	41.1 b	11.7 b	61.6 a	79 a
6-30-25-5	42.8 b	11.8 b	61.3 a	78 a
6-30-25-10	41.8 b	11.8 b	61.6 a	75 a
6-30-25-15	42.0 b	11.4 b	61.6 a	72 a
Statistical Table				
Overall Mean	43.3	12.0	61.3	78
P-Value	0.014**	0.001***	0.001***	0.503
LSD (0.05)	3.6	0.6	0.5	NS
CV, %	5.5	3.5	0.6	14.4

Yield, protein, test weight, and stand count data followed by the same letter are not significantly different according to the LSD.

** Significant at the 99 % level.

*** Significant at the 99.5 % level.

NS = Not significant

Variety: Choteau planted at 20 seeds/ft²

Planting Date: May 2, 2005

Growing Season ppt: 7.45"

Harvest Date: August 29, 2005

Soil Test Results:

pH = 8.5

OM = 2.4 %

P = 16 ppm

K = 302 ppm

NO₃-N= 62.5 lbs/acre in 3 feet of soil

SO₄-S= 7110 lbs/acre in 3 feet of soil

Table 2h. Effect of selected Monty's Plant Food products on winter wheat yield and quality. Western Triangle Ag. Research Center, Conrad, MT. 2005.

Treatment	Grain Yield (bu/ac)	Grain Protein (%)	Test Weight (lb/bu)
Fertilizer Check ¹	74.5 a	10.9 a	64.2 a
No Fertilizer Check ²	58.8 b	9.3 b	64.0 ab
Seed ³	58.1 b	9.2 b	64.2 a
Seed + Tillering ⁴	62.9 b	9.2 b	63.8 b
Seed + tillering + Heading ⁵	58.7 b	8.9 b	63.4 c
Humic Acid ⁶	57.6 b	9.1 b	63.8 b
Statistical Summary			
Overall Mean	61.7	9.4	63.9
Treatment p-value	0.0001 ^{***}	0.0001 ^{***}	0.0019 ^{**}
LSD (.05)	5.9	0.4	0.4
CV (%)	6.3	3.1	0.4

Yield, protein, and test weight data followed by the same letter are not significantly different according to the LSD.

** Significant at the 99 % level.

*** Significant at the 99.5 % level.

¹6-30-0 applied with the seed, 64-0-25 applied broadcast while planting.

²No fertilizer applied.

³8 oz/ac of Monty's Seed Starter 4-15-12 applied to the seed.

⁴8 oz/ac of Monty's Seed Starter 4-15-12 applied to the seed, plus 16 oz/ac of Monty's All Purpose Growth 8-16-8.

⁵8 oz/ac of Monty's Seed Starter 4-15-12 applied to the seed, plus 16 oz/ac of Monty's All Purpose Growth 8-16-8, plus 16 oz/ac of Monty's Root & Bloom 2-15-15.

⁶Humic acid or Carbon treatment, 64 oz/ac.

Variety: Genou planted at 20 seed/ft²
Planting Date: September 23, 2004

Growing Season ppt: 6.75"
Harvest Date: August 5, 2005

Soil Test Results:

pH = 7.9

OM = 2.1 %

P = 30 ppm

K = 282 ppm

Ca = 4491 ppm

Mg = 250 ppm

NO₃-N= 53 lbs/acre in 3 feet of soil

SO₄-S= 376 lbs/acre in 3 feet of soil

Title: Effect of nitrogen and sulfur on two spring wheat cultivars.

Year: 2005.

Location: Western Triangle Ag. Research Center

Personnel: Grant Jackson and John Miller, Western Triangle Agricultural Research Center, Conrad, MT 59425;
David Weaver, Dept. of Land Resources & Environmental Science, Bozeman, MT 59717

Objectives:

To determine wheat yield and protein response to nitrogen (N) fertilization and N soil tests and sulfur (S) fertilizer and S soil tests.

Procedures:

Nitrogen fertilizer treatments of 0, 30, 60 and 90 lbs N/acre were applied in combination with sulfur fertilizer rates of 0, 10, 20, and 30 lbs S/acre to Conan and Reeder spring wheat. 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. Plots were planted into fallow using a five-row, plot drill with a 10 inch row spacing. Planting rate was 20 seeds/ft². Plot size was 5 by 25 feet with four replications. Plots were harvested with a Hege plot combine. Soil test results are as follows:

Test	Value
pH	8.5
O.M. (%)	2.4
P (ppm)	16
K (ppm)	302
EC (mmhos/cm)	0.23
NO ₃ -N (0-3', lb/ac)	62.5
SO ₄ -S (0-3', lb/ac)	7110

Results:

Grain yield, grain protein content, test weight, and seed S content data are shown in Table 1s. Grain yield averaged about 52 bu/acre and did not respond to N or S. Test weight significantly declined with increasing N, but S had no effect on test weight. Reeder had significantly higher grain yield and test weight than Conan.

Table 1s. Effect of variety, nitrogen rate, and sulfur rate on spring wheat yield and quality. Western Triangle Ag. Research Center. 2005.

Treatment		Yield	Test Wt.	Protein	S Content
Variety	N – S Rate	bu/acre	lb/bu	%	%
Reeder	0 – 0	50.2	62.5		
Reeder	30 – 0	54.6	62.0		
Reeder	60 – 0	49.2	60.4		
Reeder	90 – 0	53.4	60.4		
Reeder	0 – 10	53.7	62.7		
Reeder	30 – 10	55.3	62.0		
Reeder	60 – 10	52.0	60.6		
Reeder	90 – 10	53.4	60.6		
Reeder	0 – 20	52.2	62.6		
Reeder	30 – 20	55.4	61.6		
Reeder	60 – 20	53.1	61.2		
Reeder	90 – 20	53.4	59.7		
Reeder	0 – 30	56.6	62.5		
Reeder	30 – 30	52.3	61.7		
Reeder	60 – 30	56.3	61.7		
Reeder	90 – 30	55.1	60.9		
Conan	0 – 0	47.6	61.4		
Conan	30 – 0	51.3	61.1		
Conan	60 – 0	49.2	59.9		
Conan	90 – 0	51.4	59.6		
Conan	0 – 10	48.3	61.6		
Conan	30 – 10	50.3	61.3		
Conan	60 – 10	50.4	59.8		
Conan	90 – 10	53.1	59.8		
Conan	0 – 20	48.4	61.9		
Conan	30 – 20	50.3	60.8		
Conan	60 – 20	52.4	60.4		
Conan	90 – 20	49.9	59.3		
Conan	0 – 30	48.1	62.0		
Conan	30 – 30	51.0	62.2		
Conan	60 – 30	53.1	60.5		
Conan	90 – 30	48.1	60.4		
Nitrogen Summary					
0 lbs/acre		50.6 a	62.2 a		
30 lbs/acre		52.6 a	61.4 b		
60 lbs/acre		52.0 a	60.6 c		
90 lbs/acre		52.2 a	60.1 d		
Linear Contrast, p-value		0.288	0.001		
Quadratic Contrast, p-value		0.345	0.525		

Table 1s. Continued.				
Treatment	Yield	Test Wt.	Protein	S Content
	bu/acre	lb/bu	%	%
Sulfur Summary				
0 lbs S/acre	50.8 a	60.9 a		
10 lbs S/acre	52.1 a	61.0 a		
20 lbs S/acre	51.9 a	60.9 a		
30 lbs S/acre	52.6 a	61.4 a		
Linear Contrast, p-value	0.201	0.097		
Quadratic Contrast, p-value	0.751	0.380		
Variety Summary				
Reeder	53.5 a	61.4 a		
Conan	50.2 b	60.7 b		
Statistical Summary				
Mean	51.8	61.1		
CV, %	7.6	1.0		
Interaction	Interaction p-values			
Variety x N Rate	0.503	0.972		
Variety x S Rate	0.675	0.968		
N Rate x S Rate	0.695	0.544		
Variety x N Rate x S Rate	0.945	0.997		

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

Notes:

Planting Date: 4/29/2005

Growing Season ppt: 7.45"

Harvest Date: 8/31/2005

Herbicide: None

Title: Effect of nitrogen and sulfur on winter wheat.

Year: 2005.

Location: East of Brady, MT (Knees Community) on the Dan Picard farm

Personnel: Grant Jackson and John Miller, Western Triangle Agricultural Research Center, Conrad, MT 59425;
David Weaver, Dept. of Land Resources & Environmental Science, Bozeman, MT 59717

Objectives:

To determine wheat yield and protein response to nitrogen (N) fertilization and N soil tests and sulfur (S) fertilizer and S soil tests.

Procedures:

Nitrogen fertilizer treatments of 0, 30, 60 and 90 lbs N/acre were applied in combination with sulfur fertilizer rates of 0, 10, 20, and 30 lbs S/acre. Nitrogen as urea (46-0-0) and potash (30 lbs KCl/acre as 0-0-60) fertilizers were broadcast, P (60 lbs/acre of monoammonium phosphate was placed with the seed, and S as ammonium thiosulfate (12-0-0-26) was dribbled on the surface approximately two inches from the seed row. Plots were planted into chemical fallow using a six-row, double disk plot drill with 12 inch row spacing. Planting rate was 20 seeds/ft², and the cultivar was Genou. Plot size was 6 by 25 feet with four replications. Plots were harvested with a Hege plot combine. Soil test results are as follows:

Test	Value
pH	7.8
O.M. (%)	2.5
P (ppm)	30
K (ppm)	564
EC (mmhos/cm)	0.24
NO ₃ -N (0-3', lb/ac)	88
SO ₄ -S (0-3', lb/ac)	2311

Results:

Grain yield, grain protein content, test weight, and seed S content data are shown in Table 1w. Grain yield averaged about 71bu/acre while protein content averaged about 16 %. Grain yield, protein content, and seed S content significantly increased with increasing N while test weight significantly declined, and the only response to S was a decline in test weight with increasing S.

Table 1w. Effect on nitrogen and sulfur on winter wheat yield and quality. Experiment located in the Knees community east of Brady. Western Triangle Ag. Research Center, Conrad, MT. 2005.

Treatment	Grain Yield	Protein Content	Test Weight	S Content
N - S, lb/ac	bu/ac	%	lb/bu	%
0 - 0	69.1	15.3	62.7	0.195
0 - 10	64.6	15.6	62.2	0.205
0 - 20	66.4	14.0	61.4	0.184
0 - 30	63.9	16.6	62.5	0.219
30 - 0	69.1	13.9	62.6	0.183
30 - 10	74.3	14.3	62.6	0.195
30 - 20	67.1	15.3	62.0	0.205
30 - 30	72.5	16.2	61.6	0.210
60 - 0	76.5	16.2	62.0	0.211
60 - 10	74.1	18.1	61.8	0.235
60 - 20	73.4	17.6	61.2	0.222
60 - 30	76.6	17.5	61.1	0.214
90 - 0	69.5	16.6	60.9	0.210
90 - 10	72.6	17.4	61.0	0.218
90 - 20	72.6	19.3	60.8	0.239
90 - 30	71.2	17.4	60.3	0.219
Nitrogen Summary				
0	66.0 a	15.4 a	62.2 a	0.201 ab
30	70.8 ab	15.0 a	62.2 a	0.198 a
60	75.2 b	17.4 b	61.5 b	0.221 b
90	71.5 b	17.8 b	60.7 c	0.221 b
Linear contrast p value	0.011	0.002	0.001	0.021
Quad. contrast p value	0.021	0.565	0.090	0.839
Sulfur Summary				
0	71.0	15.5 a	62.1 a	0.199 a
10	71.4	16.3 a	61.9 ab	0.213 a
20	69.9	16.6 a	61.3 b	0.213 a
30	71.1	16.9 a	61.4 b	0.215 a
Linear contrast p value	0.862	0.121	0.013	0.181
Quad. contrast p value	0.815	0.717	0.648	0.492
Statistical Summary				
Mean	70.9	16.3	61.7	0.210
CV (%)	9.9	15.7	1.5	14.9
Interaction p value	0.857	0.841	0.826	0.802

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

Notes:

Planting Date: Sept. 9, 2004
 Growing Season ppt: 7.25"
 D at 1 pt/a on May 16, 2005

Harvest Date: August 8, 2005
 Herbicide: Ally at 1/10 oz/a, LV 6 at 8 oz/a, and 2, 4-

Title: Evaluation of oil seed crops as potential feed stock for biofuels or lubricants (continuation of 2003 project #404-140, index #425165).

Year: 2005

Locations: Western Triangle Ag. Research Center (WTARC)
Knees area east of Brady (Picard farm)
Choteau area (Inbody farm)
Cut Bank area (Bradley farm)
Sunburst area (Karst farm)
Joplin area (Moog farm)

Personnel:

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

Objectives:

To determine the adaptation and suitability of camelina, canola, crambe, flax, mustard, safflower, and sunflower as potential sources of biofuel and lubricants.

Procedures:

Varieties or hybrids of several oil seed crops (early planted: camelina, canola, crambe, flax, and mustard, and late planted: safflower and sunflower) were planted at six locations with a five or six-row, 10 or 12-inch spaced planter. Plot size was 5 or 6 by 25 feet, and all locations except WTARC were planted no-till into previously fallowed land or following barley, recrop (WTARC was planted in to conventional fallow). All entries 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 the recrop site, Sunburst, 90 lbs of nitrogen as urea and 10 lbs of sulfur as potassium sulfate were applied broadcast while planting. Weeds were controlled with a labeled rate of Poast herbicide.

Results:

Seed yields and oil percentages are shown in Table 2o and Table 3o, and individual site characteristics are shown in Table 1o. The trial was not uniform. Safflower and Sunflower were only planted at WTARC. Legena seed was received in time to be only planted at Sunburst. Antelope were the significant problem at the Knees, canola, crambe, and mustard were lost at Cut Bank due to several days of 10 degree low temperatures in early June, camelina entries were lost due to poor stands from dry soil conditions at Choteau and Joplin, and buck deer polished their antlers on sunflower at WTARC. Flax varieties, Carter, Omega, and York, performed very well. The low yields of canola and mustard at Sunburst can be attributed in part to early swathing date. Only safflower were analyzed for oil content, they are respectively: Nutisaff at 44.8% and MT 2004 at 34%.

Table 1o. Site Characteristics of oilseed trials. Western Triangle Ag. Research Center, Conrad. 2005.

Crop	Location					
	Choteau	Cut Bank	Joplin	Knees	Sunburst	WTARC ¹
	Planting Date					
Cool season	5-2	4-25	4-19	4-12	5-3	4-26
Late season		-				5-24
	Swathing Date					
Cool season	8-5	8-4		8-5	8-4	
	Harvest Date					
Cool season	8-17	8-22	8-16	8-15	8-22	8-15
Late season						10-27
	Growing Season Precipitation					
Cool season		8.45	5.30	7.25	8.50	6.07
Late season						9.44
Spraying Date		June 15*	June 14*	May 8*	May 26*	

* = Poast @ 2 pt/a.

Table 2o. Oilseed species and variety trial: Seed Yield. Western Triangle Ag. Research Center, Conrad, MT. 2005.

Treatment		Location					
Species	Variety	Choteau	Cut Bank	Joplin	Knees	Sunburst	WTARC
-----lbs/acre-----							
Canola	Crosby	560	ND	1115	689	256	771
Canola	2061	697	ND	1140	510	325	773
Crambe	Meyer	1292	ND	1529	653	1681	1114
Mustard	Amulet	672	ND	881	580	340	589
Camelina	Celine	ND	742	ND	463	1201	1050
Camelina	MT 1	ND	757	ND	395	1146	999
Camelina	MT 3	ND	779	ND	411	1215	1188
Camelina	MT 5	ND	752	ND	438	1187	1043
Camelina	Ligena	ND	ND	ND	ND	938	ND
Flax	Omega	1095	1067	1052	529	1627	964
Flax	York	1012	1047	979	363	1735	866
Flax	Carter	1129	995	1043	516	1717	931
Flax	Neche	1122	804	875	472	1502	853
Safflower	Nutrisaff	ND	ND	ND	ND	ND	1980
Safflower	MT 2004	ND	ND	ND	ND	ND	1580
Summary Statistics							
Overall Mean		947	879	1077	502	1140	1047
CV, %		9.4	18.6	13.6	42.1	16.5	18.8
LSD (0.05)		131	280	214	NS	312	282