

The 21st  
ANNUAL RESEARCH REPORT  
of the  
WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER  
Montana Agricultural Experiment Station  
Conrad, Montana  
1998

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Climatic summary for the 1998 calendar year at the Western Triangle Research Center, Conrad, MT.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total or average
<b>Precipitation (inches)</b>													
Current Year	0.13	0.08	0.55	0.63	1.31	4.18	2.28	0.76	0.50	0.19	0.62	0.08	11.31
Average 14 yr	0.21	0.20	0.56	0.88	2.04	2.74	1.66	1.43	1.36	0.50	0.37	0.18	12.13
<b>Mean Temperature (°F)</b>													
Current Year	17.4	31.9	29.5	46.4	55.8	57.0	68.8	70.6	64.2	48.6	33.2	25.5	45.7
Average 13 yr	22.0	23.6	33.6	43.7	53.3	60.4	65.6	65.7	57.7	45.5	30.4	24.4	43.8
<b>Last killing frost in Spring</b>													
1998-----													May 7 (32°)
Average-----													May 14
<b>First killing frost in Fall</b>													
1998-----													Oct 5 (26°)
Average-----													Sep 22
<b>Frost free period (days)</b>													
1998-----													150
Average-----													130.1
<b>Maximum summer temperature----</b>													97° (Aug 6)
<b>Minimum winter temperature-----</b>													- 26° (Jan 12, 1998)

Summary of climatic data by month for the 1997-98 crop year (Sept - August) at the Western Triangle Research Center, Conrad, MT.

	Sep 1997	Oct 1997	Nov 1997	Dec 1997	Jan 1998	Feb 1998	Mar 1998	Apr 1998	May 1998	June 1998	July 1998	Aug 1998	Total or Average
<b>Precipitation (inches)</b>													
Current year	0.73	0.28	0.48	0.00	0.13	0.08	0.55	0.63	1.31	4.18	2.28	0.76	11.41
Average 14 yr	1.43	0.52	0.35	0.19	0.21	0.20	0.56	0.88	2.04	2.74	1.66	1.43	12.21
<b>Mean Temperature (°F)</b>													
Current year	58.9	44.5	31.4	28.4	17.4	31.9	29.5	46.4	55.8	57.0	68.8	70.6	45.1
Average 13 yr	57.2	45.2	30.2	24.3	22.0	23.6	33.6	43.7	53.3	60.4	65.6	65.7	43.7

**Last killing frost in Spring**

1998-----May 7 (32°)  
Average----- May 14

**First killing frost in Fall**

1998----- Oct 5 (26°)  
Average----- Sept. 22

**Frost free period (days)**

1998----- 150  
Average----- 130.1

**Maximum summer temperature----- 97° (Aug 6)**

**Minimum winter temperature----- -26° (Jan. 12, 1998)**

## 1998 Winter Wheat Variety Evaluations in the Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak and Ron Thaut, Research Center, Conrad; and Dr. Phil Bruckner, MSU Plant Science Dept.

An off-station winter wheat variety trial was grown at the Knees area east of Brady. The Chester trial was not planted due to dry fall conditions. Preliminary sawfly and advanced yield trials were grown on station at Conrad.

Results: Fall and spring moisture were below normal, but rainfall in June and July was twice the normal amount and contributed to exceptionally high yields. Winter wheat was under moisture stress for a longer period of time at the Knees, and plant heights were shorter than normal for that location.

Sawfly wasps and larval infestation were abundant at both locations, but stem cutting was minimal. Stem examination indicated that most of the sawfly larvae were parasitized.

The sawfly resistant varieties Vanguard and Rampart yielded about 8% less than Rocky at the Knees, and 12% less than Rocky at Conrad. If the sawfly larvae would have escaped parasitism, the yield differences between Rocky, Vanguard and Rampart would probably have been less.

Experimental lines MTS 9719 and MTS 9720 had higher yield and winter survival than Rampart and Vanguard, but lower test weight and protein. These experimental lines are hollow-stemmed sawfly-resistant. The mode and reliability of sawfly resistance in these two lines is not yet known.

Data for 1998 and five-year averages are presented in Tables 1-3 for Conrad, and Tables 4-5 for the Knees.

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

Winterhardness ratings: 5 = very good; 1 = poor.

Coleoptile length: Long = 3.4" or more; Short = 3" or less.

Quality ratings: 4 = good; 3 = average; 2 = poor; 1 = very poor.

Abilene (AgriPro NA 362-5, 1987): Low winter-hardiness (2). Very short semidwarf. Early maturity. Yield ranked low at Conrad 1988. Adapted north of Ks/Okla borders and Texas panhandle. Susceptible to Hessian fly. Quality = 2.5.

Agassiz (ND, 1983): Recommended for District 6 only to replace Froid (Eastern Montana). High winterhardness (4), slightly less than Roughrider. Tall very weak straw, lodges bad. Long coleoptile. Medium late maturity. Shatter resistance fairly good. Low yield, high protein. Quality = 3.

Akron (CO, 1994): Tested in 1996. Winterhardness probably poor. Medium coleoptile.

Alliance (Nebr, 1993): Developed for dryland in Nebraska panhandle. Winter hardiness medium (3). Short coleoptile. Early maturing, low test weight.

Arapaho (Nebr, 1989): Winterhardness medium (3). Medium-short height with long coleoptile and moderate straw strength. Early heading. Heterozygous (mixed) resistance to Great Plains strain of Hessian fly, moderate tolerance to Cephalosporium stripe. Medium yield, low test weight.

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

Blizzard (ID 0297) (Idaho/Oregon/USDA, 1989): Probably similar to Weston for winterhardness which is not very high (2-3). Long coleoptile. Snow mold resistance, for high elevation areas under snow. Better dwarf bunt resistance than Weston or Manning. Tough to thresh; lots of spikelets in grain sample. High protein.

Bighorn (Hybritech Intl, 1985): Winterhardness somewhat tender in Triangle area tests, but others rate it a 3. Short straw. Medium coleoptile. Medium early maturity. Susceptible to stem rust but resistant to dwarf smut. Fairly good yield. Protein is medium.

Bonneville (ID, 1994): Tested in 1996. Long coleoptile.

Boundary (ID, 1997): Awnless. Poor winterhardness. Long coleoptile.

Centurk (Nebr, 1971): Medium low winterhardness (2), less than Redwin and Tiber. Medium stiff straw. Long coleoptile. Early maturity, which sometimes allows escape from sawfly. High yield. Very susceptible to yellow berry expression under low nitrogen conditions. Medium-low protein.

Cheyenne: Medium winterhardness. Tall straw. Medium maturity. Medium to high yield, shatters bad -(see 'Cree' for an improvement). High protein.

Chisolm (Oklahoma): Winterhardness equal or less than Cimmaron (low).

Cimmaron (Oklahoma): Awnless (awnletted), red head. Winterhardness adequate for Kansas, Nebraska, and Colorado. Stiff-straw semidwarf. Hard to thresh due to very stiff straw.



Cree (MSU, 1983): Shatter resistant version of Cheyenne. Identical to Cheyenne in other respects except has red head and brown chaff. Winterhardiness medium (3). Tall straw. Medium maturity and highly vulnerable to sawfly. Medium to high yield. High protein. Seed supply no longer maintained.

Crimson (SD89153, 1997): TAM105/Winoka. Very long coleoptile.

Dawn (S.Dak.): Fair winterhardiness, greater than Hawk. Medium short height, good lodging resistance. Early maturity. Quality is fair.

Dynamic I & II (Russia): Intro, Big Sky Seeds. Tested in 1996. Beardless. Long and medium coleoptile, respectively.

Eklund (private var.- eastern Mta grower): Beardless. High winterhardiness (4 or 5). Medium-short height. Medium maturity. Medium shatter resistance.

Elkhorn (ND, 1994): Good winter hardiness (4). Medium height and straw strength. Long coleoptile. Medium-late maturity. Quality = 3.

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, Agassiz and Seward in NE Montana.

Froid: High winterhardiness (5). Low yield and tall weak straw.

Garland (UT, 1994): Tested in 1996. Very short straw, shorter than Norwin. Short coleoptile. Powdery mildew & dwarf bunt resistant.

Halt (Colorado, 1994): Winterhardiness (2). Short semidwarf. Medium coleoptile. Early maturing. Has Russian wheat aphid resistance.

Hawk (AgriPro): Winterhardiness moderate to poor, probably less than Centurk. Short straw & good lodging resistance. Medium coleoptile. Early maturity. Sometimes yields high, but not consistently. Adapted to Southern Great Plains.

Hill-81 (Oregon): Soft White. Compared to other soft-white wheats, winter-hardiness is good, but still may be risky for Triangle area. Good straw strength.

Ike (Kansas, 1993): Tall semidwarf. Medium coleoptile. Very early heading (2 days earlier than Rocky). Resistant to stem & leaf rust, and Hessian fly.

Judith (MT 8039, MSU, 1989): Winterhardiness = 3, higher than Rocky and Cheyenne, and equal to Redwin. Low vernalization requirement. Medium short straw; straw less stiff than Neeley, Tiber and Redwin; but stiffer than Rocky and Centurk. Short coleoptile. Heading slightly later than Rocky, but earlier than Tiber. However, it had more sawfly damage than Rocky & Tiber at the Knees plot in 1991. Stripe and stem rust resistant. Yields fair to good, sometimes equal to Rocky and Tiber. Medium shatter resistance. Test weight is sometimes low, and may be a problem. Protein is medium: equal to Tiber, greater than Centurk, and less than Redwin. Quality = 3.

Jules (Colorado, 1992): Winterhardiness medium low (2). Semidwarf with better straw strength than Lamar. Short coleoptile. Early maturity (like Rocky). Resistant to stem rust; some tolerance to wheat streak mv. Better yield than Lamar. High yield in 1994 and 1995. Medium to low test weight.

Karl 92 (Kansas, 1992): Poor winterhardiness. Early maturing. Low yield.

Kestrel (Sask, Can, 1993): Winterhardy and high yielding in Canada (hardiness = 5, similar to Norstar). Shorter straw & slightly better lodging resistance than Norstar. Short coleoptile. Medium late; three days earlier than Norstar (similar maturity as Redwin). Probably will not tolerate drought stress very well. Very susceptible to physiological leaf spot. Susceptible to stem, stripe, & leaf rust. Higher yield than Norstar. Test weight and protein less than Norstar (very low). Dockage for low protein is almost certain with this variety.

Lamar (Colorado, 1988): Very poor winterhardiness (1-2). Medium height with weak straw. Long coleoptile. Very early heading. Adapted to severe low moisture conditions of Colorado. Heterogeneous reaction to Great Plains biotype of Hessian fly. Shattered in 1993. Medium yield. High test weight.

Manning (Utah, 1979): Poor winterhardiness (1-2). Medium short; good straw strength. Medium coleoptile. Adapted to deep snow areas; resistant to dwarf bunt and moderately tolerant to snow mold.

McGuire (MT88046, MSU, 1996): Red chaff. Winterhardiness intermediate (3), similar to Neeley & Judith. Height 2 inches shorter than Neeley & Judith. Long coleoptile. Good lodging resistance, similar to Tiber & Redwin and superior to Neeley & Rocky. Very early maturity, 1 to 2 days earlier than Rocky. Resistant to stem rust. Susceptible to stripe rust, dwarf bunt, WSMV, RWA and sawfly. Low to medium yield; similar to Redwin and 7bu/a lower than Neeley. Test weight intermediate, similar to Rocky. Has the highest protein and baking quality of any winter wheat tested in our lab. Very high protein, 1% higher than Redwin. Possibly useful for specialty markets.

Meridian (Idaho, 1991): Poor winterhardiness (2). Good straw strength; developed for irrigated conditions in Idaho. Medium coleoptile. Very late maturity (several days later than Neeley). Too late in maturity for satisfactory performance in the Triangle area; needs long, moist growing season. Moderate resistance to stripe rust, snow mold and dwarf bunt. Susceptible to stem rust. Yields rank from low to very high depending on year. Medium to low test weight. Low to very low protein.

Minter: High winterhardiness (4-5). Medium height and maturity. Low yield. Good shatter resistance.

Morgan (Sask & WPB, S89-142, 1996): Norstar/Archer. Good winterhardiness. Height similar to Rocky. Very short coleoptile. Slightly later maturity than Rocky, 3 days later to head. Yield avgs 4 bu less than Rocky. Protein equal or slightly higher than Rocky.

MT 8713 (MSU): Experimental; sister seln of Erhardt with similar traits, but much shorter. Very good winterhardiness (similar to Norwin). Three inches taller than Norwin and 7" shorter than Redwin. Lodging resistance similar to Norwin. Early to medium maturity: 1-2 days later than Rocky & Judith. Stem rust resistant. Moderate yield, 2 bu/a higher than Norwin. Higher test wt than Norwin. Adequate quality and 1% higher protein than Norwin. Potential replacement for Norwin, but will not be released unless there is interest in another Norwin type.

MT 9432 (MSU): Experimental, Nuwest/Tiber, hard red. White chaff. Long coleoptile. Possible replacement for Tiber if released. Better yield and possibly less dormancy than Tiber.

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

Nekota (Nebr & SD, 1994): Tested in 1996. Semidwarf. Medium coleoptile. Supposedly early.

Niobrara (Nebr & SD, 1994): Tested in 1996. Semidwarf. Medium coleoptile. Moderately early.

Norstar (Canada, 1977): Maximum Winterhardiness (5). Very tall straw, poor lodging resistance. Long coleoptile. Late maturity. Susceptible to stem rust & leaf spot. Low yield. Medium to low shatter resistance (head shattering occurred at Conrad in 1980). Protein medium-low; lower than Roughrider. Quality = 3.

Norwin (MSU, 1984): Winterhardiness = 5 (high). Licensed in Canada. Very short semidwarf straw, but not a tripledwarf. Too short for dryland. Very short coleoptile. Medium maturity. Severe *Pseudomonas* bacterial leaf blight symptoms. Medium yield. Good shatter resistance. Protein medium to low. Quality = 2.

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

Pronghorn (Nebr, SD & Wyo, 1995): Probably poor WH. Tall straw. Long coleoptile.

Quantum 542 (Hybritech, 1988): An F<sub>1</sub> hybrid; needs new seed each year. Planting F<sub>2</sub> (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). F<sub>1</sub> vs F<sub>2</sub> tests in 1992 indicated a 12% yield reduction from planting 2nd generation seed. Winterhardiness is fairly good (3), but less than Winalta. Medium short height, but taller than 547, giving an advantage in dry conditions. Lodging resistance equal to Rocky. Long coleoptile. Early maturity like Rocky. Susceptible to stem rust. High yield. Protein as good as Rocky (medium low). Recommended in 1991 for districts 2,3,4, & 5 (but not for dwarf smut areas).

Quantum 547 (Hybritech, 1994): F<sub>1</sub> hybrid. Tested as XNH1609 in 1993-94. Winterhardiness = 3. Shorter straw than 542, giving an advantage in high rainfall areas. Short coleoptile. Yielded higher than Neeley in 1994 & 1995. Quality may be marginal.

Quantum 555 (Hybritech): F<sub>1</sub> hybrid (see Q 542). Awnletted. Good winterhardiness. Semidwarf. Excellent straw strength. Intended for irrigated only. Two days later than Centurk. According to Hybritech, adapted to Montana.

Quantum 566 (Hybritech, 1994): F<sub>1</sub> hybrid. Tested as XNH1727 in 1994. Short coleoptile. Late maturing; mainly intended for eastern Montana & South Dakota. Yielded higher than Neeley in 1994 & 1995.

Quantum 7424 (Hybritech, 1997): F<sub>1</sub> hybrid. Formerly XNH1824. Long coleoptile.

Ram (NAPB): Winterhardiness less than Centurk (low). Tall semidwarf with good straw strength. Early maturity (similar to the Centurk-type wheats). Adapted to Southern Great Plains. Susceptible to Hessian fly. Medium-low test weight.

Rampart (MTS92042, MSU, 1996): Sawfly resistant (sister line to Vanguard). Red chaff, upright head. May have some improvements over Vanguard for yield, stem solidness, and quality. Equal or marginally better winterhardiness than Vanguard (1.5 to 2) but slightly less than Rocky. Should not be grown in areas where high levels of winterhardiness are needed, unless protected by stubble. Height 1 inch shorter than Judith & Neeley. Very long coleoptile. Matures 1 day later than Judith & Rocky, 2 days earlier than Neeley. Some resistance to stem rust, and some tolerance to wheat streak mv. Yield averages 6% higher than Vanguard; and 4% less than Rocky in the absence of sawflies, but equal to Rocky under heavy sawfly conditions. Does not seem as prone to shatter as Vanguard. Good test weight, protein and quality.

Rawhide (Nebraska): Not tested in Montana. For Southern Plains.

Readymade (W188) (Canada, 1994): Selection from Redwin by Agr Canada at Lethbridge. Winter hardiness (3), yield and maturity similar to Redwin. Medium-short height, stiff straw. Long coleoptile. Had similar leaf spot problems as Redwin at Conrad 1992, and is susceptible to leaf & stem rust. Head color same as Redwin; but stems are yellow, whereas Redwin stems are mixture of red and yellow. Redwin has a mix of small spring wheat-like seeds with large seeds. Readymade is all large seed that grade properly under the Canadian system. Slightly lower protein, and larger

kernels than Redwin.

Redwin (MSU, 1979): Red head. Winterhardiness = 3, greater than Cheyenne but slightly less than Winalta. Medium short height. Very stiff straw, (along with Tiber, is among the stiffest available among Mta wheats). Long coleoptile. Medium-late maturity, medium yield. Very susceptible to leaf spot fungi and bacterial leaf blight. Good shatter resistance. Yields similar to Winalta. Tiber and Readymade were selected from Redwin. Redwin is among the highest protein winter wheats.

Rita (SD, 1980): Fair winterhardiness. Medium height, stiff straw. Early maturity. Quality = 3.

Rio Blanco (NAPB): Not tested in Montana. For Southern Plains.

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

Rose (SD, 1981): Fair WH. Short stiff straw. Early mat. Quality = 2.

Roughrider (ND, 1975): Good winter hardiness (5). Tall, but more lodging resistant than Winalta. Long coleoptile. Medium-late maturity. For Eastern Montana. Susceptible to leaf spot diseases. Heterogeneous for GP biotype Hessian fly. Low yield. Has a shatter problem in the Triangle area. Protein slightly greater than Winalta (high).

Seward (ND, 1987): Winterhardiness of Winalta (4). Medium height and is shorter and stiffer than Winalta (about like Rocky). Good lodging resistance. Medium late maturity. Susceptible to leaf rust & leaf spot. Low yield at Conrad. Medium shatter resistance. Low protein & poor quality (2).

Sierra (Agripro): Short, stiff straw for irrigated lodging resistance. Higher yield & lower protein than Tomahawk.

Siouxland (S.Dak or Neb, 1984): Winterhardiness not adequate for Triangle area of Montana. Early maturity. Sticky dough problems, and could damage our market quality image. Quality = 2.

Tam 107 (Texas): Red head. Winterhardiness medium to low. Short straw. Early maturing. Moderate resistance to wheat curl mite infestation, and thus may be able to escape wheat streak mosaic virus. However, wheat streak symptoms were observed on Tam 107 at Conrad in 1993 (average level).

Tandem (SD 89119, 1997). Brule/Agate. Very long coleoptile.

Thunderbird (Agripro): Winterhardiness may be low, less than Centurk. Short straw with good lodging resistance. Long coleoptile. Early maturity.

Tiber (MSU, 1988): Dark Red head, (darker than redwin); blackish red in years of favorable moisture. This trait makes Tiber popular for wheat weaving and other crafts. Winterhardiness comparable to Redwin (3), greater than Cheyenne, and slightly lower than Winalta. Medium short height with good lodging resistance. Stiff straw - stiffer than Judith, but not quite as stiff as Redwin. Straw stiffness 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. Long coleoptile. Very resistant to sprouting, causing some dormancy problems. Medium maturity, slightly earlier than Redwin, but still late enough to be sawfly vulnerable. Much greater tolerance to leaf spot diseases than Redwin. Susceptible to stem rust. Among highest yielders. Equal, or sometimes 1 bushel less than Neeley. Higher yielding and more tillers than Redwin. Good shatter resistance. Protein is medium: higher than Rocky, and similar to Neeley; 1/2% less than Redwin. Good milling and baking quality. See also MT 9432.

Tomahawk (Agripro): No Montana data, but probably similar to Rocky in most agronomic traits. Short, stiff straw for good irrigated lodging resistance. Lower yield and higher protein than Sierra.

Vanguard (MTSF2238) (MSU, 1995): Sawfly resistant. (Lew/Tiber//Redwin cross). Good stem solidness. White chaff, nodding head. Winterhardiness slightly less than Rocky (1.5 to 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 8-12% lower than Rocky and 5% less than Redwin; but under heavy sawfly infestation, yield was equal to Rocky and Tiber, and greater than Neeley and Judith. May have a tendency to shatter. Test weight = Rocky. Protein high (similar to Redwin); 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.

Vista (Nebr, 1992): Winterhardiness (3). Semidwarf. Very short coleoptile. Early heading. Resistance to Hessian fly, leaf rust & stem rust. Medium to low yield.

Vona (Colorado): Winterkilled fairly often in Triangle area tests, but yields high if it survives without injury. Short stiff straw. Very early maturity if not winter-injured. Poor milling and baking quality.

Warrior (Nebr): Tall straw and medium maturity. Yields lower than Cree. Medium shatter resistance. May be resistant to the Great Plains strain of Hessian fly. High protein. Seed supply no longer available.

Weston (Idaho): Winter killed at Moccasin in 1989, winterhardiness poor (2). Tall straw, lodges. Dwarf smut resistant, but less than Blizzard. Moderate snowmold tolerance. Low to medium yield.

Winalta: Good winterhardiness (4). Tall weak straw. Medium yield. Good shatter resistance. High protein. Redwin and Tiber offer improvements.

Windstar (Nebr, 1997): Winterhardiness unknown. Very short coleoptile. Yield similar to Rewin (med-low) in 1998.

Winoka: Similar to Winalta, but slightly earlier to mature.

Wings (Private variety): Winterhardiness less than Centurk. Sister to Vona, but a little more winterhardiness. Early maturity.

Winridge (MSU, 1981): Winterhardiness 2 (medium low), similar to Centurk but less than Cheyenne. Medium height with stiff straw. Very long coleoptile. Medium late maturity, and therefore highly vulnerable to sawfly. For dwarf smut areas. Medium to high yield. Good shatter resistance. Low test weight and protein. Quality = 1.

Yuma (Colorado, 1991): Winter hardiness somewhat poor (2). Semidwarf. Early maturing. Very short coleoptile. Some tolerance to wheat streak mv. Good yield & test weight potential if not winter-injured. Very low protein.

### **Hard White Winter Wheat**

NuPlains (Nebr 1998): Hard white. Currently under testing in Montana; adaptation yet unknown.

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

Table 1                    **Dryland Winter Wheat variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
QUANTUM 542	90.3	63.9	35	154	3	11.8
QUANTUM 1881	89.4	63.6	31	150		10.9
QUANTUM 7424	88.0	62.4	31	154		12.8
NEELEY	87.1	60.9	37	160	3	10.4
MORGAN	86.2	63.2	37	162		10.8
MT9524	85.1	63.9	36	158		11.7
KESTREL	84.8	61.0	37	159	5	11.4
MTS9719	84.6	62.6	36	161		10.9
TIBER	84.1	63.1	36	160	3	12.8
MTW9441	83.9	62.4	35	161		11.6
MT 9409	83.8	61.7	32	160		10.6
JUDITH	83.7	61.8	36	158	3	11.1
BLIZZARD	83.4	63.3	35	162		11.6
ROCKY	82.7	63.8	35	157	2	10.5
MT 9432	82.4	64.1	35	157		11.4
MT9514	81.9	61.7	36	161		11.1
NUWEST *	80.9	62.4	36	159	3	10.9
JULES	80.8	63.1	31	157	2	11.5
CRIMSON	80.5	64.4	32	158		11.4
PROMONTORY	80.4	63.1	31	158	2	11.4
ND9272	80.0	62.2	33	155		11.0
SD93380	79.9	62.1	31	151		13.1
ERHARDT	79.5	63.1	33	160	4	12.3
BIGHORN	78.6	62.7	28	157	3	12.2
MANNING	78.0	62.6	32	159	2	11.1
MTS9720	77.7	61.3	35	159		12.4
MCGUIRE	77.5	62.7	31	152	3	13.5
SD92107	77.1	61.7	34	155		12.8
S93-7	77.1	63.9	34	153		10.2
S86-1533	76.3	62.2	32	157		11.3

**( CONTINUED ON NEXT PAGE )**



Table 2                      **Dryland Winter Wheat variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, Montana.**  
**( abbreviated list )**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
QUANTUM 542	90.3	63.9	35	154	3	11.8
QUANTUM 1881	89.4	63.6	31	150		10.8
QUANTUM 7424	88.0	62.4	31	154		12.8
NEELEY	87.1	60.9	37	160	3	10.4
MORGAN	86.2	63.2	37	162		10.8
KESTREL	84.8	61.0	37	159	5	11.4
TIBER	84.1	63.1	36	160	3	12.8
JUDITH	83.7	61.8	36	158	3	11.1
BLIZZARD	83.4	63.3	35	162		11.6
ROCKY	82.7	63.8	35	157	2	10.5
NUWEST *	80.9	62.4	36	159	3	10.9
JULES	80.8	63.1	31	157	2	11.5
CRIMSON	80.5	64.4	32	158		11.4
PROMONTORY	80.4	63.1	31	158	2	11.4
ERHARDT	79.5	63.1	33	160	4	12.3
BIGHORN	78.6	62.7	28	157	3	12.2
MANNING	78.0	62.6	32	159	2	11.1
MCGUIRE	77.5	62.7	31	152	3	13.5
REDWIN	74.9	63.4	36	160	3	11.9
BOUNDARY	74.7	60.4	30	159		11.4
WINDSTAR	73.5	62.2	32	154		12.7
AKRON	73.1	63.3	31	152		11.3
ELKHORN	72.9	62.0	41	161	4	12.0
UTAH 100	72.4	60.8	34	160		11.8
NORSTAR	72.2	62.7	40	163	5	11.8
NIOBRARA	72.2	62.4	31	152		12.3
VANGUARD **	72.0	63.1	33	157	1.5	13.0

( Continued on next page )



*Winter Wheat variety trial, abbreviated list continued.*

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
RAMPART	**	71.3	63.0	33	158	1.5	13.1
PRONGHORN		70.7	62.9	32	152		13.1
HALT	***	70.3	63.0	27	150	2	12.9
TANDEM		69.9	63.1	31	151		12.9
ALLIANCE		69.6	63.0	31	151	3	12.8
ROUGH RIDER		65.4	62.5	38	160	5	12.7
NEKOTA		62.6	62.6	28	151		14.0

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, Pondera County.  
 Fertilizer: 100# 11-51-0 with the seed, + 60# N broadcast.  
 Previous crop: Fallow.  
 Date seeded: Sept. 22, 1997.  
 Date harvested: Aug. 11, 1998.  
 Rainfall: From April 1 to harvest was 9.07 inches.  
 1/ = Spring survival class: 5=best; 1=very low; based  
 several location-years of observation.

\* = Hard white wheat.  
 \*\* = Sawfly resistant variety.  
 \*\*\* = Russian wheat aphid resistant.

Yield experimental mean: 78.06  
 Error degrees of freedom: 96  
 F test for var. = 5.53  
 C.V. 2 = 3.44  
 LSD (0.05) = 7.53

Table 3      **Five-year summary for Winter Wheat varieties grown near Conrad, MT.      1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

-----					
5 - year comparable average					
Variety	Yield bu\ac	Test wt. lbs\bu.	Plant hgt. inches	Head date	% Protein 1/
-----					
JULES	79.0	61.5	32	168	11.1
QUANTUM 542	78.4	62.5	36	168	11.9
PROMONTORY	76.9	62.0	32	168	11.2
KESTREL	76.4	60.4	36	171	10.9
MANNING	75.9	60.7	32	168	11.2
ALLIANCE	75.2	62.2	32	164	11.6
NEELEY	74.3	61.1	36	172	11.5
ROCKY	72.7	62.8	35	168	11.6
BLIZZARD	72.6	61.5	38	174	12.2
NUWEST	* 72.4	61.0	36	170	11.7
BIGHORN	72.0	61.7	29	170	11.9
AKRON	70.9	62.4	33	165	11.4
JUDITH	70.9	60.0	35	169	11.9
RAMPART	** 70.0	62.0	34	170	13.1
ERHARDT	68.5	62.5	34	170	13.0
TIBER	68.5	61.5	38	172	12.1
HALT	67.6	61.7	28	164	12.7
NIOBRARA	66.7	61.1	32	164	11.9
ELKHORN	64.1	61.3	42	172	12.6
NEKOTA	64.0	62.1	30	163	12.9
MCGUIRE	63.7	61.9	34	166	13.9
VANGUARD	** 63.1	61.8	34	169	13.3
REDWIN	62.3	60.9	37	172	13.1
NORSTAR	59.1	61.4	44	175	12.5
ROUGH RIDER	55.0	61.9	41	171	13.1
-----					

Cooperator: Conrad Research Center.

Location: Ten miles north of Conrad, MT.      (Pondera County)

1/ = Proteins based on four years of data.      (1995-96-97-1998)

\*\* = Sawfly resistant varieties.

\* = Hard white wheat, (MT 7811).

Table 4 **Dryland Winter Wheat** variety trial grown near the Knees, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Res. Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Spring survival class 1/	% protein
QUANTUM 542	59.1	62.7	25	3	14.0
MT 9432	51.3	62.5	25		15.0
JUDITH	50.1	61.6	27	3	14.7
MT9514	50.1	61.9	27		13.1
MANNING	49.7	62.2	26	2	13.3
NEELEY	49.7	60.9	25	3	13.5
ROCKY	49.1	63.0	23	2	14.0
TIBER	48.8	62.6	24	3	14.1
NUWEST *	48.6	61.8	24	3	14.9
PROMONTORY	48.4	63.1	24	2	13.5
ALLIANCE	48.0	62.1	21	3	14.0
MTW9441	47.4	61.8	25		14.9
KESTREL	47.4	61.0	27	5	13.5
PRONGHORN	47.0	61.9	24		15.1
VANGUARD **	46.1	61.8	23	1.5	14.6
MT9524	45.7	62.6	24		14.6
RAMPART **	45.5	61.5	24	1.5	14.4
NORSTAR	44.2	62.2	29	5	14.3
ELKHORN	43.1	61.4	25	4	14.7
REDWIN	42.1	61.6	25	3	14.8
BIGHORN	41.7	62.0	22	3	14.7
HALT	41.4	62.6	20	2	15.1
ERHARDT	40.9	62.2	24	4	15.6
MCGUIRE	39.3	61.8	22	3	16.0

Cooperator: Dan Picard.

Location: Thirty miles east of Brady, Chouteau County.

Fertilizer: 100# 11-51-0 with the seed, + 60# N AA-N.

Rainfall: April 28 to harvest = 5.15 inches.

Previous crop: Fallow.

Date seeded: Sept. 22, 1997.

Date harvested: Aug. 5, 1998.

1/ = Spring survival class: 5=best; 1=very low; based on several location-years of observation.

Yield exp. mean: 46.86 Error degrees of freedom: 46.

F test for var. = 2.86, C.V. 2 = 5.4, LSD (0.05) = 7.2

\* = Hard white wheat.

\*\* = Sawfly resistant variety.

Table 5 **Five-year summary on dryland Winter Wheat varieties grown near the Knees. 1991 - 1993 - 1996 - 1997 - 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

-----					
5 - year comparable average					
Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
-----					
ROCKY		50.6	60.5	32	13.3
VANGUARD	**	47.7	59.4	30	14.1
TIBER		46.9	60.0	31	13.6
QUANTUM 542		46.9	59.7	33	13.4
RAMPART	**	46.5	59.5	31	14.1
NUWEST	*	43.9	58.8	31	14.0
KESTREL		42.4	58.0	35	13.1
NEELEY		41.8	58.6	31	13.2
BIGHORN		41.0	59.9	27	13.7
JUDITH		39.9	58.1	32	14.2
REDWIN		39.6	58.8	31	14.4
MCGUIRE		38.8	59.3	29	14.9
ERHARDT		37.8	59.0	29	15.0
PROMONTORY		36.7	60.4	31	13.1
MANNING		36.4	57.9	31	13.2
NORSTAR		36.3	59.2	37	14.3
-----					

Cooperator: Dan Picard.

Location: Thirty miles east of Brady. (Chouteau County)

\*\* = Sawfly resistant varieties.

\* = Hard white wheat, (MT 7811).

Several years of data were under heavy infestation of saw flies.

1998 Spring wheat variety evaluations in the Western Triangle Area.

Year: 1998

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak and Ron Thaut, Research Center, Conrad; and Dr. Luther Talbert, MSU Plant Science Dept.

Off-station spring wheat variety trials were grown in Teton County near Choteau, Toole County near Oilmont, and Glacier County near Cut Bank. These three locations represent diverse environments with Choteau having deep soil and typically favorable moisture, Oilmont having less than favorable moisture, and Cut Bank with short growing season. The Cut Bank trial was no-till planted on chem-fallow. Trials on station at Conrad included both hard red and hard white spring wheat, and durum. Data for the hard red wheat trials at Conrad are presented in Tables 6-10, and include the 1998 data and five-year averages. Hard white results are in Table 11.

Data for the three off-station locations are presented in Tables 12-18, and include the 1998 data and five-year averages. Spring wheat varieties were also tested under no-till recrop conditions, and are discussed in the "no-till variety" section of this report. Durum data are presented in Tables 19-22.

Results: Rainfall was nearly twice the normal amount during June and July, followed by hot dry conditions in late July and August. This weather pattern contributed to high yield but low test weight. Nitrogen fertilizer rates were insufficient for the high yield conditions for Conrad dryland wheat and durum, and at Cut Bank. Therefore, the proteins are very low for those trials.

Sawfly wasps were active at Choteau, but no stem cutting was observed. This was likely due to parasitism of the sawfly larvae. McNeal, Westbred 936, Fergus and Hiline performed consistently well across all locations for yield and protein. Among these four varieties, McNeal and WB936 had a slight yield advantage in higher moisture conditions, while Fergus and Hiline maintained higher test weight under moisture stress.

Scholar showed slight advantages over Amidon for yield, test weight and protein, and had a slightly shorter straw height and similar maturity date. Scholar has medium sawfly resistance that is slightly better than Amidon.

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

## Spring Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad MT

### Far-Go herbicide tolerance:

Most Tolerant: Bergen, Bronze Chief, Butte-86, Dalen, Ernest, Fortuna, Glenman, Grandin, Gus, Kodiak, Len, Marshall, McNeal, NK 751, Pioneer 2398, Pioneer 2731, Rambo, Stoa, Vanna, Westbred 926 & 936. Scholar is tolerant per initial test; final test is underway.

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

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

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

### Sawfly Resistant Hard Red Spr Wheat Varieties

(Resistance among varieties ranges from low to high; none have total resistance)

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

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

Conan (BZ992598; WPB, 1998): Rambo/906R. Sawfly resistance equal or better than Rambo, equal to Scholar, greater than Amidon, and less than Fortuna. Similar in yield and appearance to Rambo. Two to 4 days earlier than Rambo. Some tolerance to Wheat Streak M V. Protein 0.5-0.9% higher than Rambo, and better protein quality than Rambo.

Cutless (ND): Bearded. Tall-semidwarf; poor lodging resistance. Very good sawfly resistance (slightly more so than Fortuna). Moderately susceptible to septoria. Among lowest yielders. Medium test weight. Protein high.

Eatonia (Ag Canada Sask; Agripro): Tall; straw strength poor, slightly less than Leader. Greater sawfly resistance than Leader. Maturity similar to leader. Better resistance to common root rot than Leader. Larger kernels and 3% higher yield than Leader (Leader has low yield).

Ernest (ND677) (ND, 1995): Bearded. Tall, weak straw. Sawfly resistance fairly good (slightly less than Lew, Fortuna & Cutless). Moderately late maturing (like Amidon). Tolerant to Far-go. Resistant to prevalent races of leaf & stem rust. Yield slightly less than Amidon, but greater than Lew, Fortuna and Cutless. High protein and test weight, greater than Amidon. Quality = 4.5.

Fortuna (ND): Beardless, tall. Very good sawfly resistance. Early maturing. Tolerant to Fargo. Very susceptible to septoria. Medium to low yield. Somewhat susceptible to shattering. High test weight and protein. Quality = 4.5.

Glenman (MSU, 1985): Beardless semidwarf, poor lodging resistance, (weak straw for a semidwarf). Sawfly resistance has been very good in Triangle area tests (better than Amidon & Rambo), but the variety tends to produce some hollow stems under certain conditions, especially at Bozeman. Thus, it is rated "moderately" resistant (27% less solid than Fortuna). Medium-late maturity. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). High yield; higher than Lew most years, and about equal to Rambo. Hard to thresh. Low test weight and protein (1% < Lew, 2% < Fortuna). Quality = 2 (poor).

Lancer (Sask. Canada): Beardless. Tall; tangled lodging mess due to weak straw. Fairly good sawfly resistance. Among lowest yielders and seldom a protein advantage over Lew and Fortuna. Test weight medium-low.

Leader (Canada): Tall. Fairly good sawfly resistance. Among lowest yielders. Seldom a protein advantage over Lew and Fortuna.

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

Rambo, Westbred (WPB, 1986): Bearded. Semidwarf; short stiff straw, but medium lodging resistance. Partial sawfly resistance (36% less solid than Fortuna). Threshes easily. Some tolerance to dryland root rot. May have more tolerance to septoria than Fortuna, but is still moderately susceptible. High yield, similar to Glenman. Test weight high. Medium-low protein similar to Glenman, but 1% lower than Lew and 2% lower than Fortuna.

Scholar (MT9433; MSU, 1999): Medium tall, but slightly shorter than Fortuna, 1 inch shorter than Amidon. Partial resistance to sawfly (semi-solid stem), slightly better than Amidon and equal to Rambo and Conan. Maturity medium-late, like McNeal. Good yield, agronomics and quality. Intended to replace Amidon. Marberg is in the parentage, which had a high tolerance to dryland root rot. It is not yet known if this tolerance has been transferred to Scholar.

Shoofly (private var.): Bearded semidwarf with short stiff straw. Slightly shorter than Rambo, thus may be a little too short for dryland. Good stem solidness. Severe physiological leaf spotting in 1995.

Tioga (ND): Beardless. Tall; susceptible to lodging. Good sawfly resistance. Septoria tolerant. Low yield. Good shatter resistance. Medium test weight, high protein.

#### **Hollow-Stem, Sawfly Susceptible Hard Red Spr Wheat Varieties**

Alex (ND, 1981): Beardless tall; medium lodging. Medium-late mat. Good shatter resistance. Good test weight and medium-high protein. Quality = 3.

Barrie (Canada): Height and lodging resistance medium. Good test weight and high protein at Conrad 1997, but reportedly low elsewhere.

Bergen (Agripro, 1991): Bearded semidwarf for Minnesota. Stiff straw, good lodging resistance. Medium-late maturity. Tends to shatter. Tolerant to Septoria. Medium test weight, medium-low protein. Quality = 2.

Bronze Chief (GP Seed & Research Inc, 1985): Bearded semidwarf. Very low yield and tough threshability. Very high protein. Used in specialty milling market at Three Forks, MT.

Butte 86 (ND): Bearded. Medium tall, medium straw strength. Early maturity. Septoria susceptible. Low yield. Medium test weight, med-high protein. Quality = 3.

Copper (Idaho): Bearded semidwarf. Straw weaker than Pondera and 906R. Late maturity. Intended to replace McKay (higher quality) in Idaho, but acreage was less than expected. Test weight and protein is 1% less than Pondera.

Dalen (Agripro, 1991): Bearded semidwarf; stiff straw. Medium early maturity. Tolerant to Far-go. Shatter susceptible. Protein medium to low. Quality = 2.

Express, Westbred (WPB, 1991): Bearded semidwarf with very strong straw. Medium maturity. Reported to be tolerant to Avenge herbicide, but very susceptible to FarGo. Resistant to Septoria. Among highest yielders when tested at Conrad 1993. Medium protein, similar to Glenman. Quality = 4.

Fergus, Westbred (WPB, TR983239): Red chaff. Bearded semidwarf. Good straw strength, same height as Newana. Medium early maturity, 4 days earlier than Newana and 3 days earlier than McNeal. Similar to WB926, but is shatter resistant, and susceptible to dryland root rot. Slightly susceptible to Fargo. Moderate resistance to stripe & stem rust. More suited for dryland (while 936 is better for irrigated). Protein slightly less than McNeal, but 1% higher than Newana. Quality = 4.

Field (Agripro): Short stiff straw. Medium maturity. Medium yield. Low test weight and protein.

Glupro (ND, 1995): Bearded. Tall, weak straw. Late maturity. Medium protein. Quality = 4. Not tested at Conrad.

Grandin (ND, 1989): Bearded semidwarf; good lodging resistance. Maturity similar to Pondera (medium-early). Moderately susceptible to leaf spot. Yields less than Pondera and Hi-Line. Medium high protein. Quality = 5. To replace Stoa in North Dakota.

Gus (ND, 1989): Bearded semidwarf for high yield areas of Eastern Montana. Good lodging resistance. Medium-late maturity (like Newana). Susceptible to leaf rust. Lower yield than Pondera and Hi-Line. Very high protein. Quality = 5.

Hamer (Agripro, 1995): Bearded. Semidwarf; strong straw. Med-late maturity. Test wt & protein are medium. Quality = 2.

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

Kamut (T. polonicum 4x): Polish wheat: about like durum; seeds larger than durum. 4 to 6" taller than Fortuna, too tall for irrigation. Four days later to mature than Pondera. Claimed to have non-allergenic gluten. 1% more protein than Pondera. For pasta & cereal products.

Keene (ND): Possible replacement for Amidon in North Dakota.

Kodiak Dwarf (GP Seed & Research Inc): Triple Dwarf (10" shorter than Newana; 18" shorter than Fortuna. Very low yield.

Krona (Agripro, 1991): Bearded Semidwarf. Strong straw, good lodging resistance. Late maturity. Moderate resistance to Septoria. High yield, low protein. Quality = 2.



Kulm (ND, 1994): Bearded. Med-tall, good straw strength. Early maturing. Fairly high protein. Quality = 4. Intended to replace Butte-86 in N Dakota in areas where early maturity is desired.

Lars (Agripro, 1995): Bearded semidwarf. Short stiff straw. Med-late maturity. High yield under good growing conditions. Low protein.

Len (ND, 1979): Bearded semidwarf. Straw not as stiff as Newana. Medium maturity. Tolerant to septoria. Yields similar to Pondera and Hi-Line. Good shatter resistance. Good test weight. High protein, but slightly less than Hi-Line & Pondera. Quality = 5.

Marshall (Minn): Bearded semidwarf; good lodging resistance. High yield and test weight on irrigated. Low protein. Irrigation only.

McKay (Idaho): Bearded semidwarf. Very late maturing. High yield if water lasts, otherwise low yield. Lower quality than Copper.

McNeal (MT8849, MSU, 1994): Red chaffed. Bearded semidwarf but slightly taller and more uniform height than Hiline. Good lodging resistance, but lodged more than Hiline in the high rainfall year of 1995. Medium maturity, slightly earlier than Newana and slightly later than Hiline. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Some tolerance to dryland root rot. Higher yield than Hiline. Not as tough to thresh as Pondera and Glenman, but may have a tendency toward toughness. Test weight about equal to Newana & Hiline, but 1#/bu less than Pondera. Very good quality with high protein and loaf volume. Quality = 4.

Minnproe (Minn) - Bearded semidwarf. Short, stiff straw. Medium maturity. Low test weight; medium protein.

Minto (Can, 1991) - Beardless. Tall; weak straw. Med-late maturity. Low test weight, medium protein.

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

Nomad Westbred (WPB): Beardless semidwarf, good lodging resistance. Medium-early maturity, medium test weight (but higher than Glenman), medium protein.

Norak (NAPB).

Nordic: Tall-semidwarf; straw and protein are marginal for high yield, irrigation areas.

Norlander (Agripro, 1995): Bearded semidwarf. Medium strong straw. Early maturing. Intended for eastern Montana. High yield under good conditions. Medium protein. Quality = 2.

Olaf (ND): Bearded semidwarf. Medium lodging. Septoria leaf blotch tolerant. Medium-low yield. Medium to low shatter resistance. Medium high protein, but most of it is concentrated in the bran, resulting in low flour protein.

Pioneer 2369 (ND, 1993): Bearded semidwarf, good lodging resistance. High yield and test weight on irrigated. Protein medium. (All pioneer materials turned over to NDSU).

Pioneer 2371 (ND, 1991): Bearded semidwarf, strong straw. Medium maturity. Medium protein. Quality = 3.

Pioneer 2370 (ND, 1990): Bearded semidwarf, strong straw. Medium maturity. Medium protein. Quality = 2.5.

Pioneer 2375 (ND, 1990): Bearded semidwarf, medium straw strength. Med-early maturity. Medium yield on dryland, high on irrigated. Medium to high protein, depending on level of N fertilizer. Protein response to fertilizer was higher

than for other varieties in 1995. Quality = 2.5.

Pioneer 2398 (ND, 1995): Bearded semidwarf with shorter and stronger straw than 2375. Medium late maturity (similar to Amidon). Low protein. Quality = 2.

Pondera (MSU): Bearded semidwarf with good lodging resistance. Medium-early maturity, 3 days earlier than Newana. Sawfly susceptible. Tolerant to septoria. Good on irrigation or dryland. High yield and test weight. Higher protein than Newana. Replaced by Hi-Line on recommended list.

Prospect (SD): Bearded semidwarf. Medium lodging. Medium maturity. Low yield. High test weight and protein.

Probrand 751 (NK): Bearded semidwarf. Short stiff straw. High yield on irrigated. For irrigation only. Good shatter resistance. Low test weight and protein.

Russ (SD, 1995): Bearded tall; weak straw. Medium maturity. Medium protein.

Sonja (Agripro, 1992): Bearded semidwarf; short strong straw and very good lodging resistance. Medium late maturity. Good leaf disease resistance, but very susceptible to Fusarium head blight. High yield under irrigated conditions. Protein is medium.

Stoa (ND, 1984): Bearded med-tall height; medium straw strength. Med-late maturity; later to mature than Pondera and Grandin. Poor yield in triangle area. Lew and Pondera compete with it quite well in Triangle area. To be replaced in ND by Grandin. Medium protein. Quality = 3.

Success (Cenex): Semidwarf with medium lodging resistance. Late maturity. Medium high yield with irrigation. Low test weight and protein.

Teal (Sask Can, 1991): Beardless tall. Medium straw strength. Med-late maturity. High protein.

Telemark (Agripro): Semidwarf with short stiff straw. Medium early maturity. Good yield with irrigation. Good protein.

Thatcher: Beardless tall. Very low yield. Used as quality check.

Trenton (ND673; ND, 1995): Bearded tall. Medium straw strength. Hollow stem, sawfly susceptible. Med-late maturity. High protein. Quality = 2.5.

Vance (Minn): Bearded semidwarf. Medium test weight, low protein.

Vandal (Idaho): For irrigated only.

Wampum (Minn): Bearded semidwarf. Very susceptible to rust. Very high yield on irrigated. Low protein.

Westbred - See also Border, Express, Fergus, Nomad, Rambo.

Westbred 926R (WPB, 1987): Bearded semidwarf. Good straw strength; 2 inches shorter than Newana, and 4 inches shorter than McNeal. Earlier maturity than Newana, 4 days earlier than McNeal. Susceptible to Avenge herbicide; good tolerance to FarGo. Has some resistance to Washington race of Hessian fly. Fairly good tolerance to dryland root rot. Among highest yielders. Tendency to shatter. Test weight similar to McNeal and slightly less than Newana. Protein higher than Newana and similar to McNeal. See also Fergus & WB-936. Quality = 4.5.

Westbred 936 (WPB): Bearded semidwarf for irrigated only. 936 is stiffer strawed than 926; 3 inches shorter than Newana and 5 inches shorter than McNeal. Four days earlier than Newana, 3 days earlier than McNeal. Reportedly tolerant to Avenge herbicide; fairly good tolerance to FarGo. Does not have Hessian fly or dryland root rot resistance,

thus 926 is preferred in those areas. More susceptible to dryland root rot than 926 and Fergus (although IMZ helps to control root rot). Moderate resistance to stem rust, resistant to stripe rust. Susceptible to leaf rust and Septoria. Shatter resistant. Possible replacement for 906 and 926. Superior to 906 and 926 as an irrigated variety. (Tested as ph986-61 in 1992). Has low test weight on dryland. Protein appears good, 1.5% higher than Newana and 0.4% higher than McNeal. Quality = 4.

Wheaton (Minn): Bearded semidwarf. Short stiff straw, good lodging resistance. High yield with irrigation. Good shatter resistance. Low test weight and protein.

### *Hard White Spring Wheat*

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

Argent (ND, 1998): Hard white. No Montana data.

Genesis (Canada): Hard white. No Montana data.

Golden 86 (GP Seed & Research Inc, 1986): Used by a commercial milling and baking firm north of Three Forks, Montana. A high quality hard white for specialty markets. Yielded more than Klasic, but less than Tanager (1 year), and 1.5 to 2% higher protein than Tanager and Klasic.

HY 413 (Agripro/AgCan): Hard white. Some stem solidness, but not a lot. May have quality problems.

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

Klasic (NK): Hard white. Bearded semidwarf. Very short straw. Adapted to California. Not well adapted to Triangle area: low yield & protein.

MTHW 9420 (MSU, 1999): Experimental for exclusive release. Agronomically similar to Hiline. Quality excellent for bread market, but too high in protein for noodle market.

Tanager "S" (CIMMYT): Hard white. Very high yield (steep BYX).

### *Soft White Spr Wheat*

Reed, AC (Alberta, Can.): Soft white. Good lodging resistance. Two days earlier maturity than Fielder. Resistant to prevalent races of stripe rust. Higher yield than Fielder. Moderate shatter resistance. Higher milling & baking quality than Fielder. Adapted to irrigated regions of southern Alberta.

Fielder: Soft white. Bearded semidwarf, stiffer straw than Fieldwin. Highly susceptible to stripe rust and can lose 40% yield.

Owens (Idaho/Oregon): Soft white. Bearded semidwarf. Med-late maturity, earlier than Waverly and Treasure, but still may be too late for dryland in most years. Stripe rust resistant. Medium test weight.

Penawawa (Wash/Oregon): Soft white. Bearded semidwarf; shorter and stiffer straw than Owens. Later to mature than Owens. Lower test weight than Owens. Replacement for Owens?.

Sprite (WPB): Soft white.

SWS-52 (Canada): Soft white. Much better lodging resistance than Owens, but 5-6 days later than Owens and Fielder. Resistant to stripe rust (like Owens).

Treasure: Soft white. Bearded semidwarf. Late maturing. Yields higher than Owens on irrigated; and also on dryland in years of favorable moisture.

Vanna (WPB, 1994): Soft white. Bearded semidwarf; good straw strength; one inch taller than Penawawa, same height as Owens. Two days later maturing than Owens and Penawawa, but has reasonable tolerance to dryland conditions. Stripe rust resistant. Higher yield than Owens. Yield and test wt similar to Penawawa. About 1% lower protein than Penawawa.

Waverly: Soft white. Bearded semidwarf. Late maturing.

### *Durum*

Durum quality scale: 4 = good; 3 = average; 2 = poor; 1 = very poor. Quality durum has strong gluten. Growers who plan to grow weak-gluten varieties need to have a marketing organization identified that will purchase those varieties. Cool-climate areas are traditionally the good quality durum areas, as durum kernels tend to get flinty in hot areas. However, current research is underway to determine if new higher quality varieties can do well enough in hot areas. 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 90 to 110 lbs per acre) has normally been a good seeding rate for durum. Test weight can go below market standards at higher seeding rates.

Belzer (ND): Medium-tall, 4 inches taller than Laker. moderate suscept to lodging. Late maturity. Large kernels, medium protein. Quality = 4.

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

Cando (ND, 1975): Short semidwarf, shorter than McNeal spring wheat. Very high lodging resistance. Med-late maturity. For irrigation or favorable moisture. Not suited for dry conditions. Septoria susceptible. High yield and good shatter resistance. Medium maturity. Small kernel size and medium test weight. Weak gluten; quality = 2.

Cortez (WPB): Short stiff straw. Early maturity. Medium kernel size, high protein.

Coulter (Canada): Black-bearded, but blackness disappears upon ripening.

Crosby (ND, 1973): Tall. Medium lodging resistance on dryland. Medium maturity. Good shatter resistance. Test weight medium to high. Quality = 2.

Dressler (Agripro): Medium-tall, moderate suscept to lodging. Medium maturity. Good test weight and large kernel size. High protein. Quality = 4.

Durfort (Private, Rx.T.): Very short semidwarf, shorter than Lloyd or Kronos. Good yield. Quality unknown.

Fjord (Agripro, 1986): Tall. Good lodging resistance. Susceptible to Septoria. Medium yield.

Golden Ball (Canada): Black-bearded. An old variety; seed may be hard to find. for wheat weaving.

Kronos (Private): Short semidwarf, shorter than McNeal spring wheat. Severe leaf spotting, apparently due to sensitivity to chloride deficiency. Quality unknown.

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

Laker, Westbred (WPB, 1985): Tall-semidwarf, midway between standard height and semidwarf. Better height choice for all around production, not as short as Lloyd and Cando. Stiff straw, medium lodging resistance. Medium maturity. Often had leaf-spot diseases while other entries did not. High yield. High test weight, medium kernel size. Protein medium. Strong gluten; quality = 3.

Lloyd (ND, 1983): Short semidwarf, shorter than McNeal spring wheat. Stiff straw; very high lodging resistance. Too short for dry conditions. For irrigation or favorable moisture. Too short for dry conditions. Medium maturity. Susceptible to Septoria. High yield and good shatter resistance. Test weight is medium low. Medium kernel size, low protein. Strong gluten; quality = 3.

Medora (Manitoba Can, 1983): Tall, with poor lodging resistance. Dryland only, medium maturity. Good yield on dryland, better than Monroe. Test weight medium to high. Very large kernel size, high protein. Strong gluten; quality = 4.

Melita (Canada): Tall straw, moderately susceptible to lodging. Large kernels, medium protein. Quality = 4.

Monroe (ND, 1985): Tall, medium lodging resistance for dryland. Early maturity, dryland only. Medium test weight, large kernel size. Medium high protein. Strong gluten; quality = 4.

Munich (ND, 1995): Medium-tall, slightly taller than Laker. Strong straw. Med-late maturity. Higher yield than Renville, Sceptre and Medora. Medium kernel size and protein. Strong gluten; quality = 4.

Pelissier (Canada): Black-bearded. Wheat weaving.

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

Regold, Westbred (WPB): (Originally named Regal). Tall straw, susceptible to lodging. For dryland areas of Montana and North Dakota. Resistant to Septoria and most races of leaf & stem rust. Medium yield and test weight. Med-low protein. Good semolina color and strong gluten.

Renville (ND, 1988): Medium-tall, lodges bad; thus, even though it yields good on irrigation, its weak straw renders it unsuitable for irrigation. Has a niche in the low yield/low rainfall areas. Med-late maturity, one day later than Vic. Medium test weight, kernel size and protein. Strong gluten; quality = 4.

Rolette (ND): Tall, but good lodging resistance. Early maturing. Susceptible to leaf spot diseases. Low yield. Good shatter resistance and test weight. Good quality.

Rugby (ND, 1973): Tall, weak straw. Medium maturity. Moderately susceptible to septoria. Good shatter resistance. Medium test weight and kernel size. Weak gluten, poor quality (2).

Sceptre (Sask. Can): Tall to medium height, but fairly stiff straw. Taller than Laker, but shorter than Medora and other standard height varieties. Medium maturity. Susceptible to leaf rust. High yield. Strong gluten; quality = 4. Ben is a similar choice.

Stockholm (Agripro): Short semidwarf (like Lloyd and Cando); very stiff straw. Medium-early maturity. High yield (Similar to Lloyd, and higher than Fjord). Protein medium to low. Quality = 3.

Utopia (Private, General Mills, 1997): 933, DU2. Short semidwarf, shorter than McNeal spring wheat. Stiff straw. Early maturity. High yield. Grown under contract with General Mills.

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

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

Ward (ND, 1972): Tall, with only fair lodging resistance for dryland. Medium maturity. Tolerant to septoria. Test weight medium. Good shatter resistance. Weak gluten; quality = 2.

### *Spring Triticale*

Test weight of triticale = approximately 50 lbs/bu. Proteins were less than Newana wheat, but slightly higher than barley. Triticale seeding rate should be 20% higher than wheat.

Assume that all triticales have a potential ergot problem!

Carman (Canada): Shorter straw than Welsh triticale, but still tall. Early maturing (similar to Newana wheat in maturity) by triticale standards. Among the best choices for dryland. High protein.

Juan (Calif): Too late to mature, resulting in low yield & T.W. some yrs.

Karl (N. Dakota): A semidwarf; thus, easier to manage than taller & later varieties (similar height as Newana wheat). Early maturing (similar to Newana wheat in maturity) by triticale standards. Among the best choices for dryland. High yield & protein.

Kramer (N. Dakota): A semidwarf, but slightly taller than Newana wheat and Karl triticale. Kramer is medium height, while Karl and Newana are short. Very early maturity by triticale standards. Good yield.

Marval (S. Dak): Medium maturity. Low yield on dryland in some years.

T-54, T-59, T-61 (Saskatchewan): Very late maturity. Look like wheat, and have test weights nearly equal to wheat.

Wapiti (Canada): Tall weak straw. Late maturity. High yield. To replace Carman and Welsh.

Welsh (Canada): Late maturing, may be discontinued.

Whitman (Wash): Too late to mature, resulting in low yield & test weight in some years.

#### Relative maturities and heights for triticale:

Newana wheat	very early	short
Kramer	very early	med short
Carman	early	med. tall
Karl	early	short
Marval	medium	very tall
Welsh	medium late	tall

Beagle	late	tall
Wapiti	late	med. tall
Sunland	very late	med. tall
T-54	very late	tall
T-61	very late	tall
Juan	extreme late	tall
Whitman	extreme late	tall

### *Winter Triticale*

Decade (Canada): Shorter than most other winter triticales, but still as tall as some of the taller winter wheats; earlier and higher yield and shorter strawed than Winteri. Thus Decade may be the better choice. May have a head snap problem.

Flora: Short strawed (like Rocky w.wht.) and good yield, but had very low test weight. Survived winter of 1989 OK, but winterhardiness is questionable. Straw breakage observed in 1988.

Grace: Poor winterhardiness (May be a spring type). Stem-breakage and crinkle-joint.

Winteri (Canada): Very tall and late maturing.

VTO numbers from 1988: winter types according to WSU.

Table 6

**Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 1998. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	Head date	% protein
MCNEAL	76.6	61.7	38	177	9.8
MT 9748	73.9	62.7	37	176	9.7
MT 9742	73.8	62.5	37	176	9.8
BR 2306	73.4	60.5	39	175	9.8
MT 9755	72.9	62.1	34	174	9.6
MT 9675	72.5	59.7	37	180	9.6
HI-LINE	72.4	62.5	34	175	9.6
MT 9715	72.3	62.0	35	176	9.7
MT 9712	72.0	63.3	38	176	9.7
NEWANA	71.4	60.7	35	180	9.6
MT 9735	71.3	61.2	36	181	9.6
MT 9706	71.1	62.8	41	177	9.9
MT 9739	70.7	62.5	43	177	9.6
BZ987331	70.4	61.2	35	174	9.8
BZ991408	70.2	63.3	35	173	9.9
MT 9750	70.0	59.0	34	175	9.7
MT 9709	70.0	62.7	42	181	9.7
MT 9720	69.7	62.8	34	177	9.7
MT 9728	69.7	63.6	33	176	9.6
MT 9754	68.9	60.5	32	177	9.6
MT 9759	68.8	60.5	35	177	9.5
MT 9704	68.7	62.1	35	180	9.6
SCHOLAR (MT 9433) *	68.6	62.4	42	181	9.9
MT 9758	68.3	60.3	44	180	9.9
MT 9756	68.3	61.2	43	180	9.8
MT 9627	68.2	61.9	34	177	9.7
MT 9539	68.1	62.0	37	176	9.8
MT 9771	67.9	60.9	44	179	9.7
MT 9719	67.8	64.2	35	176	9.7
MT 9736	67.7	60.7	34	175	9.5

*(Continued on next page)*



*(Advanced Yield Spring Wheat, continued)*

Variety		Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	Head date	% protein
MT 9653		67.5	62.5	45	180	9.9
MT 9738		67.5	60.4	44	180	9.9
WESTBRED 926		67.2	60.7	34	174	9.7
LEN		67.2	61.3	36	177	9.9
MT 9609		66.8	61.1	44	177	9.7
MT 9727		66.7	62.5	34	180	9.6
AMIDON	*	66.5	60.7	40	179	9.7
MT 9772		66.1	61.4	43	179	9.7
ERNEST	*	65.5	62.8	42	177	9.7
MT 9716		65.4	61.7	40	179	9.9
MT 9757		64.9	60.8	44	180	9.9
MT 9558		64.8	61.4	35	180	9.7
GRANDIN		64.1	61.7	38	175	9.8
MT 9770		63.7	62.8	42	176	9.8
MT 9721		63.5	59.8	36	177	10.0
LEW	*	62.3	63.1	44	180	9.8
FORTUNA	*	62.0	63.3	43	177	9.6
MT 9631		56.5	61.7	42	178	9.6
THATCHER		55.7	59.6	48	181	9.6

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N-UREA actual  
 topdressed before seeding.

Previous crop: Fallow.

Date seeded: April 21, 1998.

Date harvested: August 19, 1998.

Rainfall: From seeding to harvest was 8.54 inches.

\* = Sawfly resistant varieties. (Amidon and Scholar have  
 partial resistance) (Also, most of the experimental lines  
 have resistance)

Yield experimental mean: 68.14

Error degrees of freedom: 96.00

F test for var: 2.76

C.V. 2: 3.58

LSD (0.05): 6.85

Table 7

**Advanced Yield Dryland Spring Wheat variety trial grown north of Conrad, 1998. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**  
*( Abbreviated list )*

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	Head date	% protein
MCNEAL	76.6	61.7	38	177	9.8
HI-LINE	72.4	62.5	34	175	9.6
NEWANA	71.4	60.7	35	180	9.6
SCHOLAR (MT 9433) *	68.6	62.4	42	181	9.9
WESTBRED 926	67.2	60.7	34	174	9.7
LEN	67.2	61.3	36	177	9.9
AMIDON *	66.5	60.7	40	179	9.7
ERNEST *	65.5	62.8	42	177	9.7
GRANDIN	64.1	61.7	38	175	9.8
LEW *	62.3	63.1	44	180	9.8
FORTUNA *	62.0	63.3	43	177	9.6
THATCHER	55.7	59.6	48	181	9.6

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N-UREA actual  
 topdressed before seeding.

Previous crop: Fallow.

Date seeded: April 21, 1998.

Date harvested: August 19, 1998.

Rainfall: From seeding to harvest was 8.54 inches.

\* = Sawfly resistant varieties. (Amidon and Scholar have partial resistance)

Yield experimental mean: 68.14

Error degrees of freedom: 96.00

F test for var: 2.76

C.V. 2: 3.58

LSD (0.05): 6.85

Table 8 **Five-year summary for dryland Spring Wheat varieties grown near Conrad, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

Variety	5 - year comparable average				
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
MCNEAL	67.0	60.0	33.8	185	12.4
WESTBRED 926	65.9	60.4	31.8	181	12.2
NEWANA	65.5	59.3	31.9	187	11.8
SCHOLAR (MT 9433) *	62.9	60.7	38.9	186	12.7
HI-LINE	62.5	61.7	31.1	183	12.4
ERNEST *	61.6	61.5	39.1	184	12.8
LEN	60.5	60.2	32.9	185	12.8
FORTUNA *	60.4	62.1	41.1	184	12.5
AMIDON *	60.1	60.1	39.0	186	12.2
LEW *	60.0	61.7	41.2	187	12.2
THATCHER	54.7	59.2	43.1	187	12.3

Cooperator: Western Triangle Agricultural Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 \* = Sawfly resistant varieties. (Amidon and Scholar have partial resistance.)

Table 9                      **Irrigated Spring Wheat variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station. Western Triangle Ag. Research Center, Conrad, Montana.**

Variety	Yield bu/ac.	Test wt. lbs/bu.	Plant hgt. inches	Head date	% protein
WESTBRED EXPRESS	82.3	59.1	32	180	13.2
GRANDIN	80.6	60.2	38	177	13.7
WESTBRED 936	80.0	59.0	33	174	14.3
PIONEER 2375	78.7	61.4	38	175	14.3
MTHW9420 (Hard white)	77.8	57.9	36	175	13.5
MCNEAL	77.4	60.3	37	179	13.7
NEWANA	76.6	58.6	36	182	12.2
WESTBRED 926	76.1	58.1	35	175	14.3
MT 9609	76.0	59.8	42	176	13.6
HI-LINE	75.9	60.5	35	175	13.6
AMIDON *	72.8	59.5	43	180	13.9
GLENMAN *	72.7	60.4	35	180	12.8
FERGUS	71.9	59.3	35	174	14.1
SCHOLAR (MT 9433) *	70.0	60.3	42	181	14.3
RAMBO *	70.0	59.5	35	180	13.2
LEN	69.8	59.8	37	178	13.9
ERNEST *	68.9	60.9	44	178	14.6
TRENTON	67.7	60.0	47	180	13.4
STOA	64.2	57.3	44	177	15.3
FORTUNA *	59.1	61.4	40	180	13.9
LEW *	58.7	60.5	44	182	14.1

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 90# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: April 21, 1998.  
 Date harvested: August 13, 1998.  
 Moisture rate: Rainfall from seeding to harvest was 8.54 inches.  
 \* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)  
 Yield experimental mean: 72.72  
 Error degrees of freedom: 40  
 F test for var: 4.15  
 C.V. 2: 4.42  
 LSD (0.05): 9.19

Table 10 Five-year summary for Irrigated Spring Wheat varieties grown north of Conrad, MT. 1993 - 1994 - 1995 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average				
	Yield bu/ac	Test wt lbs/bu	Plant hgt. inches	Head date	% Protein
WESTBRED 936	79.0	60.9	30.9	181	12.0
WESTBRED EXPRESS	78.5	61.2	30.2	184	11.5
FERGUS	76.3	61.3	33.6	181	11.9
GLENMAN *	74.2	61.8	35.8	186	10.9
MCNEAL	74.0	61.5	35.0	186	11.8
NEWANA	72.8	60.8	34.1	188	11.0
HI-LINE	71.8	62.2	33.1	183	12.1
WESTBRED 926	71.3	60.9	32.6	181	12.3
RAMBO *	71.2	59.0	32.9	187	11.1
GRANDIN	70.4	61.8	36.4	183	12.5
PIONEER 2375	69.8	62.3	36.0	181	12.2
AMIDON *	69.4	60.6	40.7	185	12.2
ERNEST *	64.4	61.5	41.4	183	13.1
SCHOLAR (MT 9433)	64.2	61.7	40.4	185	12.2
LEN	64.1	60.9	33.9	184	12.7
FORTUNA *	61.8	62.6	41.2	185	12.2
LEW *	60.7	62.4	43.2	187	11.9
STOA	60.3	60.0	39.8	184	12.5
TRENTON	60.1	61.4	44.7	184	12.0

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT (Pondera County)

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)



Table 12 **Dryland Spring Wheat variety trial grown near Cut Bank, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
MTHW9420 (Hard white)	63.2	61.5	35	8.8
GLENMAN *	62.9	62.2	35	9.5
LEN	62.1	61.7	37	10.8
HI-LINE	61.9	62.7	34	10.0
MT 9609	61.5	62.4	41	10.2
RAMBO *	60.0	62.0	33	10.1
WESTBRED EXPRESS	59.7	62.3	30	9.6
PIONEER 2375	59.4	62.8	39	10.1
MCNEAL	58.6	61.0	34	10.5
WESTBRED 936	58.4	61.5	31	10.2
FERGUS	58.2	62.2	33	9.7
GRANDIN	58.1	61.5	37	10.7
WESTBRED 926	58.0	61.0	35	10.1
STOA	57.4	62.9	44	10.3
NEWANA	56.8	60.2	32	9.6
SCHOLAR (MT 9433) *	55.1	61.9	43	10.5
AMIDON *	54.5	61.9	45	10.3
ERNEST *	51.8	63.6	43	10.6
FORTUNA *	49.7	62.9	43	9.8
TRENTON	49.5	61.8	47	10.8
LEW *	47.6	62.9	43	9.8

Cooperator: Kevin Bradley.

Location: Fifteen miles north of Cut Bank. (Glacier County)

Fertilizer: 50 # N topdressed & 100# 11-52-0 with the seed.

Previous crop: No-till chemical fallow. (wheat stubble)

Date seeded: April 20, 1998.

Date harvested: August 17, 1998.

Rainfall: 6.5 inches from May 12 to harvest.

\* = Sawfly resistant varieties. (Amidon, Rambo, and Scholar have partial resistance.)

Yield experimental mean: 57.34

Error degrees of freedom: 40

F test for var: 10.95

C.V. 2: 2.38

LSD (0.05): 3.9

Table 13 **Five-year summary for dryland Spring Wheat varieties grown near Cut Bank, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

-----					
5 - year comparable average					
-----					
Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
-----					
GLENMAN	*	45.6	60.0	32.2	10.1
FERGUS		44.9	60.0	30.4	11.5
MCNEAL		44.7	59.6	31.8	11.4
PIONEER 2375		43.9	61.0	34.8	11.0
WESTBRED 936		43.8	59.6	28.4	10.5
WESTBRED EXPRESS		43.2	60.3	26.2	11.1
HI-LINE		43.1	60.5	29.6	11.0
GRANDIN		43.0	59.3	33.2	11.6
LEN		42.9	59.5	32.0	11.7
AMIDON	*	42.8	59.5	38.8	11.0
STOA		42.4	60.7	36.6	11.3
FORTUNA	*	42.2	61.1	37.2	10.7
NEWANA		41.6	59.3	29.8	10.7
RAMBO	*	41.8	59.5	29.0	10.9
SCHOLAR (MT 9433)*		41.3	60.5	37.2	12.1
WESTBRED 926		41.3	59.0	30.2	11.5
LEW	*	41.2	60.3	37.0	10.8
TRENTON		39.5	59.9	39.4	11.3
ERNEST	*	39.1	60.6	36.8	11.6
-----					

Cooperator: Kevin Bradley.

Location: Fifteen miles north of Cut Bank. (Glacier County)

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)



Table 14      **Spring wheat variety & nitrogen rate comparisons,  
Cut Bank, 1998. Mont. Agr. Expt. Sta., Western  
Triangle Ag. Research Center, Conrad, MT.**

Variety	Nitrogen fertilizer rate	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
GLENMAN	61	62.9	62.2	35	9.5
GLENMAN	11	46.6	61.8		7.1
LEN	61	62.1	61.7	37	10.8
LEN	11	30.3	61.8		8.6
MT 9609	61	61.5	62.4	41	10.2
MT 9609	11	42.2	61.8		7.2
WB EXPRESS	61	59.7	62.3	30	9.6
WB EXPRESS	11	39.9	62.3		7.8
MCNEAL	61	58.6	61.0	34	10.5
MCNEAL	11	50.7	61.0		8.3
WB 936	61	58.4	61.5	31	10.2
WB 936	11	41.3	61.7		8.4

Cooperator: Don Bradley.

Location: Fifteen miles north of Cut Bank. (Glacier County)

Fertilizer: 50 # N topdressed & 100# 11-52-0 with the seed.

Previous crop: No-till chemical fallow. (wheat stubble)

Date seeded: April 20, 1998.

Date harvested: August 17, 1998.

Rainfall: 6.5 inches from May 12 to harvest.

Table 15                      **Dryland Spring Wheat variety trial grown near Oilmont, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% protein
MCNEAL		49.7	58.2	30	16.1
GLENMAN	*	48.3	58.6	30	14.4
HI-LINE		47.6	59.5	27	16.0
NEWANA		46.0	60.0	30	15.1
FORTUNA	*	45.8	60.0	34	14.8
MT 9609		44.7	60.0	27	15.2
RAMBO	*	44.7	61.2	27	15.7
LEW	*	44.4	59.7	35	15.4
MTHW9420 (Hard white)		43.3	59.7	24	15.1
WESTBRED EXPRESS		43.3	58.6	24	15.5
PIONEER 2375		43.1	61.3	25	15.6
WESTBRED 936		42.2	58.7	24	16.8
GRANDIN		42.0	61.2	28	16.4
SCHOLAR (MT 9433)	*	40.8	60.8	26	16.4
AMIDON	*	40.5	58.6	33	15.6
FERGUS		39.6	59.7	26	16.1
LEN		39.5	60.3	30	16.3
ERNEST	*	39.2	61.2	27	16.5
STOA		37.5	59.7	27	16.9
WESTBRED 926		37.2	58.9	24	16.9
TRENTON		36.7	61.3	28	16.5

Cooperator: Terry Alme.  
 Location: Eight miles east of Oilmont. (Toole County)  
 Fertilizer: Topdress 50# N - 30# P, and 100# 11-52-0 with seed.  
 Previous crop: Fallow.  
 Date seeded: April 14, 1998.  
 Date harvested: August 6, 1998.  
 Rainfall: From May 29 to harvest was 6.3 inches.  
 \* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Yield experimental mean: 42.67  
 Error degrees of freedom: 40  
 F test for var: 4.14  
 C.V. 2: 4.26  
 LSD (0.05): 5.2

Table 16 Five-year summary for dryland Spring Wheat varieties grown near Oilmont, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

-----				
5 - year comparable average				
Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
-----				
MCNEAL	36.5	54.4	29.2	15.7
WESTBRED 936	34.9	55.1	24.3	16.0
HI-LINE	34.5	55.0	26.6	15.8
WESTBRED EXPRESS	34.3	55.7	23.8	14.9
GLENMAN *	34.3	54.6	28.8	14.1
PIONEER 2375	33.0	56.9	28.6	14.7
GRANDIN	32.8	55.3	30.2	15.5
NEWANA	32.7	55.0	27.4	14.3
WESTBRED 926	32.6	55.4	26.6	16.2
LEW *	32.0	56.4	33.0	15.5
SCHOLAR (MT 9433) *	31.9	58.0	30.4	15.5
FORTUNA *	31.9	57.8	34.4	14.5
FERGUS	31.4	55.7	26.0	15.7
RAMBO *	31.1	56.9	27.2	15.3
ERNEST *	31.0	57.2	31.6	15.7
AMIDON *	30.9	56.7	34.4	14.9
LEN	30.0	55.2	29.8	15.4
STOA	29.5	55.1	31.0	16.0
TRENTON	28.0	56.6	33.0	15.3
-----				

Cooperator: Terry Alme.

Location: Eight miles east of Oilmont, MT. (Toole County)

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Table 17                      **Dryland Spring Wheat** variety trial grown near  
**Choteau, 1998.** Mont. Agr. Expt. Sta., Western  
 Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% protein
FERGUS	58.2	58.1	34	15.1
WESTBRED EXPRESS	54.8	59.0	28	14.1
ERNEST *	53.4	60.4	38	15.5
WESTBRED 936	52.6	56.4	29	15.8
FORTUNA *	51.5	60.5	41	14.3
PIONEER 2375	51.3	58.8	35	15.3
MTHW9420	50.5	56.5	36	14.5
GRANDIN	49.8	54.8	39	15.9
WESTBRED 926	49.4	56.2	34	15.4
MCNEAL	48.1	56.0	38	15.8
HI-LINE	46.4	56.3	36	15.2
RAMBO *	45.0	57.3	34	14.0
AMIDON *	44.8	56.6	42	15.1
MT 9609	43.6	56.2	40	16.0
GLENMAN	42.8	54.9	38	15.0
TRENTON	42.8	56.9	43	15.9
STOA	42.6	55.6	44	16.2
SCHOLAR (MT 9433) *	42.1	57.0	38	16.7
LEW *	42.1	59.8	43	15.6
NEWANA	42.0	57.0	35	14.1
LEN	41.0	55.3	37	15.9

Cooperator: Roy Inbody.

Location: Twelve miles northeast of Choteau. (Teton County)

Fertilizer: 100 # 11-52-0 with the seed, + 60 #N actual 34-0-0.

Previous crop: Fallow.

Date seeded: April 20, 1998.

Date harvested: August 10, 1998.

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Yield experimental mean: 47.37

Error degrees of freedom: 40

F test for var: 1.76

C.V. 2: 7.98

LSD (0.05): 10.81

Table 18 **Five-year summary for dryland Spring Wheat varieties grown near Choteau, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

-----				
5 - year comparable average				
Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
-----				
FERGUS	53.2	58.6	30.6	14.3
MCNEAL	52.8	56.8	32.6	14.5
WESTBRED 936	52.4	57.6	27.7	14.9
HI-LINE	52.1	59.0	30.0	14.3
NEWANA	51.8	54.6	30.2	13.6
GLENMAN *	50.7	56.1	32.2	13.7
FORTUNA *	50.3	60.3	37.8	14.7
PIONEER 2375	50.2	60.0	32.9	14.2
WESTBRED 926	50.1	57.6	29.8	14.8
RAMBO *	49.4	56.7	29.0	13.6
GRANDIN	49.3	57.7	33.4	15.0
WESTBRED EXPRESS	49.0	58.5	26.6	13.7
ERNEST *	48.3	60.5	35.8	15.2
SCHOLAR (MT 9433) *	47.5	57.1	35.7	15.2
LEN	46.5	57.4	32.8	14.8
STOA	45.8	57.7	37.0	15.1
AMIDON *	45.4	57.6	37.2	14.2
LEW *	45.0	59.1	37.8	14.5
TRENTON	44.7	58.7	38.6	15.3
-----				

Cooperator: Roy Inbody.

Location: Twelve miles northeast of Choteau, MT. (Teton County)

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Table 19      **Dryland Durum variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
LLOYD	78.8	61.5	28	181	10.9
BELZER	76.5	61.9	40	181	10.0
MUNICH	75.0	63.1	36	176	11.1
MCNEAL      (wheat)	74.3	61.8	36	176	11.1
LAKER	72.9	62.7	33	180	10.3
PLENTY	72.6	62.4	44	180	11.2
UTOPIA	72.0	63.5	29	176	11.0
RENVILLE	71.8	62.4	42	177	11.4
NPB87	71.8	61.2	28	177	11.2
KYLE	70.9	62.8	45	182	11.0
BEN	69.4	64.2	39	177	11.8
SCEPTRE	69.2	60.9	41	177	11.1
MONROE	69.0	61.9	38	173	12.5
VIC	67.8	63.7	41	175	11.1
DURFORT	66.6	60.3	28	177	11.3
CROSBY	65.1	62.6	42	176	11.9
MEDORA	63.7	63.8	40	176	11.7
PH894401	59.2	63.5	27	174	11.4
WARD	56.4	62.2	41	176	12.6

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT.      (Pondera County)  
 Fertilizer: 100# 11-51-0 with the seed, + 45# N topdressed.  
 Previous crop: Fallow  
 Date seeded: April 21, 1998.  
 Date harvested: August 19, 1998.  
 Rainfall: From seeding to harvest was 8.54 inches.  
 Yield experimental mean: 69.63  
 Error degrees of freedom: 36  
 F test for var.: 3.96  
 C.V. 2: 4.07  
 LSD (0.05): 8.12

Table 2o **Five-year summary for Dryland Durum varieties**  
grown north of **Conrad, MT.** 1993 - 1994 - 1995 - 1997 -  
1998. Mont. Agr. Expt. Station, Western Triangle  
Ag. Research Center, Conrad, MT.

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5 - year comparable average

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Variety	Yield bu/ac	Test wt lbs/bu	Plant hgt. inches	Head date	% Protein
LLOYD	64.4	58.6	28	186	11.3
LAKER	64.0	60.0	33	187	11.5
RENVILLE	62.4	60.1	39	185	12.4
SCEPTRE	62.4	60.0	37	185	12.4
KYLE	61.6	60.3	44	188	11.9
PLENTY	61.0	60.4	41	186	11.8
MONROE	56.9	60.6	38	182	12.8
MEDORA	55.1	61.1	39	184	12.5
VIC	54.8	60.7	40	185	12.1
WARD	51.6	60.6	40	184	12.4

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Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

Table 21 Irrigated Durum variety trial grown north of Conrad, 1998. Montana Agr. Experiment Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
MCNEAL (wheat)	78.6	61.0	38	179	12.2
RENVILLE	75.9	61.1	44	178	12.1
VIC	73.2	61.9	42	175	13.2
NPB87	72.6	58.4	29	181	13.0
PLENTY	72.0	59.8	46	181	13.8
MUNICH	71.4	60.7	37	180	12.9
BELZER	70.1	59.1	42	180	12.9
LAKER	69.8	60.5	33	180	12.9
KYLE	69.4	60.1	45	182	13.9
MEDORA	68.4	61.9	43	176	13.8
BEN	68.1	62.4	42	180	13.0
PH894401	67.6	62.9	30	173	13.0
DURFORT	66.4	58.0	28	181	13.1
MONROE	65.0	59.9	40	173	14.1
LLOYD	64.8	57.7	31	181	14.0
UTOPIA	64.0	60.5	30	176	13.9
SCEPTRE	63.1	57.6	41	179	14.7
CROSBY	61.3	60.5	43	179	14.1
WARD	54.6	59.1	43	180	15.3

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-51-0 with the seed, + 90# N urea topdressed.  
 Previous crop: Fallow  
 Date seeded: April 21, 1998.  
 Date harvested: August 13, 1998.  
 Moisture Data: Rainfall from seeding to harvest was 8.54 inches.  
 Yield experimental mean: 68.22  
 Error degrees of freedom: 36  
 F test for var.: 1.48  
 C.V. 2: 6.62  
 LSD (0.05): 12.96



Table 22 **Five-year summary for Irrigated Durum varieties**  
 grown north of Conrad, MT. 1993 - 1994 - 1995 - 1997 -  
 1998. Mont. Agr. Expt. Station, Western Triangle  
 Ag. Research Center, Conrad, MT.

-----					
5 - year comparable average					
Variety	Yield bu/ac	Test wt lbs/bu	Plant hgt. inches	Head date @	% Protein
-----					
LAKER	73.2	60.9	32	174	10.9
LLOYD	69.0	60.0	29	175	10.9
RENVILLE	68.7	60.8	42	184	11.1
PLENTY	68.6	61.2	42	184	11.5
VIC	67.2	61.7	39	183	11.8
SCEPTRE	66.0	59.9	37	183	11.7
KYLE	63.6	60.9	45	175	11.8
MEDORA	61.7	61.9	41	183	12.3
MONROE	60.3	61.0	40	180	12.0
WARD	59.1	61.2	40	183	12.4
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Cooperator: Western Triangle Ag. Research Center.

Location: North of Conrad, MT. (Pondera County)

@ = Head dates based on 4 years average. (1993-94-95-1998)

1998 Barley variety evaluations in the Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

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

Off-station barley variety trials were grown in Teton County near Choteau, Toole County near Oilmont, and Glacier County near Cut Bank. These three locations represent diverse environments with Choteau having deep soil and typically favorable moisture, Oilmont having less than favorable moisture, and Cut Bank with short growing season. The Cut Bank trial was no-till planted on chem-fallow. Variety trials on station at Conrad included fallow and no-till recrop, and dryland and irrigated. Data for the barley trials are presented in Tables 23 to 34, and include the 1998 data and five-year averages. Data for the no-till trial is presented in the "no-till section" of this report.

Results: Rainfall was nearly twice the normal during June and July, followed by hot dry conditions in late July and August. This weather pattern contributed to high yield but reduced kernel plump.

Baroness ranked near the top for yield at all locations. At Oilmont, Baroness was slightly down from the top yielders, which was likely due to the late maturity of Baroness coupled with moisture depletion.

Chinook ranked high at all locations, averaging 7 bu/a higher than Harrington. Harrington ranked near the bottom at all locations, averaging 11 bu/a less than Baroness over the past five years.

Merit (Busch Ag), a 2-row malt variety, was very late to mature (later than Harrington). Merit yielded less than BA1202 on dryland, but was superior to 1202 under irrigation. The late maturity and yield interaction suggest that Merit be considered for irrigated conditions only.

Stratus, a short, stiff-straw 2-row feed barley from Canada was extremely late to mature, and would normally not be suitable for dryland or short growing seasons. Stratus was the top yielder under the high moisture conditions at Conrad this year.

The MTLB lines (Lewis/Baroness) were not as consistent as Baroness across locations, but approached Baroness yield at Cut Bank, Conrad and Choteau.

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

Andre (Wash): 2-row. Was not successful.

Azure (ND, 1982): 6-row malt. Medium height, stiff straw. Medium maturity.

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

BA 1215 (Busch Ag): 2-row. Very good lodging resistance. Maturity 4 days later than Harrington. Very high irrigated yields. Tested as BA8529 prior to 1990. Discontinued due to malt quality problems.

B4311 (Busch Ag): 2-row malt. Straw strength equal to 1202, and superior to Harrington. Yield similar to 1202 and Harrington. Plump equal to, and protein slightly less than, Harrington.

BA 5133 (Busch Ag): 2-row experimental. Earlier maturity than 1202, 2 days earlier than Harrington.

BA 5648 (Busch Ag): 2-row experimental. Taller than Harrington. Later maturity than 1202, 7 days later than Harrington.

BA 2601 (Busch Ag): 6-row malt for parts of the triangle area. Erect head. Maturity later than Harrington. Very high irrigated yield.

BA 1614 (Busch Ag): 6-row experimental. Taller than 2601, shorter than Morex. Stronger strawed & higher yield than Morex. Nodding head.

Baronnesse (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 Pirolina and Gallatin; equal or slightly later maturity than Harrington; thus, may possibly rank lower for yield in dry years without irrigation. Among highest yielders when tested in favorable moisture conditions (not tested in dry years yet). Test weight is 1 lb less than Gallatin, but % plump is higher. Recommended list for irrigated and dryland.

Bearpaw (MT 81616) (MSU): 2-row feed. One day later than Clark and Hector, but slightly earlier than Harrington. Medium yield, but better than Clark and Harrington in most cases (Harrington will usually outyield Bearpaw in extremely high fertility conditions). Test weight is sometimes low on dryland, possibly due to its medium-late maturity. May sprout and skin easily. Malt tolerance is 7% skinning, thus may be difficult to manage. Has exceeded the limits in morphology of malt quality. Can "go out of condition" (germ dropped 60% in 2 years), probably due to high DP (Harrington also does this). Probably worse than Harrington for sprouting at low moisture content (ie. Bin sweat). In spite of very high malt extract, Bearpaw was dropped for consideration as a malt variety and was also dropped from the recommended list for feed.

Bellona: Dropped from recommended list, due to nonavailability of seed. Excellent lodging resistance and high yield on irrigation.

Bowman (ND, 1984): 2-row feed. Medium height; weak straw. Strictly for drought conditions. Early maturing, large seeded. Highest yielder on dryland in drought years; but in wet years, only medium to low yield. Stark is a possible alternative.

Bridge (Lethbridge Can): 2-row feed. Similar to Harrington for height and lodging resistance. Higher yield than Adee and Harrington. Good test weight and plump seed. Reportedly does well under drought conditions in Alberta. (Hector/ Pirolina/Zephyr parentage).

Chinook (MT140523) (MSU, 1995): 2-row malt with quality similar to Harrington. Medium-short straw; one to two inches shorter and 30% less lodging than Hector. Med-late maturity; one day earlier than Harrington; slightly earlier than Hector. Moderate resist to net blotch; moderate suscep to scald. Higher yield and test weight than Harrington. Recommended for dryland and irrigated.

Clark (MSU, 1981): 2-row feed. Medium height & straw strength. Medium maturity. Better yield and earlier maturity than Klages. Does not have the malt quality of Harrington. Dryland primarily.

Colter (Id/Ore/Wash): 6-row feed. Stiffer straw than Steptoe. Very low yield and test weight in Triangle area tests in 1993. Tested as ID 71966 in Western Regional (79Ab10719-66).

Columbia: 6-row feed. Short, stiff straw, and is among the best for lodging resistance. Comparable to Steptoe yield (very high).

Crest (WA, OR, ID). 2-row malt for eastern Washington & Idaho.

Conlon (ND): 2-row feed. 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.

Crystal (78AB6871) (ID): 2-row malt (AMBA for Idaho & Montana). (Klages cross). Same height and head date as Klages, but better lodging resistance. Good tolerance to Pseudomonas Kernel Blight. 5% greater yield than Klages but 2% less than Clark. Did not "store" well in Idaho (lost germination in six months), and thus was dropped from production by Coors.

Eight-Twelve (Id/Oregon): 6-row winter barley. Feed. Not adapted to winter conditions of the Triangle area.

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.

Galena (Coors): 2-row malt in Colorado. Short stiff straw. Among latest to mature at Conrad 1993. High irrigated yield. Probably will replace Moravian III & Triumph in Coors program.

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

Harrington (Sask. Can): 2-row malt. Medium height; medium weak straw, lodging resistance better than Klages. Late maturity, but earlier than Klages. Sensitive to hot dry areas; yields good in moist areas. Can sprout or germinate (internal falling number) at a lower moisture content than any other barley except perhaps Bearpaw. Sweating in the bin has been suspected of being sufficient enough to ruin the germination. Susceptible to skinning unless carefully threshed. Montana AMBA. See notes on Bearpaw.

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. (See also Westford). Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting.

Hector (Lethbridge Can., 1973): 2-row feed. Weaker strawed and slightly later to mature than Gallatin (medium maturity). High yield on dryland (similar to Gallatin); yields less than Gallatin on irrigated.

Idage (Coors): 2-row feed. Late maturing. Lower irrigated yield than Galena at Conrad 1993. May be marketed by WPE.

Karla (Idaho): 6-row feed. Tall, but fairly good lodging resistance. Medium-high yield. Low test weight on dryland. Rejected for malt.

Kimberly (Idaho): 2-row. Poor lodging resistance. Later to mature than Harrington. Slightly lower yield than Harrington in dry conditions, but slightly higher in moist conditions.

Klages (ID): 2-row malt. Late maturity; for irrigation or high rainfall only. Replaced on contracted acres by Harrington, BA 1202, etc.

Lamont (ID): 2-row feed. Rejected by AMBA. (74Ab10167).

Lewis (MSU): 2-row feed. Similar yield to Gallatin but not as stiff strawed. Higher yield than Clark and Klages. Lewis (and Gallatin) are good for both dry and wet conditions. Rejected by AMBA due to flavor.

Logan (ND, 1995): 2-row feed. Medium height & straw strength. Medium maturity.

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.

Medallion, Westbred (WPB): 6-row feed. Semidwarf with very stiff straw, but can be lodged in very high yield conditions (see WB 501, which reportedly "cannot" be lodged). Very high yield at Conrad 1993 under high rainfall conditions. Not intended for dryland as test weight may drop unless high rainfall.

Meltan (Wash): 2-row. Short stiff straw; very good lodging resistance. Late maturing irrigated type.

Menuet (Netherlands): Marketed by Cenex. 2-row feed. Short stiff straw.

Merit (Busch Ag 2B91-4947): 2-row malt. Semidwarf. Very late maturing (later than Harrington), too late for dryland.

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

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.

MTLB 5 & 6 (MSU): 2-row feed. Experimental lines from Lewis/Baronesse cross. Carry the Baronesse yield gene on chromosome 3. Maturity 1.5 days earlier than Baronesse. 10% better feed efficiency. If either line is released, it will probably be named 'Valier'.

Nancy (Wash): 2-row. Short stiff straw; very good lodging resistance. Late maturing irrigated type.

Nebula (WPB): 6-row feed. Short stiff straw. Late maturity. Low test weight.

Piroline: 2-row. Medium yield, except during drought years it yielded high relative to most varieties.

Prowashonupana (line 3) (MSU): 2-row hullless. 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 per ND AMBA list; but not Montana's. 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.

Russell (Idaho): 6-row (tested in 83-85 as ID 789009). Greater yield and plump, but less protein than Morex and Robust. Shatters; swathing advised.

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.

Sissy, Westbred (WPB): 2-row feed. Intended for irrigated/high rainfall.

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.

Stark (ND 9866, ND, 1991): 2-row feed. Medium height; weak straw. Med-late maturity. Medium to high yield. Related to Bowman; but yields higher than Bowman except in extremely dry conditions. Probably not as drought tolerant as Bowman. Birds selectively damaged this variety 2 years in a row.

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

Stratus (Can): 2-row feed. Short semidwarf, stiff straw. Very late maturing, needs long growing season (Yellowstone valley).

Targhee(78-Ab10099) (Id/Wash/Ore): 2-row feed. Two inches shorter than Hector, but straw too weak for irrigated. Lower test weight and yield than Hector.

Triumph: 2-row. Malt type in Europe, but does not fit USA malt requirements (germinates too slow). Very high yields on irrigation, but very late to mature, and thus not recommended except for "lower Yellowstone valley type" of growing season.

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. Hooded barleys are sometimes vulnerable to ergot, but the amount is slight. Caution should be taken to avoid high nitrate levels when using any small grain as a forage. Test forage for nitrate before the crop is harvested.

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

Table 23 **Dryland Intrastate Barley variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
MT960228	112.0	52.8	34	90	4	177	10.5
Stratus	111.4	50.8	30	87	4	181	10.8
MT960099	107.0	50.7	33	78	4	181	11.6
96/1114	106.2	49.4	34	91	4	177	10.9
MT940214	106.0	51.7	35	87	4	175	11.6
MTLB 2	105.6	52.5	37	91	4	176	12.4
MT950186	104.8	55.8	37	95	4	176	11.5
GS 1750	104.3	52.9	33	92	4	176	11.3
Baronesse	104.0	50.0	34	81	4	177	11.2
MT960170	103.0	46.3	38	73	5	173	9.8
MTLB 5	102.8	52.8	38	90	4	180	11.9
MT960045	102.5	51.4	32	76	4	181	12.0
MT950102	102.4	50.3	35	84	4	177	11.0
Stark	102.0	52.8	37	98	4	172	12.6
MT960226	101.6	53.9	35	89	4	175	12.0
H1851195	101.4	51.8	37	94	4	175	12.3
MT920073	100.9	52.7	34	87	4	174	11.3
MTLB 30	100.5	52.3	36	78	4	180	11.9
MTLB 6	100.4	52.7	37	90	4	175	11.9
MT960225	100.2	52.7	35	91	4	176	10.4
Gallatin	100.2	52.5	36	80	4	175	12.0
BZ594-19	100.2	51.3	33	89	4	176	12.1
MT940053	100.2	54.4	35	84	4	176	12.5
MTLB 13	99.9	52.3	35	84	4	175	12.0
MT960101	99.9	51.3	34	81	4	180	11.4
B2L20-42	99.7	48.3	40	87	4	174	12.2
B2L20-36	99.2	48.5	40	82	4	173	11.9
MT950156	98.9	48.9	35	85	4	175	12.1
MT940177	98.6	51.7	35	92	4	175	12.5
Coors C22	98.2	47.5	31	86	4	176	11.3
MT960198	98.0	50.3	34	75	5	177	12.6
MT920053	97.7	53.9	39	92	4	176	11.8
H3860224	97.5	49.9	37	80	4	176	11.8

(Continued on next page)

(Dryland Intrastate Barley, continued)

MT950155	96.9	50.0	35	81	4	175	11.6
Hector	95.7	51.8	36	84	4	176	12.3
MT960178	95.3	49.4	35	87	4	181	11.2
Logan	94.9	53.3	35	95	4	172	11.9
BCL32	94.2	46.4	43	77	4	175	12.0
MT960154	94.2	47.3	36	84	4	177	11.2
MT960222	93.9	49.2	37	73	4	177	11.7
B2L20-08	93.5	48.1	38	77	4	172	12.3
MT960082	92.6	52.3	38	87	4	177	11.7
B2L20-46	92.4	48.6	41	77	4	172	12.3
MT960104	92.3	53.5	35	92	4	175	12.0
BA 1202	91.7	46.5	35	86	4	180	11.4
BA 1614	91.7	48.8	40	87	4	176	11.6
MT960199	91.2	51.4	38	87	4	175	12.5
MT960175	89.7	47.5	40	68	5	177	12.2
Lewis	88.5	50.4	37	75	5	176	13.0
MT960140	88.2	48.9	35	82	4	177	11.6
MT960089	88.2	49.5	33	87	4	174	12.6
MTLB 57	87.8	49.3	34	71	5	175	11.6
Merit	87.1	46.7	35	85	4	177	10.9
MT960152	87.1	45.3	38	67	5	182	12.4
MT960174	85.7	45.9	36	61	5	177	12.5
B2L32-42	84.7	46.2	42	70	5	173	11.9
MT910189	83.9	51.3	34	86	4	173	10.5
B2L20-22	83.9	47.3	39	76	4	174	12.1
Chinook	83.5	49.0	38	69	5	176	12.7
Harrington	80.0	46.2	34	76	4	177	12.0
WPB BZ594-33	78.3	52.9	27	75	4	180	14.8
WPB Stanuwax	76.1	59.7	38	79	4	173	13.7
B2L20-39	70.2	50.6	42	83	4	172	12.3
Morex (6-row)	69.7	48.8	43	81	4	173	12.1

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

Fertilizer: 100# 11-52-0 with the seed, + 45# N topdressed.

Previous crop: Fallow.

Date seeded: April 21, 1998. Date harvested: Aug. 6, 1998.

Rainfall: From seeding to harvest was 8.39 inches.

Yield experimental mean: 95.16 Error degrees of freedom: 126

F test for var.: 7.34, --- C.V. 2: 3.50, --- LSD (0.05): 9.33



Table 24 **Dryland Intrastate Barley variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**  
*( Abbreviated list )*

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
Stratus	111.4	50.8	30	87	4	181	10.8
Baronesse	104.0	50.0	34	81	4	177	11.2
MTLB 5	102.8	52.8	38	90	4	180	11.9
Stark	102.0	52.8	37	98	4	172	12.6
MT920073	100.9	52.7	34	87	4	174	11.3
Gallatin	100.2	52.5	36	80	4	175	12.0
Hector	95.7	51.8	36	84	4	176	12.3
Logan	94.9	53.3	35	95	4	172	11.9
BA 1202	91.7	46.5	35	86	4	180	11.4
BA 1614	91.7	48.8	40	87	4	176	11.6
Lewis	88.5	50.4	37	75	5	176	13.0
MTLB 57	87.8	49.3	34	71	5	175	11.6
Merit	87.1	46.7	35	85	4	177	10.9
MT910189	83.9	51.3	34	86	4	173	10.5
Chinook	83.5	49.0	38	69	5	176	12.7
Harrington	80.0	46.2	34	76	4	177	12.0
WPB Stanuwax	76.1	59.7	38	79	4	173	13.7
Morex (6-row)	69.7	48.8	43	81	4	173	12.1

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: April 21, 1998. Date harvested: Aug. 6, 1998.  
 Rainfall: From seeding to harvest was 8.39 inches.  
 Yield experimental mean: 95.16  
 Error degrees of freedom: 126  
 F test for var.: 7.34  
 C.V. 2: 3.50  
 LSD (0.05): 9.33

Table 25

**Five-year summary for Dryland Barley varieties**  
 grown north of **Conrad, MT.** 1994 - 1995 - 1996  
 1997 - 1998. Mont. Agr. Expt. Station, Western  
 Triangle Ag. Research Center, Conrad, MT.

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5 - year comparable average							
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Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% thin	Head date	% Protein
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BARONESSE	105.3	52.0	31	86	4	184	10.8
STARK	99.6	53.9	35	97	2	180	11.2
GALLATIN	98.2	53.2	35	88	4	183	11.0
LEWIS	95.5	52.5	34	84	4	184	11.2
CHINOOK	90.9	51.7	34	82	5	184	11.5
BA 1202	90.9	49.5	34	86	5	185	11.3
LOGAN	88.9	53.3	33	94	3	180	11.4
HARRINGTON	87.2	49.9	34	83	5	185	10.7
MOREX (6-row)	68.5	50.7	39	83	4	180	11.5
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Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

Table 26 **Irrigated Intrastate Barley variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
MT950186	117.4	55.8	38	87	3	176	12.6
MT960228	112.3	55.3	35	79	8	180	11.9
Nebula	111.4	43.9	33	57	15	181	12.6
AC 96/1114	109.8	48.4	34	61	13	180	12.3
Stratus	109.4	48.7	32	48	21	181	13.4
Baronesse	107.3	50.7	34	59	16	180	12.1
GS 1750	104.7	54.0	36	81	8	176	12.6
MT960170	104.3	46.2	37	41	31	172	11.4
MT960099	103.7	51.6	34	50	25	180	12.7
MT960045	101.9	50.0	31	38	27	181	12.7
Gallatin	101.6	52.9	36	60	18	175	12.7
MT940053	101.2	53.5	37	62	19	180	13.2
MT940121	101.2	54.3	35	88	4	177	11.9
Coors C22	101.1	49.6	33	63	14	182	12.3
Stark	100.8	54.6	37	85	7	173	12.4
MTLB 5	100.5	53.5	37	52	22	180	13.5
H3860224	100.3	52.3	38	74	12	180	13.8
Logan	99.9	54.7	36	85	6	172	14.6
MT940177	99.5	51.2	36	68	15	176	13.5
MT960226	99.5	52.5	37	74	12	175	12.5
MTLB 6	99.3	51.1	34	49	27	176	14.3
MT940214	99.0	50.0	35	52	24	175	13.4
2B945328	98.6	50.3	37	81	8	177	13.1
MT960225	98.5	53.2	36	67	13	176	10.8
MTLB 30	96.4	51.1	37	43	28	180	14.7
MT960222	96.1	51.4	38	64	14	177	12.6
MT940082	95.6	52.8	38	68	16	177	13.8
WPB BZ594-19	95.6	50.6	35	63	21	177	13.5
Galena	95.4	48.9	33	36	33	181	12.9
Coors C37	94.0	49.8	34	61	15	180	14.4
MTLB 2	93.9	51.9	36	54	26	177	13.4
BA 1614	93.6	48.7	40	52	16	178	13.5
BA 2B94-5602	93.5	51.0	38	71	11	181	13.7

( Continued on next page )

( *Irrigated Intrastate Barley, continued* )

MT960152	93.1	49.4	36	54	23	182	13.3
H1851195	91.7	51.8	37	70	12	177	14.0
MT950102	91.5	52.4	34	74	12	181	12.9
MT950155	91.1	50.5	34	65	16	177	12.9
MTLB 13	90.8	52.4	30	60	20	178	13.8
MT920059	90.6	52.2	40	47	30	176	14.0
MT960104	90.1	52.1	35	52	26	177	13.9
Merit	89.4	47.4	35	64	12	179	12.9
MT960101	88.8	49.7	35	38	33	180	12.7
MT920073	86.9	51.1	33	68	17	174	15.0
MT960082	86.5	51.2	38	61	19	180	13.1
BA 1202	86.0	48.7	34	66	13	179	12.1
MT920053	85.2	50.2	37	48	30	177	14.4
MT940218	84.3	50.9	35	59	18	175	13.2
Lewis	83.9	51.0	38	48	31	177	14.1
MT950156	83.5	50.2	36	61	20	174	13.7
MT910189	82.6	49.2	33	50	30	174	12.6
Morex	82.4	50.4	42	56	17	173	12.9
MT960154	81.7	46.6	36	61	15	181	12.2
MTLB 57	81.7	49.7	32	38	31	177	13.0
MT960178	80.2	46.8	37	54	19	181	14.1
WPB Stanuwax	80.1	58.9	38	53	14	173	15.1
MT960198	79.6	48.5	35	28	41	177	14.6
MT960174	79.6	45.3	37	28	41	180	14.6
MT960089	79.1	50.7	34	59	20	175	13.7
WPB BZ594-33	78.8	50.8	31	43	27	180	17.5
MT960199	78.1	51.4	37	48	26	176	13.0
MT960175	72.9	42.6	38	31	45	181	13.7
Chinook	71.3	49.3	37	43	37	177	15.3
Harrington	70.9	46.9	35	50	30	180	13.2
MT960140	67.6	48.0	33	49	20	180	12.9

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

Fertilizer: 100# 11-52-0 with the seed, + 90# N topdressed.

Previous crop: Fallow.

Date seeded: April 21, 1998. Date harvested: Aug. 6, 1998.

Moisture Data: Rainfall from seeding to harvest was 8.4 inches.

Yield exp. mean = 92.45, Error degrees of freedom = 126

F test for var. = 5.70 --- C.V. 2 = 4.95 --- LSD (0.05) = 12.82

Table 27      **Irrigated Intrastate Barley variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT. (Abbreviated list)**

Variety	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
Nebula	111.4	43.9	33	57	15	181	12.6
Stratus	109.4	48.7	32	48	21	181	13.4
Baronesse	107.3	50.7	34	59	16	180	12.1
Gallatin	101.6	52.9	36	60	18	175	12.7
Stark	100.8	54.6	37	85	7	173	12.4
MTLB 5	100.5	53.5	37	52	22	180	13.5
Logan	99.9	54.7	36	85	6	172	14.6
Galena	95.4	48.9	33	36	33	181	12.9
BA 1614	93.6	48.7	40	52	16	178	13.5
MT920059	90.6	52.2	40	47	30	176	14.0
Merit	89.4	47.4	35	64	12	179	12.9
MT920073	86.9	51.1	33	68	17	174	15.0
BA 1202	86.0	48.7	34	66	13	179	12.1
Lewis	83.9	51.0	38	48	31	177	14.1
MT910189	82.6	49.2	33	50	30	174	12.6
Morex (6-row)	82.4	50.4	42	56	17	173	12.9
MTLB 57	81.7	49.7	32	38	31	177	13.0
WPB Stanuwax	80.1	58.9	38	53	14	173	15.1
Chinook	71.3	49.3	37	43	37	177	15.3
Harrington	70.9	46.9	35	50	30	180	13.2

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 90# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: April 21, 1998. Date harvested: Aug. 6, 1998.  
 Moisture Data: Rainfall from seeding to harvest was 8.4 inches.  
 Yield exp. mean = 92.45, Error degrees of freedom = 126  
 F test for var. = 5.70  
 C.V. 2 = 4.95  
 LSD (0.05) = 12.82

Table 28      **Five-year summary for Irrigated Barley varieties**  
 grown north of Conrad, MT. 1994 - 1995 - 1996  
 1997 - 1998. Mont. Agr. Expt. Station, Western  
 Triangle Ag. Research Center, Conrad, MT.

Variety	5-year comparable average						
	Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	% Plump	% thin	Head date *	% Protein **
BARONESSE	114.2	53.4	31	89	4	184	9.2
GALLATIN	103.3	53.9	35	88	5	181	9.7
GALENA	103.3	51.8	31	83	8	186	9.6
LOGAN	101.5	54.7	35	97	2	177	10.8
STARK	101.2	54.6	36	94	3	179	10.4
BA 1202	94.9	52.1	34	90	3	184	9.9
LEWIS	92.4	54.1	36	86	8	183	10.3
HARRINGTON	86.0	51.4	35	84	8	184	9.9
CHINOOK	78.7	51.9	33	81	10	182	10.8
MOREX (6-row)	70.9	51.6	39	81	6	179	10.0

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

\* = Head date based on four years only. (1994-95-96-98)

\*\* = Proteins based on four years only. (1994-95-97-98)

Table 29

**Dryland Barley variety trial grown north of Cut Bank, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Baronesse	89.7	53.3	36	79	5	7.5
Chinook	89.4	55.4	38	93	2	8.8
MT910189	87.6	55.9	38	96	1	9.3
MTLB 32	86.0	54.9	38	87	4	9.4
MTLB 57	84.4	55.1	39	94	2	8.4
MT910150	84.2	56.0	40	92	3	8.9
MTLB 5	83.8	54.4	40	80	6	8.5
MT920073	83.2	54.7	37	96	2	8.4
Stark	79.9	54.8	40	95	2	10.0
Lewis	79.5	55.9	41	92	2	8.9
Harrington	79.3	53.8	38	89	3	8.7
MTLB 6	78.9	55.1	39	91	3	8.9
Gallatin	78.5	55.7	38	90	3	9.0
Hector	78.2	55.7	42	92	2	8.9
Logan	75.6	54.8	37	95	2	9.5
Bowman	73.7	54.0	37	97	2	10.1

Cooperator: Kevin Bradley.

Location: Fifteen miles north of Cut Bank, MT. (Glacier Co.)

Fertilizer: 100# 11-52-0 with seed, and 50# N-urea topdressed.

Rainfall: 6.5 inches from May 12 to harvest.

Previous crop: Wheat stubble, no-till chemical fallow.

Date seeded: April 20, 1998.

Date harvested: August 13, 1998.

Yield experimental mean: 82.00

Error degrees of freedom: 30

F test for var: 7.04

C.V. 2: 2.19

LSD (0.05): 5.2

Table 30 **Five-year summary for Dryland Barley varieties grown near Cut Bank, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu. **	Plant hgt. inches	% Plump	% thin	% Protein
CHINOOK	67.6	50.7	31	75	10	9.9
BARONESSE	66.0	49.7	28	72	13	9.5
LOGAN	64.4	51.6	32	94	4	10.1
STARK	64.3	52.4	32	86	5	10.5
GALLATIN	62.4	50.6	31	77	9	9.9
BOWMAN	59.8	51.6	31	93	2	10.2
LEWIS	59.1	50.9	31	74	12	10.3
HARRINGTON	58.8	48.9	30	73	12	10.1
HECTOR	58.2	49.6	32	73	12	10.1

Cooperator: Kevin Bradley.

Location: Fifteen miles north of Cut Bank. (Glacier County)

\*\* = Test weight averages were based on four years only.  
(1994-1995-1996-1997)



Table 31 Dryland Barley variety trial grown east of Oilmont, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Lewis	74.7	51.8	27	88	4	13.4
Bowman	73.5	50.7	29	90	5	12.9
Chinook	72.1	51.6	24	87	4	13.5
Baronesse	71.8	49.0	23	68	13	13.1
Hector	70.8	51.1	30	78	10	13.4
MT920073	70.1	50.8	22	90	5	14.0
Gallatin	70.0	51.3	30	74	8	13.6
MT910189	69.1	52.3	21	93	2	12.5
Stark	68.8	51.0	28	90	5	13.2
MT910150	68.1	51.5	21	85	4	14.1
MTLB 57	65.4	50.5	19	79	6	13.0
Harrington	63.1	50.4	25	82	7	13.3
MTLB 6	61.8	50.5	19	78	7	13.9
Logan	60.2	49.2	21	79	8	13.0
MTLB 5	55.0	50.1	20	65	11	14.1
MTLB 32	54.0	49.7	19	70	9	13.5

Cooperator: Terry Alme.

Location: Eight miles east of Oilmont, MT. (Toole County)

Fertilizer: 50# N + 30# P, and 100# 11-52-0 with the seed.

Previous crop: Fallow.

Date seeded: April 14, 1998.

Date harvested: August 6, 1998.

Rainfall: From May 12 to harvest was 6.32 inches.

Yield experimental mean: 66.76

Error degrees of freedom: 30

F test for var.: 1.28

C.V. 2: 8.34

LSD (0.05): 16.08

Table 32                   **Five-year summary for Dryland Barley varieties**  
**grown near Oilmont, MT. 1994 - 1995 - 1996 -**  
**1997 - 1998. Mont. Agr. Expt. Sta., Western**  
**Triangle Ag. Research Center, Conrad, MT.**

-----						
5 - year comparable average						
Variety	Yield bu/ac	Test wt. lbs/bu. **	Plant hgt. inches	% Plump	% thin	% Protein
-----						
BOWMAN	59.0	47.5	29	71	17	12.6
STARK	58.5	46.7	29	51	32	13.1
CHINOOK	57.7	46.8	28	44	39	13.9
BARONESSE	56.5	46.6	24	39	40	14.1
HECTOR	55.7	46.1	30	43	37	13.7
LEWIS	55.4	47.2	29	48	37	13.4
LOGAN	54.3	47.2	25	61	27	13.0
GALLATIN	53.1	45.9	30	38	43	13.6
HARRINGTON	51.0	46.0	27	43	38	14.4
-----						

Cooperator: Terry Alme.  
 Location: Eight miles east of Oilmont, MT. (Toole County)  
 \*\* = Test weights based on 4 years average. (1994-95-96-1997)

Table 33                      **Dryland Barley variety trial grown northeast of Choteau, 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Baronesse	82.0	48.8	37	57	20	13.8
MTLB 6	81.3	50.8	38	82	9	14.8
MT920073	78.1	49.5	39	79	12	14.1
Chinook	77.9	50.1	39	66	15	14.6
Stark	75.6	51.4	40	82	7	14.7
MTLB 5	74.2	50.5	41	42	25	15.9
MTLB 57	73.7	48.7	36	65	18	14.0
MTLB 32	71.5	48.8	39	46	21	15.4
MT910150	70.3	52.5	39	77	11	15.0
Hector	70.2	49.9	39	69	18	14.1
Bowman	70.1	50.8	35	74	14	14.2
MT910189	69.6	51.0	40	70	14	13.9
Lewis	68.3	52.3	40	78	9	14.6
Logan	64.9	50.6	39	70	14	14.3
Gallatin	58.5	49.4	37	41	24	15.6
Harrington	57.8	45.7	38	45	26	15.3

Cooperator: Roy Inbody.  
 Location: Twelve miles northeast of Choteau. (Teton Co.)  
 Fertilizer: 100# 11-52-0 with the seed, + 60# actual 34-0-0.  
 Previous crop: Fallow.  
 Date seeded: April 20, 1998.  
 Date harvested: August 10, 1998.  
 Yield experimental mean: 71.49  
 Error degrees of freedom: 30.00  
 F test for var.: 3.9  
 C.V. 2: 4.97  
 LSD (0.05): 10.26

Table 34 **Five-year summary for Dryland Barley varieties grown near Choteau, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

-----						
5 - year comparable average						
Variety	Yield bu/ac	Test wt. lbs/bu. **	Plant hgt. inches	% Plump	% thin	% Protein
-----						
BARONESSE	87.0	51.4	31	70	10	12.8
STARK	86.7	53.3	34	90	3	12.6
CHINOOK	82.5	51.8	33	68	11	12.9
LEWIS	81.1	53.0	34	77	7	13.0
HECTOR	80.5	52.0	36	74	10	12.8
BOWMAN	78.7	52.6	33	90	4	12.6
GALLATIN	78.5	51.6	34	68	11	13.1
LOGAN	76.8	52.1	33	86	6	12.6
HARRINGTON	73.3	50.6	33	68	11	13.0
-----						

Cooperator: Roy Inbody.

Location: Twelve miles northeast of Choteau. (Teton County)

\*\* = Test weights based on 4 years average. (1994-95-96-1997)

Title: Small grain variety performance under no-till conditions.

Year: 1998.

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Gregory D. Kushnak, Research Center, Conrad; Luther Talbert and Tom Blake, MSU Plant Science Dept.

Objectives: Identify small grain varieties which are adapted to no-till conditions.

Methods: Spring wheat and barley varieties were no-till planted into barley stubble at right angles to the previous crop. Crop history for the site was barley in 1997, fallow in 1996, and barley in 1995. Planting was accomplished with a double-disk no-till plot planter constructed by our Research Center Staff. Row space was 12 inches. Fertilizer included 100 pounds/acre ammonium phosphate (11-52-0) and 100 pounds/acre actual nitrogen top-dressed as urea. Roundup herbicide was used for preplant weed & volunteer control. Hoelon and Bronate herbicides were used for wild oat and broadleaf control, respectively.

Results: Data for 1998, along with 5-year averages, are presented in Tables 1 and 2 for spring wheat, and Tables 3 and 4 for barley. Rainfall was twice the normal amount for June and July, followed by very hot dry conditions in late July and August. This weather pattern resulted in reduced test weight and kernel plump.

Spring wheat varieties that were able to maintain 60-pound or better test weight under these conditions included Amidon, Newana, Ernest, Scholar, HiLine and Lew. The 111 pounds of added nitrogen fertilizer was insufficient, and proteins averaged about 10%.

Among the barleys, Baroness was the top yielding variety, but was surpassed by three of its progeny lines (MTLB). The MTLB lines carry the Baroness yield gene, but are slightly earlier to mature. The earlier maturity may explain the yield advantage under these moisture-depleted conditions.

Future Plans: Continue the no-till continuous-crop variety evaluations in efforts to include seasons of disease and environmental stress.

Table 35

**Dryland Recrop No-till Spring Wheat variety trial**  
 grown north of Conrad, 1998. Mont. Agr. Expt.  
 Station. Western Triangle Ag. Research Center,  
 Conrad, Montana.

Variety		Yield bu/ac.	Test wt. lbs/bu.	Plant hgt. inches	Head date	% protein
AMIDON	*	38.4	60.8	37	173	10.0
NEWANA		36.4	61.1	29	176	9.1
STOA		35.8	59.8	35	174	10.4
WESTBRED 926		35.7	58.8	29	171	10.6
MCNEAL		35.6	59.3	32	175	10.3
ERNEST	*	35.5	60.2	35	173	10.8
WESTBRED 936		35.2	59.7	27	171	10.1
RAMBO	*	35.1	59.7	28	175	10.6
MT 9609		34.6	59.6	34	173	10.8
SCHOLAR (9433)	*	34.0	61.0	34	174	10.4
HI-LINE		33.9	60.3	29	172	10.1
LEW	*	33.6	60.5	37	176	10.3
FERGUS		33.5	58.8	29	171	11.9
TRENTON		33.4	59.8	37	174	10.5
GRANDIN		33.2	59.3	32	173	10.4
GLENMAN	*	33.1	59.1	32	176	10.0
MTHW9420 (Hard white)		32.2	57.0	31	172	11.4
PIONEER 2375		32.1	58.6	33	173	11.1
WESTBRED EXPRESS		31.6	58.0	27	175	11.0
FORTUNA	*	31.4	59.2	34	174	10.8
LEN		31.0	58.6	30	175	11.5

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

Fertilizer: 100# 11-52-0 with the seed, + 100# N topdressed.

Previous crop: Barley.

Date seeded: April 22, 1998.

Date harvested: August 10, 1998.

Rainfall: From seeding to harvest was 8.39 inches.

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar  
 have partial resistance.)

Yield experimental mean: 34.06

Error degrees of freedom: 40

F test for var: 1.45

C.V. 2: 4.54

LSD (0.05): 4.42

Table 36 **Five-year summary for No-till Recrop Spring Wheat varieties grown near Conrad, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Agr. Research Center, Conrad, MT.**

-----						
5 - year comparable average						
-----						
Variety		Yield bu/ac	Test wt lbs/bu	Plant hgt. inches	Head date 1/	% Protein
-----						
GLENMAN	*	47.0	58.6	30	180	11.3
WESTBRED 936		46.7	58.8	27	176	12.2
RAMBO	*	46.5	59.3	29	179	11.5
AMIDON	*	45.2	59.5	35	178	12.1
SCHOLAR (MT 9433)	*	45.1	60.0	34	178	12.2
WESTBRED EXPRESS		44.9	59.0	27	177	12.2
NEWANA		44.8	59.8	30	180	11.1
FERGUS		44.4	59.6	29	176	12.2
HI-LINE		43.8	60.2	29	176	12.0
WESTBRED 926		43.6	58.6	29	175	12.1
MCNEAL		43.3	58.7	32	178	12.2
STOA		43.1	59.1	35	179	11.8
ERNEST	*	42.9	60.3	36	178	12.4
LEN		42.2	58.4	31	179	12.1
PIONEER 2375		41.7	59.8	32	177	12.0
TRENTON		41.3	59.8	33	178	12.3
GRANDIN		40.9	59.6	33	178	12.4
LEW	*	40.3	59.9	36	180	11.8
FORTUNA	*	39.9	59.9	36	178	12.5
-----						

Cooperator: Western Triangle Ag. Research Center.

Location: North of Conrad, MT. (Pondera County)

\* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

1/ = Head dates based on 3 years average. (1994 - 95 - 1998)

Table 37      **Dryland Recrop No-till Barley** variety trial grown north of Conrad, 1998. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	TestWt lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
MTLB	32	61.5	47.9	26.7	67	7	178	8.3
MTLB	6	61.4	52.0	29.3	86	4	177	9.0
MTLB	57	59.6	48.6	28.7	60	12	177	8.9
Baronesse		58.9	46.8	27.7	48	19	177	8.9
MT920073		57.7	50.8	27.7	85	4	176	8.4
Stark		56.9	51.7	31.0	87	4	173	8.5
MTLB	5	56.4	51.2	28.7	68	7	178	8.3
MT910189		55.6	50.1	27.3	71	8	177	8.2
Gallatin		54.8	52.6	30.3	79	5	177	7.8
Hector		53.9	48.9	31.7	60	14	177	8.7
MT910150		53.6	50.8	30.7	74	8	177	8.9
Lewis		53.0	50.6	30.7	66	11	177	9.0
Chinook		52.9	50.6	29.3	72	9	176	8.7
Bowman		52.8	50.8	30.7	83	4	173	9.4
Logan		52.2	52.1	27.7	88	3	173	8.2
Harrington		50.8	45.6	28.0	69	9	177	8.6

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 50# N actual top-dressed after planting.  
 Previous crop: Barley.  
 Method of seeding: Double-disc drill into standing stubble.  
 Date seeded: April 22, 1998.  
 Date harvested: August 6, 1998.  
 Rainfall: From seeding to harvest was 8.39 inches.  
 Yield experimental mean: 55.73  
 Error degrees of freedom: 30  
 F test for var.: 3.56  
 C.V. 2: 3.16  
 LSD (0.05): 5.09



Table 38 **Five-year summary for Recrop Dryland No-Till Barley varieties grown north of Conrad, MT. 1994 - 1995 - 1996 - 1997 - 1998. Mont. Agr. Expt. Station, Western Triangle Agr. Res. Center, Conrad, MT.**

-----							
5 - year comparable average							
Variety	Yield bu/ac	Tst wt lbs/bu **	Plant hgt. inches	% Plump	% thin	Head date *	% Protein
-----							
BARONESSE	75.5	51.0	27	75	8	178	10.1
LOGAN	68.1	51.1	30	89	3	175	10.2
STARK	67.4	51.8	29	89	3	176	10.4
GALLATIN	66.2	50.0	29	81	6	178	10.0
BOWMAN	63.2	51.9	29	90	2	176	10.9
HARRINGTON	62.7	48.5	28	76	7	178	10.1
HECTOR	62.2	49.4	31	73	9	179	10.4
LEWIS	60.8	50.3	29	77	8	178	10.8
CHINOOK	59.5	48.9	29	69	11	178	10.8
-----							

Cooperator: Western Triangle Ag. Research Center.

Location: Ten miles north of Conrad, MT. (Pondera County)

\* = Head dates based on 3 years average. (1994-95-98)

\*\* = Test weights based on 4 years average. (1994-95-96-97)

Title: Effect of boron (B) and phosphorus (P) on irrigated alfalfa.

Year: 1998

Location: 4 J Farms (Clark and Paul Jones), East of Ledger.

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

Objectives: 1) To predict the response of alfalfa to B fertilization using soil and/or tissue tests; 2) and prepare a final report at the conclusion of the project addressing the above objective.

Procedures: Nine fertilizer treatments (0, 40, and 80 lbs. P<sub>2</sub>O<sub>5</sub>, and 1 and 2 lbs B/a) and blanket applications of 10 lbs. Zn, and 30 lbs. K/a were applied to an existing alfalfa stand. Phosphorus treatments were applied on October 7, 1997 with potash (KCl), zinc (Zn), and B applied on March 25, 1998. The P plots were soil sampled prior to P application on October 7, 1997 and B plots were soil sampled on March 25, 1998 prior to B application. The field plot design was a 3 x 3 factorial with four replicates. Plot size was 6 x 15 feet. A three foot Jari mower was used to cut the plots. After weighing, plot samples were sub-sampled for nutrient and moisture content analysis. Harvest dates were June 23 for cut one, August 4 for cut 2, and September for cut 3. Fertilizer materials were treble super phosphate, potassium chloride, zinc sulfate, and Granubor® (14.3% B).

Results: The yield data are summarized in Table 1s and represent the second year of information collected from this research area. The average yield for three cuttings was 8.60 tons/a. No response to either P or B was detected. A composite sample of all P and B treatments, following the 1997 growing season, were taken on October 7, 1997 and March 25, 1998, respectively. These data are summarized in Table 2s. Both P and B soil tests increased following P and B fertilization.

Table 1s. The effect of phosphorus and boron on irrigated alfalfa quality and yield. The experiment was located east of Ledger, MT. Western Triangle Ag. Research Center, Conrad, MT. 1998.

Entry	Treatment		Yield <sup>1</sup>			
	P <sub>2</sub> O <sub>5</sub> ----- (lbs/a) -----	B -----	1 <sup>st</sup> cut	2 <sup>nd</sup> cut	3 <sup>rd</sup> cut	Total
9	80	2	3.69	2.52	2.55	8.63
6	80	1	3.72	2.40	2.43	8.42
3	80	0	3.64	2.62	2.32	8.18
8	40	2	3.61	2.42	2.23	8.10
5	40	1	3.84	2.57	2.30	8.16
2	40	0	3.62	2.25	2.51	8.49
7	0	2	3.54	2.42	2.52	8.50
4	0	1	3.59	2.27	2.67	8.76
1	0	0	3.63	2.45	2.54	8.50

#### Summary Statistics

Experimental Means	3.65	2.44	2.51	8.60
Error Mean Square	0.028	0.058	0.062	0.282
P-value	0.49	0.227	0.369	0.204
Standard Error of the Mean	0.048	0.058	0.072	0.153
C.V. 1: (s/mean)*100	4.54	2.86	9.89	6.17
LSD (0.05)	NS	NS	NS	NS

#### Phosphorus Summary

0	3.68	2.38	2.46	8.43
40	3.69	2.41	2.45	8.55
80	3.59	2.51	2.62	8.81
LSD (0.05)	NS	NS	NS	NS

#### Boron Summary

0	3.63	2.44	2.49	8.56
1	3.72	2.41	2.48	8.61
2	3.62	2.45	2.56	8.63
LSD (0.05)	NS	NS	NS	NS
Interaction P-value	0.49	0.227	0.369	0.204

<sup>1</sup> Yields based on 12% moisture.

Table 2s. Soil test for P and B separated by fertilizer rates for 0 to 6" depth.

Treatment		Soil Test <sup>1</sup>	
P	B	P	B
----- (lbs/a) -----		----- (ppm) -----	
0	0	9.5	0.51
40	1	16.9	0.66
80	2	18.0	0.79

<sup>1</sup> Soil sampled for P on October 7, 1997 and for B on March 25, 1998.

## Pre-Experiment Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	OM	pH
----- (ppm) -----								----- (%) -----	
0 - 6"	0.9	6.86	0.41	5.85	0.48	234	13.8	2.25	8.0
(ft)	B (ppm)	Cl	NH <sub>4</sub> -N (lbs/a)	NO <sub>3</sub> -N	SO <sub>4</sub> -S				
0 - 1	0.35	12.3	13.2	31.7	143.5				
1 - 2	0.38	14.2	7.0	7.8	245.9				
2 - 3	0.42	35.0	15.0	3.3	727.9				
3 - 4	0.78	143.5	7.1	2.6	1293.6				
4 - 5	1.08	410.0	7.6	2.2	4335.2				

Title: Effect of nitrogen (N), phosphorus (P), potassium (K), and chloride (Cl) on grain yield and quality of spring barley.

Year: 1998

Location: 1. Western Triangle Agricultural Research Center, Conrad, MT  
2. North of Cut Bank, MT at the Bruce Bradley farm.  
3. East of Sunburst, MT at the Phil Aschim farm.

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

Objectives: To determine spring barley yield and protein response to N fertilization and N soil tests; to determine spring barley response to P fertilizer and P soil tests; survey spring barley response to K and Cl fertilization; and at the end of the project (three growing seasons) prepare yield, protein, and N and P fertilizer prediction models or equations using the soil tests and climatic information.

Procedures: Fourteen fertilizer treatments were applied, N, K, and Cl were broadcast and P was placed with the seed while planting. Plots at Conrad were seeded into fallow with a four-row, plot drill with three inch shovels and 12" spacing. Plot size was 4 x 12 feet with four replications. At Cut Bank, plots were planted into chemical fallow with a six-row, 12 inch spaced, double disk, no-till plot drill. At Sunburst, plots were planted no-till into burned barley stubble with a six-row, 12 inch spaced, double disk, no-till plot drill. Plot size was 6 x 20 feet with four replicates. Seeding rates were 20 seeds/ft<sup>2</sup>. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 3s (WTARC), Table 4s (Cut Bank) and Table 5s (Sunburst). All locations responded to N, the level of response was related to initial soil nitrate-N. No response to P was measured, however, all locations had high P soil tests. The data from East of Sunburst must be interpreted with caution due to dry conditions until the end of June and early July, when about six inches of rain fell within one week.

Table 3s. Effect of N, P, K, and Cl on spring barley yield and quality. Experiment located at Western Triangle Agricultural Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
11	80-50-30-30	103.2	12.0	50.0	72.7	10.5
2	40-0-30-30	102.6	10.4	51.0	77.6	7.5
3	80-0-30-30	102.6	11.9	49.2	74.8	10.5
10	40-50-30-30	102.5	10.2	50.7	77.8	7.5
14	80-25-30-0	102.3	10.8	51.2	79.0	7.3
13	80-25-0-30	102.1	11.6	50.0	71.4	12.0
8	120-25-30-30	101.1	12.6	49.7	72.4	11.1
4	120-0-30-30	100.8	12.4	49.6	70.7	12.0
12	120-50-30-30	100.7	12.7	49.5	71.6	11.3
1	0-0-30-30	99.4	9.4	52.3	82.6	5.6
7	80-25-30-30	99.0	11.9	49.8	74.3	10.7
6	40-25-30-30	98.7	11.0	51.1	74.3	9.3
9	0-50-30-30	97.0	9.3	52.3	84.4	4.9
5	0-25-30-30	91.9	10.2	51.4	77.3	8.2

  

Summary Statistics						
Experimental Means		100.3	11.2	50.5	75.8	9.2
Error Mean Square		31.11	0.4536	0.5013	29.71	7.62
P-value		0.3310	0.0000	0.0000	0.0161	0.0051
Standard Error of the Mean		2.789	0.3368	0.3540	2.725	1.381
C.V. 1: (s/mean)*100		2.8	3.0	0.7	3.6	15.1
LSD (0.05)		8.0	1.0	1.0	7.8	3.9

  

Nitrogen Summary						
0		96.1	9.6	52.0	81.5	6.2
40		101.3	10.5	50.9	76.5	8.1
80		101.6	11.9	49.6	73.9	10.5
120		100.9	12.6	49.6	71.6	11.4
LSD (0.05)		4.0	0.5	0.6	4.4	2.2

  

Phosphorus Summary						
0		101.4	11.0	50.5	76.4	8.9
25		97.7	11.4	50.5	74.6	9.8
50		100.8	11.0	51.0	76.6	8.5
LSD (0.05)		NS	NS	NS	NS	NS
Interaction P-value		0.7963	0.5533	0.2988	0.6629	0.8060

## Notes:

Variety: Harrington

Seeding Date: 4/28/98

Harvest Date: 8/10/98

Growing Season ppt: 8.44"

Planting Rate: 20 seeds/ft<sup>2</sup>

Previous Crop: Fallow

Herbicide: Hoelon @ 2 $\frac{2}{3}$  pt./ac and Buctril @ 1 $\frac{1}{2}$  pt./ac applied on 5/28/98.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)		(%)		
0 - 6"	2.16	14.8	0.4	14.0	4.98	426	37.2	0.7	0.23	2.31	7.8	
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----							----- (lbs/a) -----				
0 - 1 ft.	1.85	12.2	0.43	11.85	1.19			10.4	16.1	45.9	234.8	
1 - 2 ft.	1.51	9.3	0.51	3.91	0.40			15.2	13.3	13.7	1439.5	
2 - 3 ft.	1.72	10.0	0.80	4.02	0.58			11.4	15.6	11.9	2701.8	
3 - 4 ft.	1.79	10.1	1.81	1.61	0.87			14.2	16.1	8.5	7858.1	

Table 4s. Effect of N, P, K, and Cl on spring barley yield and quality. Experiment located North of Cut Bank, MT at the Bruce Bradley farm. Western Triangle Agricultural Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
11	80-50-30-30	87.9	10.3	52.8	75.4	5.6
12	120-50-30-30	86.2	12.4	50.1	61.8	13.0
3	80-0-30-30	84.8	9.9	52.4	69.8	8.8
7	80-25-30-30	84.5	10.3	52.7	75.0	7.1
14	80-25-30-0	84.0	10.5	52.2	65.6	11.1
13	80-25-0-30	83.8	10.4	52.3	72.5	7.7
4	120-0-30-30	83.8	12.4	51.1	60.6	12.8
8	120-25-30-30	83.6	12.0	51.3	65.1	11.3
2	40-0-30-30	80.9	8.7	53.2	80.9	6.0
6	40-25-30-30	78.0	8.3	54.4	83.1	4.7
10	40-50-30-30	77.3	8.5	54.3	84.1	3.9
1	0-0-30-30	61.0	7.5	54.6	88.0	3.3
9	0-50-30-30	58.5	7.4	54.4	85.1	4.0
5	0-25-30-30	53.5	7.3	54.1	81.8	4.3

#### Summary Statistics

Experimental Means	77.7	9.7	52.8	74.9	7.4
Error Mean Square	25.15	0.2507	0.3834	15.06	3.722
P-value	0.0000	0.0000	0.0000	0.0000	0.0000
Standard Error of the Mean	2.508	0.2504	0.3096	1.940	0.9646
C.V. 1: (s/mean)*100	6.5	5.2	1.2	5.2	26.1
LSD (0.05)	7.2	0.7	0.9	5.6	2.8

#### Nitrogen Summary

0	57.6	7.4	54.3	85.0	3.8
40	78.7	8.5	54.0	82.7	4.9
80	85.7	10.2	52.6	73.4	7.2
120	84.5	12.3	50.8	62.5	12.3
LSD (0.05)	4.3	0.4	0.5	3.5	1.7

#### Phosphorus Summary

0	77.6	9.6	52.8	74.8	7.7
25	74.9	9.4	53.1	76.2	6.9
50	77.5	9.6	52.9	76.6	6.6
LSD (0.05)	NS	NS	NS	NS	NS
Interaction P-value	0.6383	0.7850	0.0288	0.1240	0.4170



## Notes:

Variety: Harrington

Seeding Date: 4/22/98

Harvest Date: 8/10/98

Growing Season ppt: 6.71"

Planting Rate: 20 seeds/ft<sup>2</sup>

Previous Crop: Chemical Fallow

Herbicide: Amber.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)			(%)	
0 - 6"	2.2	22.3	0.29	41.6	0.81	328	21.4	0.2	0.09	2.39	7.2	
	Cu	Fe	B	Mn	Zn		Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S		
	----- (ppm) -----						----- (lbs/a) -----					
0 - 1 ft.	2.12	13.2	0.20	14.77	0.91		16.0	19.2	19.6	85.1		
1 - 2 ft.	2.19	10.7	0.23	4.16	0.47		13.9	21.6	10.1	76.6		
2 - 3 ft.	1.96	12.9	0.26	3.15	0.44		10.8	22.6	4.3	82.2		
3 - 4 ft.	2.01	12.2	0.46	2.53	0.65		11.2	23.7	2.7	1865.8		

Table 5s. Effect of N, P, K, and Cl on spring barley yield and quality. Experiment located East of Sunburst, MT at the Phil Aschim farm. Western Triangle Agricultural Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
8	120-25-30-30	56.8	12.7	48.4	48.7	27.1
14	80-25-30-0	56.1	10.1	49.8	64.7	18.5
3	80-0-30-30	55.6	10.2	48.9	60.4	19.7
10	40-50-30-30	54.1	7.9	50.8	76.5	11.1
2	40-0-30-30	54.0	7.6	50.7	75.8	10.2
7	80-25-30-30	53.9	10.8	48.7	50.6	24.4
12	120-50-30-30	53.3	12.6	47.6	46.1	29.1
4	120-0-30-30	53.1	12.4	48.3	51.1	23.8
6	40-25-30-30	52.0	8.8	50.2	68.1	16.9
11	80-50-30-30	51.9	11.1	48.1	55.8	24.6
13	80-25-0-30	49.3	11.4	48.5	58.8	21.2
9	0-50-30-30	31.5	7.0	52.1	85.0	5.4
1	0-0-30-30	30.7	6.4	51.8	85.6	5.3
5	0-25-30-30	30.1	6.8	52.7	85.5	4.8

#### Summary Statistics

Experimental Means	48.7	9.7	49.7	65.2	17.3
Error Mean Square	63.54	0.3814	1.536	83.47	38.10
P-value	0.0005	0.0000	0.0006	0.0000	0.0000
Standard Error of the Mean	4.602	0.7666	0.7155	8.092	20.60
C.V. 1: (s/mean)*100	16.4	6.4	2.5	14.0	35.7
LSD (0.05)	13.4	1.6	2.1	15.3	10.4

#### Nitrogen Summary

0	30.7	7.0	51.9	85.3	5.2
40	53.4	8.1	50.6	73.5	12.7
80	53.8	10.7	48.6	55.6	22.9
120	54.4	12.6	48.1	48.6	26.7
LSD (0.05)	8.2	1.6	1.2	8.4	5.8

#### Phosphorus Summary

0	48.3	9.3	49.9	68.2	14.7
25	48.2	9.8	49.8	63.2	18.3
50	47.7	9.6	49.7	65.8	17.6
LSD (0.05)	NS	NS	NS	NS	NS
Interaction P-value	0.9912	0.9860	0.9486	0.8959	0.8671

## Notes:

Variety: Moravian 22

Seeding Date: 4/23/98

Growing Season ppt: 9.20

Previous Crop: Barley

Herbicide: None.

Harvest Date: 8/11/98

Planting Rate: 20 seeds/ft<sup>2</sup>

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH
	----- (ppm) -----							(%)		(%)	
0 - 6"	1.79	52.6	0.55	37.9	1.73	398	22.3	<0.1	0.10	3.31	6.1
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S
	----- (ppm) -----							----- (lbs/a) -----			
0 - 1 ft.	1.77	32.4	0.39	23.63	1.31			33.2	18.9	25.1	41.3
1 - 2 ft.	1.88	12.0	0.31	5.08	0.38			17.2	11.8	1.9	55.0
2 - 3 ft.	1.60	11.6	0.35	3.89	0.57			26.0	13.5	3.0	106.7
3 - 4 ft.	1.61	11.9	0.54	2.20	0.34			8.6	12.2	10.4	67.6
4 - 5 ft.	1.76	11.9	0.73	2.42	0.37			7.4	15.8	14.4	73.0

Title: Canola variety evaluation.

Year: 1998

Location: Western Triangle Agriculture Research Center, Conrad, MT.

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

Objectives: To evaluate the performance of canola varieties or hybrids under irrigation.

Procedures: Twenty-seven canola varieties were seeded no-till into burned barley stubble with a four-row, 12 inch spaced, double disk, no-till plot drill. Nitrogen, potassium, and chloride were broadcast and phosphorus was placed with the seed while planting. Plot size was 4 x 12 feet with four replicates. Seeding rate was seven lbs seed/a. Plots were irrigated May 15, 1998 for seed germination. Plots were swathed with a plot swather, then threshed with a Hege plot combine.

Results: The data are summarized in Table 6s. Due to dry conditions at planting initial emergence was erratic, but as the growing and irrigation season progressed, the canola recovered.

Table 6s. Irrigated no-till canola variety and hybrid trial located at Western Triangle Ag. Research Center, Conrad, MT. 1998.

Variety or Hybrid	Seed Yield (lbs/a)	Oil Content (%) <sup>1</sup>
Hyola 420	3422	40.3
JB 114	3072	40.4
JA 716	3058	40.3
Advantage	2925	38.9
Hyola 401	2919	39.0
LC 605	2842	39.0
CL2078	2797	38.6
Hudson	2743	40.2
Hyola 308	2717	38.7
Integra 701	2712	38.8
Battleford	2690	38.7
IMC 02	2689	40.7
Roseau (CID 705)	2649	39.4
Crackerjack	2622	38.5
94-22685	2611	39.4
Crown	2604	40.7
IMC 03	2599	39.6
Cavalier (FAZ 601-1)	2592	39.5
Eagle	2582	38.6
CL2070	2579	38.3
Quantum	2519	36.4
Springfield	2494	38.4
91-15026 NA	2365	37.9
Hysyn 110	2338	38.1
CL2020	2330	37.9
92FR0206	2325	37.2
CLEX57	2282	37.8

#### Summary Statistics

Experimental Means	2669
Error Mean Square	188,900
P-value	0.1191
Standard error of the Mean	217.3
C.V.: (s/mean)*100	16.28
LSD (0.05)	611.8

<sup>1</sup> Oil content reported on a dry weight basis.

Notes:

Seeding Date: 4/28/98

Swathed: 8/18/98

Threshing Date: 8/24/98

Growing Season ppt plus Irrigation: 11.53"

Planting Rate: 7 lbs/a

Previous Crop: Barley

Herbicide: None

Fertilizer: 150-30-30-20

Title: Effect of nitrogen (N) and phosphorus (P) on seed yield, oil content, and oil yield of dryland canola.

Year: 1998

Location: 1) North of Cut Bank, MT at the Don Bradley farm.  
2) East of Sunburst, MT on the Phil Aschim farm.

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

Objectives: To determine dryland canola response to N fertilizer and N soil tests; to determine canola response to P fertilizer and P soil tests.

Procedures: Four N rates (17, 50, 100, and 150 lbs N/a) in combination with three P rates (0, 25, and 50 lbs P<sub>2</sub>O<sub>5</sub>/a) were applied to canola while planting into barley stubble, no-till. All fertilizers except P were broadcast while planting. Phosphorus was placed with the seed while planting. Plot size was 6 x 20 feet with four replicates. Plots were planted with a six-row, 12 inch spaced, double disk, no-till plot drill. Seeding rate was five lb/a. Plots were direct cut with a Hege plot combine.

Results: The data are summarized in Table 7s. The Sunburst location was not harvested due to deer damage. In spite of the drought conditions during pod fill and subsequent low yields, the canola responded to N. No response to P was detected.

Table 7s. Effect of N and P on dryland canola seed yield, oil content, and oil yield.  
 Experiment located North of Cut Bank, MT at the Don Bradley farm. Western  
 Triangle Ag. Research Center, Conrad, MT. 1998.

<b>Fertilizer N-P<sub>2</sub>O<sub>5</sub>-K-S (lbs/a)</b>	<b>Seed Yield (lbs/a)</b>	<b>Oil Content (%)</b>	<b>Oil Yield (lbs/a)</b>
100-50-25-20	995.8	34.25	341.0
100-0-25-20	971.6	34.23	332.7
150-25-25-20	947.6	32.53	308.4
150-50-25-20	912.7	32.33	295.3
100-25-25-20	884.9	35.38	309.8
150-0-25-20	843.0	32.45	273.5
50-25-25-20	797.4	38.38	306.0
50-50-25-20	769.4	38.08	292.9
50-0-25-20	717.9	38.20	274.2
17-50-25-20	407.5	39.10	159.0
17-25-25-20	407.3	39.70	161.7
17-0-25-20	395.5	39.75	157.3

#### Summary Statistics

<b>Experimental Means</b>	<b>754.2</b>	<b>36.20</b>	<b>267.6</b>
<b>Error Mean Square</b>	<b>7210</b>	<b>0.6032</b>	<b>796.3</b>
<b>P-value</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
<b>Standard error of the Mean</b>	<b>42.46</b>	<b>0.3883</b>	<b>14.11</b>
<b>C.V.: (s/mean)*100</b>	<b>11.2</b>	<b>2.15</b>	<b>10.5</b>
<b>LSD (0.05)</b>	<b>122.2</b>	<b>1.12</b>	<b>40.6</b>

#### Nitrogen Summary

<b>17</b>	<b>403.4</b>	<b>39.52</b>	<b>159.3</b>
<b>50</b>	<b>761.6</b>	<b>38.22</b>	<b>291.0</b>
<b>100</b>	<b>950.8</b>	<b>34.62</b>	<b>327.8</b>
<b>150</b>	<b>901.1</b>	<b>32.43</b>	<b>292.4</b>
<b>LSD (0.05)</b>	<b>70.5</b>	<b>0.6451</b>	<b>23.44</b>

#### Phosphorus Summary

<b>0</b>	<b>732.0</b>	<b>36.16</b>	<b>259.4</b>
<b>25</b>	<b>759.3</b>	<b>36.49</b>	<b>271.4</b>
<b>50</b>	<b>771.3</b>	<b>35.94</b>	<b>272.0</b>
<b>LSD (0.05)</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>Interaction P-value</b>	<b>0.3504</b>	<b>0.7118</b>	<b>0.4074</b>

## Notes:

Variety: Hysn 110

Soil Water Depth at Planting: 8"

Seeding Date: 4/22/98

Harvest Date: 8/4/98

Growing Season ppt: 6.70"

Planting Rate: 5 lbs/a

Previous Crop: No-till Barley Stubble

Herbicide: Stinger @ 1/3 pt./a, Poast @ 2 pt./a, and Muster @ 0.4 oz/a applied on 6/4/98.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)		(%)		
0 - 6"	2.52	17.5	0.35	23.2	1.38	540	17.0	0.8	0.2	2.88	7.9	
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----							----- (lbs/a) -----				
0 - 1 ft.	2.32	20.4	0.35	15.53	0.87			12.3	19.3	8.1	59.2	
1 - 2 ft.	1.98	9.4	0.40	3.16	0.20			5.5	17.7	1.2	46.1	
2 - 3 ft.	1.87	9.2	0.79	2.21	0.36			5.3	21.4	5.1	87.2	
3 - 4 ft.	1.67	8.8	1.34	2.04	0.27			4.8	17.4	5.2	60.8	



Title: Evaluation of sulfur (S) sources on dryland canola.

Year: 1998

Location: 1) North of Cut Bank, MT at the Don Bradley farm.  
2) East of Sunburst, MT on the Phil Aschim farm.

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

Objectives: To evaluate the performance of sulfate plus (16-0-0-40), ammonium sulfate, and elemental sulfur on dryland canola.

Procedures: Three S rates (10, 20, and 30 lbs S/a) and three S sources (Sulfate Plus, ammonium sulfate (21-0-0-24), and elemental S (Tiger 90, 0-0-0-90) along with an unfertilized check were evaluated on spring canola planted no-till in barley stubble. All fertilizers except phosphorus (P) were broadcast while planting. Phosphorus was placed with the seed while planting. Plot size was 6 x 20 feet with four replicates. Plots were planted with a six-row, 12 inch spaced, double disk, no-till plot drill. Seeding rate was five lb/a. Plants from each plot were sampled at maturity for S analysis. Plots were direct cut with a Hege plot combine.

Results: The data are summarized in Table 8s. No response to S was measured. Seed yield and oil content were reduced by drought conditions during pod fill. All S-fertilizers were dissolved when evaluated July 15, 1998. No data were collected at the Sunburst location due to deer damage.

Table 8s. Evaluation of sulfur sources on dryland canola.

Sulfur Source <sup>1</sup>	Rate (lbs/a)	Seed Yield (lbs/a)	Oil Content <sup>2</sup> (%)	Oil Yield <sup>2</sup> (lbs/a)	Plant S Content (%)	S Uptake (lbs/a)
es	30	1005	33.9	340.8	0.206	7.7
s	30	992.5	33.8	335.5	0.224	9.4
	0	937.5	33.7	316.0	0.208	11.0
as	30	927.2	34.0	315.6	0.309	9.7
s	10	924.5	33.1	306.1	0.254	10.4
es	20	919.3	33.9	312.1	0.263	7.8
es	10	910.5	33.0	300.9	0.236	7.6
as	20	897.9	33.2	298.3	0.214	10.3
as	10	869.7	34.0	296.8	0.232	9.2
s	20	865.8	33.1	287.2	0.228	11.5
<b>Experimental Means</b>		<b>925.0</b>	<b>33.6</b>	<b>310.9</b>	<b>0.237</b>	<b>9.5</b>
<b>Error Mean Square</b>		<b>4085</b>	<b>0.5831</b>	<b>745.6</b>	<b>0.0037</b>	<b>14.59</b>
<b>P-value</b>		<b>0.2119</b>	<b>0.5760</b>	<b>0.3766</b>	<b>0.6451</b>	<b>0.9270</b>
<b>Standard error of the Mean</b>		<b>36.9</b>	<b>0.4409</b>	<b>15.77</b>	<b>0.035</b>	<b>2.205</b>
<b>C.V.: (s/mean)*100</b>		<b>6.9</b>	<b>2.275</b>	<b>8.782</b>	<b>25.61</b>	<b>40.39</b>
<b>LSD (0.05)</b>		<b>109.6</b>	<b>NS</b>	<b>46.8</b>	<b>NS</b>	<b>NS</b>

<sup>1</sup> s = Elemental Sulfur (Tiger 90 0-0-0-90)

as = Ammonium Sulfate (21-0-0-24)

es = Sulfate Plus (Sulfur Enhanced Ammonium Sulfate 16-0-0-40)

<sup>2</sup> Oil content and oil yield reported on a dry weight basis.

Notes:

Variety: Hysn 110

Seeding Date: 4/22/98

Harvest Date: 8/4/98

Growing Season ppt: 6.70"

Planting Rate: 5 lbs/a

Previous Crop: Barley

Herbicide: Stinger @ 1/3 pt./a, Poast @ 2 pt./a, and Muster @ 0.4 oz/a applied on 6/4/98.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)		(%)		
0 - 6"	2.52	17.5	0.35	23.2	1.38	540	17.0	0.8	0.2	2.88	7.9	
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----							----- (lbs/a) -----				
0 - 1 ft.	2.32	20.4	0.35	15.53	0.87			12.3	19.3	8.1	59.2	
1 - 2 ft.	1.98	9.4	0.40	3.16	0.20			5.5	17.7	1.2	46.1	
2 - 3 ft.	1.87	9.2	0.79	2.21	0.36			5.3	21.4	5.1	87.2	
3 - 4 ft.	1.67	8.8	1.34	2.04	0.27			4.8	17.4	5.2	60.8	

Title: Lentil variety evaluation.

Year: 1998

Location: Western Triangle Agricultural Research Center, Conrad, MT 59425.

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

Objectives: To evaluate lentil varieties under dryland, no-till barley stubble.

Procedures: Plots were planted no-till into barley stubble with a four-row plot drill using 12" spacing. Seeding rate was seven seeds/ft<sup>2</sup>. Granular soil borne inoculum was placed with the seed. Plot size was 4 x 16 feet. The plots were direct cut with a Hege plot combine using pickup guards on the cutter bar. Laird was harvested a week later than the other varieties.

Results: The data are summarized in Table 9s.

Table 9s. Dryland re-crop lentil performance nursery trial located at Western Triangle Agricultural Research Center, Conrad, MT. 1998.

Entry	Variety	Color	Flowering Date	Seed Yield (lbs/a)
LENT04	Pardina		7/2/98	1734.0
LENT02	Red Chief	Red	6/29/98	1546.0
LENT01	Richlae		7/2/98	1456.0
LENT06	French Green	Green and Black	7/6/98	1294.0
LENT03	Indianhead	Black	6/29/98	842.4
LENT05	Laird		7/6/98	595.8

#### Summary Statistics

Experimental Means	1245.0
Error Mean Square	37020
P-value	0.0000
Standard Error of the Mean	96.2
C.V. 1: (s/mean)*100	15.5
LSD (0.05)	290.0

#### Notes:

Planting Date: 4/29/98

Threshed: 8/6/98 for all except the Laird variety which was threshed on 8/13/98

Previous crop: Barley

Growing season ppt. = 8.29"

Fertilizer: 30 lbs./ac P<sub>2</sub>O<sub>5</sub> as 11-52-0 was placed with the seed.

Herbicide: None

Title: The effect of phosphorus (P) and sulfur (S) on yield of red lentil.

Year: 1998

Location: 1) Southeast of Conrad, MT at the Bert Rigby farm.

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

Objectives: To determine the effect of P and S fertilization and soil tests on lentil seed yields.

Procedures: Fourteen fertilizer treatments were applied, nitrogen (N), potassium (K), chloride (Cl), and S were broadcast and P was placed with the seed while planting. Plots were seeded into fallow with a six-row, 12 inch spaced, double disk, no-till plot drill. Plot size was 6 x 20 feet with four replicates. Seeding rate was seven seeds/ft<sup>2</sup>. Inoculum was mixed with the seed before planting. Three feet from each of the two center rows were harvested by hand due to lodging.

Results: The data are summarized in Table 10s. Emergence of lentil southeast of Conrad were erratic due to soil crusting shortly after seeding. Crusting was caused by a precipitation event shortly after seeding. The lentil weathered a slight hail storm on June 1, 1998. Soil tests had high levels of P and S, but lentil stover, and total plant N and S content responded to P-fertilizer treatments.

Table 10s. The effect of P and S fertilizer on yield of red lentils. Experiment located Southeast of Conrad, MT. Western Triangle Ag. Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-CI-S (lbs/a)	Seed Yield (lbs/a)	Stover Yield (lbs/a)	Plant Nutrients in Stover <sup>1</sup>		
				N ----- (lbs/a)	P ----- (lbs/a)	S -----
14	0-0-0-0-0	1249.0	4806	120.2	9.0	6.5
10	0-40-68-68-30	925.1	4144	105.3	7.7	5.4
1	8.5-0-68-68-0	905.3	3164	83.3	5.9	4.4
4	8.5-0-68-68-15	882.9	3966	100.1	7.8	5.5
12	8.5-40-0-68-30	863.8	5291	137.7	9.3	7.2
13	8.5-40-0-0-0	859.0	4557	114.8	8.3	6.2
8	8.5-20-68-68-30	853.1	4451	108.1	7.5	5.9
2	8.5-20-68-68-0	825.9	3390	79.6	5.3	4.0
5	8.5-20-68-68-15	771.5	5138	129.6	9.1	6.9
3	8.5-40-68-68-0	691.5	3846	98.0	7.2	4.9
11	8.5-40-68-0-30	658.3	3683	80.1	5.9	5.9
9	8-5-40-68-68-30	640.3	5551	134.1	9.1	7.2
7	8.5-0-68-68-30	634.9	2444	60.0	3.9	3.3
6	8.5-40-68-68-15	477.5	5258	132.6	9.5	7.0

<sup>1</sup> Chemical analysis done on dry plant matter containing straw and pods with lentils.

#### Summary Statistics

Experimental Means	802.7	4263	105.9	7.5	5.7
Error Mean Square	23120	1,100,000	589.8	3.529	1.772
P-value	0.0316	0.2329	0.1201	0.1807	0.1770
Standard Error of the Mean	107.5	741.7	17.2	1.4	0.9
C.V. 1: (s/mean)*100	18.9	24.6	22.9	25.1	23.3
LSD (0.05)	328.5	2266	52.5	4.1	2.9

#### Phosphorus Summary

0	865.0	3465	87.3	6.4	4.8
20	816.8	4326	105.8	7.3	5.6
40	674.9	4709	117.8	8.4	6.3
LSD (0.05)	NS	1400	34.5	NS	1.7

#### Sulfur Summary

0	892.7	3859	95.9	6.8	5.0
15	710.6	4787	120.8	8.8	6.5
30	753.3	3854	94.1	6.4	5.2
LSD (0.05)	NS	NS	NS	NS	NS
Interaction P-value	0.1921	0.4694	0.4006	0.3389	0.2674

Notes:

Planting Date: 4/21/98

Threshed: 7/30/98

Previous crop: Fallow

Growing season ppt. = 6.61"

Herbicide: Pre-plant: Tillage.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)			(%)	
0 - 6"	2.32	21.6	0.55	48.7	2.55	612	26.6	<0.1	0.15	1.99	6.9	
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----							----- (lbs/a) -----				
0 - 1 ft.	2.24	20.1	0.41	17.62	0.98			17.4	16.3	54.0	65.8	
1 - 2 ft.	1.91	15.1	0.60	6.76	0.88			51.9	17.0	37.9	1818.5	
2 - 3 ft.	1.86	14.5	1.53	4.01	0.68			163.1	21.8	26.0	4759.0	
3 - 4 ft.	1.50	12.2	1.45	2.81	0.41			251.6	22.0	25.7	9619.3	



Title: Spring pea variety and seed treatment evaluation.

Year: 1998

Location: Western Triangle Agricultural Research Center, Conrad, MT 59425.

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

Objectives: To evaluate spring pea varieties and seed treatments under no-till, dryland conditions.

Procedures: Plots were planted no-till into barley stubble with a four-row plot drill using 12" spacing. Seeding rate was seven seeds/ft<sup>2</sup>. Granular soil borne inoculum was placed with the seed. Plot size was 4 x 16 feet with four replications. The plots were direct cut with a Hege plot combine using pickup guards on the cutter bar.

Results: The data are summarized in Table 11s. TSG982 pods had a tendency to shatter when hit by the reel during threshing.

Table 11s. Dryland re-crop spring pea performance nursery and seed treatment trial located at Western Triangle Agricultural Research Center, Conrad, MT. 1998.

Entry	Variety (Color and Flowering Date)	Seed Yield (lbs/a)
PEA02	Pekisko (Green 6/16/98)	2434.0
PEA03	Carrera (Yellow 6/29/98)	2135.0
PEA09	TSG982 (Green 6/18/98)	1409.0
PEA07	Seedtreat-Captan (2.5 oz/cwt.) + Allegiance (0.5 oz/cwt.) (Trapper) <sup>1</sup>	1314.0
PEA08	Seedtreat-Apron(0.16 oz/cwt.) (Trapper) <sup>1</sup>	1239.0
PEA10	Seedtreat-Maxim(0.04 oz) + Apron(0.16 oz/cwt.) (Trapper) <sup>1</sup>	1095.0
PEA04	Trapper (Yellow 7/2/98)	1046.0
PEA06	Granger (Austrian Winter Pea 7/1/98)	864.0
PEA01	Grande (Green 7/1/98)	810.5
PEA05	Melrose (Austrian Winter Pea 7/8/98)	734.2

<sup>1</sup> Flowering Date 6/29/98

#### Summary Statistics

Experimental Means	1308.0
Error Mean Square	68300.0
P-value	0.0000
Standard Error of the Mean	130.7
C.V. 1: (s/mean)*100	20.0
LSD (0.05)	379.2

#### Notes:

Planting Date: 4/29/98

Threshed: 8/6/98

Previous crop: Barley

Growing season ppt. = 8.29"

Fertilizer: 30 lbs./ac P<sub>2</sub>O<sub>5</sub> as 11-52-0 was placed with the seed.

Herbicide: None

Title: The effect of phosphorus (P) and sulfur (S) on yield of yellow pea.

Year: 1998

Location: 1) Northwest of Cut Bank, MT at the Dave and Barbra Broberg farm.  
2) Southeast of Conrad, MT at the Bert Rigby farm.  
3) South of Joplin, MT at Moog Farms

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

Objectives: To determine the effect of P and S fertilization and soil tests on pea seed yield.

Procedures: Fourteen fertilizer treatments were applied, nitrogen (N), potassium (K), chloride (Cl), and S were broadcast and P was placed with the seed while planting. Plots were seeded into spring wheat stubble, no-till at Cut Bank, into fallow at Conrad, and into broken CRP grass at Joplin with a six-row, 12 inch spaced, double disk, no-till plot drill. Plot size was 6 x 20 feet with four replicates. Seeding rate was seven seeds/ft<sup>2</sup>. Inoculum was mixed with the seed before planting. The plots were direct cut with a Hege plot combine using pickup guards on the cutter bar.

Results: The data are summarized in Table 12s (northwest of Cut Bank) and Table 13s (southeast of Conrad). Yellow pea at the Cut Bank location responded to S, but did not respond to P. About 5 to 20% shatter damage was noted prior to harvest. The peas survived a hail storm on July 1, 1998. Soil tests Southeast of Conrad had high levels of P and S, and pea did not respond to P or S fertilization. Emergence of pea Southeast of Conrad were erratic due to soil crusting shortly after seeding. Crusting was caused by a precipitation event shortly after seeding. The peas Southeast of Conrad weathered a slight hail storm on June 1, 1998. The location near Joplin was planted on broken CRP and was abandoned due to drought.

Table 12s. The effect of P and S fertilizer on yield of yellow pea. Experiment located Northwest of Cut Bank, MT. Western Triangle Ag. Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-CI-S (lbs/a)	Seed Yield (lbs/a)
14	0-0-0-0-0	765.8
10	0-40-68-68-30	1003.0
1	8.5-0-68-68-0	840.8
4	8.5-0-68-68-15	1000.0
7	8.5-0-68-68-30	955.7
2	8.5-20-68-68-0	802.3
5	8.5-20-68-68-15	851.6
8	8.5-20-68-68-30	777.8
13	8.5-40-0-0-0	829.5
12	8.5-40-0-68-30	677.0
11	8.5-40-68-0-30	849.3
3	8.5-40-68-68-0	835.0
6	8.5-40-68-68-15	945.2
9	8.5-40-68-68-30	895.3

#### Summary Statistics

Experimental Means	859.2
Error Mean Square	18460
P-value	0.0692
Standard Error of the Mean	67.94
C.V. 1: (s/mean)*100	15.8
LSD (0.05)	194.5

#### Phosphorus Summary

0	915.2
20	810.6
40	877.9
LSD (0.05)	NS

#### Sulfur Summary

0	808.0
15	932.3
30	863.2
LSD (0.05)	114.8
Interaction P-value	0.6095

## Notes:

Planting Date: 4/27/98

Threshed: 8/12/98

Previous crop: Spring wheat.

Growing season ppt. = 6.20"

Herbicide: Pre-plant: Roundup @ 16oz/a and Prowl @ 32 oz/a, applied on 4/16/98, then harrowed in on 4/17/98. Post-plant: Assure @ 8 oz/a.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH	
	----- (ppm) -----							(%)		(%)		
0 - 6"	1.68	6.9	0.6	11.5	1.60	496	8.5	3.1	0.21	2.56	8.2	
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----							----- (lbs/a) -----				
0 - 1 ft.	1.97	10.3	0.32	9.01	0.57			22.8	11.5	18.0	119.7	
1 - 2 ft.	2.25	9.4	0.39	3.60	0.29			11.8	13.3	0.9	113.4	
2 - 3 ft.	2.32	12.1	0.75	2.61	0.74			33.2	20.3	1.7	5031.9	
3 - 4 ft.	2.65	14.5	1.10	3.08	1.37			174.8	21.4	7.6	8035.2	

Table 13s. The effect of P and S fertilizer on yield of yellow pea. Experiment located Southeast of Conrad, MT. Western Triangle Ag. Research Center, Conrad, MT. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-CI-S (lbs/a)	Seed Yield (lbs/a)	Stover Yield (lbs/a)	Plant Nutrients in Stover <sup>1</sup>		
				N	P (lbs/a)	S
13	8.5-40-0-0-0	2749	5282	119.3	10.8	8.8
7	8.5-0-68-68-30	2718	5714	131.1	10.0	7.9
1	8.5-0-68-68-0	2623	5186	110.8	8.6	6.2
5	8.5-20-68-68-15	2588	6194	137.8	12.1	10.3
10	0-40-68-68-30	2518	4754	115.3	9.8	7.1
6	8.5-40-68-68-15	2373	7202	189.6	14.5	10.5
4	8.5-0-68-68-15	2353	5810	146.1	10.1	9.2
8	8.5-20-68-68-30	2345	5330	124.2	10.5	8.5
3	8.5-40-68-68-0	2328	6434	154.4	11.8	9.8
14	0-0-0-0-0	2257	5426	130.7	9.4	7.9
11	8.5-40-68-0-30	2168	9075	220.4	19.4	17.0
2	8.5-20-68-68-0	2162	3457	82.8	5.6	4.5
12	8.5-40-0-68-30	2149	5954	146.2	12.4	10.7
9	8-5-40-68-68-30	2070	6722	158.6	12.8	10.1

<sup>1</sup> Chemical analysis done on dry plant matter containing straw and pods with peas.

#### Summary Statistics

Experimental Means	2386	5896	140.5	11.2	9.2
Error Mean Square	76780	3,819,000	1380	18.97	14.59
P-value	0.3363	0.6020	0.1765	0.4601	0.4175
Standard Error of the Mean	195.9	1382	26.27	3.1	2.7
C.V. 1: (s/mean)*100	11.6	33.5	26.4	38.8	41.7
LSD (0.05)	599	4222	80.3	9.4	8.3

#### Phosphorus Summary

0	2169	6306	149.9	12.8	10.4
20	2301	5406	133.1	10.1	8.1
40	2394	5814	140.2	10.8	8.7
LSD (0.05)	NS	NS	NS	NS	NS

#### Sulfur Summary

0	2408	5814	133.1	10.7	8.8
15	2208	7014	170.0	14.1	10.8
30	2248	4698	120.1	9.0	7.6
LSD (0.05)	NS	NS	NS	NS	NS
Interaction P-value	0.0417	0.2027	0.3616	0.0944	0.0837

## Notes:

Planting Date: 4/21/98

Threshed: 7/28/98

Previous crop: Fallow

Growing season ppt. = 6.61"

Herbicide: Pre-plant: Tillage.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH
	----- (ppm) -----							(%)		(%)	
0 - 6"	2.32	21.6	0.55	48.7	2.55	612	26.6	<0.1	0.15	1.99	6.9
	Cu	Fe	B	Mn	Zn			Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S
	----- (ppm) -----							----- (lbs/a) -----			
0 - 1 ft.	2.24	20.1	0.41	17.62	0.98			17.4	16.3	54.0	65.8
1 - 2 ft.	1.91	15.1	0.60	6.76	0.88			51.9	17.0	37.9	1818.5
2 - 3 ft.	1.86	14.5	1.53	4.01	0.68			163.1	21.8	26.0	4759.0
3 - 4 ft.	1.50	12.2	1.45	2.81	0.41			251.6	22.0	25.7	9619.3

Title: Effect of nitrogen (N) and phosphorus (P) on yield and quality of spring wheat and durum.

Year: 1998

Location: Western Triangle Agricultural Research Center, Conrad, MT 59425.

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

Objectives: To evaluate the effect N and P fertilizer have on yield and quality of spring wheat and durum and to compare spring wheat and durum response to N and P.

Procedures: Plots were planted with a four-row planter with one-foot spacing. Phosphorus fertilizer was applied with the seed and N and potassium (K) fertilizers were broadcast during planting.

Results: Grain yield, protein content, and test weight data are summarized in Table 14s. Grain yield relative to N fertilization was similar for both crops. McNeal had higher protein levels than Spectre with similar N fertility. As expected Spectre had higher test weight than McNeal, but test weight of both crops declined with increasing N. Neither crop responded to P fertilization, as expected, since the P soil test was very high.



Table 14s. The effect of N and P on spring wheat and durum yield and quality. The experiment was located at Western Triangle Ag. Research Center, Conrad, MT. 1998.

Entry	Fertilizer		Crop	Grain Yield (bu/a)	Test Weight (lbs/bu)	Protein (%)	
	N	P <sub>2</sub> O <sub>5</sub>					
	------(lbs/a) -----						
8	150	25	Spring Wt.	95.3	92.9	60.0	14.2
4	150	0	Spring Wt.	92.6		59.7	14.3
6	50	50	Spring Wt.	91.2		61.3	12.5
12	150	50	Spring Wt.	90.8		59.9	14.2
11	100	50	Spring Wt.	90.3	89.8	60.5	13.5
3	100	0	Spring Wt.	89.6		60.4	13.6
10	50	50	Spring Wt.	89.5	88.9	61.1	12.5
7	100	25	Spring Wt.	88.3		60.4	13.7
2	50	0	Spring Wt.	86.0		61.1	13.0
9	0	50	Spring Wt.	84.6		61.8	11.6
1	0	0	Spring Wt.	81.5	81.3	61.7	11.5
5	0	25	Spring Wt.	77.8		61.6	11.8
16	150	0	Durum	94.7		61.7	12.6
22	50	50	Durum	92.8		62.6	11.4
24	150	50	Durum	91.9		61.1	13.4
18	50	25	Durum	91.5		62.2	11.9
23	100	50	Durum	90.5		62.0	12.5
19	100	25	Durum	90.4		62.2	12.2
20	150	25	Durum	88.5		61.2	13.4
15	100	0	Durum	87.8		61.3	12.9
14	50	0	Durum	87.6		62.2	11.6
17	0	25	Durum	83.6		62.9	10.5
21	0	50	Durum	82.5		62.6	10.8
13	0	0	Durum	79.5		63.1	10.1

#### Summary Statistics

Experimental Means	88.3	61.4	12.5
Error Mean Square	27.6	0.179	0.191
P-value	0.0002	0.0000	0.0000
Standard Error of the Mean	2.63	0.211	0.218
C.V. 1: (s/mean)*100	6.0	0.7	3.5
LSD (0.05)	7.4	0.6	0.7

#### Variety Summary

Spring Wheat (McNeal)	88.1	60.8	13.0
Durum (Sceptre)	88.4	62.1	11.9
LSD (0.05)	NS	0.2	0.2

Table 14s Continued.

## Nitrogen Summary

0	81.6	62.3	11.0
50	89.8	61.8	12.2
100	89.5	61.1	13.1
150	92.3	60.6	13.7
LSD (0.05)	3.0	0.2	0.3

## Phosphorus Summary

0	87.4	61.4	12.4
25	88.3	61.5	12.5
50	89.1	61.4	12.5
LSD (0.05)	NS	NS	NS
Interaction P-value	0.541	0.318	0.066

## Notes:

Varieties: Durum = Sceptre

Spring Wheat = McNeal

Seeding Date: 4/28/98

Harvest Date: 8/20/98

Growing Season ppt: 8.44"

Planting Rate: 20 seeds/ft<sup>2</sup>

Previous Crop: Fallow

Fertilizer: N applied as urea (broadcast) and P applied with the seed. 30 lbs K/ac as KCl applied to all plots (broadcast).

Herbicide: Hoelon @ 2 $\frac{2}{3}$  pt./ac and Buctril @ 1 $\frac{1}{2}$  pt./ac applied on 5/28/98.

## Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	CaCO <sub>3</sub>	EC	OM	pH
	----- (ppm) -----							(%)		(%)	
0 - 6"	2.16	14.8	0.4	14.0	4.98	426	37.2	0.7	0.23	2.31	7.8
	Cu	Fe	B	Mn	Zn		Cl	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	
	----- (ppm) -----						----- (lbs/a) -----				
0 - 1 ft.	1.85	12.2	0.43	11.8	1.19		10.4	16.1	45.9	234.8	
1 - 2 ft.	1.51	9.3	0.51	3.91	0.40		15.2	13.3	13.7	1439.5	
2 - 3 ft.	1.72	10.0	0.80	4.02	0.58		11.4	15.6	11.9	2701.8	
3 - 4 ft.	1.79	10.1	1.81	1.61	0.87		14.2	16.1	8.5	7858.1	

0-3" 12

Title: Effect of nitrogen (N), phosphorus (P), potassium (K), and chloride (Cl) on winter wheat.

Year: 1998

Locations: 1) North of Loma, MT at the Lyle McKeever farm.  
2) East of Choteau, MT at the Roy Inbody farm

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

Objectives: To determine winter wheat yield and protein response to nitrogen (N) fertilization and N soil tests; to determine winter wheat response to P fertilizer and P soil tests; survey winter wheat response to K and Cl fertilization; and at the end of the project (three growing seasons) prepare yield, protein, and N and P fertilizer prediction models or equations using the soil tests and climatic information.

Procedures: Fourteen fertilizer treatments were applied, N, K, and Cl were broadcast and P was placed with the seed while planting. At Loma plots were seeded into fallow and at Choteau plots were seeded into chemical-fallow using a six-row, double disk plot drill with 12" spacing between rows. Seeding rates were 20 seeds/ft<sup>2</sup>. Plot size was 6 x 20 feet with four replications. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 15s (Loma) and Table 16s (Choteau). Soils of both locations had high nitrate-N and medium P levels. The Choteau site had a yield and protein response to N in spite of the high soil nitrate-N. However, this location yielded 61 bu/ac at 14% protein without additional N. Neither location responded to P.

Table 15s. Effect of N, P, K, and Cl on winter wheat yield and quality. Experiment located North of Loma, MT at the Lyle McKeever farm. 1998.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lb/bu)
14	100-25-30-0	66.8	13.5	62.9
7	100-25-30-30	66.8	13.7	62.9
10	50-50-30-30	61.0	13.5	63.2
8	150-25-30-30	60.6	13.3	62.8
2	50-0-30-30	60.1	13.9	62.8
4	150-0-30-30	59.7	14.1	62.4
12	150-50-30-30	57.9	13.8	62.9
1	0-0-30-30	56.2	13.4	63.1
11	100-50-30-30	55.7	14.1	62.9
6	50-25-30-30	55.2	13.9	62.0
9	0-50-30-30	55.0	13.4	62.5
13	100-25-0-30	54.7	13.9	62.6
3	100-0-30-30	54.4	14.2	62.6
5	0-25-30-30	50.3	13.7	62.6

#### Summary Statistics

Experimental Means	57.5	13.7	62.7
Error Mean Square	49.69	0.3880	0.3202
P-value	0.2615	0.6432	0.3794
Standard Error of the Mean	3.524	0.3115	0.2829
C.V. 1: (s/mean)*100	12.3	4.5	0.9
LSD (0.05)	NS	NS	0.8

#### Nitrogen Summary

0	53.8	13.5	62.7
50	58.8	1.8	62.7
100	55.9	14.0	62.8
150	59.4	13.7	62.7
LSD (0.05)	NS	0.5	NS

#### Phosphorus Summary

0	57.6	13.9	62.7
25	55.9	13.7	62.6
50	57.4	13.7	62.9
LSD (0.05)	NS	NS	NS
Interaction p-value	0.7864	0.6452	0.1719

## Notes:

Variety: Rampart

Seeding Date: 9/23/97

Harvest Date: 7/24/98

Growing Season ppt: No data

Planting Rate: 20 seeds/ft<sup>2</sup>

Previous Crop: Fallow

Herbicide: Bronate @ 1½ pt/ac and Mavrick @ ⅔oz/ac applied on 5/5/98.

## Soil Test Summary:

Depth	K ----- (ppm)	Olsen P -----	EC (mmhos/cm)	OM (%)	pH
0 - 6"	324	15.7	0.1	1.47	7.0
	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	Cl	
	----- (lbs/a) -----				
0 - 1	8.2	41.8	24.4	16.5	
1 - 2	8.3	37.2	74.0	27.8	
2 - 3	10.9	43.9	1702.5	52.9	
3 - 4	15.2	51.2	3757.7	71.9	

Table 16s. Effect of N and P on winter wheat yield and quality. Experiment located East of Choteau, MT on the Roy Inbody farm.

Entry	Fertilizer N-P <sub>2</sub> O <sub>5</sub> -K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)
2	50-0-30-30	67.1	14.9	60.5
10	50-50-30-30	65.3	14.5	60.7
3	100-0-30-30	64.5	15.1	60.4
4	150-0-30-30	64.5	15.1	60.0
6	50-25-30-30	64.0	14.8	60.9
8	150-25-30-30	63.1	15.3	60.2
11	100-50-30-30	62.8	15.1	60.5
12	150-50-30-30	62.3	15.2	60.1
9	0-50-30-30	62.0	14.3	61.1
7	100-25-30-30	61.1	15.1	60.2
5	0-25-30-30	60.7	13.9	61.4
1	0-0-30-30	60.3	13.9	61.6

## Summary Statistics

Experimental Means	63.1	14.8	60.6
Error Mean Square	13.04	0.2497	0.8689
P-value	0.2977	0.0008	0.3109
Standard Error of the Mean	1.805	0.2499	0.4661
C.V. 1: (s/mean)*100	5.7	3.4	1.5
LSD (0.05)	5.2	0.7	1.3

## Nitrogen Summary

0	61.0	14.0	61.4
50	65.5	14.7	60.7
100	62.8	15.1	60.3
150	63.3	15.2	60.1
LSD (0.05)	3.0	0.4	0.8

## Phosphorus Summary

0	64.1	14.7	60.6
25	62.2	14.8	60.7
50	63.1	14.8	60.6
LSD (0.05)	NS	NS	NS
Interaction p-value	0.8833	0.7648	0.9877

## Notes:

Variety: Rampart

Seeding Date: 9/22/97

Harvest Date: 8/11/98

Growing Season ppt: No data

Planting Rate: 20 seeds/ft<sup>2</sup>

Previous Crop: Chemical-fallow

Herbicide: No data.

## Soil Test Summary:

Depth	K ----- (ppm)	Olsen P -----	EC (mmhos/cm)	OM (%)	pH
0 - 6"	614	13.3	0.22	1.72	8.1
	NH <sub>4</sub> -N	NO <sub>3</sub> -N	SO <sub>4</sub> -S	Cl	
		----- (lbs/a) -----			
0 - 1	15.0	28.6	24.2	34.6	
1 - 2	13.3	32.9	45.2	34.1	
2 - 3	12.7	75.7	125.1	61.0	
3 - 4	11.9	55.2	415.9	127.3	