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The 22nd

ANNUAL RESEARCH REPORT

of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

1999

Submitted by

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Soils Research

Climatic summary for the 1999 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
Precipitation (inches)													
Current Year	0.10	0.17	0.06	1.48	0.81	3.44	0.37	1.98	1.07	0.60	0.55	0.05	10.68
Average 15 yr	0.20	0.20	0.53	0.92	1.96	2.79	1.57	1.47	1.34	0.51	0.38	0.17	12.04
Mean Temperature (^{0}F)													
Current Year	25.1	33.9	39.5	39.6	50.1	56.6	64.9	69.2	54.8	48.6	41.3	33.8	44.0
Average 14 yr	22.2	24.3	34.0	43.4	53.1	60.1	65.6	65.9	57.5	45.7	31.2	25.1	44.0

Last killing frost in Spring
1999----------May 13 (32^0)
Average----------May 14

First killing frost in Fall
1999----------Sep 27 (29^0)
Average----------Sep 22

Frost free period (days)
1999----------137
Average----------130.6

Maximum summer temperature--- 95^0 (Jul 29)

Minimum winter temperature---- - 13^0 (Jan 25, 1999)

Summary of climatic data by month for the 1998-99 crop year (Sept - August) at the Western Triangle Research Center, Conrad, MT.

	Sep 1998	Oct 1998	Nov 1998	Dec 1998	Jan 1999	Feb 1999	Mar 1999	Apr 1999	May 1999	June 1999	July 1999	Aug 1999	Total or Average
Precipitation (inches)													
Current year	0.50	0.19	0.62	0.08	0.10	0.17	0.06	1.48	0.81	3.44	0.37	1.98	9.80
Average 15 yr	1.36	0.50	0.37	0.18	0.20	0.20	0.53	0.92	1.96	2.79	1.57	1.47	12.05
Mean Temperature (^{0}F)													
Current year	64.2	48.6	33.2	25.5	25.1	33.9	39.5	39.6	50.1	56.6	64.9	69.2	45.9
Average 14 yr	57.7	45.5	30.4	24.4	22.2	24.3	34.0	43.4	53.1	60.1	65.6	65.9	43.9

Last killing frost in Spring
1999----------May 13 (32^0)
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1999---------- Sep 27 (29^0)
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Maximum summer temperature------- 95^0 (Jul 29)

Minimum winter temperature--------- -13^0 (Jan. 25, 1999)

Winter Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

Winterhardiness ratings: 5 = very good; 1 = poor.
Coleoptile length: Long = 3.4" or more; Short = 3" or less.
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 winterhardiness (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. Winterhardiness 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): Winterhardiness medium (3). Medium-short height with long coleptile 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): Winterhardiness less than Centurk, but greater than Vona (probably should classify as a 2). Not widely adapted for Montana. Short straw and good lodging resistance. Early maturity. Good shatter resistance. Sometimes can have test weight problems due to its massive tillering. Low protein.

Big Sky (MT9432, 1999): Nuwest/Tiber cross, hard red kernels, white chaff. Good winterhardiness, greater than Judith, and equal or slightly better than Tiber. Strong, stiff straw, very good lodging resistance, height equal to Tiber. Long coleoptile. Medium maturity, heading 1-2 days later than Rocky, but 2 days earlier than Neeley and Tiber. Yield about equal to Rocky and Neeley, and 2-3 bu higher than Tiber. High test wt and protein, protein = Tiber. Post-harvest seed dormancy is high, like Tiber. Septoria and tan spot resistance is good. A good alternative to Tiber.

Blizzard (ID 0297) (Idaho/Oregon/USDA, 1989): Probably similar to Weston for winterhardiness 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): Winterhardiness 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 winterhardiness. Long coleoptile.

Centurk (Nebr, 1971): Medium low winterhardiness (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 winterhardiness. Tall straw. Medium maturity. Medium to high yield, shatters bad -(see `Cree' for an improvement). High protein.

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

Cimmaron (Oklahoma): Awnless (awnletted), red head. Winterhardiness 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.

Culver (Nebr 1998).

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. Better yield than Agassiz and Roughrider, but lower protein than Roughrider. Recommended only for eastern Montana, not competitive in other areas. 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 suscept to shatter. Higher test wt than Roughrider, Judith & Neeley, and similar to Tiber & Rocky. High protein (similar to Redwin) & excellent quality. Intended to replace Roughrider, Agassiz and Seward in NE Montana.

Fidel (Amer Cyanamid).

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. Excellent winterhardiness (5). Height similar to Rocky. Very short coleoptile. Three days later to head and slightly later maturity than Rocky; heading similar to Neeley. Yield avgs 1 bu less than Rocky. Test wt 1 lb less than Rocky or Tiber. Protein equal or slightly higher than Rocky, similar to Neeley, and about 1% less than Tiber and Rampart. Milling and baking acceptable, about equal to Neeley. Recommended for areas needing high levels of winterhardiness.

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.

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 Pseudumonas 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_1 hybrid; needs new seed each year. Planting F_2 (second generation) seed may result in yield reduction and developement of ergot due to sterility in a small percentage of florets (ms ratio less than 3:1). F_1 vs F_2 tests in 1992 indicated a 12% yield reduction from planting 2nd generation seed. Winterhardiness is fairly good (3), but less than Winalta. Medium short height, but taller than 547, giving an advantage in dry conditions. Lodging resistance equal to Rocky. 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_1 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_1 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_1 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): F1 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.

Ransom (ND, 1998): Good winterhardiness. Medium height, maturity and protein.

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. Medium winterhardiness. Very long coleoptile. Early maturity.

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 sraw 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 medium. Very short coleoptile. Early maturity. 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.

MTW 9441 (MSU): Experimental, Nuwest/Tiber, hard white. (Sister line to the hard red var Big Sky). Good dual purpose quality for noodles & bread. Similar or slightly better agronomics than Nuwest. Short coleoptile. Will be considered for release in 2000.

Platte (Agripro/ConAgra): Hard white for Kansas and Colorado. Winterhardiness and adaptation to Montana unknown.

Snow White (Goertzen/Carghill): Hard white for Kansas and Colorado. Winterhardiness and adaptation to Montana unknown.

Note for 1999 plots: Winter survival was too poor to collect yield data. However, important information on sawfly resistance was collected at the Knees and Conrad locations, so the year wasn't a total loss.

1999 Spring 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. Luther Talbert, MSU Plant Science Dept.

Off-station spring wheat variety trials were grown in Teton County near Choteau, Toole County near Oilmont, Glacier County near Cut Bank, and Chouteau County in the Knees Area. These four locations represent diverse environments with Choteau having deep soil and typically favorable moisture; the Knees with deep soil, intermediate moisture and warmer temperatures; Oilmont having less than favorable moisture; and Cut Bank with short growing season. The Cut Bank and Choteau trials were no-till planted on chem-fallow. Trials on station at Conrad included dryland and irrigated, hard red and hard white spring wheat, and durum.

Results: Data for the hard red wheat trials at Conrad are presented in Tables 1-5, and include the 1999 data and five-year averages. Hard white results are in Table 6. Data for the four off-station locations are presented in Tables 7-13, and include the 1999 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 14-18.

Rainfall was about 83% of normal amount during the growing season, resulting in below normal test weight, but cool temperatures relieved some stress and allowed for reasonably good yields.

Many of the wheat and durum varieties were severely cut by sawfly at the Knees, including Rambo and Amidon. Exceptions were Conan and Scholar with medium stem cutting; Fortuna, Lew and Ernest with slight cutting; and Lloyd, Laker, Medora and Utopia durums with slight cutting. These durums had no stem solidness, and escaped sawfly damage for unknown reasons.

Ernest and Scholar had similar average yield and agronomics at most locations, except Ernest had better sawfly resistance. Scholar was superior to Amidon for yield, agronomics and sawfly resistance at all locations (Scholar has medium sawfly resistance).

McNeal ranked high for yield at all locations.

Among the durums, Utopia and Mountrail were among the top performers on both dryland and irrigated. Maier ranked high on dryland and had a nice height for dryland conditions, being slightly shorter than Sceptre.

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

Spring Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad MT

Far-Go herbicide tolerance:

Most Tolerant: Argent, Bergen, Bronze Chief, Butte-86, Dalen, Ernest, Fortuna, Glenman, Grandin, Gus, 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 Qaulity 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 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), slightly earlier than McNeal. Poor threshability, similar to 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 and Amidon. Good yield, agronomics and quality; higher yield than Amidon. 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 elswhere.

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. Maturity similar to Hiline and 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.

Fjeld (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.

Gunner (Agripro): Standard height. For scab resistance in eastern ND and MN.

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.

Hagar (Agripro): Intermediate height, medium-late maturity. Medium yield and high protein.

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 McNeal (maturity similar to Lew & Pondera). Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Somewhat susceptible to dryland root rot, more so than McNeal. Susceptible to leaf rust. 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.

Ivan (Agripro): Medium late maturity, high yield, low protein. For ND and MN.

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. Straw is less resilient, and is prone to breaking over in strong wind. Medium maturity, 1 day earlier than Newana and 3 days later than Hiline. Fair tolerance to wheat streak mv (2.5 on scale of 1-3). Some tolerance to dryland root rot, more so than Hiline. 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.

Parshall (ND): Maturity 3 days earlier than McNeal, and equal to Hiline.

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.

Pristine (WPB): Bearded semidwarf. Maturity 3 days earlier than McNeal. Yield similar to McNeal. Protein 0.5% lower than McNeal.

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.

Reeder (ND): Maturity later than McNeal.

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, Conan, Express, Fergus, Nomad, Pristine, Rambo, Zeke.

Westbred 926R (WPB, 1987): Bearded semidwarf. Good straw strength; 2 inches shorter than Newana, and 4 inches shorter than McNeal. Maturity equal to Hiline, and 3 days earlier than McNeal. Susceptible to Avenge herbicide; good tolerance to FarGo. Has some resistance to Washington race of Hessian fly. Fairly good tolerance to dryland root rot. Among highest yielders. Tendency to shatter. Test weight similar to McNeal 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. Maturity 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.

Zeke (WPB): Similar maturity and protein as Pristine, but lower yield and test wt.

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. Semidwarf, lodging resistant. Early maturity. Fargo tolerant. High protein.

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 Tananger 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. Maturity eaqual 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. Fargo tolerant.

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.

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

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): Standard height, moderate suscept to lodging. Medium maturity. Good test weight and large kernel size. High protein and strong gluten. 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. Large kernel. Good quality.

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

Kari (Agripro): Intermediate height, medium maturity, medium yield. High protein and strong gluten.

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. Leaf spots in 1999. High yield and good shatter resistance. Test weight is medium low. Medium kernel size, low protein. Strong gluten; quality = 3.

Maier (ND, 1998): Medium height, slightly taller than Laker; good lodging resistance. Late maturity. High yield. Medium large kernels, high protein and good quality.

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. Large kernel size, high protein. Strong gluten; quality = 4.

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

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

Mountrail (ND,1998): Medium-tall, but fair lodging resistance. Medium-late maturity. Medium large kernel and medium protein; good quality.

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. Stong 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 1 **Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 1999. 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
MT 9735		68.0	62.9	32	182	11.2
SDM50005		64.8	61.8	33	183	12.2
NW CONSORTIUM		63.7	61.8	34	182	11.2
MCNEAL		63.2	61.1	33	183	12.4
Pristine		62.9	63.1	33	180	11.9
MT 9675		62.1	59.5	34	183	10.6
NEWANA		62.1	62.2	31	183	12.0
Reeder		62.0	61.9	35	182	12.9
MT 9720		61.3	63.1	33	183	12.2
MT 9755		60.0	60.7	31	181	12.1
MT 9874		59.8	61.3	33	183	12.7
MT 9712		59.0	62.4	35	182	13.2
MT 9706		58.7	61.7	36	182	13.6
BZ996472		58.7	63.2	29	181	12.8
ERNEST	*	58.3	62.1	38	182	12.7
MT 9836		57.9	62.3	31	181	12.9
WESTBRED 926		57.3	60.4	32	181	13.3
MT 9807		57.0	62.0	33	182	12.7
MTHW9420		56.8	60.3	32	183	11.5
HI-LINE		56.7	60.3	34	181	12.5
MT 9739		56.6	61.2	38	183	12.9
FORTUNA	*	56.4	61.6	38	182	13.2
Conan	*	56.0	61.7	33	181	12.9
GRANDIN		55.9	61.1	35	183	12.8
MT 9772		55.9	60.5	38	182	13.6
MT 9834		55.6	60.0	32	184	13.4
MT 9754		55.3	61.5	29	183	12.0
MT 9719		55.3	63.0	32	183	12.3
MT 9849		55.2	61.8	36	183	12.0
MT 9835		54.8	62.1	32	180	12.2

(Continued on next page)

(Advanced Yield Spring Wheat, continued)

Variety		Yield bu/ac	Test weight lbs/bu	Plant hgt. inches	Head date	% protein
MT 9748		54.4	60.9	33	183	12.6
Zeke		54.4	58.4	33	181	11.9
MT 9813		54.0	61.6	35	182	13.7
MT 9866		53.9	60.3	40	183	13.3
MT 9801		53.5	60.0	33	183	13.9
MT 9806		53.4	61.3	34	182	14.6
MT 9771		53.0	60.3	38	183	13.8
Scholar	*	52.4	61.5	39	185	12.9
MT 9715		52.4	59.9	33	183	12.7
THATCHER		52.1	59.6	40	185	11.9
Parshall		52.1	60.9	39	182	14.0
MT 9875		52.0	60.5	33	183	11.5
MT 9850		49.7	61.2	35	184	13.2
MTHW9603		49.7	58.1	33	184	12.8
MTHW9701		49.3	58.3	30	182	12.7
AMIDON	*	48.6	59.3	38	183	13.0
MT 9815		47.5	62.6	37	184	12.8
MT 9802		47.1	60.1	34	181	13.4
LEW	*	43.1	58.6	37	184	12.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N-UREA actual topdressed before seeding.
Previous crop: Fallow.
Date seeded: April 13, 1999.
Date harvested: August 23, 1999.
Rainfall: From seeding to harvest was 7.78 inches.
* = Sawfly resistant varieties. (Amidon, Conan and Scholar have partial resistance)
Yield experimental mean: 55.91
Error degrees of freedom: 96
F test for var: 2.13
C.V. 2: 6.10
LSD (0.05): 9.58

Table 2 **Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 1999. 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		63.2	61.1	33	183	12.4
Pristine		62.9	63.1	33	180	11.9
NEWANA		62.1	62.2	31	183	12.0
Reeder		62.0	61.9	35	182	12.9
ERNEST	*	58.3	62.1	38	182	12.7
WESTBRED 926		57.3	60.4	32	181	13.3
MTHW9420		56.8	60.3	32	183	11.5
HI-LINE		56.7	60.3	34	181	12.5
FORTUNA	*	56.4	61.6	38	182	13.2
Conan	*	56.0	61.7	33	181	12.9
GRANDIN		55.9	61.1	35	183	12.8
Zeke		54.4	58.4	33	181	11.9
Scholar	*	52.4	61.5	39	185	12.9
THATCHER		52.1	59.6	40	185	11.9
Parshall		52.1	60.9	39	182	14.0
MTHW9701		49.3	58.3	30	182	12.7
AMIDON	*	48.6	59.3	38	183	13.0
LEW	*	43.1	58.6	37	184	12.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N-UREA actual topdressed before seeding.
Previous crop: Fallow.
Date seeded: April 13, 1999.
Date harvested: August 23, 1999.
Rainfall: From seeding to harvest was 7.78 inches.
* = Sawfly resistant varieties. (Amidon, Conan and Scholar have partial resistance)
Yield experimental mean: 55.91
Error degrees of freedom: 96
F test for var: 2.13
C.V. 2: 6.10
LSD (0.05): 9.58

Table 3 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Conrad, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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		70.0	60.7	34	185	11.8
ZEKE		67.3	60.6	32	183	11.6
NEWANA		67.2	60.0	32	187	11.3
WESTBRED 926		65.6	60.7	32	182	12.0
HI-LINE		65.2	61.9	33	184	11.9
ERNEST	*	64.4	62.1	40	185	12.2
SCHOLAR	*	64.3	61.2	40	187	12.1
GRANDIN		63.3	61.4	36	184	11.9
AMIDON	*	62.2	60.4	40	186	11.8
FORTUNA	*	61.9	62.5	41	185	12.1
CONAN	*	61.9	60.5	33	185	12.0
LEW	*	60.1	61.4	42	188	11.7
THATCHER		58.7	59.8	44	188	11.4

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

Table 4 **Irrigated Spring Wheat** variety trial grown north of **Conrad, MT**. 1999. 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
MTHW9701		102.7	62.7	32	182	12.9
MTHW9420		99.7	62.9	35	182	13.7
WESTBRED 936		92.8	61.7	29	181	14.5
PARSHALL		89.8	63.9	41	183	13.9
WESTBRED EXPRESS		89.8	62.3	29	181	14.9
FERGUS		89.3	62.6	32	180	14.3
SCHOLAR	*	89.0	62.7	37	184	15.3
REEDER		88.3	62.6	38	182	14.6
AMIDON	*	88.2	61.1	40	181	14.6
PNR 2375		86.7	61.8	36	180	13.9
ERNEST	*	85.6	61.3	38	184	14.6
HI-LINE		83.3	62.8	32	180	14.5
NEWANA		83.1	62.0	34	185	13.6
WESTBRED 926		82.3	61.9	31	182	13.8
RAMBO	*	81.3	62.7	33	184	14.1
MCNEAL		80.3	62.4	35	181	14.8
GRANDIN		79.9	61.3	36	184	14.9
CONAN	*	78.4	61.7	33	181	14.7
LEW	*	74.3	63.8	40	184	14.2
FORTUNA	*	73.9	62.4	37	184	14.6

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 90# N topdressed.
Previous crop: Fallow.
Date seeded: April 15, 1999.
Date harvested: August 30, 1999.
Moisture rate: Rainfall from seeding to harvest was 7.8 inches, with two applications of sprinkler irrigation. (6/21 - 7/8)
* = Sawfly resistant varieties. (Amidon, Conan, Rambo and Scholar have partial resistance.)
Yield experimental mean: 85.92
Error degrees of freedom: 38
F test for var: 1.66
C.V. 2: 6.66 LSD (0.05): 16.39

Table 5 **Five-year summary** for **Irrigated Spring Wheat** varieties grown north of **Conrad, MT.** 1994 - 1996 - 1997 - 1998 - 1999. 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		84.4	61.2	30	180	12.9
MTHW9420 (hard white)		84.1	61.5	34	181	12.1
WESTBRED EXPRESS		83.3	61.5	30	182	12.6
FERGUS		81.5	61.7	33	180	12.8
NEWANA		77.9	61.1	34	186	11.8
HI-LINE		77.6	62.7	32	182	12.7
MCNEAL		77.5	61.8	35	184	12.8
GRANDIN		76.2	61.7	36	183	13.3
PIONEER 2375		75.7	62.2	36	180	12.9
WESTBRED 926		75.1	61.3	32	180	12.6
RAMBO	*	74.1	59.6	32	185	12.2
AMIDON	*	73.3	60.8	40	183	13.0
SCHOLAR	*	71.7	61.9	39	184	13.2
ERNEST	*	70.6	61.5	40	183	13.8
FORTUNA	*	64.7	62.7	40	184	13.0
LEW	*	64.6	62.9	42	185	12.8

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT (Pondera County)
* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have have partial resistance.)
@ = Head dates based on four years. (1994-1996-1998-1999)

Table 6 **Hard White Spring Wheat** variety trial grown north of **Conrad**, 1999. 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
MTHW9701	64.4	61.4	32	182	
MTHW9905	60.1	61.5	34	182	
MTHW9904	60.1	62.9	35	182	
MTHW9705	60.0	61.0	31	182	
MTHW9910	59.9	60.6	34	183	
MTHW9804	59.8	62.7	32	180	
MTHW9709	59.7	60.2	32	182	
ID377S	59.0	60.7	33	182	
MTHW9706	58.2	60.7	34	182	
MTHW9901	56.8	61.5	37	183	
MTHW9715	56.7	62.9	36	182	
MTHW9903	56.1	61.5	34	183	
MTHW9710	56.1	60.7	31	180	
MTHW9906	56.1	61.2	33	182	
MTHW9603	56.0	60.3	35	183	
KLASIC	55.1	61.2	24	179	
HI-LINE (hard red)	55.0	59.8	32	181	
MTHW9902	54.6	60.4	37	185	
MTHW9915	54.1	62.0	35	182	
ID533	54.0	61.2	34	183	
MTHW9914	53.8	60.3	37	183	
MTHW9911	53.7	60.7	34	185	
MTHW9912	53.2	60.1	31	183	
MTHW9716	53.2	61.5	33	180	
MTHW9908	52.3	60.8	33	183	
MTHW9420	51.2	60.4	32	182	
MTHW9913	51.2	60.1	33	183	
MTHW9907	49.9	60.6	34	183	
MTHW9909	47.0	59.1	32	185	
ARGENT	46.6	60.6	38	183	

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N-UREA actual topdressed before seeding.

Previous crop: Fallow.
Date seeded: April 15, 1999.
Date harvested: August 23, 1999.
Rainfall: From seeding to harvest was 7.78 inches.
Yield experimental mean: 55.46
Error degrees of freedom: 58.00
F test for var: 1.97
C.V. 2: 5.20 ---------- LSD (0.05): 8.16

Table 7 **Dryland Spring Wheat** variety trial grown near **Cut Bank**, 1999. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
PARSHALL		46.9	58.9	34	16.8
MCNEAL		46.2	58.0	30	17.2
WESTBRED EXPRESS		45.8	57.4	26	15.4
REEDER		45.6	59.0	32	17.3
FERGUS		45.0	57.8	26	16.8
WESTBRED 926		44.4	55.9	30	16.1
WESTBRED 936		44.4	57.8	25	16.7
MTHW9701		44.2	56.2	29	16.3
HI-LINE		44.2	57.9	27	15.7
ERNEST	*	43.5	59.5	31	17.9
SCHOLAR	*	43.4	55.7	31	17.1
PNR 2375		43.3	57.8	31	15.4
NEWANA		42.4	56.0	26	15.7
GRANDIN		41.8	56.8	30	17.0
CONAN	*	41.6	58.0	27	16.9
FORTUNA	*	40.8	59.3	32	16.6
LEW	*	39.0	56.7	32	15.9
MTHW9420		38.9	56.5	26	15.8
AMIDON	*	38.3	57.2	32	17.0
RAMBO	*	36.6	57.8	27	16.4

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. (Barley stubble)
Date seeded: April 8, 1999.
Date harvested: August 29, 1999.
Rainfall: 5.25 inches from April 1 to harvest.
* = Sawfly resistant varieties. (Amidon, Conan, Rambo, and Scholar have partial resistance.)
Yield experimental mean: 42.80
Error degrees of freedom: 38
F test for var: 2.59
C.V. 2: 4.14
LSD (0.05): 5.07

Table 8 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Cut Bank, MT**. 1995 - 1996 - 1997 - 1998 - 1999. 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	% Protein
MCNEAL		45.9	58.9	32	12.8
FERGUS		45.7	59.2	30	12.7
WESTBRED 936		44.7	58.9	28	11.8
PIONEER 2375		44.6	60.0	35	12.0
HI-LINE		44.5	59.7	30	12.1
WESTBRED EXPRESS		44.4	59.3	27	12.1
MTHW9420	(hard white)	43.8	58.1	30	11.8
GRANDIN		43.3	58.4	33	12.9
SCHOLAR	*	42.6	59.1	37	13.2
NEWANA		42.6	58.2	30	11.9
WESTBRED 926		42.6	58.0	31	12.7
AMIDON	*	42.4	58.9	38	12.3
FORTUNA	*	42.1	60.7	37	12.0
LEW	*	41.9	59.3	36	11.9
RAMBO	*	41.8	59.0	29	12.0
ERNEST	*	40.1	60.1	36	13.0

Cooperator: Kevin Bradley.
Location: Fifteen miles north of Cut Bank. (Glacier County)
* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Table 9 **Dryland Spring Wheat** variety trial grown near **Oilmont**, 1999. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% protein
FORTUNA	*	28.3	52.0	29	15.0
CONAN	*	27.8	52.4	27	16.1
REEDER		27.4	52.5	28	16.8
AMIDON	*	26.0	51.6	29	15.7
MCNEAL		25.5	46.7	26	16.8
WESTBRED 926		24.9	51.6	26	17.6
SCHOLAR	*	24.9	49.0	28	16.8
PNR 2375		24.9	51.3	28	15.5
MTHW9420		24.4	47.9	27	16.8
PARSHALL		24.2	49.8	31	16.8
NEWANA		24.1	52.3	26	16.6
FERGUS		24.0	53.4	25	16.8
LEW	*	23.9	49.0	29	16.5
RAMBO	*	23.5	52.1	25	16.3
ERNEST	*	23.5	55.0	26	17.0
HI-LINE		23.2	48.4	25	17.1
GRANDIN		23.0	53.6	27	16.8
MTHW9701		22.9	48.7	26	16.6
WESTBRED 936		22.5	53.3	25	16.7
WESTBRED EXPRESS		22.5	54.3	24	15.5

Cooperator: Terry Alme.
Location: Eight miles east of Oilmont. (Toole County)
Fertilizer: Topdress 45# N-UREA, and 100# 11-52-0 with seed.
Previous crop: Fallow.
Date seeded: April 7, 1999.
Date harvested: August 10, 1999.
Rainfall: From May 17 to harvest was 4.27 inches.
* = Sawfly resistant varieties. (Amidon, Conan, Rambo and Scholar have partial resistance.)
Yield experimental mean: 24.57
Error degrees of freedom: 38
F test for var: 2.80
C.V. 2: 4.12
LSD (0.05): 2.90

Table 10 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Oilmont, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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	% Protein
MCNEAL		38.5	53.0	30	15.2
HI-LINE		36.6	53.7	28	15.3
WESTBRED 936		36.4	54.7	26	15.5
WESTBRED EXPRESS		35.8	55.4	25	14.4
PIONEER 2375		35.1	55.7	30	14.3
WESTBRED 926		34.7	54.7	28	15.8
NEWANA		34.6	54.5	28	14.3
GRANDIN		34.6	55.3	31	15.2
FORTUNA	*	34.4	56.6	35	14.0
SCHOLAR	*	34.2	55.8	31	15.1
RAMBO	*	34.0	55.7	28	14.8
LEW	*	33.7	55.0	34	14.9
FERGUS		33.4	55.2	27	15.3
AMIDON	*	32.9	55.6	35	14.6
ERNEST	*	32.8	56.6	32	15.5

Cooperator: Terry Alme.
Location: Eight miles east of Oilmont, MT. (Toole County)
* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Table 11 **Dryland Spring Wheat** variety trial grown near **Choteau**, 1999. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% protein
NEWANA		66.1	59.4	26	14.5
RAMBO	*	65.8	57.7	27	14.2
MCNEAL		63.8	59.0	28	15.8
SCHOLAR	*	62.4	58.0	34	14.3
ERNEST	*	61.0	57.2	33	14.7
LEW	*	59.7	59.1	34	13.5
FORTUNA	*	57.2	59.0	34	14.9
REEDER		56.8	57.0	34	15.4
FERGUS		56.6	58.2	28	15.2
MTHW9420		55.8	57.4	28	14.0
WESTBRED 936		53.7	57.9	28	15.8
CONAN	*	53.6	57.7	29	15.4
GRANDIN		52.0	56.7	32	16.0
MTHW9701		51.9	56.7	26	14.5
PNR 2375		49.5	59.4	33	14.7
HI-LINE		48.5	57.0	26	15.1
AMIDON	*	48.4	55.1	32	14.6
PARSHALL		47.9	56.7	36	14.4
WESTBRED 926		47.6	57.2	28	16.1
WESTBRED EXPRESS		32.7	55.9	26	15.7

Cooperator: Roy Inbody.
Location: Twelve miles northeast of Choteau. (Teton County)
Fertilizer: 100 # 11-52-0 with the seed, + 45 #N actual urea.
Previous crop: No-till chemical fallow.
Date seeded: April 12, 1999.
Date harvested: August 30, 1999.
* = Sawfly resistant varieties. (Amidon, Conan, Rambo and Scholar have partial resistance.)
Yield experimental mean: 54.55
Error degrees of freedom: 38
F test for var: 5.10
C.V. 2: 6.39
LSD (0.05): 9.98

Table 12 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Choteau, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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	% Protein
MCNEAL		58.7	57.3	33	14.5
NEWANA		58.4	55.6	31	13.4
FERGUS		57.9	58.7	32	14.2
WESTBRED 936		56.7	57.9	29	14.8
FORTUNA	*	56.3	60.5	39	14.3
RAMBO	*	56.2	56.5	30	13.4
MTHW9420 (hard white)		55.9	57.7	31	13.5
ERNEST	*	55.0	60.3	37	14.8
HI-LINE		54.9	58.8	31	14.1
SCHOLAR	*	54.5	57.5	37	14.7
WESTBRED 926		54.0	57.9	31	14.8
GRANDIN		54.0	57.7	35	15.0
PIONEER 2375		53.9	60.1	35	14.0
LEW	*	51.1	59.4	39	14.1
WESTBRED EXPRESS		49.5	58.2	28	13.9
AMIDON	*	49.0	57.3	38	14.1

Cooperator: Roy Inbody.
Location: Twelve miles northeast of Choteau, MT.(Teton County)
* = Sawfly resistant varieties. (Amidon, Rambo and Scholar have partial resistance.)

Table 13 **Dryland Spring Wheat** variety trial grown near the **Knees**, 1999. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
CONAN	*	31.3	54.5	29	16.2
FORTUNA	*	31.1	52.5	32	15.6
HI-LINE		26.8	51.2	28	17.1
PARSHALL		26.4	51.5	35	16.5
REEDER		26.0	52.2	31	16.8
MCNEAL		25.5	49.4	28	17.1
WESTBRED 926		25.4	50.2	27	17.1
NEWANA		25.4	51.4	27	16.6
LEW	*	23.9	51.5	30	17.1
ERNEST	*	23.8	52.8	32	17.2
PNR 2375		20.9	49.8	31	15.9
RAMBO	*	20.3	50.7	26	16.7
GRANDIN		20.0	46.7	27	16.7
MTHW9701		19.8	48.3	28	16.6
WESTBRED 936		19.8	49.9	26	17.3
MTHW9420		19.3	47.2	28	16.4
FERGUS		17.3	50.0	27	16.7
SCHOLAR	*	15.4	48.3	32	17.1
WESTBRED EXPRESS		14.9	49.6	25	15.4
AMIDON	*	13.5	49.2	28	16.3

Cooperator: Dan Picard.
Location: Thirty miles east of Brady. (Chouteau, County)
Fertilizer: 60# N topdressed & 60# 11-52-0 with the seed.
Previous crop: Fallow
Date seeded: April 7, 1999.
Date harvested: August 16, 1999.
Rainfall: 4.9 inches from May 6 to harvest.
* = Sawfly resistant varieties. (Amidon, Conan, Rambo, and Scholar have partial resistance.)
Yield experimental mean: 22.34
Error degrees of freedom: 38
F test for var: 12.75
C.V. 2: 6.31
LSD (0.05): 4.04

Table 14 **Dryland Durum** variety trial grown north of **Conrad**, 1999. 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
Maier	67.9	63.7	33	183	11.9
DH894401	67.4	63.6	30	181	11.9
D91080	67.0	62.9	29	183	11.3
UTOPIA (NW CONSORT.)	66.5	60.3	27	182	12.1
Munich	64.4	62.4	33	183	12.2
LLOYD	61.1	61.0	29	183	11.6
Mountrail	59.1	60.7	36	184	11.4
MCNEAL (wheat)	58.8	59.8	33	183	12.5
MONROE	58.7	62.2	37	183	12.1
KYLE	58.6	62.1	39	185	12.4
MEDORA	58.2	63.4	37	183	12.1
D901442	58.1	62.8	32	183	12.9
LAKER	57.9	62.2	31	184	12.0
Belzer	57.6	60.6	36	184	12.3
COMMAND	54.8	62.8	29	184	12.7
CROSBY	54.4	61.7	41	181	12.9
SCEPTRE	53.8	60.9	36	183	12.0
RENVILLE	53.6	61.6	37	184	12.9
WARD	52.8	61.9	40	182	12.6
VIC	52.3	62.4	39	183	11.9
PLENTY	51.6	61.7	40	184	12.2
BEN	50.7	62.7	38	183	12.5

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N topdressed.
Previous crop: Fallow
Date seeded: April 15, 1999.
Date harvested: August 23, 1999.
Rainfall: From seeding to harvest was 7.8 inches.
Yield experimental mean: 58.42
Error degrees of freedom: 42
F test for var.: 1.59
C.V. 2: 7.29 ---------- LSD (0.05): 12.16

Table 15 **Five-year summary** for dryland **Durum** varieties grown north of **Conrad, MT**. 1994 - 1995 - 1997 - 1998 - 1999. 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
MUNICH	63.6	61.1	33	184	11.9
LLOYD	62.6	59.5	28	185	11.5
LAKER	61.7	60.7	31	185	11.7
KYLE	59.8	60.8	42	187	12.1
SCEPTRE	58.8	60.2	37	184	12.2
RENVILLE	57.7	60.4	38	184	12.5
PLENTY	57.3	60.7	40	185	12.1
CROSBY	57.1	60.1	35	183	12.3
MONROE	56.7	61.0	38	182	12.6
BEN	56.4	61.8	37	184	12.5
MEDORA	55.8	61.7	39	183	12.4
VIC	53.8	61.0	40	184	12.2
WARD	50.5	60.7	39	183	12.7

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)

Table 16 **Irrigated Durum** variety trial grown north of **Conrad**, 1999. 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
LLOYD	99.9	61.6	29	182	12.5
LAKER	92.8	62.0	32	182	12.1
COMMAND	91.3	.0	29	184	13.7
D91080	89.7	63.6	29	182	12.4
UTOPIA (NW CONSORT.)	88.6	61.9	28	181	13.0
Mountrail	88.4	62.9	36	182	13.1
Belzer	85.1	61.2	39	184	13.6
SCEPTRE	80.8	62.6	37	182	13.8
MEDORA	80.7	61.5	37	180	14.8
CROSBY	80.5	61.6	40	181	14.7
Munich	80.4	63.7	33	184	14.2
PH894401	79.4	64.6	29	180	12.7
D901442	78.4	63.6	31	181	14.7
Maier	77.3	64.0	33	181	14.0
VIC	74.5	61.9	41	184	14.2
KYLE	73.4	61.7	42	184	13.9
MONROE	73.3	63.0	36	180	14.1
MCNEAL (wheat)	72.9	62.0	34	182	13.3
PLENTY	70.2	62.1	40	183	13.4
WARD	69.3	60.4	41	184	15.2
RENVILLE	67.2	62.4	37	182	13.6
BEN	64.2	63.1	39	184	13.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 90# N urea topdressed.
Previous crop: Fallow
Date seeded: April 15, 1999.
Date harvested: August 30, 1999.
Moisture Data: Rainfall from seeding to harvest was 7.8 inches, with two applications of sprinkler irrigation. (6/21 - 7/8)
Yield experimental mean: 79.91
Error degrees of freedom: 42
F test for var.: 2.26
C.V. 2: 7.61
LSD (0.05): 17.35

Table 17 **Five-year summary** for **Irrigated Durum** varieties grown north of **Conrad, MT.** 1994 - 1995 - 1997 - 1998 - 1999. 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	79.6	61.2	32	173	11.3
CROSBY	77.8	61.3	35	184	12.3
LLOYD	77.7	60.3	29	173	11.7
MUNICH	75.2	62.1	34	173	12.3
VIC	71.8	61.8	39	184	12.5
RENVILLE	71.4	61.3	41	184	12.0
SCEPTRE	71.3	60.5	37	184	12.7
PLENTY	70.3	61.5	41	185	12.4
MEDORA	68.5	62.0	40	183	13.1
BEN	68.0	62.7	40	173	12.4
KYLE	68.0	61.2	43	174	12.6
MONROE	64.8	61.6	39	181	12.7
WARD	62.8	61.0	39	185	13.4

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
@ = Head dates based on 4 years average. (1994-95-98-1999)

Table 18 **Dryland Durum** variety trial grown near the **Knees**, 1999. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
UTOPIA	35.9	51.8	27	16.9
LAKER	31.1	53.6	26	16.5
PLENTY	29.6	53.8	33	17.8
Mountrail	29.3	50.8	29	18.3
Maier	29.0	52.2	32	18.9
Belzer	27.8	51.2	34	17.4
MEDORA	27.4	54.4	32	18.8
LLOYD	27.2	50.8	26	18.0
KYLE	26.0	53.7	35	18.1
CROSBY	24.2	51.6	31	18.0
MONROE	23.9	52.3	34	17.2
SCEPTRE	23.9	50.5	33	18.1
BEN	23.7	52.9	33	18.2
Munich	23.4	50.8	31	18.6
WARD	23.1	51.6	31	18.0
MCNEAL (wheat)	22.5	48.0	30	16.6
RENVILLE	22.5	51.6	32	18.5
VIC	20.0	53.2	32	17.6

Cooperator: Dan Picard.
Location: Thirty miles east of Brady. (Chouteau, County)
Fertilizer: 60 # N topdressed & 60# 11-52-0 with the seed.
Previous crop: Fallow
Date seeded: April 7, 1999.
Date harvested: August 16, 1999.
Rainfall: 4.9 inches from May 6 to harvest.
Yield experimental mean: 26.13
Error degrees of freedom: 34
F test for var: 6.09
C.V. 2: 6.01
LSD (0.05): 4.51

1999 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, Glacier County near Cut Bank, and Chouteau County in the Knees Area. These four locations represent diverse environments with Choteau having deep soil and typically favorable moisture; the Knees with deep soil, intermediate moisture and higher temperatures; Oilmont having less than favorable moisture; and Cut Bank with short, cool growing season. The Cut Bank and Choteau trials were 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 19 to 29, and include the 1999 data and five-year averages. Data for the re-crop trial is presented in the "no-till section" of this report.

Results: Rainfall was about 83% of normal during the growing season, but cool temperatures allowed for high yield and test weight, except at Oilmont. The Choteau location was lost to hail damage.

Baroness, Xena and MT960228 ranked near the top for yield at all dryland 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 yielded higher than Harrington at all locations, except at Conrad where the two were similar. Valier yielded similar to Harrington in most cases.

Merit (Busch Ag), a 2-row malt variety, was grown only at Conrad, and ranked high in both dryland and irrigated trials; yielding higher than BA1202. Merit was late to mature (later than Harrington), suggesting that Merit be considered for irrigated conditions only.

The MTLB line #13 (Lewis/Baroness) was not as consistent as Baroness across locations, but approached Baroness yield in the Cut Bank, Conrad and re-crop trials.

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.

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

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

BA 2978 (Busch Ag): Higher yield than morex. Has 30% resistance to vomatoxin.
BA 4311 (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.

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 Piroline 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 (severe stem breakage at Oilmont, 1999). 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/ Piroline/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 suscept 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.

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

Jersey: 2-row European. Short, stiff straw. High yield, irrigated.

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

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

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 hulless. Does not have soluble B-glucan unless they can find a way to steam process it out. Potential specialty market.

Robust (Mn, 1983): 6-row malt 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 (some straw breakage, Oilmont 1999). 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 3 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. 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.

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

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

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

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

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

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

Table 19 **Dryland Intrastate Barley** variety trial grown north of **Conrad**, 1999. 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
MT970148		106.8	53.6	29	95	1.0	179	9.9
MT940214		105.0	54.5	31	97	1.0	179	10.5
H3860224		104.2	53.6	32	97	1.0	182	10.6
MT960045		103.8	53.3	25	94	1.0	182	10.3
MT940053		102.6	56.7	31	95	1.0	179	10.1
MT960226		100.9	52.3	33	96	1.0	179	10.9
MT910189		100.5	54.8	29	98	1.0	179	10.1
MT960225		100.2	53.6	33	95	1.0	178	10.4
MT970196		98.5	55.7	31	96	1.0	178	00.0
MT960198		98.4	54.5	30	94	1.0	179	10.5
MT960228		98.1	53.6	28	94	2.0	180	11.1
MT970218		97.1	53.5	33	97	1.0	178	11.2
MT970228		96.5	53.3	30	96	1.0	180	10.1
GS 1750		96.2	51.7	32	95	1.0	179	10.0
MT960099		96.0	51.5	28	87	3.0	180	10.2
MT970177		95.9	54.4	33	98	0.4	178	10.7
MT970110		95.5	54.0	34	97	1.0	181	10.2
MT970129		95.5	53.6	29	81	3.0	182	10.1
MT960170	(6-row)	95.4	47.6	29	77	6.0	177	8.5
MT960222		93.2	52.8	33	95	1.0	179	10.2
MTLB 13		93.0	52.8	29	91	1.0	179	10.3
MT970207		93.0	54.2	30	93	1.0	179	10.0
MT960101		92.7	53.0	28	79	4.0	181	10.5
MT970116		92.2	54.5	34	94	1.0	179	10.6
Baronesse		91.7	52.6	29	92	2.0	180	10.3
MTLB 5		91.6	54.2	31	86	2.0	180	10.1
MT920053		91.5	54.8	32	91	2.0	178	10.9
Coors C37		91.4	52.6	23	92	1.0	183	9.7
MT960082		91.3	53.5	30	92	1.0	180	11.1
WPB Xena		91.3	52.4	29	96	1.0	181	11.3
MT970214		91.2	52.1	33	95	1.0	179	11.2
Merit		91.0	48.3	32	84	5.0	180	10.4
MT970086		90.8	54.8	28	96	1.0	179	00.0

(Continued on next page)

(Dryland Intrastate Barley, continued)

Harrington	89.4	52.5	29	88	3.0	181	10.0
MTLB 6	89.0	53.3	32	87	2.0	179	10.9
MT970245	88.9	51.4	33	91	1.0	177	10.3
Valier (MTLB 30)	88.8	53.9	33	88	2.0	180	10.2
Chinook	88.5	54.3	32	96	1.0	178	10.1
H1851195	88.3	53.5	34	98	1.0	179	11.8
B2120-22	88.3	51.7	34	80	3.0	176	10.4
MT920073	88.1	52.6	28	89	2.0	178	11.7
MT970019	87.7	54.3	30	97	1.0	179	11.0
Hector	87.3	53.7	30	94	1.0	179	10.6
Jersey	87.1	52.8	25	90	1.0	180	10.8
MT950186	87.1	54.8	32	96	1.0	179	10.5
MT970026	86.7	54.3	32	93	1.0	179	9.8
96/1114	86.6	47.2	28	98	1.0	181	10.7
B2L20-46	86.6	51.2	34	80	5.0	176	10.5
B2L20-36	86.2	52.2	36	90	2.0	176	10.2
Moravian 22	85.6	50.7	24	94	1.0	183	10.2
BA 1202	85.4	50.3	32	89	2.0	179	11.4
Gallatin	85.0	54.0	32	93	1.0	178	10.7
MT970053	84.3	52.8	33	98	1.0	179	10.8
MT970107	84.0	53.8	32	89	2.0	179	10.7
MT970231	83.6	52.5	33	94	1.0	177	10.7
Lewis	83.4	54.5	30	95	1.0	179	11.1
MT920059	83.0	54.8	29	97	1.0	179	11.2
MT970248	82.8	53.3	33	92	2.0	178	11.0
MT970229	81.2	54.0	29	99	0.3	180	17.7
B2L20-42	79.7	50.8	34	87	2.0	177	10.3
Stark	79.2	54.5	31	99	0.3	176	11.3
Logan	74.2	53.6	32	97	1.0	177	10.7
Morex	73.8	51.0	36	70	5.0	177	9.8
WPB BZ594-35	72.5	60.5	28	75	3.0	177	13.3

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N topdressed.
Previous crop: Fallow.
Date seeded: April 13, 1999. Date harvested: Aug. 10, 1999.
Rainfall: From seeding to harvest was 6.8 inches.
Yield experimental mean:90.55 Error degrees of freedom: 126
F test for var.: 2.18, --- C.V. 2: 5.54, --- LSD (0.05): 14.03

Table 20 **Dryland Intrastate Barley** variety trial grown north of **Conrad,** 1999. 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
MT960228	98.1	53.6	28	94	2.0	180	11.0
MTLB 13	93.0	52.8	29	91	1.0	179	11.2
Baronesse	91.7	52.6	29	92	2.0	180	10.1
MTLB 5	91.6	54.2	31	86	2.0	180	9.7
WPB Xena	91.3	52.4	29	96	1.0	181	10.4
Merit	91.0	48.3	32	84	5.0	180	10.3
Harrington	89.4	52.5	29	88	3.0	181	10.1
MTLB 6	89.0	53.3	32	87	2.0	179	10.6
Valier (MTLB 30)	88.8	53.9	33	88	2.0	180	10.2
Chinook	88.5	54.3	32	96	1.0	178	10.0
MT920073	88.1	52.6	28	89	2.0	178	11.8
Hector	87.3	53.7	30	94	1.0	179	10.7
Jersey	87.1	52.8	25	90	1.0	180	9.9
MT950186	87.1	54.8	32	96	1.0	179	13.3
Moravian 22	85.6	50.7	24	94	1.0	183	10.4
BA 1202	85.4	50.3	32	89	2.0	179	9.8
Gallatin	85.0	54.0	32	93	1.0	178	10.3
Lewis	83.4	54.5	30	95	1.0	179	10.7
Stark	79.2	54.5	31	99	0.3	176	10.5
Logan	74.2	53.6	32	97	1.0	177	11.1
Morex	73.8	51.0	36	70	5.0	177	8.5

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 45# N topdressed.
Previous crop: Fallow.
Date seeded: April 13, 1999. Date harvested: Aug. 10, 1999.
Rainfall: From seeding to harvest was 6.8 inches.
Yield experimental mean:90.55 Error degrees of freedom: 126
F test for var.: 2.18, --- C.V. 2: 5.54, --- LSD (0.05): 14.03

Table 21 **Five-year** summary for **Dryland Barley** varieties grown north of **Conrad, MT**. 1995 - 1996 - 1997 1998 - 1999. 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	104.6	52.6	30	90	3	184	10.5
STARK	98.0	54.2	35	97	2	180	11.2
VALIER	97.1	53.4	34	80	6	186	10.7
GALLATIN	95.6	53.5	34	88	3	183	10.9
LEWIS	95.1	52.8	33	85	4	184	11.2
HECTOR	93.7	52.6	34	90	3	184	11.3
BA 1202	92.8	50.2	34	89	3	185	11.0
CHINOOK	90.6	52.3	33	83	5	184	11.2
HARRINGTON	87.7	50.3	32	84	4	185	10.3
LOGAN	87.3	53.5	33	96	2	180	11.2
MOREX	71.2	50.9	38	79	4	181	10.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)

Table 22 **Irrigated Intrastate Barley** variety trial grown north of **Conrad**, 1999. 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
MT970205	146.2	53.2	36	99	1.0	181	10.6
MT960228	139.8	53.5	35	95	1.0	179	9.7
MT970110	139.3	54.1	37	97	1.0	179	12.2
MT970148	138.1	53.3	33	98	0.2	181	11.0
GS 1750	138.0	51.2	37	97	1.0	180	10.2
MT960099	137.6	52.6	31	97	1.0	181	10.4
MT970228	137.4	53.0	37	96	1.0	180	11.0
MT960226	137.1	53.2	32	93	2.0	179	11.1
Baronesse	136.9	50.8	32	98	1.0	180	10.4
AC 96/1114	136.4	47.5	32	99	0.3	180	10.8
Coors C37	136.3	50.7	28	98	1.0	183	11.0
Jersey	135.9	50.5	31	98	1.0	182	10.0
MT970129	134.8	55.0	35	98	0.4	181	10.6
Moravian 22	132.5	49.0	30	95	2.0	183	10.6
Harrington	132.4	49.6	34	94	3.0	180	10.7
MT960222	131.4	55.0	38	98	0.2	180	9.8
MT960101	130.4	53.5	34	96	1.0	181	10.4
MT960045	129.2	54.3	30	98	1.0	183	11.1
MT970155	128.9	54.1	32	98	1.0	181	10.1
MT970229	128.1	55.3	35	98	0.3	180	10.9
MT970116	127.8	54.5	38	97	1.0	179	11.6
H3860224	127.0	51.0	34	98	1.0	181	10.0
MT970214	126.9	51.5	38	98	1.0	178	10.9
MT970019	126.7	54.7	35	98	1.0	180	11.3
MT960225	125.4	53.8	34	94	2.0	179	10.5
Merit	123.5	46.9	36	95	1.0	180	11.1
MT920053	123.3	49.9	33	84	8.0	178	11.8
MT960198	123.3	53.8	30	97	1.0	179	10.6
MT970086	123.0	55.2	39	99	0.2	180	11.6
MT970245	123.0	55.0	40	98	0.2	178	10.6
MT940053	122.6	52.6	33	98	1.0	179	10.4
MT950186	122.3	50.9	39	93	3.0	179	10.7
MT940214	122.3	51.6	34	98	1.0	179	9.9

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(Irrigated Intrastate Barley, continued)

MTLB 13	122.2	52.5	33	93	4.0	179	11.6
MT960100	122.0	53.1	34	96	1.0	181	10.1
MT970207	121.7	54.3	32	98	0.2	180	11.5
MT970026	121.6	54.8	36	99	0.3	178	11.1
MT970125	121.5	52.9	39	97	1.0	179	10.5
Gallatin	121.3	50.9	34	87	6.0	178	11.9
H1851195	120.9	49.3	39	97	1.0	179	12.1
MT910189	120.3	51.3	34	97	1.0	176	10.7
BA 1202	120.1	48.6	37	96	1.0	181	10.5
MT920073	117.5	49.4	34	98	1.0	179	11.5
MT940082	116.9	52.3	33	97	1.0	179	10.8
MT970053	116.7	52.7	38	95	2.0	180	10.9
MT960082	116.6	53.2	37	98	1.0	182	12.0
Logan	116.0	48.8	37	89	2.0	176	10.8
MT970248	115.7	53.1	38	97	1.0	180	10.9
Chinook	115.5	50.2	36	95	1.0	179	11.7
MT970231	115.5	52.8	37	96	1.0	180	11.0
WPB Xena	115.2	47.2	36	97	1.0	180	12.3
MT970218	114.4	52.7	36	98	0.4	180	10.7
MTLB 5	113.9	53.3	35	91	4.0	179	11.6
Valier (MTLB 30)	112.8	53.9	37	97	1.0	180	11.3
MTLB 6	112.4	53.3	38	97	1.0	179	11.2
MT970105	111.4	51.5	38	93	2.0	179	11.8
Stark	110.7	50.1	35	91	1.0	176	11.5
MT920059	110.6	50.4	34	94	1.0	179	10.0
MT970107	110.2	53.7	35	95	2.0	180	10.7
MT970196	109.9	50.6	37	93	2.0	179	10.3
BZ594-35	107.5	58.2	31	95	1.0	180	13.8
Lewis	105.9	50.4	37	96	1.0	179	11.3
MT970177	101.9	52.7	38	97	1.0	178	10.9
Morex * (6-row)	95.4	47.4	43	93	2.0	176	11.5

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 90# N topdressed.
Previous crop: Fallow.
Date seeded: April 15, 1999. Date harvested: Aug. 16, 1999.
Moisture Data: Rainfall from seeding to harvest was 6.8 inches, plus two applications of sprinkler irrigation. (6/21 - 7/8)
Yield exp. mean = 123.09, Error degrees of freedom = 126
F test for var. = 3.91 --- C.V. 2 = 4.28 --- LSD (0.05) = 14.74
* = Severely shattered.

Table 23 **Irrigated Intrastate Barley** variety trial grown north of **Conrad**, 1999. 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
MT960228	139.8	53.5	35	95	1.0	179	10.3
Baronesse	136.9	50.8	32	98	1.0	180	11.1
Jersey	135.9	50.5	31	98	1.0	182	10.7
Moravian 22	132.5	49.0	30	95	2.0	183	10.9
Harrington	132.4	49.6	34	94	3.0	180	9.7
Merit	123.5	46.9	36	95	1.0	180	10.7
MT950186	122.3	50.9	39	93	3.0	179	10.1
MTLB 13	122.2	52.5	33	93	4.0	179	10.0
Gallatin	121.3	50.9	34	87	6.0	178	10.7
BA 1202	120.1	48.6	37	96	1.0	181	11.0
MT920073	117.5	49.4	34	98	1.0	179	10.4
Logan	116.0	48.8	37	89	2.0	176	10.4
Chinook	115.5	50.2	36	95	1.0	179	10.6
WPB Xena	115.2	47.2	36	97	1.0	180	11.2
MTLB 5	113.9	53.3	35	91	4.0	179	11.6
Valier (MTLB 30)	112.8	53.9	37	97	1.0	180	11.5
MTLB 6	112.4	53.3	38	97	1.0	179	10.9
Stark	110.7	50.1	35	91	1.0	176	10.4
Lewis	105.9	50.4	37	96	1.0	179	11.7
Morex * (6-row)	95.4	47.4	43	93	2.0	176	10.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 90# N topdressed.
Previous crop: Fallow.
Date seeded: April 15, 1999. Date harvested: Aug. 16, 1999.
Moisture Data: Rainfall from seeding to harvest was 6.8 inches, plus two applications of sprinkler irrigation. (6/21 - 7/8)
Yield exp. mean = 123.09, Error degrees of freedom = 126
F test for var. = 3.91 --- C.V. 2 = 4.28 --- LSD (0.05) = 14.74
* = Severely shattered.

Table 24 **Five-year summary** for **Irrigated Barley** varieties grown north of **Conrad, MT.** 1995 - 1996 - 1997 1998 - 1999. 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	122.8	52.6	32	89	4	184	10.1
MORAVIAN 22	115.2	51.1	30	90	4	187	10.1
GALLATIN	110.4	53.1	35	86	6	181	10.6
STARK	108.2	53.8	37	93	2	179	11.0
VALIER	106.2	54.3	36	84	7	184	11.4
BA 1202	103.2	51.2	35	90	3	184	10.3
LOGAN	103.0	52.9	35	92	3	179	11.3
LEWIS	99.1	53.2	37	87	7	183	11.2
HARRINGTON	97.6	50.5	34	84	8	184	10.7
CHINOOK	87.7	51.3	34	82	9	183	11.8
MOREX	78.6	50.5	40	82	6	179	10.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
* = Head date based on four years only. (1995-96-98-99)
** = Proteins based on four years only. (1995-97-98-99)

Table 27 **Dryland Barley** variety trial grown east of **Oilmont,** 1999. 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
MT950186	48.2	47.3	26	29	32	13.8
Xena	46.9	43.8	29	15	44	14.6
Stark	46.1	47.3	29	53	23	13.5
MT960228	45.8	42.2	25	13	44	14.3
Baronesse	43.6	45.1	22	24	41	15.1
MT920073	41.0	43.5	26	34	38	13.8
Lewis	40.5	43.8	27	18	51	15.1
Hector	40.5	43.5	27	11	58	14.3
MTLB 6	40.4	44.7	24	21	44	15.3
Gallatin	39.9	43.0	26	21	45	14.3
Chinook	39.7	44.5	27	16	46	14.9
MTLB 5	39.3	43.5	24	11	59	15.3
Bowman	38.2	46.6	26	64	16	14.0
Harrington	36.3	44.4	25	19	37	15.1
Valier	35.7	44.5	24	8	63	15.7
MTLB 13	34.9	43.9	23	16	49	15.1

Cooperator: Terry Alme.
Location: Eight miles east of Oilmont, MT. (Toole County)
Fertilizer: 45# N urea topdressed & 100# 11-52-0 with the seed.
Previous crop: Fallow.
Date seeded: April 7, 1999.
Date harvested: August 3, 1999.
Rainfall: From May 17 to Aug. 3, was 4.15 inches.
Yield experimental mean: 41.05
Error degrees of freedom: 30
F test for var.: 1.42
C.V. 2: 8.28
LSD (0.05): 9.81

Table 28 **Five-year** summary for **Dryland Barley** varieties grown near **Oilmont, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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
STARK	59.0	48.1	30	58	28	12.6
BARONESSE	57.9	46.3	24	40	42	13.6
BOWMAN	57.8	48.2	29	70	18	12.7
CHINOOK	57.7	47.5	28	46	37	13.4
LEWIS	56.0	47.5	29	48	38	13.4
HECTOR	55.9	46.6	30	42	40	13.1
GALLATIN	53.6	46.4	30	40	41	13.4
HARRINGTON	52.3	46.2	27	43	40	13.6

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

Table 25 **Dryland Barley** variety trial grown north of **Cut Bank**, 1999. 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
Xena	69.3	51.5	32	78	4	14.6
MT960228	67.5	52.4	32	71	5	14.9
Chinook	65.8	51.8	33	64	8	16.3
MT950186	65.8	54.3	34	67	6	14.8
MTLB 13	65.3	51.2	31	42	16	16.0
Baronesse	64.9	51.6	30	58	11	16.0
Bowman	63.5	53.3	34	94	1	14.6
MT920073	63.0	51.4	34	61	10	16.4
Hector	61.8	52.3	33	66	7	15.5
Stark	60.0	53.1	34	85	3	14.6
Gallatin	57.3	52.7	34	70	6	15.8
MTLB 5	56.9	52.0	32	43	16	16.5
Harrington	56.4	51.3	31	36	20	16.8
MTLB 6	56.4	51.5	30	48	16	16.2
Lewis	55.6	53.7	32	37	20	16.7
Valier	54.5	51.7	32	43	15	16.6

Cooperator: Kevin Bradley.
Location: Fifteen miles north of Cut Bank, MT. (Glacier Co.)
Fertilizer: 100# 11-52-0 with seed, and 45# N-urea topdressed.
Rainfall: 5.25 inches from April 1 to harvest.
Previous crop: No-till chemical fallow, barley stubble.
Date seeded: April 8, 1999.
Date harvested: August 26, 1999.
Yield experimental mean: 61.48
Error degrees of freedom: 30
F test for var: 1.97
C.V. 2: 5.54
LSD (0.05): 9.84

Table 26 **Five-year** summary for **Dryland Barley** varieties grown near **Cut Bank, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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	69.4	51.8	33	74	11	11.3
BARONESSE	66.9	51.0	29	68	14	10.8
STARK	64.6	52.8	34	84	5	11.4
GALLATIN	62.4	52.0	32	73	10	11.2
BOWMAN	60.4	52.4	32	92	2	11.1
HECTOR	59.1	51.3	33	70	12	11.3
LEWIS	59.0	52.5	33	65	16	11.8
HARRINGTON	57.8	50.2	31	62	16	11.7

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

Table 29 **Dryland Barley** variety trial grown east of the **Knees**, 1999. 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
Stark	80.1	51.4	31	57	16	14.0
Bowman	74.0	50.8	29	66	9	13.9
MT950186	71.3	51.4	29	37	28	14.9
Baronesse	70.5	48.6	25	21	34	16.3
MT960228	69.1	48.1	27	15	39	14.9
Xena	68.8	46.9	28	20	33	14.5
MT920073	67.4	48.9	28	35	32	15.6
Gallatin	63.9	47.8	28	14	43	15.9
MTLB 6	58.4	49.5	26	25	36	15.2
Lewis	57.9	49.4	27	34	33	15.5
MTLB 13	56.5	46.9	26	15	48	15.0
MTLB 5	56.3	49.3	26	16	44	16.0
Chinook	55.3	48.5	30	37	32	15.6
Valier	51.4	48.3	27	19	36	15.7
Hector	50.9	48.2	27	19	44	15.3
Harrington	49.1	46.4	25	27	37	15.5

Cooperator: Dan Picard.
Location: Thirty miles east of Brady, MT. (Chouteau, County)
Fertilizer: 45# N urea topdressed & 100# 11-52-0 with the seed.
Previous crop: Fallow.
Date seeded: April 7, 1999.
Date harvested: August 5, 1999.
Rainfall: From May 6 to Aug. 5, was 4.9 inches.
Yield experimental mean: 62.54
Error degrees of freedom: 30
F test for var.: 11.54
C.V. 2: 4.38
LSD (0.05): 7.91

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

Year: 1999.

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 1998, fallow in 1997, and barley in 1996. Planting was accomplished with a double-disk no-till plot planter constructed by our Research Center Staff. Row space was 12 inches. Fertilizer included 60 pounds/acre ammonium phosphate (11-52-0) and 60 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 1999, along with 5-year averages, are presented in Tables 1 and 2 for spring wheat, and Tables 3 and 4 for barley. Rainfall was 83% of normal for the growing season, but cool temperatures relieved stress and allowed for fairly good wheat yield with only slightly reduced test weight. Barley yield, test weight and kernel plump were exceptionally high for continuous-crop conditions.

McNeal spring wheat, normally a high ranking yielder under fallow conditions, was among the lowest performers for yield and test weight under these recrop conditions. Likewise, Amidon ranked low. Both of these varieties had later maturity than most other entries, which likely contributed to their poor performance under re-crop. Some of the other late maturing varieties, however, yielded quite well in this trial.

Among the barleys, Baroness was the top yielding variety, along with one of its progeny lines (MTLB13). This is consistent with previous years re-crop performance. The malt types Chinook and Harrington maintained good kernel plump, with Chinook placing among the top yielders.

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

Table 30 **Dryland Recrop No-till Spring Wheat** variety trial grown north of **Conrad**, 1999. 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
PARSHALL		46.1	62.0	35	182	12.8
WESTBRED 936		45.5	61.2	29	182	13.0
WESTBRED 926		43.0	61.2	29	182	13.5
PNR 2375		42.5	60.7	33	180	13.0
CONAN	*	41.9	60.3	29	182	13.1
MTHW9701		41.7	59.6	28	182	12.1
REEDER		41.6	61.7	30	182	12.5
HI-LINE		41.3	61.3	27	182	12.8
ERNEST	*	41.2	61.5	33	184	12.6
RAMBO	*	40.7	61.8	30	185	11.6
FERGUS		40.7	60.0	30	182	13.6
SCHOLAR	*	40.5	61.7	35	183	13.0
NEWANA		40.0	60.7	28	185	11.2
GRANDIN		38.8	60.8	31	184	12.9
WESTBRED EXPRESS		38.5	60.4	26	182	12.9
LEW	*	38.5	61.1	24	184	11.7
MTHW9420		37.4	59.1	28	182	11.2
MCNEAL		37.3	59.8	30	183	12.1
FORTUNA	*	36.7	60.7	34	183	12.3
AMIDON	*	33.4	57.9	34	183	12.4

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 60# N topdressed.
Previous crop: Barley.
Date seeded: April 12, 1999, into no-till standing stubble.
Date harvested: August 30, 1999.
Rainfall: From seeding to harvest was 7.8 inches.
* = Sawfly resistant varieties. (Amidon, Conan, Rambo and Scholar have partial resistance.)
Yield experimental mean: 40.37
Error degrees of freedom: 38
F test for var: 2.13
C.V. 2: 5.03
LSD (0.05): 5.81

Table 31 **Five-year summary** for **No-till Recrop Spring Wheat** varieties grown near **Conrad, MT.** 1995 - 1996 - 1997 - 1998 - 1999. Mont. Agr. Expt. Station, Western Triangle Agr. Research Center, Conrad, MT.

Variety		5 - year comparable average Yield bu/ac	Test wt lbs/bu	Plant hgt. inches	Head date 1/	% Protein
WESTBRED 936		49.8	60.9	28	178	12.6
RAMBO	*	48.9	61.5	30	181	11.8
SCHOLAR	*	47.5	62.0	35	179	12.7
HI-LINE		47.1	62.1	30	178	12.3
NEWANA		47.1	61.4	31	181	11.3
FERGUS		46.8	61.3	30	178	12.8
WESTBRED EXPRESS		46.8	60.9	27	178	12.7
AMIDON	*	46.3	60.7	36	179	12.5
WESTBRED 926		46.2	60.8	30	177	12.8
ERNEST	*	45.7	62.2	36	179	12.9
MCNEAL		45.4	60.6	33	180	12.5
PIONEER 2375		44.9	61.6	33	178	12.5
MTHW9420 (hard wh.)		44.6	60.3	30	178	12.1
GRANDIN		43.2	61.4	34	180	12.9
LEW	*	42.5	61.7	35	181	12.1
FORTUNA	*	42.2	61.6	37	180	12.6

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. (1995 -1998- 1999)

Table 32 **Dryland Recrop No-till Barley** variety trial grown north of **Conrad**, 1999. Mont. Agr. Expt. Station, Westerm Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	TestWt lbs/bu	Plant hgt. inches	% Plump	% Thin	Head date	% Protein
MTLB 13	75.3	52.9	28	89	3	182	12.4
Baronesse	75.3	51.8	28	85	4	183	10.1
MT960228	74.1	51.2	30	72	7	182	10.6
Chinook	71.4	52.3	30	90	4	182	10.9
MT920073	70.9	52.6	30	90	3	181	11.3
Gallatin	70.6	50.8	29	94	2	181	10.7
Xena	70.1	52.8	28	81	5	182	11.4
MTLB 5	70.0	52.6	29	94	2	183	11.0
Hector	68.5	51.9	30	85	4	181	10.6
MT950186	67.8	54.0	31	90	3	182	10.3
Valier	67.7	53.4	30	75	7	183	11.0
Bowman	66.3	52.1	28	96	1	180	11.0
MTLB 6	66.1	52.1	29	92	2	182	11.4
Harrington	65.7	51.4	29	94	1	184	10.9
Lewis	64.7	52.9	29	77	7	183	11.6
Stark	64.6	53.3	30	93	2	180	10.8

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Fertilizer: 60# 11-52-0 with the seed, + 60# N actual top-dressed after planting.
Previous crop: Barley.
Method of seeding: Double-disc drill into standing stubble.
Date seeded: April 12, 1999.
Date harvested: August 10, 1999.
Rainfall: From seeding to harvest was 6.01 inches.
Yield experimental mean: 69.32
Error degrees of freedom: 30
F test for var.: 0.74
C.V. 2: 5.9
LSD (0.05): 11.8

Table 33 **Five-year** summary for **Recrop Dryland No-Till Barley** varieties grown north of **Conrad, MT.** 1995 - 1996 - 1997 - 1998 - 1999. 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	80.4	51.1	28	81	7	180	10.1
STARK	70.0	52.6	31	93	2	178	10.6
GALLATIN	69.6	51.8	30	84	5	179	10.3
HARRINGTON	67.6	49.2	29	83	5	180	10.4
BOWMAN	67.0	51.7	30	92	2	176	11.1
HECTOR	66.9	50.7	32	78	8	180	10.7
LEWIS	64.8	52.1	30	80	7	180	11.1
CHINOOK	64.3	50.4	30	77	8	180	10.9

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
* = Head dates based on 3 years average. (1995-98-99)

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

Year: 1999

Location: 1. North of Cut Bank, MT at the Don and Kevin Bradley farm.
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. All plots were planted with a six-row, 12 inch spaced, double disk, no-till plot drill. At the Don and Kevin Bradley farm, plots were planted, no-till into canola stubble with a six-row. At the Bruce Bradley farm, plots were planted into worked chemical-fallow barley stubble. At Sunburst , plots were planted no-till into barley stubble. Plot size was 6 x 20 feet with four replicates. Seeding rate was 20 seeds/ft^2. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 1s (Cut Bank), Table 2s (Cut Bank) and Table 3s (Sunburst). All locations responded to N, the level of response was related to initial soil nitrate-N. The data from Don and Kevin Bradley's farm should be interpreted with caution due to dry conditions throughout the growing season. The Bruce Bradley location was the only one to respond to P. All locations had a slight response to Cl, but only the Bruce Bradley and Sunburst sites had responses to K.

Table 3s. Effect of N, P, K, and Cl on spring barley yield and quality. Experiment located North of Cut Bank, MT on the Don and Kevin Bradley farm. 1999.

Entry	Fertilizer $N-P_2O_5-K-Cl$ (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
10	40-50-30-30	31.1	12.3	48.8	64.3	8.9
6	40-25-30-30	29.9	12.7	49.1	66.6	8.7
13	80-25-0-30	29.7	14.3	49.0	53.8	12.5
11	80-50-30-30	29.5	14.6	49.3	50.7	13.3
12	120-50-30-30	28.9	15.3	48.1	48.5	15.2
8	120-25-30-30	26.8	15.1	48.7	56.8	11.6
4	120-0-30-30	24.9	14.8	47.8	49.0	17.1
14	80-25-30-0	24.9	15.0	49.4	55.3	11.2
9	0-50-30-30	24.4	9.0	49.5	79.8	5.3
7	80-25-30-30	23.6	15.0	49.1	60.4	9.8
3	80-0-30-30	23.5	14.6	48.0	61.2	11.3
1	0-0-30-30	23.3	9.3	48.4	77.6	6.2
2	40-0-30-30	21.7	13.2	48.1	62.8	10.3
5	0-25-30-30	21.4	9.5	49.5	74.0	6.8
	Summary Statistics					
Experimental Means		26.0	13.2	48.8	61.5	10.6
Error Mean Square		24.32	0.3805	0.8434	42.85	8.363
P-value		0.0789	0.0000	0.1222	0.0000	0.0000
Standard Error of the Mean		2.466	0.3084	0.4592	3.273	1.446
C.V. 1: (s/mean)*100		18.99	4.682	1.884	10.65	27.34
LSD (0.05)		7.1	0.9	1.31	9.4	4.1
	Nitrogen Summary					
0		23.0	9.3	49.1	77.1	6.1
40		27.6	12.7	48.7	64.6	9.3
80		25.5	14.7	48.8	57.4	11.5
120		26.9	15.1	48.2	51.4	14.6
LSD (0.05)		4.1	0.51	0.7584	5.4	2.4
	Phosphorus Summary					
0		23.4	13.0	48.1	62.6	11.2
25		25.4	13.1	49.1	64.4	9.2
50		28.5	12.8	48.9	60.8	12.7
LSD (0.05)		3.5	NS	0.7	NS	NS
Interaction P-value		0.4627	0.4888	0.9549	0.1112	0.5144

Notes:
Variety: Harrington
Seeding Date: 4/26/99 Harvest Date: 8/17/99
Growing Season ppt: 4.15" Planting Rate: 20 seeds/ft^2
Previous Crop: Canola
Herbicide:0.6 oz/a Express and 9.6 oz/a 2,4-D Amine.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	1.98	11.7	0.25	29.3	0.68	314	12.5	0.16	1.91	8.1

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	12.0	31.9
1 - 2	2.1	43.3
2 - 3	1.7	54.4
3 - 4	2.8	73.0

Table 2s. 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. 1999.

Entry	Fertilizer N-P_2O_5-K-Cl (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
11	80-50-30-30	67.6	11.6	49.0	69.6	5.9
7	80-25-30-30	67.4	12.5	48.6	66.6	7.3
3	80-0-30-30	66.8	10.7	48.8	70.4	6.8
12	120-50-30-30	66.0	12.8	48.5	61.0	10.1
13	80-25-0-30	65.9	12.0	48.5	65.9	7.5
10	40-50-30-30	65.1	11.1	50.0	74.2	5.2
6	40-25-30-30	63.5	11.2	49.7	76.4	4.4
14	80-25-30-0	62.6	11.6	48.7	63.6	8.4
8	120-25-30-30	61.1	13.1	48.1	54.4	11.7
4	120-0-30-30	61.0	12.1	48.6	69.8	7.0
2	40-0-30-30	57.9	10.0	50.7	84.4	3.5
9	0-50-30-30	57.8	8.9	51.4	86.8	2.3
5	0-25-30-30	55.3	8.0	51.8	87.8	1.9
1	0-0-30-30	54.8	10.5	51.3	84.8	2.4
	Summary Statistics					
Experimental Means		62.4	11.2	49.6	72.5	6.0
Error Mean Square		21.67	0.9696	0.9261	53.76	5.4227
P-value		0.0202	0.0009	0.0007	0.0004	0.0016
Standard Error of the Mean		2.688	0.5685	0.5556	4.233	1.345
C.V. 1: (s/mean)*100		7.467	8.787	1.942	10.11	38.70
LSD (0.05)		7.9	1.7	1.6	12.4	4.0
	Nitrogen Summary					
0		56.0	9.5	51.7	86.3	2.2
40		62.1	10.7	44.5	78.5	4.3
80		67.3	11.6	48.8	68.9	6.6
120		62.7	12.7	48.7	61.7	9.6
LSD (0.05)		4.5	1.0	0.9385	7.2	2.3
	Phosphorus Summary					
0		60.1	10.8	45.6	77.5	4.9
25		61.8	11.4	49.7	71.3	6.3
50		64.2	11.1	49.9	72.8	5.9
LSD (0.05)		3.9	NS	0.8	6.2	NS
Interaction P-value		0.8776	0.0889	0.5861	0.4288	0.5239

Notes:
Variety: Harrington
Seeding Date: 4/21/99 Harvest Date: 8/17/99
Growing Season ppt: 4.95" Planting Rate: 20 seeds/ft^2
Previous Crop: Chem-fallow
Herbicide: 0.6 oz/a Express and 9.6 oz/a 2,4-D Amine

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	1.85	20.1	0.3	27.0	2.41	266	17.1	0.13	2.54	7.4

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	31.2	75.4
1 - 2	9.8	40.5
2 - 3	9.4	50.6
3 - 4	5.3	61.1

Table 3s. Effect of N, P, K, and Cl on spring barley yield and quality. Experiment located east of Sunburst, MT at the Phil Aschim farm. 1999.

Entry	Fertilizer $N\text{-}P_2O_5\text{-}K\text{-}Cl$ (lbs/a)	Grain Yield (bu/a)	Grain Protein (%)	Test Weight (lbs/bu)	Plump (%)	Thin (%)
12	120-50-30-30	88.4	11.7	49.7	59.0	16.2
8	120-25-30-30	86.6	12.0	48.7	52.2	19.8
7	80-25-30-30	81.3	9.5	51.1	72.6	8.3
4	120-0-30-30	80.2	11.8	48.9	51.3	19.2
11	80-50-30-30	78.8	9.8	50.4	72.4	8.4
14	80-25-30-0	77.8	9.4	52.2	83.1	4.9
3	80-0-30-30	75.7	9.5	50.6	71.9	8.9
13	80-25-0-30	71.8	9.2	51.2	81.4	4.9
2	40-0-30-30	69.2	8.4	52.4	86.8	3.5
10	40-50-30-30	65.8	8.1	53.4	92.0	2.3
6	40-25-30-30	65.1	8.5	53.0	88.5	2.8
1	0-0-30-30	43.4	8.1	53.5	95.6	1.5
5	0-25-30-30	42.9	8.1	53.5	94.8	1.8
9	0-50-30-30	35.6	8.1	53.1	93.6	1.5
Summary Statistics						
Experimental Means		68.7	9.4	51.5	78.2	7.4
Error Mean Square		55.35	0.015	0.8913	33.0	7.249
P-value		0.0000	0.0000	0.0000	0.0000	0.0000
Standard Error of the Mean		3.720	0.1937	0.4720	2.872	1.346
C.V. 1: (s/mean)*100		10.82	4.108	0.9160	7.345	36.31
LSD (0.05)		10.6	0.6	1.4	8.2	3.9
Nitrogen Summary						
0		40.6	8.1	53.4	94.7	1.6
40		66.7	8.3	52.9	89.1	2.9
80		78.6	9.6	50.7	72.3	8.5
120		85.1	11.8	49.1	54.2	18.4
LSD (0.05)		6.1	0.3	0.8	4.7	2.2
Phosphorus Summary						
0		67.1	9.5	51.3	76.4	8.3
25		69.0	9.5	51.6	77.0	8.1
50		67.2	9.4	51.6	79.3	7.1
LSD (0.05)		NS	NS	NS	NS	NS
Interaction P-value		0.3893	0.7238	0.4764	0.6930	0.8606

Notes:
Variety: Moravian 22
Seeding Date: 4/20/99 Harvest Date: 8/23/99
Growing Season ppt: Planting Rate: 20 seeds/ft^2
Previous Crop: Barley stubble, third year recrop
Herbicide: Buctril at 1.5 pt/a and Hoelon at 2 pt/a on 6/7/99. On 6/14/99 sprayed with Stinger at ⅓ pt/a.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	1.86	71.6	0.5	25.7	1.67	308	17.3	0.08	2.95	5.9

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	22.9	27.1
1 - 2	3.6	47.2
2 - 3	2.1	134.4
3 - 4	5.0	251.5

Title: Canola variety evaluation.

Year: 1999

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: Thirty-one canola varieties were seeded no-till into barley stubble with a six-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 6 x 16 feet with three replicates. Seeding rate was seven lbs seed/a. Plots were swathed with a Swift plot swather, then threshed with a Hege plot combine. Plots were irrigated five times starting June 21.

Results: The data are summarized in Table 4s. Nursery was planted into dry soil which resulted in erratic emergence, however, yields still ranged between 2413 and 3561 lbs./a. This indicates that canola growers have an excellent selection of high yielding varieties and hybrids to choose from.

Table 4s. 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 (%)[1]	Oil yield (lbs./a)[2]
Hyola 223 RR[3] B/G[4]	3561	40.2	1431.6
Hyola 420 B/G	3417	39.6	1353.1
Hyola 401 Helix	3270	38.6	1262.1
Hudson	3250	42.0	1365.0
Cavalier	3236	41.9	1355.7
Hyola 308 B/G	3160	39.1	1235.6
LG3369	3159	43.1	1361.4
Ebony	3145	41.0	1389.5
Arrow RR B/G	3094	39.5	1222.2
Hyola 357 RR B/G	3086	41.0	1265.1
LG3311 (RR5269)	3069	42.3	1298.4
Hyola 401 B/G	3057	40.3	1231.9
Crackerjack	3035	40.4	1226.1
LG3295	3015	40.7	1227.1
Roseau	2997	42.4	1270.8
Battleford	2989	42.3	1264.4
LG3235	2972	41.1	1221.4
LG3275	2923	42.4	1239.2
Advantage	2846	42.1	1198.4
Hyola 401 Benalate	2826	40.3	758.1
SW Raider RR	2794	39.0	1089.7
Minot RR	2769	42.0	774.1
LG3333	2756	41.9	1154.6
Q2 B/G	2755	41.9	1154.4
CL2078	2733	41.5	1134.0
Eagle	2730	41.8	1141.3
LG3345 (RR3665)	2717	41.4	1124.9
RR 5296	2672	40.1	713.2
PR 5292	2601	42.0	1092.6
Quest RR B/G	2461	40.6	999.2
70.1 Hybrid	2413	40.3	972.6

Summary Statistics

Experimental Means	2958
Error Mean Square	325500
P-value	0.9116
Standard error of the Mean	329.4
C.V.: (s/mean)*100	19.34
LSD (0.05)	933

[1] Oil content reported on a dry weight basis.
[2] Calculated using oil content multiplied by average yield.
[3] Roundup Ready
[4] Seed treated with Benalate and Gaucho

Notes:

Seeding Date: 4/27/99	Swathed: 8/19/99
Threshing Date: 9/8/99	Growing Season ppt plus Irrigation: 16.06"
Planting Rate: 7 lbs/a	Previous Crop: Barley

Herbicide: Sprayed on 6/7/99 with Poast @ 2 pt/a and Muster @ 0.4 oz/a.
Fertilizer: 150-30-30-20

Title: Dormant fall and winter-seeding of canola in the Chinook region of Montana

Year: 1999

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

Personnel: Perry Miller, Dept. Land Resources and Environmental Sciences, Grant Jackson, and John Miller, Western Triangle Ag. Research Center, Conrad, MT 59425.

Objectives:
1. To test the viability of fall-seeded canola in the Chinook region of Montana in advancing crop maturity and increasing seed yield and quality.
2. To test the importance of fall seeding date to ensure seed dormancy and result in good spring stand establishment.
3. To test different polymer coatings for their ability to ensure seed dormancy and provide good spring stand establishment.

Procedures: In the fall of 1998 until January of 1999, 'Ebony' spring canola was planted no-till into barley stubble with a six-row, 12 inch spaced, double disk, no-till plot drill. 'Ebony' spring canola seed was coated with thiram and benomyl fungicides, Gaucho insecticide and then coated with one of three polymer formulations or left as an uncoated control. The experiment design consists of five seeding dates (4 fall + 1 conventional spring) and four seed coatings (3 polymers + 1 uncoated) in a split-plot arrangement, with dates as the main plot and coatings as the subplot, replicated four times. This design was modified to suit plot space constraints. Adjacent spring-seeded canola variety trials were used to represent the spring seeding date. Due to persistent dry fall seedbed conditions, seeding date intervals were expanded to coincide with precipitation patterns(Table 5s). Plots were swathed with a Swift small plot swather and threshed with a Hege small plot combine.

Results:
Objective 1: The yield of the best fall-seeded dormant canola treatment equaled the yield of spring-seeded canola (Table 6s). This indicates there is merit in continuing to investigate the potential of fall-seeded dormant canola in the Chinook region of Montana.

Objective 2: Among the fall seeding dates, the highest plant densities occurred at the third fall seeding date (Table 6s). This may indicate that the recommended fall seeding window for the Chinook region of Montana is 4 to 8 weeks later than that currently being recommended in the Canadian prairie region.

Objective 3: The polymer seed coatings had no effect on plant density (Table 7s).

Conclusions:

No conclusions are drawn at this time, other than there is merit in continuing this investigation. However, additional questions have been raised about seedbed integrity and optimal plant density. Regulatory hurdles could not be overcome in sufficient time to seed a glyphosate-tolerant variety in 1998, but Hyola 357 (RR) will be used in 1999. This should enable adequate weed control in thin plant densities.

Table 5s. Parameters for the fall-seeded dormant canola study at the Western Triangle Ag. Research Center.

Seed Bed	Barley Stubble
Fall Date 1	Oct 26
Fall Date 2	Dec 08
Fall Date 3	Dec 17
Fall Date 4	Jan 20
Spring Date	Apr 27

Table 6s. Seed yield (lbs./a) for the fall-seeded dormant canola study at the Western Triangle Ag. Research Center.

Statistical Comparison	Conrad¶
Spring vs. Best Fall Date x Coat§	**3150 vs 3100**
Seeding Date (bare control only)	* (2100 - 2750)
Seed Coating (fall date only)	NS (2250- 2450)
Fall Date X Seed Coating	NS (1800 - 3100)

¶ Experimental design was modified to reference spring seeding date in adjacent canola variety trial, otherwise receiving identical experimental treatment.
§ Not a statistical comparison.
* Significant F-test at P=0.05.

Table 7s. Plant density (plants ft^{-2}) for fall-seeded dormant canola study at the Western Triangle Ag. Research Center.

Statistical Comparison	Conrad¶
Spring vs. Best Fall Date x Coat§	**5.2 vs 6.0**
Seeding Date (uncoated seed only)	** (2.2 - 5.2)
Seed Coating (fall date only)	NS (3.2 - 3.6)
Fall Date X Seed Coating	NS (2.2 - 6.0)

¶ Experimental design was modified to reference spring seeding date in adjacent canola variety trial, otherwise receiving identical experimental treatment.
§ Not a statistical comparison.
** Significant F-test at P=0.01.

Notes:
Fertilizer: 150-30-30-20, P was placed with the seed and all other fertilizer was broadcast.
Herbicide: Sprayed on 6/7/99 with Poast @ 2 pt/a and Muster @ 0.4 oz/a.
Plot area was irrigated five times starting June 21, 1999. Total irrigation plus precipitation was 16.06".

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

Year: 1999

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 (0, 50, 100, and 150 lbs N/a) in combination with three P rates (0, 25, and 50 lbs P_2O_5/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 swathed with a Swift small plot swather and threshed with a Hege small plot combine.

Results: The data are summarized in Table 8s and Table 9s. The canola responded to nitrogen at both locations. The crop responded to P at the Sunburst location even though the P soil test was 17 ppm. No response to P was detected at the Cut Bank site. The low yield at the Cut Bank location was indicative of drought stressed canola, although the canola seed oil percentage was almost as high as the canola grown at the Sunburst location.

Table 8s. 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. 1999.

Fertilizer $N-P_2O_5-K-S$ (lbs/a)	Seed Yield (lbs/a)	Oil Content (%)	Oil Yield (lbs/a)
100-50-25-20	647.7	36.4	238.0
150-25-25-20	633.0	36.4	230.8
150-0-25-20	628.4	36.4	230.5
100-0-25-20	622.4	36.6	228.4
100-25-25-20	612.5	36.4	224.3
50-25-25-20	596.8	37.6	226.7
50-0-25-20	594.0	37.1	197.1
150-50-25-20	565.5	35.8	202.9
50-50-25-20	559.5	36.9	208.1
0-50-25-20	441.3	40.3	174.0
0-25-25-20	432.6	40.2	174.8
0-0-25-20	396.4	39.7	142.1
Summary Statistics			
Experimental Means	560.8	37.5	215.0
Error Mean Square	9927	0.3815	1335
P-value	0.0054	0.0000	0.0418
Standard error of the Mean	49.82	0.3088	18.27
C.V.: (s/mean)*100	17.77	1.648	17.69
LSD (0.05)	143.3	0.9	52.8
Nitrogen Summary			
0	402.4	40.1	163.6
50	560.9	37.2	210.6
100	627.5	36.5	230.3
150	609.0	36.2	221.4
LSD (0.05)	82.5	0.5	30.5
Phosphorus Summary			
0	532.2	37.4	199.5
25	568.7	37.6	214.2
50	548.9	37.4	205.7
LSD (0.05)	NS	NS	NS
Interaction P-value	0.8082	0.4331	0.6803

Notes:
Variety: Hyola 357 RR
Seeding Date: 4/26/99
Swathing Date: 8/18/99 Harvest Date: 8/30/99
Growing Season ppt: 4.15" Planting Rate: 5 lbs/a
Previous Crop: No-till Barley Stubble
Herbicide: Stinger @ ⅓ pt./a, Poast @ 2 pt./a, and Muster @ 0.4 oz/a applied on 6/7/99.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	2.19	15.3	0.28	24.3	0.61	290	11.9	0.11	1.75	7.9

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	7.9	59.8
1 - 2	2.0	57.7
2 - 3	1.4	71.8
3 - 4	1.8	84.1

Table 9s. Effect of N and P on dryland canola seed yield, oil content, and oil yield. Experiment located Easy of Sunburst, MT at the Phil Aschim farm. Western Triangle Ag. Research Center, Conrad, MT. 1999.

Fertilizer $N-P_2O_5-K-S$ (lbs/a)	Seed Yield (lbs/a)	Oil Content (%)	Oil Yield (lbs/a)
150-25-25-20	1956	37.4	730.7
150-50-25-20	1865	37.2	693.4
150-0-25-20	1628	36.6	596.4
100-25-25-20	1596	38.1	603.8
50-25-25-20	1554	39.7	617.1
100-50-25-20	1546	38.0	586.5
100-0-25-20	1501	37.8	568.0
50-50-25-20	1351	39.2	528.7
50-0-25-20	1278	39.3	502.0
0-25-25-20	851	39.7	337.6
0-50-25-20	780	39.7	308.9
0-0-25-20	741	40.0	296.0
Summary Statistics			
Experimental Means	1386	38.5	530.8
Error Mean Square	16280	0.1422	2632
P-value	0.0000	0.0000	0.0000
Standard error of the Mean	63.80	0.1886	25.65
C.V.: (s/mean)*100	9.203	0.9787	9.666
LSD (0.05)	184	0.5	73.8
Nitrogen Summary			
0	791	39.8	314.2
50	1394	39.4	549.3
100	1544	37.9	586.1
150	1816	37.1	673.5
LSD (0.05)	106	0.3	42.6
Phosphorus Summary			
0	1287	38.4	490.5
25	1487	38.7	572.3
50	1385	38.5	529.4
LSD (0.05)	92	.3	36.9
Interaction P-value	0.3523	0.1394	0.2922

Notes:
Variety: Hyola 357 RR
Seeding Date: 4/20/99 Swathing Date: 8/16/99
Threshing Date: 8/30/99 Growing Season ppt: 6.55"
Planting Rate: 5 lbs/a Previous Crop: No-till Barley Stubble
Herbicide: Stinger @ ⅓ pt./a, Poast @ 2 pt./a, and Muster @ 0.4 oz/a applied on 6/4/98, and with Roundup Ultra @ 2 pt/a on June 24, 1999.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	1.86	71.6	0.5	25.7	1.67	308	17.3	0.08	2.95	5.9

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	22.9	27.1
1 - 2	3.6	47.2
2 - 3	2.1	134.4
3 - 4	5.0	251.5

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

Year: 1999.

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, 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 (16-0-0-40), 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 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 swathed with a Swift plot swather and threshed with a Hege plot combine. No data were collected at the Cut Bank location due to drought.

Results: The data are summarized in Table 10s. All S-fertilizers were dissolved when evaluated June 24, 1999. Even though most yields of the S treatments exceeded the check, no stastically significant differences in yield, oil content, or plant tissue S content could be detected. The yield data was simply to variable to "sort out" 200 to 300 lbs./a yield differences in treatment means.

Table 10s. Evaluation of sulfur sources on dryland canola. Experiment located East of Sunburst, MT at the Phil Aschim farm. Western Triangle Ag. Research Center, Conrad, MT. 1999.

Sulfur Source[1]	Rate (lbs/a)	Seed Yield (lbs/a)	Oil Content[2] (%)	Oil Yield[2] (lbs/a)	Plant S Content (%)	S Uptake (lbs/a)
as	30	1742	37.1	645.0	0.588	78.0
s	10	1683	37.3	625.6	0.741	60.2
s	20	1651	37.1	612.1	0.532	54.9
es	30	1633	37.3	612.8	0.587	48.5
as	20	1539	36.7	561.6	0.543	43.5
s	30	1479	37.0	552.5	0.530	40.9
es	20	1475	37.0	528.1	0.552	32.3
	0	1467	36.8	535.8	0.665	47.6
as	10	1459	36.9	532.3	0.522	46.2
es	10	1458	36.9	537.3	0.601	45.6
Summary Statistics						
Experimental Means		1564	36.97	579.0	0.5858	49.74
Error Mean Square		33380	0.4569	5475	0.004754	505.4
P-value		0.2570	0.9667	0.2887	0.1483	0.7742
Standard error of the Mean		91.35	0.3380	42.72	0.04896	15.90
C.V.: (s/mean)*100		11.72	1.826	12.88	11.77	45.19
LSD (0.05)		NS	NS	NS	NS	NS

[1] 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)
[2] Oil content and oil yield reported on a dry weight basis.

Notes:
Variety: Hyola 357 RR
Seeding Date: 4/20/99 Swathing Date: 8/16/99
Threshing Date: 8/30/99 Growing Season ppt: 6.55"
Planting Rate: 5 lbs/a Previous Crop: No-till Barley Stubble
Herbicide: Stinger @ ⅓ pt./a, Poast @ 2 pt./a, and Muster @ 0.4 oz/a applied on 6/4/98, and with Roundup Ultra @ 2 pt/a on June 24, 1999.

Soil Test Summary:

Depth	Cu	Fe	B	Mn	Zn	K	Olsen P	EC	OM	pH
	---------- (ppm) ----------								(%)	
0 - 6"	1.86	71.6	0.5	25.7	1.67	308	17.3	0.08	2.95	5.9

Depth (ft)	NO_3-N (lbs./a)	SO_4-S (lbs./a)
0 - 1	22.9	27.1
1 - 2	3.6	47.2
2 - 3	2.1	134.4
3 - 4	5.0	251.5

Title: Dryland Lentil Variety Performance Trial.

Year: 1999.

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 fallow conditions.

Procedures: Plots were planted into fallow with a four-row plot drill using 12" row spacing. Seeding rate was about 14 seeds/ft^2. Granular innoculum and P fertilizer were placed with the seed. Plot size was four x 16 feet with four replications. Plots were direct cut with a Hege plot combine using lift fingers on the cutter bar. When necessary, some entries were dried before weighing. Yield data reflect a moisture content of about 9%.

Results: Seed yield, 1000 seed weight, standability, and pod shatter are summarized in Table 11s. Habitus and usage of lentil varieties are shown in Table 12s. Top yielding varieties were Brewer, Red Chief, Crimson, and Pardina. Pod shatter data were collected on 7/30/99. Pod shatter happened all at once pods seemed desiccated rather than ripened. French Green and Red Chief had the worst shatter losses. It is conceivable that French Green could have had highest yield if there were no shatter loss. CDC Vantage was the most shatter resistant of the food lentils. Also, the green manure lentil, Indianhead had excellent shatter resistance.

Table 11s. Dryland lentil performance nursery trial located at Western Triangle Agricultural Research Center, Conrad, MT. 1999.

Variety	Pod Shatter (%)	Standability[1]	1000 Seed Weight (g)	Seed Yield (lbs./a)
Brewer	19.13	0.94	60	1871
Red Chief	30.00	0.87	50	1816
Crimson	7.50	0.95	40	1780
Pardina	2.50	0.86	40	1735
CDC Vantage[2]	0.00	0.94	55	1630
CDC Richlea[2]	2.50	1.04	75	1582
CDC Milestone	10.00	0.96	40	1546
French Green	45.00	0.97	30	1492
Laird	2.47	0.92	65	1421
CDC Glamis[2]	7.50	0.85	30	1300
Mason	16.25	0.85	80	1220
Indianhead	0.00	0.90	20	1130
Palouse	21.25	0.86	70	1093
Eston	8.75	0.98	-	868
Summary Statistics				
Experimental Means	12.50	0.92	-	1463.
Error Mean Square	105.1	0.0156	-	143500
P-Value	0.0000	0.5819	-	0.0099
Standard Error of the Mean	5.13	0.0625	-	189.4
C.V. 1: (s/mean)*100	83.04	13.59	-	25.89
LSD (0.05)	14.69	0.18	-	542

Notes:

Planting date: 4/6/99 Harvested: 7/31/99 Previous crop: Summer Fallow

Swathed: N/A [2]Late threshing: 8/9/99 Growing season ppt. = 6.16"

Fertilizer: 6 lbs N/a and 30 lbs P/a P_2O_5 as mono-ammonium phosphate.

Herbicide: None

[1]Standability is an index of plant heights. The first plant height measurement is taken when the pea plants are about 50% flowered and the second height measurement is taken just before termination with a swather.

Table 12s. Habitus and usage of lentil varieties Western Triangle Agricultural Research Center, Conrad, MT. 1999.

Variety	Cotyledon Color	Seed Size	Usage
CDC Richlea	Yellow	Large	Food
Red Chief	Red	Large	Specialty Food
Indianhead	Yellow	Small	Green Manure
Pardina	Yellow	Small	Food
Laird	Yellow	Very Large	Food
French green	Yellow	Small	Specialty Food
Brewer	Yellow	Large	Food
Crimson	Red	Small	Specialty Food
Eston	Yellow	Small	Specialty Food
Mason	Yellow	Large	Food
Palouse	Yellow	Large	Food
CDC Glamis[1]	Yellow	Large	Food
CDC Milestone[1]	Yellow	Small	Food
CDC Vantage[1]	Yellow	Large	Food

[1]New varieties released by Crop Development Centre, Saskatoon, Saskatchewan, Canada. These varieties are replacements for Laird (Glamis), Eston (Milestone), and Brewer (Vantage) and are Aschochyta resistant.

Title: Dryland Spring Pea Variety Performance Trial.

Year: 1999.

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 under dryland fallow conditions.

Procedures: Plots were planted into fallow with a four-row plot drill using 12" row spacing. Seeding rate was about 14 seeds/ft^2. Granular innoculum and P-fertilizer were placed with the seed. Plot size was four x 16 feet with four replications. Plots were direct cut with a Hege plot combine using lift fingers on the cutter bar. When necessary, some entries were dried before weighing. Yield data reflect a moisture content of about 9%.

Results: Seed yield, 1000 seed weight, standability, and pod shatter are summarized in Table 14s. Habitus of pea varieties are shown in Table 15s. Top yielding varieties were CDC 9705, CDC 9704, Karita, Explorer, Melrose, Majoret, and Atomic. In general, varieties that have a lot of tendrils showed excellent standability, especially in the windstorm on 7/8/99, where wind speeds reached approximately 50 mph. Pod shatter data were collected on 7/30/99. Pod shatter happened all at once, pods seemed desiccated rather than ripened. Scuba, Profi, and Adagio had the worst shatter losses. It is conceivable that Profi could have had highest yield if there was no shatter loss. Grande and Victoria were the most shatter resistant of the food peas. Also, the forage peas, Granger, Melrose, and Trapper had excellent shatter resistance.

Table 14s. Dryland spring pea performance nursery trial located at Western Triangle Agricultural Research Center, Conrad, MT. 1999.

Variety	Pod Shatter (%)	Standability[1]	1000 Seed Weight (g)	Seed Yield (lbs./a)
CDC 9705	3.75	0.93	215	2962
CDC 9704	5.00	0.98	200	2940
Karita	5.00	0.99	230	2611
Explorer	21.25	0.98	220	2606
Melrose[2]	0.00	0.00	105	2601
Majoret	2.50	0.92	220	2552
Atomic	5.00	0.96	240	2529
Victoria	0.00	0.45	165	2475
CEB 1475	5.00	0.96	215	2433
Adagio	30.00	1.01	235	2424
Carrera	20.00	0.96	235	2404
Profi	47.50	0.91	235	2395
Carneval	15.00	0.96	200	2368
Espace	13.75	1.02	195	2361
Grande	0.00	0.79	210	2352
Toledo	10.00	1.00	250	2305
Integra	22.50	0.96	250	2264
Granger[2]	0.00	0.00	120	2179
Columba	13.75	0.96	240	2174
TSG 982	5.00	0.95	235	2154
Trapper	0.00	0.46	120	2088
Scuba	48.75	0.85	210	1544

Summary Statistics

Experimental Means	12.56	0.8160	-	2396
Error Mean Square	80.62	0.0065	-	91890
P-Value	0.0000	0.0000	-	0.0000
Standard Error of the Mean	4.490	0.0405	-	151.6
C.V. 1: (s/mean)*100	71.51	9.913	-	12.65
LSD (0.05)	12.7	0.11	-	428

Notes:

Planting date: 4/6/99 Harvested: 7/31/99 Previous crop: Summer Fallow

Swathed: N/A [2]Late threshing: 8/9/99 Growing season ppt. = 6.16"

Fertilizer: 6 lbs N/a and 30 lbs P/a P_2O_5 as mono-ammonium phosphate.

Herbicide: None

[1]Standability is an index of plant heights. The first plant height measurement is taken when the pea plants are about 50% flowered and the second height measurement is taken just before termination with a swather.

Table 16s. Irrigated spring pea performance nursery trial located at Western Triangle Agricultural Research Center, Conrad, MT. 1999.

Variety	Flowering Date[1]	Maturity Rating[2]	Standability[3]	1000 Seed Weight (g)	Seed Yield (lbs./a)
CDC 9705	7/17	3.7	0.92	260.0	5696
Grande	7/17	5.0	0.84	225.7	5319
Victoria	7/17	5.0	0.57	168.7	5092
CEB 1475	7/9	3.3	0.99	291.0	4895
Explorer	7/17	2.3	0.90	272.3	4818
Columba	7/17	4.0	0.83	289.3	4703
Toledo	7/9	2.3	0.89	308.3	4628
CDC 9704	7/9	3.3	0.90	234.3	4547
Espace	7/9	1.0	0.94	270.7	4522
Granger	-	5.0	0.67	131.7	4362
Trapper	7/17	5.0	0.52	139.7	4283
Majoret	7/9	2.3	0.98	260.7	4072
Integra	7/9	1.3	0.91	272.7	3991
Profi	7/9	1.3	0.88	258.3	1882
Karita	7/9	2.3	0.96	281.3	1824
Scuba	7/9	2.0	0.74	254.0	3647
Carrera	7/9	2.3	1.04	293.3	3434
Carneval	7/9	2.7	0.95	237.7	3261
Adagio	7/9	3.0	0.97	252.7	3023
Melrose	-	5.0	0.74	94.67	2995
TSG 982	7/9	2.7	0.92	280.7	2941
Atomic	7/5	1.0	0.89	332.7	2265

Summary Statistics

Experimental Means	3.0	0.8609	245.9	4100
Error Mean Square	0.2835	0.0097	325.2	415300
P-Value	0.0000	0.0000	0.0000	0.0000
Standard Error of the Mean	0.3074	0.0569	10.41	372.1
C.V. 1: (s/mean)*100	17.75	11.46	7.33	15.72
LSD (0.05)	0.8774	0.1625	29.72	1062

[1]Flowering date is when 50% of plants have flowers.

[2]Maturity rating is one through five with one having no green pods and five having all green pods.

[3]Standability is an index of plant heights. The first plant height measurement is taken when the pea plants are about 50% flowered and the second height measurement is taken just before termination with a swather. The first height measurement is divided by the second height measurement for the standability index.

[4]Austrian Winter Pea

Notes:
Planting date: 5/3/99
Swathed: 8/19/99
Threshed: 8/30/99
Previous crop: Barley
Growing season ppt. = 4.62" plus approximately 10" of irrigation water was applied.
Fertilizer: 6 lbs N/a and 30 lbs P/a P_2O_5 as mono-ammonium phosphate.
Herbicide: Sprayed with Poast (2 pt/a) on 6/14/99.

Title: Effect of seeding rate and nitrogen on yield and quality of spring wheat and durum.

Year: 1999

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

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

Introduction and Objectives: Low and high seeding rates can adversely affect durum quality and kernel characteristics. Low rates result in green kernels and poor color in the harvested grain. High rates can reduce test weight and kernel size below industry requirements. Nitrogen fertilizer is essential for durum to achieve adequate hard vitreous amber color, and may interact with seed rate to affect kernel characteristics. The objectives were to determine the optimum range of seed rates in durum, to determine N requirements for desired protein and vitreous levels, and to compare the responses between durum and spring wheat.

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 and Discussion: Agronomic and kernel characteristic data are presented in Table 17s. The low seeding rate (15 seeds/ft^2) increased green kernels to unacceptable levels in all but the zero nitrogen rate. Seeding rate did not significantly affect yield, test weight, and kernel size, under the conditions of this test. As shown in Table 19s, both durum and spring wheat responded to additional N. McNeal spring wheat yields were probably reduced by "crinkle joint" caused by a severe wind storm on July 8. Using these data in a regression analysis, the amount of N required to produce Utopia durum at 13% protein would be 145 lbs. N/a (includes fertilizer N and soil nitrate-N in the top three feet of soil, in this case 51 lbs. N/a), and it would produce 71 bu/a or about 2 lbs. N/bu of grain. Similarly, Utopia durum would require 165 lbs. N/a to produce 13.5% protein and 72 bu/a or 2.3 lbs. N/ bu of grain. In comparison McNeal spring wheat needs 190 lbs. N/a to produce 70 bu/a at 14% protein or 2.7 lbs N/ bu of grain. Note that Utopia durum would produce about 73 bu/a at 14% protein with 190 lbs. N/a. However, the durum protein level tends to "level out" at about 14.5% with additional N, whereas spring wheat protein would continue to increase.

Future Plans: Continue this test in 2000 and 2001 in order to sample a variety of growing season conditions.

Table 17s. Effect of seeding rate and N on spring wheat and durum yield and quality. The experiment was located at Western Triangle Ag. Research Center, Conrad, MT. 1999.

Crop	Fertilizer N (lbs./a)	Seeding Rate (seed/ft^2)	Grain Yield (bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)	DHV[1] (%)	Green Kernel (%)	Large Kernel[2] (%)
DU	225	30	81.3	59.5	14.7	709.0	99	0.0	40
DU	225	15	80.1	60.5	14.5	689.9	100	5.0	44
DU	75	30	79.1	61.3	12.0	567.7	96	0.2	52
SW	150	30	77.2	60.5	14.3	655.6			
DU	150	30	77.0	60.5	14.2	652.1	100	0.2	49
DU	225	20	76.5	60.4	14.6	660.3	100	0.2	43
DU	75	25	76.4	60.9	12.3	563.0	69	0.0	44
SW	225	25	75.0	60.5	15.0	674.1			
SW	150	15	7437	61.0	14.5	645.1			
DU	150	20	74.7	60.3	14.2	632.6	98	0.0	52
SW	225	20	73.8	60.2	15.0	659.6			
SW	150	20	73.5	60.1	14.8	646.6			
DU	150	15	73.1	60.7	14.1	615.8	98	5.0	49
DU	150	25	72.9	60.1	14.1	616.2	99	0.2	44
SW	225	15	72.3	60.7	14.8	640.4			
DU	225	25	71.4	58.9	15.1	643.8	98	0.0	35
SW	225	30	71.1	60.0	15.2	645.8			
SW	150	25	69.6	59.6	15.1	622.1			
SW	75	15	69.2	60.7	13.7	566.9			
SW	75	20	37.9	60.4	13.5	550.8			
SW	75	25	66.6	59.8	13.6	540.5			
SW	75	30	66.6	59.7	13.6	538.2			
DU	0	20	66.4	62.7	9.5	378.1	47	0.0	73
SW	0	30	66.2	60.4	10.4	413.2			
DU	75	15	66.0	60.8	12.4	488.3	97	3.0	43
DU	75	20	65.4	60.0	12.9	502.5	98	0.2	35
DU	0	30	64.1	62.2	9.7	372.8	56	0.2	62
DU	0	25	63.8	62.2	9.5	365.5	37	0.2	72
DU	0	15	62.4	62.6	9.8	367.7	42	1.0	72
SW	0	25	61.3	61.4	10.7	392.8			
SW	0	20	57.3	61.8	10.7	367.5			
SW	0	15	57.0	61.6	10.8	369.4			

[1] Dark Hard Vitreous

[2] Large Kernel Percent equal seed left on a 2.78 mm screen.

Summary Statistics

	Grain Yield (Bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
Experimental Means	70.3	60.7	13.1	554.8
Error Mean Square	91.14	1.707	0.4787	3368
P-Value	0.0190	0.0083	0.0000	0.0000
Standard Error of the Mean	4.773	0.6533	0.3459	29.02
C.V. 1: (s/mean)*100	13.58	2.152	5.283	10.46
LSD (0.05)	13.4	1.8	1.0	81.5
Variety Summary				
Utopia	71.9	60.9	12.7	551.6
McNeal	68.7	60.6	13.5	558.0
LSD (0.05)	NS	NS	0.3	NS
Seeding Rate Summary				
15	69.3	61.1	13.1	547.9
20	69.4	60.7	13.1	549.8
25	69.6	60.4	13.2	552.2
30	72.8	60.6	13.0	569.3
LSD (0.05)	NS	NS	NS	NS
Nitrogen Summary				
0	62.3	62.0	10.1	378.4
75	69.7	60.5	13.0	539.7
150	74.1	60.4	14.4	635.8
225	75.2	60.1	14.9	665.4
LSD (0.05)	4.7	0.6	0.3	28.7
Interaction P-value	0.9726	0.9796	0.8770	0.9956

Notes:
Varieties: Durum = Utopia Spring Wheat = McNeal
Seeding Date: 4/13/99 Harvest Date: 8/23/99
Growing Season ppt: 7.88" Previous Crop: Fallow
Fertilizer: N applied as urea (broadcast) while planting. Thirty lbs. P_2O_5 applied with the seed as mono-ammonium phosphate while planting. 30 lbs K/ac as KCl was applied, (broadcast), while planting.
Herbicide: Achieve @ 0.25 lbs. ai/ac and Bronate @ 1½ pt./ac applied on 5/27/98.

Soil Test Summary[1]:

Depth	K	Olsen P	EC	OM	pH
	---------- ppm ----------		mmhos/cm	%	
0 - 6"	330	26.5	0.15	2.29	8.1
	NH_4-N	NO_3-N	SO_4-S	Cl	
	---------- lbs/ac ----------				
0 - 1	11.8	27.2	131.7	14.6	
1 - 2	10.1	16.7	134.1	12.3	
2 - 3	11	6.7	3651.7	12.8	
3 - 4	10.3	4.8	4797.7	12.9	

[1]The soil was sampled during the autumn of 1998.

Title: Effect of nitrogen, phosphorus, potassium, chloride, and planting rate on winter wheat.

Year: 1999

Locations: 1) North of Loma, MT at the Lyle McKeever farm.
2) East of Choteau, MT at the Roy Inbody farm
3) East of Brady, MT (Knees) at the Dan Picard farm
4) North of Conrad, MT at the Western Triangle Ag. Research Center, seeding rate

Personnel: Grant Jackson 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 phosphorus (P) fertilizer and P soil tests; survey winter wheat response to potassium (K) and chloride (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. To evaluate planting rates on high yielding winter wheat varieties and hybrids.

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 using a four-row, shovel opener, plot drill with 12" spacing between rows. Choteau and Knees 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^2. Plot length was 20 feet with four replications. Plot length at Conrad was 10 feet. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 20s (Loma), Table 21s (Knees), Table 22s (Choteau), and Table 23s (Conrad). The data from the Choteau site should be interpreted with caution because of frost and hail damage. All locations responded to N. However, the Loma site's response was negative due to high initial soil nitrate-N levels. The Knees location had a slight, but significant response to N. No response to P, K, and Cl were detected this year. Post-harvest nitrate N data for the Choteau and Knees locations are shown in Figures 1 and 2. These data indicate that very little nitrate N is accumulated in the soil following harvest if recommended N rates are utilized. Planting rates peaked at 20 seeds/ft^2 or about 60 lbs./a depending upon seed size. Yields were very high considering that growing conditions were not conducive for winter wheat production.

Table 18s. Effect of N, P, K, and Cl on winter wheat yield and quality. Experiment located North of Loma, MT at the Lyle McKeever farm. 1999.

Entry	Fertilizer $N-P_2O_5-K-Cl$ (lbs./a)	Grain Yield (bu/a)	Grain Protein %	Test Weight (lbs./bu)	Protein Yield (lbs./a)
5	0-25-30-30	49.4	12.98	60.0	383.0
6	30-25-30-30	48.7	13.15	60.0	383.0
1	0-0-30-30	48.4	11.95	60.4	346.8
14	60-25-30-0	47.9	14.13	60.0	402.7
9	0-50-30-30	47.9	11.55	60.3	332.1
2	30-0-30-30	47.3	13.00	60.1	368.3
13	60-25-0-30	46.9	13.40	59.7	377.1
10	30-50-30-30	46.4	13.98	59.5	388.3
3	60-0-30-30	46.1	13.73	59.6	378.2
8	90-25-30-30	45.5	14.43	59.6	392.4
4	90-0-30-30	45.4	14.52	59.0	395.6
12	90-50-30-30	44.6	15.02	59.0	401.4
7	60-25-30-30	43.6	14.45	59.1	377.2
11	60-25-30-30	43.4	14.30	59.2	370.1
		Summary Statistics			
Experimental Means		46.5	13.61	59.7	378.3
Error Mean Square		13.31	0.9119	0.7202	791.4
P-value		0.4209	0.0000	02472	0.0478
Standard Error of the Mean		1.824	0.4775	0.4243	14.07
C.V. 1: (s/mean)*100		7.844	7.015	1.422	7.437
LSD (0.05)		5.218	1.366	1.214	40.24
		Nitrogen Summary			
0		48.5	12.16	60.2	354.0
30		47.5	13.38	59.9	379.8
60		44.3	14.16	59.3	375.1
90		45.1	14.66	59.2	396.5
LSD (0.05)		3.013	0.7886	0.7008	23.23
		Phosphorus Summary			
0		46.8	13.30	59.8	372.2
25		46.8	13.75	59.7	383.9
50		45.5	13.71	59.5	372.9
LSD (0.05)		2.609	0.6829	0.6069	20.12
Interaction p-value		0.9495	0.3051	0.8214	0.3042

Notes:
Variety: Rampart
Seeding Date: 9/16/98 Harvest Date: 7/26/99
Growing Season ppt: 5.25" Planting Rate: 20 seeds/ft^2
Previous Crop: Fallow
Herbicide:

Soil Test Summary:

Depth	K	Olsen P	EC	OM	pH
	ppm		mmhos/cm	%	
0 - 6"	300	19.5	0.18	1.41	8.5
	NH_4-N	NO_3-N	SO_4-S	Cl	
	lbs/ac				
0 - 1	13.9	37.3	125.1	15.5	
1 - 2	17	25.4	244.8	37.6	
2 - 3	30	20.6	4576.7	46.5	
3 - 4	33.4	34.9	10470.5	53.3	

Table 19s. Effect of N, P, K, and Cl on winter wheat yield and quality. Experiment located East of Brady (Knees), MT at the Dan Picard farm. 1999.

Entry	Fertilizer N-P_2O_5-K-Cl (lbs/ac)	Grain Yield (bu/ac)	Grain Protein %	Test Weight (lb/bu)	Protein Yield (lb/ac)
13	60-25-0-30	53.0	11.9	59.4	379.7
2	30-0-30-30	52.7	11.9	58.9	375.3
11	60-50-30-30	52.3	12.2	58.2	382.0
3	60-0-30-30	52.2	11.1	59.7	347.3
14	60-25-30-0	51.8	11.8	59.0	365.8
4	90-0-30-30	51.8	13.1	57.5	406.7
10	30-50-30-30	51.7	12.1	58.6	375.7
7	60-25-30-30	50.8	13.5	57.2	410.6
1	0-0-30-30	50.7	11.5	60.1	352.3
6	30-25-30-30	50.7	12.6	58.6	383.1
8	90-25-30-30	50.6	13.2	58.3	400.4
5	0-0-30-30	49.6	11.9	59.4	355.0
12	90-50-30-30	49.6	12.5	58.1	371.5
9	0-50-30-30	46.7	10.8	60.2	303.9
		Summary Statistics			
Experimental Means		51.0	12.2	58.8	372.1
Error Mean Square		7.360	1.676	1.586	1979
P-value		0.1769	0.1870	0.0340	0.1494
Standard Error of the Mean		1.356	0.6474	0.6296	22.25
C.V. 1: (s/mean)*100		5.319	10.66	2.142	11.96
LSD (0.05)		3.88	1.852	1.801	63.63
		Nitrogen Summary			
0		49.0	11.4	59.9	337.1
50		51.7	12.2	58.7	378.0
100		51.7	12.3	58.3	380.0
150		50.7	12.9	57.9	392.9
LSD (0.05)		2.24	1.069	1.040	36.74
		Phosphorus Summary			
0		51.9	11.9	59.0	370.4
25		50.4	12.8	58.4	387.3
50		50.1	11.9	58.7	358.3
LSD (0.05)		NS	NS	NS	NS
Interaction p-value		0.6172	0.6507	0.2748	0.5380

Notes:
Variety: Rampart
Seeding Date: 9/21/98 Harvest Date: 8/4/99
Growing Season ppt: 5.30" Planting Rate: 20 seeds/ft^2
Previous Crop: Winter Wheat Chem-fallow
Herbicide:

Soil Test Summary:

Depth	K	Olsen P	EC	OM	pH
	---------- ppm ----------		mmhos/cm	%	
0 - 6"	484	24.3	0.14	1.76	7.1
	NH_4-N	NO_3-N	SO_4-S	Cl	
	---------- lbs/ac ----------				
0 - 1	16.7	49.7	128.3	28.2	
1 - 2	13.1	30	83.4	34.2	
2 - 3	17.4	45.9	3828.5	38.3	
3 - 4	20.9	16.7	7040.2	46.3	

Summary of Plant Nitrogen Uptake

N-Fertilizer Rate	N Uptake	Seed N	Straw and Chaff N
	---------- lbs./a ----------		
0	73.4	62.3	11.1
30	104.1	67.2	36.8
60	100.5	64.2	36.4
90	126.2	70.2	55.9
Experimental Means	101.1	66.0	35.1
Error Mean Square	569.3	66.80	680.5
P-value	0.0634	0.5975	0.1803
Standard Error of the Mean	11.93	4.087	13.04
C.V. 1: (s/mean)*100	23.61	12.39	74.40
LSD (0.05)	38.2	NS	41.7

Table 20s. Effect of N, P, K, and Cl on winter wheat yield and quality. Experiment located East of Choteau, MT at the Roy Inbody farm. 1999.

Entry	Fertilizer $N\text{-}P_2O_5\text{-}K\text{-}Cl$ (lbs/ac)	Grain Yield (bu/ac)	Grain Protein %	Test Weight (lb/bu)	Protein Yield (lb/a)
8	150-25-30-30	30.7	16.1	57.5	297.5
12	150-50-30-30	28.5	16.5	57.7	281.0
4	150-0-30-30	28.4	16.3	57.8	276.3
14	100-25-30-0	27.7	16.2	57.7	269.8
7	100-25-30-30	27.4	15.5	58.4	255.5
11	100-50-30-30	27.3	15.9	58.2	259.8
10	50-50-30-30	25.3	15.6	58.1	236.3
3	100-0-30-30	25.1	16.0	57.4	240.8
13	100-25-0-30	24.9	16.0	58.0	238.0
2	50-0-30-30	21.6	15.7	57.9	202.5
6	50-25-30-30	21.4	15.8	58.0	202.0
5	0-25-30-30	14.0	16.2	58.4	133.8
1	0-0-30-30	12.7	16.4	57.5	122.5
9	0-50-30-30	12.0	16.3	58.1	116.8
Summary Statistics					
Experimental Means		23.2	16.1	57.9	222.4
Error Mean Square		9.876	0.1720	0.2738	835.0
P-value		0.0000	0.0387	0.2480	0.0000
Standard Error of the Mean		1.571	0.2074	0.2616	14.45
C.V. 1: (s/mean)*100		13.46	2.589	0.9037	12.92
LSD (0.05)		4.5	0.6	0.8	41.4
Nitrogen Summary					
0		16.0	15.9	57.9	151.9
50		22.7	15.7	58.0	213.6
100		26.4	15.9	57.9	251.6
150		29.2	16.3	57.7	285.0
LSD (0.05)		3.8	0.4	NS	35.2
Phosphorus Summary					
0		23.3	15.9	57.6	222.4
25		23.9	15.9	58.0	228.2
50		23.5	16.0	58.0	226.0
LSD (0.05)		NS	NS	NS	NS
Interaction p-value		0.4856	0.7580	0.4842	0.5661

Notes:
Variety: Rampart
Seeding Date: 9/17/98 Harvest Date:
Growing Season ppt: approximately 3.50" Planting Rate: 20 seeds/ft^2
Previous Crop: chemical-fallow
Herbicide: None

Soil Test Summary:

Depth	K	Olsen P	EC	OM	pH
	---------- ppm ----------		mmhos/cm	%	
0 - 6"	798	23.9	0.19	2.08	8.1
	NH_4-N	NO_3-N	SO_4-S	Cl	
	---------- lbs/ac ----------				
0 - 1	19.3	27.6	31.6	23.8	
1 - 2	15.4	15.0	46.2	31.7	
2 - 3	12.4	21.6	223.6	122.4	
3 - 4	9.8	30.6	1399.6	214.5	

Summary of Plant Nitrogen Uptake

N-Fertilizer Rate	N Uptake	Seed N	Straw and Chaff N
	----------lbs./a----------		
0	87.2	23.5	63.7
30	114.3	35.5	78.9
60	153.1	52.2	100.9
90	109.4	44.9	64.6
Experimental Means	116.0	39.0	77.0
Error Mean Square	326.4	33.3	332.3
P-value	0.0035	0.0000	0.0498
Standard Error of the Mean	9.033	2.886	9.114
C.V. 1: (s/mean)*100	15.57	14.81	23.67
LSD (0.05)	28.9	9.2	29.2

Table 21s. Effect of seeding rate on winter wheat variety yield and quality. The experiment was located at Western Triangle Ag. Research Center, Conrad, MT. 1999.

Variety	Seeding Rate (seeds/ft^2)	Grain Yield (bu./a)	Test Weight (lbs./bu)	Protein (%)
Quantum 7424	20	97.4	59.8	11.5
Quantum 7424	15	87.7	59.3	12.1
Neeley	20	87.5	60.6	11.9
Neeley	15	84.6	60.5	12.1
Quantum 7424	10	81.3	58.8	12.3
Neeley	10	77.1	60.2	12.6
Variety Summary				
Quantum 7424		88.8	59.3	12.0
Neeley		83.1	60.4	12.2
LSD (0.05)		NS	0.6	NS
Seeding Rate Summary				
10		79.2	59.5	12.4
15		86.1	59.9	12.1
20		92.4	60.2	11.7
LSD (0.05)		9.4	NS	0.6
Interaction P-value		0.7064	0.7108	0.7275

Notes:
Seeding Date:
Harvest Date:
Growing Season ppt: 7.88"
Previous Crop: Fallow
Fertilizer: 129 lbs. N/a applied as urea (broadcast) and P applied with the seed. 30 lbs K/ac as KCl applied to all plots (broadcast). Fertilizer treatments applied during planting.
Herbicide: Achieve @ 0.25 lbs. ai/ac and Bronate @ 1½ pt./ac applied on 5/27/98.

Soil Test Summary:

Depth	K	Olsen P	EC	OM	pH
	ppm		mmhos/cm	%	
0 - 6"	330	26.5	0.15	2.29	8.1
	NH_4-N	NO_3-N	SO_4-S	Cl	
	lbs/ac				
0 - 1	11.8	27.2	131.7	14.6	
1 - 2	10.1	16.7	134.1	12.3	
2 - 3	11	6.7	3651.7	12.8	
3 - 4	10.3	4.8	4797.7	12.9	

Figure 1. Preplant and post-harvest soil NO_3-N in winter wheat, East of Brady, MT.

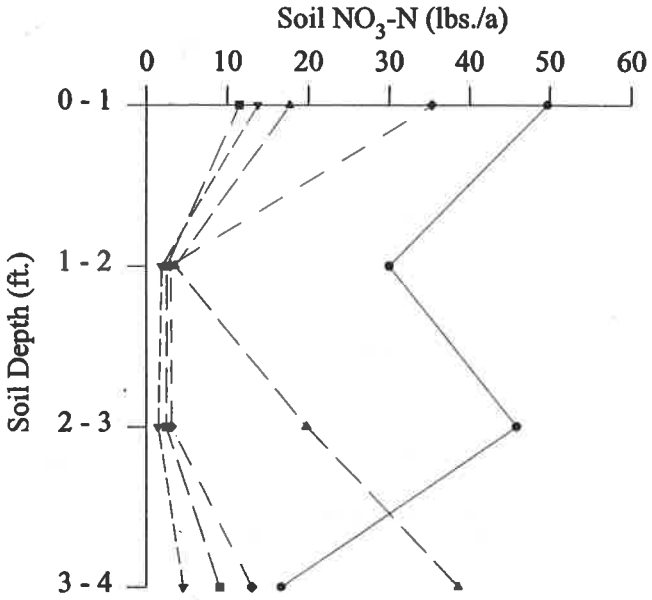

Figure 2. Preplant and post-harvest soil NO_3-N in winter wheat, East of Choteau, MT.