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of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

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Submitted by

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SOILS RESEARCH

Climatic summary for the 2000 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	0.19	0.52	0.19	0.15	1.50	1.50	0.36	0.12	0.83	0.77	0.15	0.25	6.53
Average 16 yr	0.20	0.22	0.51	0.87	1.93	2.71	1.49	1.39	1.31	0.53	0.37	0.18	11.71
Mean Temperature (^{0}F)													
Current Year	22.3	28.7	36.3	44.2	54.3	57.0	69.3	69.5	55.3	44.5	28.0	11.0	43.4
Average 15 yr	22.2	24.6	34.2	43.5	53.2	59.9	65.8	66.1	57.4	45.6	31.0	24.2	44.0

Last killing frost in Spring
2000----------June 1 (32^0)
Average----------May 15

First killing frost in Fall
2000----------Sep 20 (31^0)
Average----------Sep 22

Frost free period (days)
2000----------112
Average----------129

Maximum summer temperature--- 100^0 (Aug 10)

Minimum winter temperature---- - 26^0 (Dec 18, 2000)

Summary of climatic data by month for the 99-2000 crop year (Sept - August) at the Western Triangle Research Center, Conrad, MT.

	Sep 1999	Oct 1999	Nov 1999	Dec 1999	Jan 2000	Feb 2000	Mar 2000	Apr 2000	May 2000	June 2000	July 2000	Aug 2000	Total or Average
Precipitation (inches)													
Current year	1.07	0.60	0.55	0.05	0.19	0.52	0.19	0.15	1.50	1.50	0.36	0.12	6.80
Average 16 yr	1.34	0.51	0.38	0.17	0.20	0.22	0.51	0.87	1.93	2.71	1.49	1.39	11.72
Mean Temperature (^{0}F)													
Current year	54.8	48.6	41.3	33.8	22.3	28.7	36.3	44.2	54.3	57.0	69.3	69.5	46.7
Average 15 yr	57.5	45.7	31.2	25.1	22.2	24.6	34.2	43.5	53.2	59.9	65.8	66.1	44.1

Last killing frost in Spring
2000---------- June 1 (32^0)
Average---------- May 15

First killing frost in Fall
2000---------- Sep 20 (31^0)
Average---------- Sept. 22

Frost free period (days)
2000---------- 112
Average---------- 129

Maximum summer temperature------- 100^0 (Aug 10) and 98 (July 14)

Minimum winter temperature--------- -6^0 (Jan. 17, 2000)

2000 Winter Wheat Variety Evaluations in the Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

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

Winter wheat variety trials were grown on station at Conrad, and off-station at the Knees area east of Brady. The Knees trial was planted no-till into chem-fallow. Trials at Conrad also included preliminary and advanced sawfly trials with approximately 1100 experimental lines.

Results: Data for 2000 and five-year averages are presented in Tables 1-3 for Conrad, and Tables 4-5 for the Knees. Fall stands were good, but winter snow cover was non-existent and growing season rainfall was only 58% of normal. In spite of these conditions, winter survival, yield and test weight were good.

High-ranking varieties for yield included Rocky, Judith, Big Sky and Neeley at both locations. Morgan ranked high at Conrad. Yields of Big Sky and Tiber were not significantly different. Likewise, yields of Vanguard and Rampart were not significantly different. Vanguard and Rampart yielded about 8 bu/a less than Rocky.

The sawfly resistant line MTS-9882 yielded equal to Rocky, and maintained good test weight. Another sawfly resistant line, MTS-9720, was slightly lower for yield and two lbs/bu lower in test weight.

Sawfly damage was severe at the Knees for hollow-stemmed varieties, except Rocky suffered only moderate damage. The solid-stemmed varieties Vanguard, Rampart, MTS-9882 and MTS-9720 had only slight sawfly damage.

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

Winter Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

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

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 (4), 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): Low winterhardiness. Medium coleoptile. Slightly earlier and 2" shorter than Rocky. Medium yield and protein.

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

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.

Falcon (CDC, WPB, Sask. 1998): Good winterhardiness. Short coleoptile. Straw 4" shorter than Rocky. 1 day later than Rocky. Medium yield. Protein similar to Rocky.

Fidel (Amer Cyanamid). IMI herbicide resistant.

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.

Harding (SD, 2000): Med winterhardiness? Very long coleoptile. Height = Rocky. 1 or 2 days later than Rocky. Medium yield. High protein.

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.

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.

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.

MTS 9882R (MSU): Sawfly resistant, experimental. Much greater winterhardiness than Vanguard & Rampart, and slightly greater than Rocky. Medium coleoptile. Straw 4" shorter than Rocky. Maturity similar to Tiber. 9882 has high yield and test weight, equal to Rocky, but low protein. 9882R is re-selected for high protein and will be re-tested.

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): Med-low WH. Tall straw. Long coleoptile. Early maturity.

Prowers 99 (CO, 1999): WH was good (1st year). Long coleoptile. Similar height and maturity as Rocky. 3 bu lower yield and 0.5% higher protein than Rocky.

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. Short coleoptile. Excellent straw strength. Intended for irrigated only. Two days later than Centurk.

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. Med-long coleoptile. Medium height, maturity and protein. Low yield.

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. Adapted to southern Great Plains.

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 Big Sky for alternative.

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. Adapted to southern Great Plains.

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 Redwin (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

Golden Spike (UT, Gen Mills, 1998): Hard white. Winterhardiness and height similar to Rocky. Medium coleoptile. Medium yield. Low protein.

NuPlains (Nebr, Gen Mills, 1998): Hard white. Medium winterhardiness. Medium coleoptile. Straw 5" shorter than Rocky. Yield slightly lower than Nuwest. High protein.

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.

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.

Table 1 **Dryland Winter Wheat** variety trial grown north of **Conrad,** 2000. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
QUANTUM 542		56.6	62.8	32	158	3	13.9
BZ96-919		54.4	62.3	28	160		13.6
ID537		53.6	60.7	31	160		14.1
MORGAN		51.0	61.5	33	162	5	14.5
JUDITH		50.7	58.7	30	160	3	14.9
PROMONTORY		50.7	61.9	31	159	2	13.8
BIGHORN		50.0	61.5	26	159	3	14.6
GM10002		49.9	62.7	27	157		14.7
MT9426		49.9	62.1	29	161		14.5
ROCKY		49.5	63.1	31	159	2	14.5
MT9513		49.3	61.5	30	161		14.6
BZ96-895		49.3	61.7	29	160		14.6
UTAH 100		48.9	61.2	33	161		14.6
BLIZZARD		48.8	57.7	30	161	2-3	14.7
GM10001		48.2	62.8	25	160		13.3
MT98110		48.1	61.1	27	160		14.6
HALT	***	47.7	59.8	26	157	2	15.0
MTS9882	**	47.3	61.0	27	163		14.0
ID513		47.1	60.6	26	162		13.9
MTW9724		46.8	61.2	29	161		13.9
PRONGHORN		46.3	61.9	30	156		15.1
BIG SKY		46.1	60.1	31	161	4	15.4
ID550		45.6	61.5	30	161		13.9
NEELEY		45.3	59.6	33	160	3	14.4
S94-4		45.3	61.7	27	160		14.7
GM10003		45.0	61.8	26	158		14.1
MANNING		44.8	60.1	28	162	2	14.5
WINDSTAR		44.8	61.0	31	158		14.5
MT9857		44.5	61.4	25	166		14.8
BZ97-761		44.3	59.3	29	161		15.3

(*Continued* on next page)

(Dryland winter wheat, *continued*)

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
RAMPART	**	43.1	62.1	21	160	1.5	15.8
MTW 9441	*	42.4	60.5	31	164		14.6
RANSOM		41.7	61.4	29	161		14.8
MT9822		41.3	61.5	29	158		15.8
CULVER		41.3	57.9	28	157		15.7
SD92107		41.1	57.8	29	161		15.8
NUWEST	*	41.1	58.5	30	164	3	15.5
MTS9720		40.9	58.1	31	163		15.3
PROWERS		40.1	61.0	29	160		15.1
NUPLAINS	*	40.1	61.2	26	159		15.8
VANGUARD	**	39.9	61.2	28	163	1.5	15.3
ERHARDT		39.1	61.6	28	166	4	15.6
AKRON		39.1	60.0	27	158		15.2
TIBER		39.0	58.6	31	164	3	14.4
NORSTAR		38.7	59.6	37	165	5	14.5
REDWIN		38.5	60.4	31	163		15.3
GOLDEN SPIKE		37.8	61.5	30	162		14.2
ELKHORN		36.8	60.4	32	164	4	14.7
MCGUIRE		36.5	61.5	25	159	3	16.1

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, Pondera County.
Fertilizer: 60# 11-51-0 with the seed, + 45#N & 20#K Broadcast.
Previous crop: Fallow.
Date seeded: Sept. 16, 1999.
Date harvested: July 31, 2000.
Rainfall: From April 1 to harvest was 3.31 inches.
* = Hard white wheat.
** = Sawfly resistant variety.
*** = Russian wheat aphid resistance.
1/ = Spring survival class: 5=best; 1=very low; based several location-years of observation.
Yield experimental mean: 45.06
Error degrees of freedom: 96
F test for var. = 2.46, C.V. 2 = 6.94, LSD (0.05) = 8.78

Table 2 **Dryland Winter Wheat** variety trial grown north of **Conrad**, 2000. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

(***ABBREVIATED LIST***)

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
QUANTUM 542		56.6	62.8	32	158	3	13.9
MORGAN		51.0	61.5	33	162	5	14.5
JUDITH		50.7	58.7	30	160	3	14.9
PROMONTORY		50.7	61.9	31	159	2	13.8
BIGHORN		50.0	61.5	26	159	3	14.6
ROCKY		49.5	63.1	31	159	2	14.5
BLIZZARD		48.8	57.7	30	161	2-3	14.7
HALT	***	47.7	59.8	26	157	2	15.0
MTS9882	**	47.3	61.0	27	163		14.0
PRONGHORN		46.3	61.9	30	156		15.1
BIG SKY		46.1	60.1	31	161	4	15.4
NEELEY		45.3	59.6	33	160	3	14.4
MANNING		44.8	60.1	28	162	2	14.5
WINDSTAR		44.8	61.0	31	158		14.5
RAMPART	**	43.1	62.1	21	160	1.5	15.8
MTW9441	*	42.4	60.5	31	164		14.6
RANSOM		41.7	61.4	29	161		14.8
CULVER		41.3	57.9	28	157		15.7
NUWEST	*	41.1	58.5	30	164	3	15.5
PROWERS		40.1	61.0	29	160		15.1
NUPLAINS	*	40.1	61.2	26	159		15.8
VANGUARD	**	39.9	61.2	28	163	1.5	15.3
ERHARDT		39.1	61.6	28	166	4	15.6
AKRON		39.1	60.0	27	158		15.2

(*Continued* on next page)

(Dryland winter wheat abbreviated list, *continued*)

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	Spring survival class 1/	% protein
TIBER	39.0	58.6	31	164	3	14.4
NORSTAR	38.7	59.6	37	165	5	14.5
REDWIN	38.5	60.4	31	163		15.3
GOLDEN SPIKE	37.8	61.5	30	162		14.2
ELKHORN	36.8	60.4	32	164	4	14.7
MCGUIRE	36.5	61.5	25	159	3	16.1

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, Pondera County.
Fertilizer: 60# 11-51-0 with the seed, + 45#N & 20#K broadcast.
Previous crop: Fallow.
Date seeded: Sept. 16, 1999.
Date harvested: July 31, 2000.
Rainfall: From April 1 to harvest was 3.31 inches.
* = Hard white wheat.
** = Sawfly resistant variety.
*** = Russian wheat aphid resistance.
1/ = Spring survival class: 5=best; 1=very low; based several location-years of observation.
Yield experimental mean: 45.06
Error degrees of freedom: 96
F test for var. = 2.46
C.V. 2 = 6.94
LSD (0.05) = 8.78

Table 3 **Five-year summary** for **Winter Wheat** varieties grown near **Conrad, MT.** 1995 - 1996 - 1997 - 1998 - 2000. 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
QUANTUM 542		76.4	62.8	36	165	12.3
PROMONTORY		75.2	62.2	32	167	11.7
MORGAN		73.1	62.1	36	170	12.3
ROCKY		72.8	63.0	35	167	12.2
JUDITH		72.2	60.5	34	167	12.5
NEELEY		71.6	61.2	36	170	12.1
MANNING		71.6	60.8	32	167	11.9
BIG SKY		70.8	62.4	37	168	13.0
BIGHORN		70.8	62.0	29	168	12.5
BLIZZARD		70.6	61.2	37	171	12.7
MTW 9441	**	69.9	61.4	36	171	12.5
NUWEST	**	68.6	60.8	35	169	12.5
PRONGHORN		68.3	62.7	35	163	13.2
RAMPART	*	67.8	62.2	32	168	13.7
HALT	***	67.0	61.6	28	163	13.1
AKRON		66.7	62.2	32	164	12.2
ERHARDT		65.4	62.7	33	169	13.5
TIBER		64.3	61.1	37	170	12.6
VANGUARD	*	61.3	61.6	33	168	13.7
ELKHORN		60.4	61.4	40	171	13.0
MCGUIRE		60.0	62.0	32	164	14.3
REDWIN		59.1	60.9	36	170	13.5
NORSTAR		58.4	61.4	43	173	12.9

Cooperator: Conrad Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
* = Sawfly resistant varieties.
** = Hard white wheat.
*** = Russian wheat aphid resistant.

Table 4 **Dryland Winter Wheat** variety trial grown near the **Knees**, 2000. Mont. Agr. Expt. Station, Western Triangle Ag. Res. Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Spring survival class 1/	% protein
PRONGHORN		59.5	62.7	35		14.4
ROCKY		58.3	63.7	31	2	14.7
MTS9882	**	58.0	61.8	31		13.5
JUDITH		56.4	60.7	35	3	14.2
NEELEY		55.1	61.9	31	3	14.3
HALT	***	54.6	62.0	27	2	14.5
PROMONTORY		52.8	63.4	34	2	14.3
QUANTUM 542		52.8	62.3	34	3	14.2
MTS 9720		51.9	60.0	32		14.2
TIBER		51.6	60.7	33	3	14.4
BIG SKY		51.5	61.1	35	4	14.9
VANGUARD	**	50.1	62.1	31	1.5	15.5
BIGHORN		50.1	62.8	29	3	14.6
MT 9513		49.3	63.5	33		14.0
MORGAN		48.7	60.8	33	5	14.7
NUPLAINS	*	48.4	63.4	29		14.8
MT 9426		47.8	61.8	29		14.6
ERHARDT		47.8	61.3	28	4	15.6
MCGUIRE		47.7	61.7	32	3	16.4
MTW 9441	*	45.6	59.8	30		14.5
NUWEST	*	45.5	58.9	30	3	14.5
RAMPART	**	44.9	62.2	32	1.5	15.8
NORSTAR		44.8	60.7	39	5	14.3
ELKHORN		43.9	61.7	34	4	15.8

Cooperator: Dan Picard.
Location: Thirty miles east of Brady, Chouteau County.
Fertilizer: 60# 11-51-0 with the seed, + 45# N urea.
Rainfall: April 1 to harvest = 3.75 inches.
Previous crop: No-till chem. fallow.
Date seeded: Sept. 15, 1999. Date harvested: July, 24, 2000.
Soil probe depth at seeding: 34 inches.
* = Hard white wheat. ** = Sawfly resistant variety.
*** = Russian wheat aphid resistant.
1/ = Spring survival class: 5=best; 1=very low; based on several location-years of observation.
Yield exp. mean: 50.71 Error degrees of freedom: 46
F test for var. = 3.24,--- C.V. 2 = 4.97,--- LSD (0.05) = 7.17

Table 5 **Five-year summary** on dryland **Winter Wheat** varieties grown near the **Knees**. 1993 - 1996 - 1997 - 1998 - 2000. Mont. Agr. Expt. Sta., Western Tri. Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
ROCKY		47.2	60.3	29	13.9
TIBER		43.2	59.6	29	14.0
QUANTUM 542		43.2	59.4	31	13.8
VANGUARD	*	43.2	59.0	28	14.7
RAMPART	*	41.2	59.1	29	14.7
NUWEST	**	40.5	58.2	28	14.3
NEELEY		39.7	58.0	29	13.9
BIGHORN		38.6	59.6	25	14.1
JUDITH		38.6	57.8	31	14.4
MCGUIRE		36.8	58.9	28	15.5
PROMONTORY		36.6	60.1	29	13.5
ERHARDT		36.1	58.6	27	15.4
NORSTAR		35.2	58.8	34	14.3

Cooperator: Dan Picard.
Location: Thirty miles east of Brady. (Chouteau County)
* = Sawfly resistant varieties.
** = Hard white wheat, (MT 7811).

2000 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, Choteau and Knees 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 6-11, and include the 2000 data and five-year averages. Table 1 includes both hard red and hard white entries. Data for the four off-station locations are presented in Tables 12-19, and include the 2000 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 20-23.

Rainfall was about 58% of normal during the growing season, and drought stress occurred at all locations. Test weights were in the low to mid 50's for off-station trials, and high 50's to low 60's for Conrad. Dryland yields averaged about 19 bu/a at the Knees and Oilmont, 32 bu/a at Cut Bank and Choteau, and 40 bu/a at Conrad. Irrigated yield differences were non-significant due to shortage of irrigation water.

Yield differences between Reeder and McNeal were non-significant in most cases. Likewise, Conan and Scholar were not significantly different, except at the Knees.

Many of the wheat varieties were severely cut by sawfly at the Knees, including Rambo and Amidon. Exceptions were Conan and Scholar with medium stem cutting; and Fortuna, Lew and Ernest with slight cutting.

Scholar and Conan were superior to Amidon for yield, agronomics and sawfly resistance at all locations (Scholar and Conan have medium sawfly resistance).

High ranking yielders among the durums included Maier, Utopia, Mountrail, Plenty and Lebsock. Maier and Lebsock 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 slightly 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): Bearded. Medium tall, but slightly shorter than Fortuna, 1 inch shorter than Amidon. Moderate lodging resistance. Partial resistance to sawfly (semi-solid stem), slightly better than Amidon and Rambo, and equal to 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. Good resistance to Septoria & tan spot.

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): Beardless. 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. 6" shorter than McNeal. Medium maturity, 1 day earlier than McNeal. Reported to be tolerant to Avenge herbicide, but very susceptible to FarGo. Resistant to Septoria. High yield. For irrigated conditions. Medium protein, similar to Glenman. Quality = 4.

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 tolerance 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. For scab tolerance in ND. Test wt & protein are medium. Quality = 2.

Hank (WPB): Shatter resistant line from 926/936 cross. Probably will replace WB-926.

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, 1996): Bearded. Medium tall, weak straw. Medium late maturity. 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.

Nora (Agripro): Short strong straw. Medium early maturity. For scab tolerance in ND.

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, 1999): Bearded semidwarf. Maturity slightly later than McNeal. Similar to McNeal for agronomics and quality.

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

Sharpshooter (WPB, 1998). Bearded. Medium tall. Early maturity. For scab tolerance in ND.

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. See Hank.

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, BZ987-331): Semidwarf, similar height as WB 926. Similar maturity and protein as Pristine, but lower yield and test wt. Protein 0.5 less than 926, and 0.5 higher than Newana.

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 equal to Hiline. Very susceptible to wheat streak mosaic virus. Quality excellent for bread market, but too high in protein for noodle market.

MTHW 9710: Experimental, semi-solid stem.

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.

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

Durum

Durums are generally much more susceptible to wheat streak mv and Fusarium crown rot than spring wheat.

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.

Avonlea (Can): Medium tall, medium lodging. Good quality and protein.

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

Ben (ND, 1997): Medium height, medium strong straw. Medium maturity. 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.

Kari (Agripro): Intermediate height, good lodging resistance. 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, 1995): Tall straw, moderately suscept to lodging. Medium maturity. Large kernels, medium protein. Quality = 4.

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

Morse (Can): Medium short, good lodging resistance. Med late maturity. Medium protein, good quality.

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.

Navigator (Can): Med short, good lodging resistance. Med late maturity. Medium protein, good quality.

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

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

Plaza (ND): Med short straw, good lodging resistance. Late maturity. Low protein, medium quality.

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

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. Black awns. Awn color may not fully express under stress conditions. Short semidwarf, shorter than McNeal spring wheat. Stiff straw. Early maturity. High yield. Sensitive to Avenge herbicide. 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.

Table 6 **Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 2000. 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
REEDER	49.7	60.5	29	178	14.1
HANK	48.3	58.0	28	178	14.4
NEWANA	46.2	59.9	28	179	14.3
GENERAL MILL GM50002	45.4	58.5	27	181	13.6
SLW97606	45.3	61.9	30	179	16.2
SCHOLAR *	45.2	60.0	32	180	14.8
GENERAL MILL GM40003	44.8	61.0	30	173	12.8
WESTBRED 926	44.1	58.3	28	174	15.6
MT 9719	44.1	62.1	28	178	14.6
MT 9874	44.1	57.2	30	179	14.5
GENERAL MILLS BR2306	43.8	58.6	29	179	14.0
GENERAL MILL GM40002	43.8	60.0	29	172	14.3
CONAN *	43.7	59.7	29	178	14.6
MT 9806	43.5	58.9	30	179	15.1
PARSHALL	43.3	60.7	34	178	14.8
MTHW9701	43.2	57.2	28	178	13.7
MT 9712	43.0	60.7	32	179	15.0
MTHW0003	43.0	57.0	33	181	13.1
BZ994484	42.6	59.6	29	176	15.0
MT 9923	42.5	60.9	32	180	14.9
GENERAL MILL GM50001	42.4	56.7	28	178	14.0
BZ996472 Agawam HW	42.4	61.2	29	177	13.2
MT 9929	42.1	60.1	28	179	14.6
MTHW9804	41.9	61.0	27	177	13.7
MT 9956	41.7	61.3	29	178	14.5
MTHW9710 *, **	41.6	58.8	29	177	14.2
MTHW9420 **	41.4	58.3	29	178	13.6
GENERAL MILL GM40001	41.8	56.7	28	180	13.1
MTHW9716	41.3	60.2	29	177	14.2
MT 9931	41.1	60.6	30	180	15.1
MT 9912	41.0	62.0	32	178	15.3
MT 9955	41.0	59.1	28	178	14.6

(*Continued* on next page)

(Advanced Yield Spring Wheat, continued)

MT 9748		40.8	59.1	31	177	14.7
ARGENT	**	40.5	59.5	32	178	14.6
MT 9706		40.1	60.1	32	179	15.1
MT 9739		40.1	59.9	34	177	15.3
MT 9959		39.7	61.6	30	180	14.2
MTHW9905		39.7	59.0	30	178	14.2
MTHW9908		39.5	58.0	28	179	14.0
MCNEAL		39.1	58.1	29	179	14.5
MT 9937		38.9	60.5	29	176	14.8
MT 9755		38.7	59.1	28	177	14.7
MT 9913		38.6	61.5	31	179	15.5
MTHW9915		38.6	57.9	29	178	13.7
FORTUNA	*	38.4	59.8	36	179	15.0
LEW	*	38.1	59.1	34	181	14.7
MTHW9904		38.1	60.4	32	178	14.6
MT 9918		37.9	58.3	32	176	14.9
MT 9925		37.8	58.1	33	178	15.4
MTHW9901		37.6	59.3	33	183	14.5
MT 9954		37.5	58.8	30	179	14.4
MT 9905		37.2	58.1	32	179	15.4
MT 9960		36.9	61.0	31	180	15.0
MTHW0004		36.9	55.0	30	178	14.0
HI-LINE		36.1	58.7	27	177	15.3
ERNEST	*	36.1	59.8	34	179	16.0
MT 9958		36.0	61.9	31	181	15.4
MTHW0002		35.4	56.1	28	178	13.9
AMIDON	*	34.9	58.7	33	178	14.8
THATCHER		34.6	56.3	37	181	15.4
MTHW0001		32.0	60.5	29	178	14.1
MTRWA116		31.8	59.0	28	177	15.6
KLASIC	**	31.4	58.9	21	173	14.2
MTHW9906		31.0	59.5	29	179	15.3

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Applied fertilizer: 51-31-0 (N-P-K) Previous crop: Fallow.
Date seeded: April 19, 2000. Date harvested: August 14, 2000.
Rainfall: From planting to harvest was 3.61 inches.
Moist soil depth at planting: 34"
* = Sawfly resistant varieties. (Amidon and Scholar have partial resistance) ** = Hard white wheat.
Yield exp. mean: 40.29 ------ Error degrees of freedom: 126
F test for var: 2.46 ----- C.V. 2: 6.21 ----- LSD (0.05): 7.00

Table 7 **Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 2000. 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
REEDER		49.7	60.5	29	178	14.1
HANK		48.3	58.0	28	178	14.4
NEWANA		46.2	59.9	28	179	14.3
SCHOLAR	*	45.2	60.0	32	180	14.8
WESTBRED 926		44.1	58.3	28	174	15.6
CONAN	*	43.7	59.7	29	178	14.6
PARSHALL		43.3	60.7	34	178	14.8
MTHW9710	**, *	41.6	58.8	29	177	14.2
MTHW9420	**	41.4	58.3	29	178	13.6
ARGENT	**	40.5	59.5	32	178	14.6
MCNEAL		39.1	58.1	29	179	14.5
FORTUNA	*	38.4	59.8	36	179	15.0
LEW	*	38.1	59.1	34	181	14.7
HI-LINE		36.1	58.7	27	177	15.3
ERNEST	*	36.1	59.8	34	179	16.0
AMIDON	*	34.9	58.7	33	178	14.8
THATCHER		34.6	56.3	37	181	15.4
KLASIC	**	31.4	58.9	21	173	14.2

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Applied fertilizer: 51-31-0 (N-P-K)
Previous crop: Fallow.
Date seeded: April 19, 2000.
Date harvested: August 14, 2000.
Rainfall: From planting to harvest was 3.61 inches.
Moist soil depth at planting: 34"
* = Sawfly resistant varieties. (Amidon, Conan and Scholar have partial resistance.)
** = Hard white wheat.
Yield experimental mean: 40.29 ---Error degrees of freedom: 126
F test for var: 2.46 ----- C.V. 2: 6.21 ----- LSD (0.05): 7.00

Table 8 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Conrad, MT.** 1996 - 1997 - 1998 - 1999 - 2000. 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		62.5	60.3	33	183	12.6
NEWANA		60.5	60.9	31	185	12.1
WESTBRED 926		59.4	60.4	31	180	12.9
SCHOLAR	*	58.6	61.5	38	185	12.9
HI-LINE		57.6	61.1	31	181	12.8
ERNEST	*	56.2	61.7	38	183	13.2
AMIDON	*	56.1	60.3	38	183	12.8
CONAN	*	55.6	61.5	31	182	12.7
FORTUNA	*	54.8	62.1	39	182	12.9
THATCHER		53.0	59.2	42	185	12.6
LEW	*	52.8	61.0	39	185	12.6

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

Table 9 **Irrigated Spring Wheat** variety trial grown north of **Conrad**, 2000. Mont. Agr. Expt. Station. Western Triangle Ag. Research Center, Conrad, Montana.

Variety		Yield bu/ac.	Test wt. lbs/bu.	Plant hgt. inches	% protein
REEDER		67.5	61.9	31	12.7
ID377S		67.1	62.5	30	12.3
WESTBRED 926		64.8	61.0	28	12.9
NEWANA		60.4	62.1	29	11.5
ERNEST	*	59.0	62.9	37	14.6
SCHOLAR	*	58.5	62.2	35	13.7
RAMBO	*	57.5	61.6	27	12.0
MTHW 9420	**	57.2	61.9	30	12.6
WESTBRED EXPRESS		57.0	61.9	26	12.9
CONAN	*	56.7	60.2	31	14.1
FERGUS		55.8	61.8	32	13.2
AMIDON	*	55.5	61.4	37	13.5
MCNEAL		54.1	62.0	32	13.1
WESTBRED 936		54.1	61.5	28	13.6
HI-LINE		53.7	63.0	29	13.7
GRANDIN		53.3	62.7	33	13.1
LEW	*	51.8	63.3	38	13.9
MT 9955		51.3	61.0	30	13.9
MTHW 9710	**,*	49.2	61.5	29	13.3
FORTUNA	*	46.6	62.9	34	12.6

Cooperator: Western Triangle Ag. Research Center.
Location: Ten miles north of Conrad, MT. (Pondera County)
Applied fertilizer: 96-31-0 (N-P-K)
Previous crop: Fallow.
Date seeded: April 20, 2000.
Date harvested: August 15, 2000.
Moist soil depth at planting: 36"
Moisture rate: Rainfall from seeding to harvest was 3.6 inches, with two applications of sprinkler irrigation. (3" each)
* = Sawfly resistant varieties. (Amidon, Conan, Rambo and Scholar have partial resistance.)
** = Hard white wheat.
Yield experimental mean: 56.55
Error degrees of freedom: 38
F test for var: 0.96 ---- C.V. 2: 9.80 ---- LSD (0.05): 15.86

Table 10 **Five-year summary** for **Irrigated Spring Wheat** varieties grown north of **Conrad, MT.** 1996 - 1997 - 1998 - 1999 - 2000. 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
MTHW 9420	**	84.5	62.0	33	182	12.6
WESTBRED 936		84.2	61.7	30	181	13.5
WESTBRED EXPRESS		83.8	62.0	29	183	13.1
FERGUS		82.0	62.1	33	181	13.3
NEWANA		79.6	61.5	33	187	12.1
HI-LINE		78.4	62.9	32	182	13.4
WESTBRED 926		78.4	61.5	31	181	13.2
MCNEAL		77.6	62.1	34	184	13.4
GRANDIN		77.1	62.3	35	183	13.6
AMIDON	*	75.0	61.4	40	183	13.6
RAMBO	*	74.7	61.6	31	185	12.7
SCHOLAR	*	74.0	62.4	38	184	13.8
ERNEST	*	73.3	62.4	40	183	14.1
FORTUNA	*	66.8	63.0	39	185	13.5
LEW	*	66.4	63.2	42	186	13.6

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.)
** = Hard white wheat.
@ = Head dates based on three years. (1996-1998-1999)

Table 11 **Dryland Spring Wheat** variety trial grown near **Cut Bank**, 2000. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
MT 9955		34.9	56.4	28	15.2
REEDER		34.3	58.8	30	15.7
GRANDIN		34.3	57.3	33	15.9
CONAN	*	33.4	58.6	29	15.4
SCHOLAR	*	33.4	59.5	32	15.3
FORTUNA	*	33.2	58.1	33	14.6
MCNEAL		32.9	56.0	29	15.9
WESTBRED 936		32.6	56.6	27	15.2
ID377S		32.5	56.9	28	15.8
WESTBRED 926		32.4	56.2	29	16.0
MTHW 9710	*, **	31.5	56.8	26	15.4
HI-LINE		31.2	55.3	27	15.7
NEWANA		31.2	57.9	28	14.0
AMIDON	*	30.4	57.7	34	15.0
RAMBO	*	30.3	57.3	27	15.3
MTHW 9420	**	30.1	55.4	28	15.2
FERGUS		29.8	56.7	27	16.6
LEW	*	29.2	58.1	31	15.9
WESTBRED EXPRESS		28.7	56.2	26	15.0
ERNEST	*	27.8	56.9	31	16.8

Cooperator: Kevin Bradley.
Location: Fifteen miles north of Cut Bank. (Glacier County)
Fertilizer: 106-31-0 (N-P-K)
Previous crop: No-till chemical fallow. (wheat stubble)
Date seeded: April 25, 2000.
Date harvested: August 22, 2000.
Rainfall from planting to harvest: 1.5 inches.
Moist soil depth at planting: 30"
* = Sawfly resistant varieties. (Amidon, Conan, Rambo, and Scholar have partial resistance.)
** = Hard white wheat.
Yield experimental mean: 31.69
Error degrees of freedom: 38
F test for var: 2.07
C.V. 2: 4.40
LSD (0.05): 4.00

Table 12 **Five-year summary** for dryland **Spring Wheat** varieties grown near **Cut Bank, MT.** 1996 - 1997 - 1998 - 1999 - 2000. 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		42.1	57.6	32	13.8
HI-LINE		41.0	58.3	30	13.2
WESTBRED EXPRESS		40.9	58.1	27	13.0
WESTBRED 936		40.9	58.0	28	13.0
FERGUS		40.1	57.8	29	14.0
WESTBRED 926		40.1	56.9	30	13.9
GRANDIN		39.9	57.4	33	14.1
MT HW9420	**	39.6	57.0	30	12.9
NEWANA		39.4	57.3	29	12.6
SCHOLAR	*	39.3	58.6	35	14.1
FORTUNA	*	38.2	59.8	36	12.9
RAMBO	*	38.1	58.0	29	13.2
AMIDON	*	37.2	58.2	37	13.5
ERNEST	*	36.8	59.3	35	14.4
LEW	*	35.9	58.2	35	13.2

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

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. 2000.

Crop	Fertilizer N (lbs./a)	Seeding Rate (seed/ft²)	Grain Yield (bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)	DHV[1] (%)
SW	150	20	47.27	56.70	16.73	456.2	
SW	150	25	46.65	56.78	16.47	460.7	
SW	0	30	46.18	58.85	13.08	360.0	
SW	75	20	45.08	56.93	15.57	420.6	
SW	0	25	44.78	58.33	13.25	356.1	
SW	75	15	44.70	56.97	15.67	419.2	
SW	0	20	44.63	58.28	13.45	361.7	
SW	75	25	43.85	56.75	15.95	418.6	
SW	0	15	43.60	58.12	13.17	346.6	
DU	225	25	43.33	55.00	16.65	431.1	100.0
DU	0	30	43.30	58.85	12.63	328.2	95.5
DU	0	20	43.22	58.55	12.65	329.0	93.3
DU	0	15	43.08	57.85	13.13	338.1	94.3
DU	0	25	43.00	58.35	12.63	326.8	95.3
DU	225	30	42.55	55.15	16.68	424.5	99.8
SW	150	30	41.90	57.35	17.10	427.8	
SW	225	15	41.35	55.63	17.10	423.0	
SW	225	25	41.30	55.47	17.65	436.2	
SW	225	20	41.07	55.83	17.40	427.3	
DU	75	25	41.02	55.45	15.55	380.4	99.8
SW	75	20	40.97	56.20	16.20	396.3	
SW	225	30	40.73	55.25	17.80	433.7	
DU	75	25	40.30	55.35	15.43	371.8	99.0
DU	75	15	38.35	55.08	15.38	351.8	99.3
DU	225	15	37.92	53.85	17.00	386.2	100.0
DU	150	30	37.72	54.40	17.00	384.5	100.0
DU	75	30	37.50	55.70	15.68	351.5	99.3
DU	150	25	36.85	54.13	17.35	362.6	100.0
DU	150	15	36.43	53.88	16.73	365.2	100.0
DU	225	20	36.13	53.20	17.22	372.8	100.0
SW	150	15	35.64	56.47	17.45	360.5	
DU	150	20	33.78	53.97	17.08	345.8	99.5

[1] Dark Hard Vitreous

LSD for DHV = 1.42. The 0 lbs N/a was statistically different from plots that received N.

Summary Statistics

	Grain Yield (Bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
Experimental Means	41.47	56.21	15.71	386.1
Error Mean Square	23.34	1.102	0.4270	1788
P-Value	0.0072	0.0000	0.0000	0.0000
Standard Error of the Mean	2.416	0.5250	0.3267	21.14
C.V. 1: (s/mean)*100	11.68	1.868	4.159	10.95
LSD (0.05)	6.787	1.474	0.9176	59.38

Variety Summary

Utopia	39.75	55.55	15.53	367.5
McNeal	43.08	56.84	15.86	407.5
LSD (0.05)	1.40	0.32	0.20	11.97

Seeding Rate Summary

15	40.27	55.94	15.67	375.9
20	40.74	55.99	15.76	382.5
25	42.80	56.29	15.66	400.3
30	41.87	56.56	15.69	391.3
LSD (0.05)	1.98	0.45	NS	17.00

Nitrogen Rate Summary

0	43.97	58.40	13.00	343.3
75	41.47	56.05	15.68	388.8
150	39.68	55.40	16.92	401.1
225	40.55	54.92	17.19	416.8
LSD (0.05)	2.00	0.46	0.29	17.19
Interaction P-value	0.6521	0.9546	0.9268	0.4940

Notes:
Varieties: Durum = Utopia Spring Wheat = McNeal
Seeding Date: 4/24/00 Harvest Date: 8/14/00
Growing Season ppt: 3.46" 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 6/8/00.

Soil Test Summary[1]

Depth (ft)	NO_3-N (lbs/a)
0 - 1	35.4
1 - 2	15.6
2 - 3	11.0
3 - 4	7.7

[1]The soil was sampled during autumn of 1999.

Title: Effect of nitrogen, phosphorus, and sulphur on winter wheat.

Year: 2000.

Locations: 1) East of Brady, MT (Knees) at the Dan Picard farm

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 and to determine winter wheat response to phosphorus (P) fertilizer and P soil tests.

Procedures: Fourteen fertilizer treatments were applied, N, K, and Cl were broadcast and P was placed with the seed while planting. The Knees plot was 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 size was 6 x 20 feet with four replications. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 18s. Winter wheat at this location had a yield response to N and P, a protein response to N, and no response to S.

Table 18s. Effect of N, P and S on winter wheat yield and quality. Experiment located East of Brady (Knees), MT at the Dan Picard farm. 2000.

Fertilizer $N\text{-}P_2O_5\text{-}K$ (lbs/ac)	Grain Yield (bu/ac)	Grain Protein %	Test Weight (lb/bu)
90-50-30	56.7	13.7	61.5
30-50-0	54.7	12.5	61.7
90-25-30	54.6	13.6	61.0
30-25-30	53.1	12.7	61.9
60-50-30	52.9	13.0	61.7
30-0-30	49.2	12.9	62.2
90-0-30	48.7	13.7	61.2
0-50-30	48.5	11.3	62.3
0-25-30	48.5	12.7	61.7
0-0-30	48.4	11.7	62.0
60-0-30	46.9	13.2	61.5
60-25-30	35.2	13.4	61.5

Summary Statistics

Experimental Means	49.77	12.86	61.68
Error Mean Square	81.64	0.5438	0.2522
P-value	0.1626	0.0007	0.0446
Standard Error of the Mean	4.518	0.3687	0.2511
C.V. 1: (s/mean)*100	18.15	5.736	0.8143
LSD (0.05)	13.00	1.061	0.7225

Nitrogen Summary

0	48.5	11.9	62.0
30	52.3	12.7	61.9
60	49.9	13.2	61.6
90	53.3	13.7	61.2
LSD (0.05)	2.7	0.6125	0.4171

Phosphorus Summary

0	48.3	12.9	61.71
25	51.5	13.1	61.54
50	53.2	12.6	61.79
LSD (0.05)	2.4	NS	NS
Interaction p-value	0.3469	0.4751	0.6564

Sulphur Summary

0	53.07	12.65	61.93
20	51.40	12.88	61.85
40	55.62	12.63	62.00
LSD (0.05)	NS	NS	NS

Notes:
Variety: Rampart
Seeding Date: 9/15/99 Harvest Date: 7/25/00
Growing Season ppt: 3.75" Planting Rate: 20 seeds/ft²
Previous Crop: Chemical fallow
Herbicide: 1½ pt/a Buctril® mixed with 2⅔ pt/a Hoelon® applied at a rate of 10 gallons solution/a.

Soil Test Summary

Depth (ft)	NH_4-N	NO_3-N
	---------- lbs/ac ----------	
0 - 1	12.1	28.3
1 - 2	16.8	23.4
2 - 3	23.9	30.8
3 - 4	31.9	28.9
4 - 5	34.2	22.1

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. 2000.

Crop	Fertilizer N (lbs./a)	Seeding Rate (seed/ft²)	Grain Yield (bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)	DHV[1] (%)
SW	150	20	47.27	56.70	16.73	456.2	
SW	150	25	46.65	56.78	16.47	460.7	
SW	0	30	46.18	58.85	13.08	360.0	
SW	75	20	45.08	56.93	15.57	420.6	
SW	0	25	44.78	58.33	13.25	356.1	
SW	75	15	44.70	56.97	15.67	419.2	
SW	0	20	44.63	58.28	13.45	361.7	
SW	75	25	43.85	56.75	15.95	418.6	
SW	0	15	43.60	58.12	13.17	346.6	
DU	225	25	43.33	55.00	16.65	431.1	100.0
DU	0	30	43.30	58.85	12.63	328.2	95.5
DU	0	20	43.22	58.55	12.65	329.0	93.3
DU	0	15	43.08	57.85	13.13	338.1	94.3
DU	0	25	43.00	58.35	12.63	326.8	95.3
DU	225	30	42.55	55.15	16.68	424.5	99.8
SW	150	30	41.90	57.35	17.10	427.8	
SW	225	15	41.35	55.63	17.10	423.0	
SW	225	25	41.30	55.47	17.65	436.2	
SW	225	20	41.07	55.83	17.40	427.3	
DU	75	25	41.02	55.45	15.55	380.4	99.8
SW	75	20	40.97	56.20	16.20	396.3	
SW	225	30	40.73	55.25	17.80	433.7	
DU	75	25	40.30	55.35	15.43	371.8	99.0
DU	75	15	38.35	55.08	15.38	351.8	99.3
DU	225	15	37.92	53.85	17.00	386.2	100.0
DU	150	30	37.72	54.40	17.00	384.5	100.0
DU	75	30	37.50	55.70	15.68	351.5	99.3
DU	150	25	36.85	54.13	17.35	362.6	100.0
DU	150	15	36.43	53.88	16.73	365.2	100.0
DU	225	20	36.13	53.20	17.22	372.8	100.0
SW	150	15	35.64	56.47	17.45	360.5	
DU	150	20	33.78	53.97	17.08	345.8	99.5

[1] Dark Hard Vitreous

LSD for DHV = 1.42. The 0 lbs N/a was statistically different from plots that received N.

Summary Statistics

	Grain Yield (Bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
Experimental Means	41.47	56.21	15.71	386.1
Error Mean Square	23.34	1.102	0.4270	1788
P-Value	0.0072	0.0000	0.0000	0.0000
Standard Error of the Mean	2.416	0.5250	0.3267	21.14
C.V. 1: (s/mean)*100	11.68	1.868	4.159	10.95
LSD (0.05)	6.787	1.474	0.9176	59.38

Variety Summary

Utopia	39.75	55.55	15.53	367.5
McNeal	43.08	56.84	15.86	407.5
LSD (0.05)	1.40	0.32	0.20	11.97

Seeding Rate Summary

15	40.27	55.94	15.67	375.9
20	40.74	55.99	15.76	382.5
25	42.80	56.29	15.66	400.3
30	41.87	56.56	15.69	391.3
LSD (0.05)	1.98	0.45	NS	17.00

Nitrogen Rate Summary

0	43.97	58.40	13.00	343.3
75	41.47	56.05	15.68	388.8
150	39.68	55.40	16.92	401.1
225	40.55	54.92	17.19	416.8
LSD (0.05)	2.00	0.46	0.29	17.19
Interaction P-value	0.6521	0.9546	0.9268	0.4940

Notes:
Varieties: Durum = Utopia Spring Wheat = McNeal
Seeding Date: 4/24/00 Harvest Date: 8/14/00
Growing Season ppt: 3.46" 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 6/8/00.

Soil Test Summary[1]

Depth (ft)	NO_3-N (lbs/a)
0 - 1	35.4
1 - 2	15.6
2 - 3	11.0
3 - 4	7.7

[1]The soil was sampled during autumn of 1999.

Title: Effect of nitrogen, phosphorus, and sulphur on winter wheat.

Year: 2000.

Locations: 1) East of Brady, MT (Knees) at the Dan Picard farm

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 and to determine winter wheat response to phosphorus (P) fertilizer and P soil tests.

Procedures: Fourteen fertilizer treatments were applied, N, K, and Cl were broadcast and P was placed with the seed while planting. The Knees plot was 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 size was 6 x 20 feet with four replications. Plots were harvested with a Hege plot combine.

Results: The data are summarized in Table 18s. Winter wheat at this location had a yield response to N and P, a protein response to N, and no response to S.

Table 18s. Effect of N, P and S on winter wheat yield and quality. Experiment located East of Brady (Knees), MT at the Dan Picard farm. 2000.

Fertilizer $N\text{-}P_2O_5\text{-}K$ (lbs/ac)	Grain Yield (bu/ac)	Grain Protein %	Test Weight (lb/bu)
90-50-30	56.7	13.7	61.5
30-50-0	54.7	12.5	61.7
90-25-30	54.6	13.6	61.0
30-25-30	53.1	12.7	61.9
60-50-30	52.9	13.0	61.7
30-0-30	49.2	12.9	62.2
90-0-30	48.7	13.7	61.2
0-50-30	48.5	11.3	62.3
0-25-30	48.5	12.7	61.7
0-0-30	48.4	11.7	62.0
60-0-30	46.9	13.2	61.5
60-25-30	35.2	13.4	61.5

Summary Statistics

Experimental Means	49.77	12.86	61.68
Error Mean Square	81.64	0.5438	0.2522
P-value	0.1626	0.0007	0.0446
Standard Error of the Mean	4.518	0.3687	0.2511
C.V. 1: (s/mean)*100	18.15	5.736	0.8143
LSD (0.05)	13.00	1.061	0.7225

Nitrogen Summary

0	48.5	11.9	62.0
30	52.3	12.7	61.9
60	49.9	13.2	61.6
90	53.3	13.7	61.2
LSD (0.05)	2.7	0.6125	0.4171

Phosphorus Summary

0	48.3	12.9	61.71
25	51.5	13.1	61.54
50	53.2	12.6	61.79
LSD (0.05)	2.4	NS	NS
Interaction p-value	0.3469	0.4751	0.6564

Sulphur Summary

0	53.07	12.65	61.93
20	51.40	12.88	61.85
40	55.62	12.63	62.00
LSD (0.05)	NS	NS	NS

Notes:
Variety: Rampart
Seeding Date: 9/15/99 Harvest Date: 7/25/00
Growing Season ppt: 3.75" Planting Rate: 20 seeds/ft²
Previous Crop: Chemical fallow
Herbicide: 1½ pt/a Buctril® mixed with 2⅔ pt/a Hoelon® applied at a rate of 10 gallons solution/a.

Soil Test Summary

Depth (ft)	NH_4-N	NO_3-N
	---------- lbs/ac ----------	
0 - 1	12.1	28.3
1 - 2	16.8	23.4
2 - 3	23.9	30.8
3 - 4	31.9	28.9
4 - 5	34.2	22.1