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WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

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Submitted by

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Climatic summary for the 1996 calendar year at the Western Triangle Research Center, Conrad, MT.

|  | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Total or average |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------------------|
| <b>Precipitation (inches)</b>          |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| Current Year                           | 0.21 | 0.09 | 0.87 | 0.46 | 2.74 | 1.82 | 0.23 | 0.14 | 1.79 | 0.37 | 0.43 | 0.76 | 9.91             |
| Average 12 yr                          | 0.22 | 0.21 | 0.58 | 0.91 | 2.02 | 2.64 | 1.66 | 1.52 | 1.49 | 0.54 | 0.34 | 0.21 | 12.34            |
| <b>Mean Temperature (°F)</b>           |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| Current Year                           | 11.0 | 24.7 | 24.0 | 44.7 | 47.3 | 60.5 | 66.5 | 68.6 | 52.8 | 42.4 | 18.1 | 17.4 | 39.8             |
| Average 11 yr                          | 23.0 | 22.3 | 34.1 | 44.2 | 53.2 | 60.7 | 65.3 | 65.1 | 57.0 | 45.3 | 30.1 | 18.9 | 43.3             |
| <b>Last killing frost in Spring</b>    |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| 1996-----                              |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| Average-----                           |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| <b>First killing frost in Fall</b>     |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| 1996-----                              |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| Average-----                           |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| <b>Frost free period (days)</b>        |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| 1996-----                              |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| Average-----                           |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| <b>Maximum summer temperature---</b>   |      |      |      |      |      |      |      |      |      |      |      |      |                  |
| <b>Minimum winter temperature-----</b> |      |      |      |      |      |      |      |      |      |      |      |      |                  |

Summary of climatic data by month for the 1995-96 crop year (Sept - August) at the Western Triangle Research Center, Conrad, MT.

|   | Sep 1995             | Oct 1995 | Nov 1995 | Dec 1995 | Jan 1996 | Feb 1996 | Mar 1996 | Apr 1996 | May 1996 | June 1996 | July 1996 | Aug 1996 | Total or Average |
|---|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|----------|------------------|
| <b>Precipitation (inches)</b>                               |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| Current year  | 0.93                 | 0.61     | 0.59     | 0.19     | 0.21     | 0.09     | 0.87     | 0.46     | 2.74     | 1.82      | 0.23      | 0.14     | 8.88             |
| Average 12 yr   | 1.46                 | 0.56     | 0.33     | 0.16     | 0.22     | 0.21     | 0.58     | 0.91     | 2.02     | 2.64      | 1.66      | 1.52     | 12.27            |
| <b>Mean Temperature (°F)</b>                                |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| Current year  | 56.1                 | 44.0     | 29.6     | 19.5     | 11.0     | 24.7     | 24.0     | 44.7     | 47.3     | 60.5      | 66.5      | 68.6     | 41.4             |
| Average 11 yr   | 57.5                 | 45.6     | 31.3     | 19.1     | 23.0     | 22.3     | 34.1     | 44.2     | 53.2     | 60.7      | 65.3      | 65.1     | 43.5             |
| <b>Last killing frost in Spring</b>                         |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| 1996  | ----- May 13 (30°)   |          |          |          |          |          |          |          |          |           |           |          |                  |
| Average   | ----- May 15         |          |          |          |          |          |          |          |          |           |           |          |                  |
| <b>First killing frost in Fall</b>                          |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| 1996  | ----- Sept. 23 (28°) |          |          |          |          |          |          |          |          |           |           |          |                  |
| Average   | ----- Sept. 21       |          |          |          |          |          |          |          |          |           |           |          |                  |
| <b>Frost free period (days)</b>                             |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| 1996  | ----- 134            |          |          |          |          |          |          |          |          |           |           |          |                  |
| Average   | ----- 129            |          |          |          |          |          |          |          |          |           |           |          |                  |
| <b>Maximum summer temperature----- 98° (Aug 12)</b>         |                      |          |          |          |          |          |          |          |          |           |           |          |                  |
| <b>Minimum winter temperature----- -30° (Jan. 30, 1996)</b> |                      |          |          |          |          |          |          |          |          |           |           |          |                  |

## 1996 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 Dept Plant, Soil & Environ Sci.

Off-station winter wheat variety trials were grown near Chester, the Knees area east of Brady, and at Dutton. The Chester trial was lost to severe hail. In addition to the standard 24-entry variety trial, the Dutton location included sawfly-resistance selection and yield trials involving over 5000 experimental lines of winter wheat. Preliminary sawfly and advanced yield trials were grown on station at Conrad.

Results: Abundant soil moisture contributed to good yield levels in spite of low rainfall during the summer. The Knees and Dutton trials were both severely damaged by sawfly, which had a substantial impact on grain yield and on how the varieties ranked for yield. The non-resistant varieties were heavily cut by sawfly and lodged flat on the ground. The two resistant varieties, Vanguard and Rampart, were about 20% lodged.

The sawfly infestation at these two locations provided an opportunity to measure the effectiveness of the solid-stem sawfly resistance of Vanguard and Rampart, and to compare the yield of these two varieties with susceptible varieties under sawfly pressure. In the absence of sawfly, Vanguard and Rampart yield approximately 10 and 5% less than Rocky, respectively. But under the heavy sawfly conditions at the Knees, Vanguard and Rampart were the top yielders (Table 4). At Dutton, Vanguard and Rampart ranked fairly high, although less than Rocky (Table 6).

Harvest of Vanguard and Rampart was easily accomplished with the combine cutter-bar off the ground. For Rocky and the other susceptible varieties, the cutter bar had to be placed on the ground and risking rock-damage to the combine.

At Conrad, sawfly infestation was light, with no stem-cutting. Yield rankings of Vanguard and Rampart were low at Conrad (Table 1), in comparison to their performance at the Knees and Dutton. Vanguard and Rampart are recommended only for areas of heavy sawfly infestation, and should not be grown where high levels of winterhardiness are needed unless protected by stubble.

Five-year summaries for the Conrad, Knees and Dutton winter wheat trials are presented in Tables 3, 5 and 7, respectively.

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.

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

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

Mounty: (Wally Johnson's) Stiffer straw than Neeley, and yield claimed to be equal to or better than Neeley, according to Johnson?? Not tested by MSU.

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

Neeley (Idaho): 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, 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. Short coleoptile. Medium maturity. Severe Pseudomonas bacterial leaf blight symptoms. Medium yield. Good shatter resistance. Protein medium to low. Quality = 2.

Nuwest (MT 7811) (MSU, WPB, 1994): Hard white winter wheat for specialty markets. 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. Test weight 1 lb/bu lower than Rocky & Tiber, but 1 lb/bu higher than Judith. Medium resistance to preharvest sprouting - 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.

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(Conrad Winter Wheat, continued)

| Variety          | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | Spring<br>survival<br>class <u>1</u> / | %<br>protein |
|------------------|----------------|---------------------|-------------------------|--------------|--|--------------|
| JUDITH           | 52.2           | 61.0                | 34                      | 169          | 3                                      | 14.1         |
| AC READYMADE     | 52.0           | 63.7                | 35                      | 177          | 3                                      | 15.1         |
| ERHARDT (8719)   | 51.9           | 64.1                | 32                      | 173          | 4                                      | 15.9         |
| IKE              | 50.7           | 63.0                | 30                      | 168          |  | 16.0         |
| NORSTAR          | 50.5           | 62.9                | 41                      | 179          | 5                                      | 14.4         |
| MT 9453          | 50.5           | 62.6                | 32                      | 175          |  | 15.4         |
| TIBER            | 48.9           | 62.2                | 35                      | 177          | 3                                      | 14.2         |
| BONNEVILLE       | 48.4           | 62.3                | 35                      | 180          |  | 15.2         |
| ELKHORN          | 48.4           | 62.3                | 40                      | 176          |  | 15.0         |
| MCGUIRE (88046)  | 47.4           | 61.9                | 33                      | 169          | 3                                      | 16.5         |
| VISTA            | 47.3           | 63.1                | 31                      | 167          |  | 14.0         |
| NIOBRARA         | 46.4           | 61.8                | 31                      | 167          |  | 14.2         |
| VANGUARD(2238)** | 46.0           | 62.6                | 33                      | 173          | 1.5                                    | 16.0         |
| REDWIN           | 44.8           | 62.6                | 34                      | 175          |  | 15.3         |
| AGASSIZ          | 42.1           | 63.1                | 37                      | 174          | 4                                      | 15.7         |
| YUMA             | 41.5           | 63.0                | 31                      | 171          |  | 13.2         |
| BZ92712B         | 39.2           | 62.2                | 35                      | 179          |  | 13.4         |
| ROUGH RIDER      | 37.1           | 62.8                | 40                      | 175          | 5                                      | 15.9         |
| BZ92712A         | 32.7           | 61.5                | 31                      | 175          |  | 12.9         |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, Pondera County.  
 Fertilizer: 100# 11-51-0 with the seed, + 60# N broadcast.  
 Previous crop: Fallow.

Date seeded: Sept. 21, 1995.

Date harvested: Aug. 20, 1996.

Rainfall: From April 1 to harvest was 5.39 inches.

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

2/ = Russian wheat aphid resistant.

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

\*\* = Sawfly resistant variety. (Sawflies were not a problem at  
 this location in 1996.)

Yield experimental mean: 54.98

Error degrees of freedom: 96

F test for var. = 5.05, C.V. 2 = 6.87, LSD (0.05) = 10.6

Table 2            **Dryland Winter Wheat variety trial grown north of Conrad, 1996. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT. (abbreviated list)**

| Variety          | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | Spring<br>survival<br>class <u>1</u> / | %<br>protein |
|------------------|----------------|---------------------|-------------------------|--------------|--|--------------|
| QUANTUM 547      | 67.6           | 63.8                | 31                      | 169          |  | 13.9         |
| ROCKY            | 66.0           | 63.6                | 32                      | 174          | 2                                      | 14.2         |
| PROMONTORY       | 65.9           | 64.2                | 31                      | 172          | 2                                      | 12.8         |
| NUWEST *         | 64.5           | 62.4                | 34                      | 175          | 3                                      | 14.3         |
| KESTREL          | 63.8           | 62.7                | 34                      | 174          | 5                                      | 12.6         |
| CENTURK          | 63.3           | 64.0                | 34                      | 169          | 2                                      | 14.1         |
| JULES            | 62.9           | 64.3                | 30                      | 168          | 2                                      | 12.8         |
| ALLIANCE         | 62.9           | 63.6                | 33                      | 167          |  | 13.0         |
| WINRIDGE         | 62.3           | 62.4                | 34                      | 178          | 2                                      | 12.9         |
| MANNING          | 62.1           | 64.1                | 31                      | 172          | 2                                      | 13.3         |
| QUANTUM 566      | 61.5           | 63.0                | 33                      | 171          |  | 15.1         |
| NORWIN           | 61.5           | 64.2                | 26                      | 174          | 5                                      | 13.9         |
| BLIZZARD         | 60.5           | 63.3                | 37                      | 180          | 2-3                                    | 14.5         |
| NEELEY           | 59.8           | 62.5                | 34                      | 176          | 3                                      | 13.9         |
| DYNAMIC II       | 59.7           | 59.8                | 31                      | 176          |  | 13.1         |
| QUANTUM 1643     | 58.7           | 63.8                | 32                      | 175          |  | 13.6         |
| AKRON            | 58.5           | 63.6                | 34                      | 168          |  | 13.8         |
| RAMPART(92042)** | 58.0           | 62.7                | 33                      | 176          | 1.5                                    | 15.9         |
| HYBRITECH 542    | 56.9           | 63.1                | 36                      | 169          | 3                                      | 13.9         |
| GARLAND          | 56.0           | 60.3                | 21                      | 175          |  | 13.8         |
| MERIDIAN         | 55.4           | 61.2                | 30                      | 179          | 2                                      | 14.0         |
| BIGHORN          | 55.3           | 62.6                | 30                      | 174          |  | 14.4         |
| DYNAMIC I        | 55.2           | 59.4                | 32                      | 175          |  | 13.2         |
| NEKOTA           | 54.5           | 63.1                | 30                      | 166          |  | 14.4         |
| HALT <u>2</u> /  | 53.6           | 62.9                | 27                      | 168          |  | 14.1         |
| JUDITH           | 52.2           | 61.0                | 34                      | 169          | 3                                      | 14.1         |
| AC READYMADE     | 52.0           | 63.7                | 35                      | 177          | 3                                      | 15.1         |
| ERHARDT (8719)   | 51.9           | 64.1                | 32                      | 173          | 4                                      | 15.9         |
| IKE              | 50.7           | 63.0                | 30                      | 168          |  | 16.0         |
| NORSTAR          | 50.5           | 62.9                | 41                      | 179          | 5                                      | 14.4         |

(continued on next page)

(Conrad abbreviated list Winter Wheat, continued)

| Variety           | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | Spring<br>survival<br>class 1/ | %<br>protein |
|-------------------|----------------|---------------------|-------------------------|--------------|--------------------------------|--------------|
| TIBER             | 48.9           | 62.2                | 35                      | 177          | 3                              | 14.2         |
| BONNEVILLE        | 48.4           | 62.3                | 35                      | 180          |                                | 15.2         |
| ELKHORN           | 48.4           | 62.3                | 40                      | 176          |                                | 15.0         |
| MCGUIRE (88046)   | 47.4           | 61.9                | 33                      | 169          | 3                              | 16.5         |
| VISTA             | 47.3           | 63.1                | 31                      | 167          |                                | 14.0         |
| NIOBRARA          | 46.4           | 61.8                | 31                      | 167          |                                | 14.2         |
| VANGUARD (2238)** | 46.0           | 62.6                | 33                      | 173          | 1.5                            | 16.0         |
| REDWIN            | 44.8           | 62.6                | 34                      | 175          |                                | 15.3         |
| AGASSIZ           | 42.1           | 63.1                | 37                      | 174          | 4                              | 15.7         |
| YUMA              | 41.5           | 63.0                | 31                      | 171          |                                | 13.2         |
| ROUGH RIDER       | 37.1           | 62.8                | 40                      | 175          | 5                              | 15.9         |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, Pondera County.  
 Fertilizer: 100# 11-51-0 with the seed, + 60# N broadcast.  
 Previous crop: Fallow.

Date seeded: Sept. 21, 1995.

Date harvested: Aug. 20, 1996.

Rainfall: From April 1 to harvest was 5.39 inches.

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

2/ = Russian wheat aphid resistant.

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

\*\* = Sawfly resistant variety. (Sawflies were not a problem at  
 this location in 1996).

Yield experimental mean: 54.98

Error degrees of freedom: 96

F test for var. = 5.05, C.V. 2 = 6.87, LSD (0.05) = 10.6

Table 3 Five-year summary on Winter Wheat varieties grown near Conrad, MT. 1990 - 1993 - 1994 - 1995 - 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety          | 5 - year comparable average |                     |                         |              |                    |
|------------------|-----------------------------|---------------------|-------------------------|--------------|--------------------|
|                  | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | %<br>Protein<br>1/ |
| JULES            | 79.6                        | 61.7                | 33                      | 170          | 10.1               |
| MERIDIAN         | 76.0                        | 59.7                | 33                      | 177          | 11.2               |
| KESTREL          | 73.7                        | 60.5                | 38                      | 174          | 10.0               |
| PROMONTORY       | 73.6                        | 61.4                | 33                      | 170          | 11.3               |
| MANNING          | 72.7                        | 60.2                | 33                      | 171          | 11.2               |
| QUANTUM 542      | 71.4                        | 62.1                | 38                      | 171          | 11.7               |
| NEELEY           | 71.1                        | 60.8                | 36                      | 176          | 11.3               |
| NUWEST **        | 69.2                        | 60.6                | 36                      | 174          | 11.7               |
| VISTA            | 68.7                        | 61.9                | 30                      | 167          | 11.9               |
| ROCKY            | 68.6                        | 62.5                | 36                      | 171          | 11.4               |
| YUMA             | 68.1                        | 62.0                | 32                      | 168          | 10.7               |
| BLIZZARD         | 68.1                        | 61.1                | 39                      | 177          | 12.0               |
| BIGHORN          | 67.8                        | 61.4                | 31                      | 174          | 11.8               |
| JUDITH           | 67.3                        | 59.9                | 36                      | 172          | 10.8               |
| RAMPART(92042) * | 67.0                        | 61.8                | 35                      | 174          | 12.6               |
| NORWIN           | 66.4                        | 61.7                | 28                      | 175          | 11.1               |
| WINRIDGE         | 66.3                        | 59.4                | 39                      | 177          | 10.7               |
| CENTURK          | 65.8                        | 62.0                | 36                      | 169          | 11.8               |
| TIBER            | 63.4                        | 61.4                | 39                      | 175          | 11.4               |
| ERHARDT (8719)   | 63.3                        | 61.9                | 34                      | 173          | 12.6               |
| AC READYMADE     | 63.1                        | 61.3                | 39                      | 177          | 12.6               |
| REDWIN           | 60.3                        | 61.3                | 37                      | 175          | 12.4               |
| VANGUARD(2238) * | 58.0                        | 61.6                | 35                      | 172          | 12.8               |
| MCGUIRE          | 57.6                        | 61.7                | 34                      | 169          | 13.4               |
| NORSTAR          | 54.9                        | 61.0                | 45                      | 179          | 12.2               |
| AGASSIZ          | 54.3                        | 61.4                | 42                      | 175          | 12.3               |
| ROUGH RIDER      | 49.1                        | 61.7                | 40                      | 174          | 12.6               |

Cooperator: Conrad Research Center.

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

1/ = Proteins based on four years of data. (1990-93-95-1996)

\* = Sawfly resistant varieties.

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

1996 Spring wheat variety evaluations in the Western Triangle Area.

Year: 1996

Location: Western Triangle Research Center, Conrad, MT.

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

Off-station spring wheat variety trials were grown in Teton County near Choteau, Toole County near Oilmont, and Glacier County near Cut Bank. Trials on station at Conrad included both hard red and hard white spring wheat. The hard white data is reported elsewhere by Luther Talbert. Data for the hard red wheat trials are presented in Tables 8 to 18, and include the 1996 data and five-year averages. Spring wheat varieties were also tested under no-till conditions, and are discussed in the "no-till variety" section of this report.

In addition, sawfly-resistance-evaluation spring wheat trials were grown at Dutton, and are reported elsewhere by Luther Talbert.

Results: The season started with good soil moisture but rainfall was below average for the season. The Conrad and Choteau locations were able to produce good yields, which was attributed to deep soil moisture and timeliness of rainfall. Yields at Oilmont were limited by moisture depletion early in the season. Cut Bank yields were limited by insufficient nitrogen levels, as indicated by the low proteins.

Sawfly wasps were active at Choteau and Conrad, but for the second year in a row, did not cause heavy stem-cutting that normally occurs at these sites. Parasitism of the sawfly larvae was evident in straw samples. Therefore, yields of susceptible varieties were as good or better than those of resistant varieties. Sawfly damage was not encountered at Oilmont and Cut Bank.

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

## Spring Wheat Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad MT

### Far-Go herbicide tolerance:

Most Tolerant: Bergen, Bronze Chief, Butte-86, Dalen, Ernest, Fortuna, Glenman, Grandin, Gus, Kodiak, Len, Marshall, McNeal, NK 751, Pioneer 2398, Pioneer 2731, Rambo, Stoa, Westbred 926 & 936.

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

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

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

### Sawfly Resistant Hard Red Spr Wheat Varieties

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

Amidon (ND606, ND, 1988): Bearded. Medium tall; lodges worse than Fortuna; weak broken stems. Partial sawfly resistance (30% less solid than Fortuna); sawfly resistance not sufficient for severely infested areas. Medium-late; same maturity as Lew, slightly later than Pondera. 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). Susceptible to leaf rust. Medium yield and protein. Quality = 5.

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

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

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

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

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

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

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

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

Rambo, Westbred (WPB, 1986): Bearded. Semidwarf; short stiff straw, but medium lodging resistance. Partial sawfly resistance (36% less solid than Fortuna). Threshes easily. 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.

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.

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Norak (NAPB).

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

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

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

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

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

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

Pioneer 2375 (ND, 1990): Bearded semidwarf, medium straw strength. Med-early maturity. Medium yield on dryland, high on irrigated. Medium to high protein, depending on level of N fertilizer. Protein response to fertilizer was higher than for other varieties in 1995. Quality = 2.5.

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

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

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

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

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

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

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

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

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

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

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

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

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

Vandal (Idaho): For irrigated only.

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

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

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

Westbred 936 (WPB): Bearded semidwarf for irrigated only. 936 is stiffer strawed than 926; 3 inches shorter than Newana and 5 inches shorter than McNeal. Four days earlier than Newana, 3 days earlier than McNeal. Reportedly tolerant to Avenge herbicide; fairly good tolerance to FarGo. Does not have Hessian fly or dryland root rot resistance, thus 926 is preferred in those areas. More susceptible to dryland root rot than 926 and Fergus (although IMZ helps to control root rot). Moderate resistance to stem rust, resistant to stripe rust. Susceptible to leaf rust and Septoria. Shatter resistant. Possible replacement for 906 and 926. Superior to 906 and 926 as an irrigated variety. (Tested as ph986-61 in 1992). Has low test weight on dryland. Protein appears good, 1.5% higher than Newana and 0.4% higher than McNeal. Quality = 4.

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

### ***Hard White Spring Wheat***

For specialty market. Protein of hard white will probably need to be at least 14% to meet market standards. In order to be officially classified as Hard White by U.S. Grain Standards, the developer/owner of the variety must petition for classification. Hard whites 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.

Genesis (Canada): Hard white. Not tested in Montana.

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

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

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

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

### ***Soft White Spr Wheat***

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

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

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

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

Sprite (WPB): Soft white.

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

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

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

Waverly: Soft white. Bearded semidwarf. Late maturing.

## ***Durum***

Durum quality scale: 4 = good; 3 = average; 2 = poor; 1 = very poor. Quality durum has strong gluten. Growers who plan to grow weak-gluten varieties need to have a marketing organization identified that will purchase those varieties.

Cando (ND, 1975): Very short semidwarf. 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.

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.

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

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

Kyle (Canada, 1984): Very tall weak straw, poor lodging resistance. Very late maturing. 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. Often had leaf-spot diseases while other entries did not. High yield. Recommended for Dist 2-6. High test weight. Protein medium. Strong gluten; quality = 3.

Lloyd (ND, 1983): Very short, stiff straw; very high lodging resistance. Too short for dry conditions. For irrigation or favorable moisture. Too short for dry conditions. Medium maturity. Susceptible to Septoria. High yield and good shatter resistance. Test weight is medium. Strong gluten; quality = 3.

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

Monroe (ND, 1985): Tall, medium lodging resistance for dryland. Early maturity, dryland only. Test weight is medium. Strong gluten; quality = 4.

Munich (ND, 1995): Medium height, strong straw. Med-late maturity. Higher yield than Renville, Sceptre and Medora. Strong gluten; quality = 4.

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

Pendur (WPB): Does not do well in Triangle area.

Plenty (Canada, 1990): Very tall weak straw; lodges easily. Late maturing. High yield. 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): 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. 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, fairly strong straw. Medium maturity. Moderately susceptible to septoria. Good shatter resistance. Medium test weight. 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.

Stockholm (Agripro): Semidwarf (short 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.

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 and high test weight. Strong gluten; quality = 4.

Voss (Agripro, 1994): Semidwarf; very stiff straw. Latest maturing of all entries in 1995. Quality = 3. Intended to replace Stockholm.

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

### *Spring Triticale*

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

Assume that all triticales have a potential ergot problem!

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

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

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

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

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

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

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

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

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

Relative maturities and heights for triticale:

|              |            |           |
|--------------|------------|-----------|
| Newana wheat | very early | short     |
| Kramer       | very early | med short |
| Carman       | early      | med. tall |

|        |             |           |
|--------|-------------|-----------|
| Karl   | early       | short     |
| Marval | medium      | very tall |
| Welsh  | medium late | tall      |

|         |           |           |
|---------|-----------|-----------|
| Beagle  | late      | tall      |
| Wapiti  | late      | med. tall |
| Sunland | very late | med. tall |

|         |              |      |
|---------|--------------|------|
| T-54    | very late    | tall |
| T-61    | very late    | tall |
| Juan    | extreme late | tall |
| Whitman | extreme late | tall |

Table 8 **Advanced Yield Dryland Spring Wheat variety trial grown north of Conrad, 1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

| Variety             | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | Head<br>date | %<br>protein |
|---------------------|----------------|--------------------------|-------------------------|--------------|--------------|
| BZ992632            | 75.4           | 62.7                     | 34                      | 188          | 12.3         |
| PENAWAWA (s. white) | 74.7           | 61.5                     | 28                      | 188          | 10.4         |
| MT 9559             | 73.6           | 61.6                     | 29                      | 187          | 13.2         |
| MT 9504             | 72.6           | 58.3                     | 33                      | 193          | 13.4         |
| WESTBRED EXPRESS    | 72.2           | 60.7                     | 27                      | 189          | 13.3         |
| MT 9502             | 69.9           | 60.7                     | 32                      | 188          | 12.1         |
| WESTBRED 926        | 69.4           | 61.0                     | 30                      | 186          | 13.3         |
| BZ987331            | 68.9           | 61.2                     | 29                      | 185          | 13.1         |
| VANNA (s. white)    | 68.3           | 60.3                     | 30                      | 190          | 10.7         |
| WESTBRED 936        | 68.2           | 60.2                     | 26                      | 186          | 13.7         |
| MT 9542             | 67.7           | 60.7                     | 32                      | 188          | 12.3         |
| MT 9533             | 67.7           | 62.3                     | 36                      | 186          | 14.5         |
| MCNEAL              | 67.5           | 60.5                     | 32                      | 189          | 13.8         |
| GLENMAN *           | 67.0           | 60.6                     | 31                      | 190          | 12.8         |
| MT 9565             | 66.7           | 62.9                     | 36                      | 187          | 13.1         |
| SONJA               | 66.7           | 60.5                     | 29                      | ---          | 13.1         |
| AMIDON *            | 66.6           | 61.3                     | 38                      | 188          | 13.9         |
| MT 9553             | 66.2           | 61.4                     | 31                      | 185          | 13.1         |
| MT 9515             | 66.1           | 62.2                     | 31                      | 188          | 13.5         |
| MT 9513             | 64.8           | 61.2                     | 32                      | 188          | 12.8         |
| NORLANDER           | 64.3           | 61.7                     | 29                      | ---          | 13.8         |
| MT 9558             | 64.3           | 60.7                     | 32                      | 189          | 13.1         |
| ERNEST *            | 64.1           | 61.0                     | 36                      | 188          | 14.9         |
| MT 9524             | 64.1           | 62.9                     | 34                      | 187          | 14.0         |
| LEN                 | 63.9           | 60.9                     | 31                      | 188          | 13.8         |
| HI-LINE             | 63.8           | 61.3                     | 29                      | 187          | 14.1         |
| MT 9508             | 63.4           | 61.5                     | 31                      | 187          | 13.9         |
| MT 9554             | 63.4           | 60.5                     | 31                      | 188          | 12.3         |
| MT 9517             | 63.4           | 62.2                     | 30                      | 185          | 13.2         |
| BZ992588            | 63.0           | 62.0                     | 31                      | 188          | 13.3         |

(Continued on next page)

(Advanced Yield Spring Wheat, continued)

| Variety          | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | Head<br>date | %<br>protein |
|------------------|----------------|--------------------------|-------------------------|--------------|--------------|
| NEWANA           | 62.8           | 60.5                     | 30                      | 191          | 13.2         |
| MT 9503          | 62.7           | 58.4                     | 31                      | 191          | 13.3         |
| MT 9541          | 62.3           | 61.5                     | 32                      | 187          | 13.8         |
| TRENTON          | 62.1           | 60.9                     | 39                      | 188          | 14.3         |
| MT 9539          | 61.5           | 61.0                     | 32                      | 188          | 13.6         |
| MT 9311          | 61.3           | 60.4                     | 33                      | 193          | 14.0         |
| VOSS (durum)     | 60.7           | 61.2                     | 28                      | ---          | 13.2         |
| MT 9433          | 60.6           | 61.5                     | 37                      | 189          | 14.8         |
| THATCHER         | 60.3           | 59.0                     | 41                      | 192          | 13.9         |
| MT 9430          | 60.2           | 61.3                     | 37                      | 187          | 14.4         |
| MT 9410          | 60.1           | 61.7                     | 35                      | 187          | 13.9         |
| MT 9332          | 60.0           | 60.3                     | 34                      | 190          | 13.9         |
| MT 9507          | 60.0           | 62.4                     | 32                      | 186          | 13.8         |
| MT 9407          | 59.7           | 60.1                     | 39                      | 188          | 14.1         |
| FERGUS           | 58.4           | 61.5                     | 30                      | 187          | 13.5         |
| MT 9453          | 58.1           | 61.2                     | 36                      | 188          | 14.3         |
| MT 9532          | 58.0           | 63.6                     | 37                      | 187          | 14.7         |
| FORTUNA *        | 57.7           | 62.4                     | 39                      | 188          | 14.1         |
| MT 9420          | 57.5           | 60.5                     | 36                      | 187          | 14.2         |
| MT 9427          | 57.4           | 61.0                     | 32                      | 186          | 14.5         |
| LEW *            | 57.0           | 61.4                     | 38                      | 192          | 13.8         |
| MTRWA116         | 55.4           | 61.4                     | 31                      | 187          | 14.1         |
| DRESSLER (durum) | 51.9           | 60.7                     | 37                      | ---          | 14.0         |

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

Previous crop: Fallow.

Date seeded: May 1, 1996.

Date harvested: August 27, 1996.

Rainfall: From seeding to harvest was 4.89 inches.

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

Yield experimental mean: 64.08

Error degrees of freedom: 96.00

F test for var: 2.39

C.V. 2: 4.96

LSD (0.05): 8.92

Table 9 **Advanced Yield Dryland Spring Wheat** variety trial grown north of **Conrad**, 1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.  
(Abbreviated list)

| Variety          |            | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | Head<br>date | %<br>protein |
|------------------|------------|----------------|--------------------------|-------------------------|--------------|--------------|
| PENAWAWA         | (s. white) | 74.7           | 61.5                     | 28                      | 188          | 10.4         |
| WESTBRED EXPRESS |            | 72.2           | 60.7                     | 27                      | 189          | 13.3         |
| WESTBRED 926     |            | 69.4           | 61.0                     | 30                      | 186          | 13.3         |
| VANNA            | (s. white) | 68.3           | 60.3                     | 30                      | 190          | 10.7         |
| WESTBRED 936     |            | 68.2           | 60.2                     | 26                      | 186          | 13.7         |
| MCNEAL           |            | 67.5           | 60.5                     | 32                      | 189          | 13.8         |
| GLENMAN          | *          | 67.0           | 60.6                     | 31                      | 190          | 12.8         |
| SONJA            |            | 66.7           | 60.5                     | 29                      | ---          | 13.1         |
| AMIDON           | *          | 66.6           | 61.3                     | 38                      | 188          | 13.9         |
| NORLANDER        |            | 64.3           | 61.7                     | 29                      | ---          | 13.8         |
| ERNEST           | *          | 64.1           | 61.0                     | 36                      | 188          | 14.9         |
| LEN              |            | 63.9           | 60.9                     | 31                      | 188          | 13.8         |
| HI-LINE          |            | 63.8           | 61.3                     | 29                      | 187          | 14.1         |
| NEWANA           |            | 62.8           | 60.5                     | 30                      | 191          | 13.2         |
| TRENTON          |            | 62.1           | 60.9                     | 39                      | 188          | 14.3         |
| VOSS             | (durum)    | 60.7           | 61.2                     | 28                      | ---          | 13.2         |
| THATCHER         |            | 60.3           | 59.0                     | 41                      | 192          | 13.9         |
| FERGUS           |            | 58.4           | 61.5                     | 30                      | 187          | 13.5         |
| FORTUNA          | *          | 57.7           | 62.4                     | 39                      | 188          | 14.1         |
| LEW              | *          | 57.0           | 61.4                     | 38                      | 192          | 13.8         |
| DRESSLER         | (durum)    | 51.9           | 60.7                     | 37                      | ---          | 14.0         |

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

Previous crop: Fallow.

Date seeded: May 1, 1996.

Date harvested: August 27, 1996.

Rainfall: From seeding to harvest was 4.89 inches.

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

Yield experimental mean: 64.08

Error degrees of freedom: 96.00

F test for var: 2.39

C.V. 2: 4.96

LSD (0.05): 8.92



Table 10 Five-year summary on dryland Spring Wheat varieties grown near Conrad, MT. 1991 - 1993 - 1994 - 1995 - 1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety            | 5 - year comparable average |                     |                         |              |              |
|--------------------|-----------------------------|---------------------|-------------------------|--------------|--------------|
|                    | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | %<br>Protein |
| PENAWAWA (s white) | 79.5                        | 60.3                | 32                      | 186          | 9.5          |
| VANNA (s white)    | 74.3                        | 59.5                | 33                      | 187          | 10.0         |
| GLENMAN *          | 70.3                        | 59.7                | 35                      | 187          | 11.8         |
| NEWANA             | 69.1                        | 59.1                | 33                      | 187          | 12.1         |
| WESTBRED 926       | 68.8                        | 60.9                | 33                      | 182          | 12.5         |
| MCNEAL             | 68.4                        | 60.4                | 34                      | 186          | 12.6         |
| WESTBRED 936       | 67.3                        | 59.5                | 30                      | 183          | 13.1         |
| WESTBRED EXPRESS   | 67.2                        | 60.4                | 29                      | 186          | 12.2         |
| ERNEST *           | 66.1                        | 61.5                | 40                      | 185          | 13.2         |
| HI-LINE            | 65.8                        | 61.6                | 31                      | 184          | 12.7         |
| FERGUS             | 64.3                        | 60.3                | 34                      | 183          | 12.6         |
| AMIDON *           | 63.1                        | 60.5                | 40                      | 186          | 12.1         |
| LEW *              | 62.4                        | 61.9                | 41                      | 188          | 12.6         |
| FORTUNA *          | 61.8                        | 62.1                | 42                      | 186          | 12.8         |
| LEN                | 61.2                        | 60.0                | 34                      | 185          | 13.3         |
| THATCHER           | 55.8                        | 59.5                | 44                      | 187          | 12.4         |

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

Table 11

Irrigated Spring Wheat variety trial grown north of Conrad, 1996. Mont. Agr. Expt. Station. Western Triangle Ag. Research Center, Conrad, Montana.

| Variety  |            | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | Head<br>date | %<br>protein |
|----------|------------|----------------|---------------------|-------------------------|--------------|--------------|
| VANNA    | (s. white) | 108.1          | 63.2                | 32                      | 190          |              |
| WESTBRED | 936        | 102.4          | 63.5                | 29                      | 187          |              |
| FERGUS   |            | 101.1          | 64.1                | 32                      | 188          |              |
| GLENMAN  | *          | 100.3          | 63.9                | 35                      | 192          |              |
| WESTBRED | EXPRESS    | 98.2           | 64.0                | 28                      | 188          |              |
| MTHW9503 |            | 94.8           | 63.3                | 33                      | 188          |              |
| NEWANA   |            | 94.8           | 62.3                | 33                      | 193          |              |
| HI-LINE  |            | 94.6           | 64.0                | 32                      | 190          |              |
| MT 9311  |            | 94.3           | 64.7                | 39                      | 193          |              |
| MT 9565  |            | 93.2           | 65.3                | 40                      | 187          |              |
| RAMBO    | *          | 91.1           | 63.5                | 32                      | 191          |              |
| MTHW9420 |            | 91.0           | 63.8                | 32                      | 188          |              |
| MCNEAL   |            | 90.7           | 63.5                | 35                      | 193          |              |
| GRANDIN  |            | 88.7           | 63.6                | 35                      | 188          |              |
| MT 9410  |            | 86.0           | 64.6                | 39                      | 187          |              |
| WESTBRED | 926        | 84.9           | 63.0                | 32                      | 187          |              |
| AMIDON   | *          | 82.9           | 62.4                | 42                      | 188          |              |
| LEN      |            | 80.5           | 63.0                | 34                      | 188          |              |
| FORTUNA  | *          | 79.4           | 64.2                | 44                      | 190          |              |
| PIONEER  | 2375       | 79.1           | 63.8                | 37                      | 187          |              |
| MT 9433  |            | 73.4           | 63.5                | 42                      | 188          |              |
| LEW      | *          | 73.0           | 64.5                | 44                      | 193          |              |
| STOA     |            | 72.8           | 62.6                | 40                      | 190          |              |
| TRENTON  |            | 71.9           | 63.3                | 43                      | 188          |              |
| ERNEST   | *          | 69.6           | 63.4                | 40                      | 188          |              |

Cooperator: Western Triangle Ag. Research Center.

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

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

Previous crop: Fallow.

Date seeded: May 1, 1996.

Date harvested: August 9, 1996.

Irrigation Dates: June 20, --- July 2, --- July 8, --- July 18.

\* = Sawfly resistant varieties. (Amidon and Rambo have partial resistance.) (Also, most experimental lines are resistant).

Yield experimental mean: 87.88

Error degrees of freedom: 48.00

F test for var: 7.14,

C.V. 2: 4.59,

LSD (0.05): 11.48

Table 12 Five-year summary on Irrigated Spring Wheat varieties grown north of Conrad, MT. 1990 - 1991 - 1993 - 1994 - 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety      | 5 - year comparable average |                   |                         |              |              |
|--------------|-----------------------------|-------------------|-------------------------|--------------|--------------|
|              | Yield<br>bu/ac              | Test wt<br>lbs/bu | Plant<br>hgt.<br>inches | Head<br>date | %<br>Protein |
| RAMBO *      | 73.9                        | 60.3              | 33                      | 187          | 10.4         |
| HI-LINE      | 72.3                        | 63.0              | 33                      | 183          | 11.7         |
| GLENMAN *    | 72.2                        | 62.5              | 36                      | 186          | 10.8         |
| NEWANA       | 71.0                        | 61.7              | 34                      | 187          | 11.2         |
| WESTBRED 926 | 69.2                        | 62.1              | 33                      | 180          | 11.8         |
| AMIDON *     | 67.0                        | 61.5              | 41                      | 184          | 11.4         |
| GRANDIN      | 65.8                        | 62.6              | 37                      | 183          | 12.4         |
| LEN          | 64.6                        | 62.0              | 33                      | 182          | 11.9         |
| LEW *        | 61.5                        | 63.5              | 42                      | 186          | 11.5         |
| FORTUNA *    | 60.9                        | 63.6              | 42                      | 184          | 11.7         |
| STOA         | 59.4                        | 61.7              | 40                      | 184          | 11.6         |

Cooperator: Western Triangle Ag. Research Center.  
 Location: North of Conrad, MT. (Pondera County)  
 \* = Sawfly resistant varieties. (Amidon and Rambo have partial resistance.)

Table 13                      **Dryland Spring Wheat** variety trial grown near  
**Choteau, 1996.** Mont. Agr. Expt. Sta., Western  
Triangle Ag. Research Center, Conrad, MT.

| Variety          |            | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>protein |
|------------------|------------|----------------|---------------------|-------------------------|--------------|
| VANNA            | (s. white) | 41.9           | 54.3                | 25                      | 12.2         |
| FORTUNA          | *          | 41.5           | 59.4                | 35                      | 14.6         |
| HI-LINE          |            | 41.3           | 58.1                | 25                      | 14.2         |
| MTHW9503         |            | 41.1           | 57.6                | 25                      | 14.0         |
| NEWANA           |            | 41.1           | 47.3                | 27                      | 12.6         |
| GRANDIN          |            | 39.8           | 57.0                | 29                      | 14.3         |
| WESTBRED 936     |            | 39.6           | 57.0                | 25                      | 14.8         |
| RAMBO            | *          | 39.3           | 52.6                | 24                      | 13.2         |
| STOA             |            | 38.2           | 56.3                | 31                      | 14.8         |
| WESTBRED 926     |            | 38.1           | 56.9                | 26                      | 14.7         |
| GLENMAN          | *          | 38.1           | 54.1                | 28                      | 13.3         |
| MT 9410          |            | 37.8           | 58.6                | 32                      | 13.7         |
| PIONEER 2375     |            | 37.8           | 59.0                | 29                      | 13.9         |
| LEN              |            | 37.5           | 55.0                | 27                      | 14.1         |
| MCNEAL           |            | 36.9           | 55.2                | 27                      | 13.7         |
| ERNEST           | *          | 36.2           | 59.4                | 31                      | 14.7         |
| MT 9565          |            | 36.0           | 59.3                | 31                      | 14.3         |
| TRENTON          |            | 35.8           | 57.4                | 34                      | 14.7         |
| MTHW9420         |            | 35.0           | 55.4                | 25                      | 13.8         |
| MT 9433          |            | 34.9           | 52.3                | 32                      | 14.6         |
| MT 9311          |            | 34.3           | 53.6                | 30                      | 13.5         |
| LEW              | *          | 33.9           | 54.5                | 34                      | 14.0         |
| FERGUS           | *          | 33.5           | 56.2                | 25                      | 14.5         |
| WESTBRED EXPRESS |            | 33.0           | 57.0                | 25                      | 13.4         |
| AMIDON           | *          | 29.4           | 54.3                | 32                      | 13.6         |

Cooperator: Roy Inbody.

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

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

Previous crop: Fallow.

Date seeded: April 29, 1996. Date harvested: August 19, 1996.

Rainfall: From seeding to harvest was 2.9 inches.

\* = Sawfly resistant varieties. (Amidon and Rambo have partial resistance.) (Also, most experimental lines are resistant).

Yield experimental mean: 37.27

Error degrees of freedom: 48.00

F test for var: 2.27, C.V. 2: 5.56, LSD (0.05): 5.89

Table 14 **Five-year summary on Dryland Spring Wheat varieties grown near Choteau, MT. 1992 - 1993 - 1994 - 1995 - 1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

| Variety      |   | 5 - year comparable average |                     |                         |              |
|--------------|---|-----------------------------|---------------------|-------------------------|--------------|
|              |   | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Protein |
| GLENMAN      | * | 49.5                        | 56.7                | 31                      | 14.3         |
| NEWANA       |   | 47.0                        | 55.0                | 29                      | 14.4         |
| HI-LINE      |   | 46.6                        | 59.0                | 28                      | 15.1         |
| MCNEAL       |   | 46.6                        | 56.3                | 31                      | 15.1         |
| RAMBO        | * | 45.8                        | 57.0                | 29                      | 14.2         |
| LEW          | * | 44.3                        | 58.8                | 35                      | 15.1         |
| FORTUNA      | * | 43.9                        | 59.5                | 35                      | 15.5         |
| GRANDIN      |   | 41.8                        | 58.0                | 31                      | 15.8         |
| WESTBRED 926 |   | 41.4                        | 57.2                | 28                      | 15.2         |
| AMIDON       | * | 41.4                        | 57.0                | 35                      | 15.2         |
| ERNEST       | * | 40.7                        | 60.3                | 35                      | 16.1         |
| LEN          |   | 39.0                        | 56.7                | 30                      | 15.5         |
| STOA         |   | 38.7                        | 57.1                | 34                      | 15.7         |

Cooperator: Roy Inbody in 1994 - 1995 - 1996, and Rick Corey in 1992 - 1993.

Location: Northeast of Choteau, MT. (Teton County)

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

Table 15                      **Dryland Spring Wheat** variety trial grown near Oilmont, 1996. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

| Variety          |           | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>protein |
|------------------|-----------|----------------|---------------------|-------------------------|--------------|
| WESTBRED EXPRESS |           | 26.2           | 47.7                | 23                      | 16.9         |
| HI-LINE          |           | 22.4           | 44.3                | 26                      | 19.0         |
| MCNEAL           |           | 22.1           | 43.3                | 30                      | 18.5         |
| GLENMAN          | *         | 21.9           | 43.0                | 29                      | 16.4         |
| MT 9565          |           | 21.1           | 46.0                | 32                      | 18.2         |
| MT 9410          |           | 20.9           | 48.0                | 30                      | 18.5         |
| RAMBO            | *         | 20.8           | 47.6                | 28                      | 18.0         |
| PIONEER 2375     |           | 20.6           | 46.1                | 29                      | 17.6         |
| WESTBRED 936     |           | 20.5           | 45.3                | 25                      | 19.0         |
| WESTBRED 926     |           | 20.5           | 47.3                | 25                      | 19.4         |
| MTHW9503         |           | 20.3           | 45.9                | 28                      | 17.8         |
| FORTUNA          | *         | 20.3           | 49.9                | 35                      | 17.2         |
| VANNA            | (s. white | 20.1           | 42.1                | 26                      | 16.8         |
| MTHW9420         |           | 20.1           | 44.9                | 26                      | NA           |
| ERNEST           | *         | 19.8           | 47.1                | 35                      | 18.4         |
| LEW              | *         | 19.4           | 47.3                | 32                      | 18.7         |
| FERGUS           |           | 19.2           | 46.1                | 24                      | 18.9         |
| NEWANA           |           | 18.7           | 43.7                | 24                      | 17.7         |
| GRANDIN          |           | 18.1           | 43.8                | 31                      | 17.7         |
| MT 9433          |           | 17.3           | 46.8                | 32                      | 18.9         |
| AMIDON           | *         | 17.1           | 48.3                | 38                      | 17.7         |
| LEN              |           | 17.1           | 45.2                | 31                      | 17.9         |
| STOA             |           | 16.7           | 43.3                | 34                      | 19.4         |
| MT 9311          |           | 16.6           | 45.9                | 29                      | 17.4         |
| TRENTON          |           | 14.4           | 46.6                | 36                      | 18.0         |

Cooperator: Terry Alme.

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

Fertilizer: 100# 11-52-0 with the seed.

Previous crop: Fallow.

Date seeded: May 22, 1996. Date harvested: August 12, 1996.

Rainfall: From seeding to harvest was 3.75 inches.

\* = Sawfly resistant varieties. (Amidon and Rambo have partial resistance.) (Also, most experimental lines are resistant).

Yield experimental mean: 19.69

Error degrees of freedom: 48.00

F test for var: 2.31, C.V. 2: 8.00, LSD (0.05): 4.48

Table 16 **Five-year summary on dryland Spring Wheat varieties grown near Oilmont, MT. 1992 - 1993 - 1994 - 1995 - 1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

| Variety      | 5 - year comparable average |                     |                         |              |
|--------------|-----------------------------|---------------------|-------------------------|--------------|
|              | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Protein |
| MCNEAL       | 43.8                        | 57.1                | 30                      | 15.5         |
| GLENMAN      | *                           | 41.4                | 29                      | 13.6         |
| ERNEST       | *                           | 39.6                | 34                      | 14.9         |
| HI-LINE      | 38.9                        | 57.6                | 28                      | 15.5         |
| GRANDIN      | 37.9                        | 57.7                | 30                      | 15.5         |
| LEW          | *                           | 37.5                | 33                      | 14.9         |
| NEWANA       | 36.4                        | 57.1                | 27                      | 13.5         |
| AMIDON       | *                           | 36.1                | 33                      | 14.5         |
| RAMBO        | *                           | 36.0                | 28                      | 14.2         |
| LEN          | 35.9                        | 57.8                | 30                      | 15.1         |
| WESTBRED 926 | 35.3                        | 56.9                | 26                      | 14.8         |
| STOA         | 34.4                        | 57.5                | 33                      | 15.1         |
| FORTUNA      | *                           | 34.2                | 34                      | 14.2         |

Cooperator: Terry Alme.

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

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

Table 17 **Dryland Spring Wheat** variety trial grown near **Cut Bank, 1996.** Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

| Variety          | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Protein |
|------------------|----------------|---------------------|-------------------------|--------------|
| MT 9565          | 34.7           | 61.3                | 34                      | 8.9          |
| VANNA (s. white) | 31.5           | 57.4                | 29                      | 6.6          |
| LEN              | 29.6           | 59.8                | 29                      | 10.2         |
| MT 9311          | 29.1           | 59.4                | 33                      | 9.8          |
| WESTBRED EXPRESS | 28.9           | 60.0                | 24                      | 9.3          |
| WESTBRED 936     | 28.7           | 59.1                | 25                      | 9.0          |
| RAMBO *          | 28.6           | 58.1                | 26                      | 9.5          |
| MT 9410          | 28.1           | 60.1                | 34                      | 9.4          |
| PIONEER 2375     | 28.0           | 60.7                | 33                      | 9.3          |
| MTHW9420         | 27.6           | 59.5                | 29                      | 8.5          |
| FERGUS           | 27.6           | 59.5                | 26                      | 10.1         |
| TRENTON          | 27.4           | 59.8                | 32                      | 9.5          |
| AMIDON *         | 27.3           | 58.8                | 35                      | 9.4          |
| STOA             | 27.1           | 58.8                | 32                      | 9.1          |
| GRANDIN          | 26.8           | 59.8                | 30                      | 10.1         |
| WESTBRED 926     | 26.5           | 59.2                | 27                      | 9.4          |
| HI-LINE          | 26.3           | 61.0                | 28                      | 8.8          |
| FORTUNA *        | 25.7           | 59.1                | 34                      | 9.0          |
| MTHW9503         | 25.1           | 57.2                | 27                      | 9.9          |
| MT 9433          | 25.1           | 58.9                | 35                      | 10.0         |
| LEW *            | 25.1           | 55.5                | 34                      | 9.3          |
| ERNEST *         | 25.0           | 60.0                | 35                      | 10.4         |
| NEWANA           | 24.9           | 57.2                | 28                      | 8.9          |
| GLENMAN *        | 24.7           | 57.9                | 31                      | 8.6          |
| MCNEAL           | 24.7           | 58.2                | 31                      | 9.4          |

Cooperator: Don Bradley.

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

Fertilizer: 100# 11-52-0 with the seed.

Previous crop: Fallow.

Date seeded: May 15, 1996.

Date harvested: August 27, 1996.

Rainfall: Data not available.

\* = Sawfly resistant varieties. (Amidon and Rambo have partial resistance.) (Also, most experimental lines are resistant).

Yield experimental mean: 27.36

Error degrees of freedom: 48.00

F test for var: 1.05, C.V. 2: 8.33, LSD (0.05): 6.48



Table 18 **Five-year summary on Dryland Spring Wheat varieties grown near Cut Bank, MT. 1992 - 1993 - 1994 - 1995-1996. Montana Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

| Variety      |   | 5 - year comparable average |                     |                         |              |
|--------------|---|-----------------------------|---------------------|-------------------------|--------------|
|              |   | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Protein |
| AMIDON       | * | 43.4                        | 57.6                | 37                      | 10.3         |
| GLENMAN      | * | 42.2                        | 57.9                | 32                      | 9.4          |
| FORTUNA      | * | 40.8                        | 59.7                | 36                      | 10.4         |
| LEW          | * | 40.8                        | 58.3                | 37                      | 10.0         |
| MCNEAL       |   | 40.6                        | 58.6                | 32                      | 10.6         |
| GRANDIN      |   | 40.5                        | 59.4                | 33                      | 11.1         |
| RAMBO        | * | 40.5                        | 58.2                | 29                      | 10.0         |
| LEN          |   | 39.6                        | 58.4                | 31                      | 11.2         |
| WESTBRED 926 |   | 39.6                        | 58.3                | 30                      | 10.1         |
| HI-LINE      |   | 39.2                        | 60.3                | 29                      | 10.4         |
| STOA         |   | 39.2                        | 59.7                | 35                      | 10.1         |
| NEWANA       |   | 38.3                        | 58.2                | 30                      | 9.6          |
| ERNEST       | * | 37.6                        | 58.9                | 37                      | 10.7         |

Cooperator: Don Bradley.

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

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

## 1996 Barley variety evaluations in the Western Triangle Area.

Location: Western Triangle Research Center, Conrad, MT.

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

Off-station barley variety trials were grown in Teton County near Choteau, Toole County near Oilmont, and Glacier County near Cut Bank. Barley variety trials on station at Conrad included fallow and no-till recrop, and dryland and irrigated. Data for the barley trials are presented in Tables 19 to 30, and include the 1996 data and five-year averages. Data for the no-till trial is presented in the "no-till section" of this report.

Results: The season started with good soil moisture but rainfall was below average for the season. The Conrad and Choteau locations were able to produce good yields, which was attributed to deep soil moisture and timeliness of rainfall. Yields at Oilmont were limited by moisture depletion early in the season. In addition to moisture shortages, Cut Bank yields were limited by insufficient nitrogen levels.

The varieties Stark and Baronesse ranked high at each location. This was expected in the case of Stark, as it has shown good adaptation to dry conditions in previous years. Baronesse is somewhat late to mature, and performed surprisingly well under the dry conditions of 1996. Chinook had superior performance in 1996 only at the high yield location of Choteau, but performed well in previous years at Oilmont and Cut Bank as indicated in the 5-year averages.

Comments on barley varieties are presented in the following pages. Also refer to MSU Extension Bulletin 1094.

## Barley Variety Notes & Comments

Western Triangle Agricultural Research Center, Conrad, MT

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

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

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

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

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

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

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

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

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

Baronnesse (Ackermann-Germany): Seed produced in USA by Western Plant Breeders. 2-row feed. Short straw and good lodging resistance; 2.5" & 3" shorter than Harrington & Gallatin, respectively. One to four days later maturity than Pirolina and Gallatin; equal or slightly later maturity than Harrington; thus, may possibly rank lower for yield in dry years without irrigation. Among highest yielders when tested in favorable moisture conditions (not tested in dry years yet). Test weight is 1 lb less than Gallatin, but % plump is higher. Recommended list for irrigated and dryland.

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

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

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

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

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

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

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

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

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

Conlon (ND): 2-row feed. Weak straw, slightly weaker than Bowman. Early maturity, 1-2 days earlier and higher test weight than Bowman. Developed for areas of heat & drought stress. High resistance to net blotch; susceptible to spot blotch & Fusarium head blight.

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

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

Excel (Minn, 1990): 6-row malt for upper Midwest. Supposed to combine the superior agronomics of Robust and the malt quality of Morex. Stiff straw. Later maturity and higher yield than Morex.

Foster (ND, 1995): 6-row malt for North Dakota. Med-short; stiff straw. Medium maturity.

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

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

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

Haybet (MSU): 2-row, hooded hay barley. Later to mature than Horsford, and higher forage yield. Similar to Horsford for grain yield, which is low. (See also Westford). Caution: any cereal grain grown for hay should be tested for nitrate level prior to cutting.

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

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

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

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

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

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

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

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

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

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

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

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

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

Morex (Minn, 1978): 6-row malt. Tall; medium straw strength. Early maturity. Shatters readily - swathing advised.

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

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

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

Robust (Mn, 1983): 6-row malt per ND AMBA list; but not Montana's, in order to keep Montana clear for Morex. Tall; medium straw strength. Medium maturity. The 1992 Robust crop in Minnesota did not malt due to dormancy for unknown reasons. Growers therefore switched to 'Stander' in 1993.

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

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

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

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

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

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

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

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

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

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

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

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

Table 19 Dryland Intrastate Barley variety trial grown north of Conrad, 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety         | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | Head<br>date | %<br>Protein |
|-----------------|----------------|--------------------------|-------------------------|------------|-----------|--------------|--------------|
| Steptoe (6-row) | 118.4          | 48.3                     | 27                      | 86         | 4         | 183          | 9.6          |
| Stark           | 116.5          | 54.8                     | 34                      | 93         | 2         | 185          | 11.1         |
| MT920053        | 116.5          | 55.0                     | 31                      | 91         | 3         | 187          | 11.4         |
| MT890008        | 116.3          | 52.0                     | 29                      | 88         | 4         | 190          | 10.4         |
| MT940177        | 116.2          | 52.9                     | 31                      | 85         | 6         | 187          | 11.1         |
| MT940049        | 114.4          | 55.0                     | 30                      | 81         | 8         | 190          | 11.3         |
| MT930204        | 113.5          | 53.4                     | 30                      | 92         | 3         | 185          | 10.7         |
| MT940163        | 113.4          | 54.5                     | 30                      | 87         | 5         | 188          | 11.5         |
| MT930059        | 113.3          | 53.9                     | 30                      | 95         | 1         | 185          | 12.3         |
| MT920073        | 112.9          | 54.3                     | 28                      | 91         | 4         | 186          | 11.0         |
| Lewis           | 112.7          | 53.7                     | 31                      | 85         | 7         | 188          | 11.7         |
| MT940206        | 112.2          | 55.7                     | 30                      | 94         | 2         | 186          | 11.8         |
| MT940053        | 111.8          | 55.4                     | 29                      | 87         | 6         | 190          | 11.4         |
| Baronesse       | 111.5          | 52.8                     | 28                      | 85         | 5         | 189          | 11.3         |
| MT910160        | 110.9          | 54.5                     | 33                      | 91         | 3         | 188          | 11.3         |
| MT910033        | 110.5          | 54.9                     | 29                      | 92         | 2         | 185          | 11.3         |
| MT930203        | 110.1          | 53.3                     | 33                      | 93         | 2         | 186          | 12.5         |
| MT940013        | 110.1          | 51.8                     | 29                      | 83         | 7         | 187          | 11.3         |
| OPTIC 1         | 109.4          | 54.4                     | 32                      | 86         | 5         | 185          | 11.3         |
| MT920041        | 109.3          | 54.1                     | 30                      | 94         | 2         | 187          | 11.4         |
| MT886610        | 108.6          | 52.4                     | 31                      | 78         | 10        | 187          | 11.6         |
| H5870120        | 108.6          | 49.5                     | 28                      | 89         | 4         | 183          | 9.3          |
| MT910150        | 108.5          | 54.7                     | 30                      | 89         | 3         | 186          | 12.6         |
| MT940205        | 108.5          | 55.0                     | 30                      | 91         | 3         | 187          | 11.7         |
| MT890018        | 107.7          | 53.3                     | 30                      | 84         | 6         | 187          | 11.7         |
| Gallatin        | 107.5          | 52.9                     | 32                      | 84         | 7         | 186          | 11.1         |
| MT940196        | 107.4          | 52.8                     | 32                      | 89         | 4         | 188          | 11.5         |
| MT940169        | 106.6          | 51.4                     | 29                      | 77         | 10        | 189          | 11.3         |
| MT940218        | 106.4          | 53.9                     | 27                      | 91         | 3         | 185          | 10.6         |
| MT920201        | 105.6          | 53.0                     | 32                      | 81         | 7         | 188          | 12.0         |
| H1851195        | 105.5          | 53.1                     | 32                      | 83         | 7         | 187          | 12.5         |
| MT920059        | 105.3          | 53.9                     | 31                      | 84         | 7         | 188          | 11.6         |
| MT940067        | 104.8          | 55.5                     | 33                      | 94         | 2         | 188          | 11.6         |

(Continued on next page)

(Intrastate Dryland Barley trial, *continued* )

|                |       |      |    |    |    |     |      |
|----------------|-------|------|----|----|----|-----|------|
| MT940064       | 104.7 | 54.8 | 30 | 89 | 3  | 187 | 11.5 |
| MT940099       | 104.5 | 55.2 | 28 | 86 | 6  | 190 | 11.8 |
| MT940071       | 104.0 | 55.8 | 29 | 91 | 3  | 186 | 11.8 |
| MT940220       | 103.5 | 55.0 | 30 | 87 | 4  | 187 | 11.9 |
| MT940214       | 103.4 | 53.2 | 28 | 85 | 5  | 186 | 10.7 |
| Busch Agr 1202 | 103.3 | 51.9 | 32 | 84 | 6  | 189 | 11.4 |
| MT940121       | 103.2 | 53.4 | 28 | 85 | 7  | 190 | 11.0 |
| BSWS 2         | 102.4 | 54.4 | 30 | 93 | 2  | 189 | 12.6 |
| MT940203       | 100.9 | 54.0 | 31 | 85 | 6  | 186 | 11.2 |
| MT930132       | 100.9 | 53.4 | 29 | 95 | 1  | 185 | 11.2 |
| MT940106       | 100.6 | 52.9 | 27 | 88 | 4  | 188 | 10.7 |
| H3860224       | 100.4 | 52.1 | 31 | 87 | 6  | 188 | 11.2 |
| MT940201       | 100.2 | 55.4 | 28 | 84 | 5  | 186 | 11.8 |
| MT910189       | 100.0 | 54.2 | 27 | 86 | 5  | 185 | 10.8 |
| MT940087       | 100.0 | 54.4 | 30 | 96 | 1  | 191 | 12.2 |
| Chinook        | 99.9  | 53.6 | 29 | 85 | 6  | 188 | 11.4 |
| MT940082       | 99.9  | 55.2 | 27 | 90 | 3  | 188 | 12.1 |
| MT940048       | 99.9  | 55.4 | 28 | 80 | 7  | 191 | 11.1 |
| 11231-11       | 99.6  | 53.9 | 29 | 91 | 3  | 185 | 11.4 |
| MT930169       | 99.0  | 51.5 | 30 | 77 | 10 | 191 | 10.7 |
| MT940079       | 98.4  | 55.1 | 30 | 89 | 4  | 187 | 11.1 |
| Harrington     | 97.5  | 51.7 | 32 | 75 | 9  | 188 | 10.6 |
| Hector         | 97.1  | 52.4 | 31 | 86 | 4  | 188 | 11.8 |
| BA 2B89-4311   | 95.9  | 51.4 | 30 | 76 | 11 | 189 | 11.7 |
| BA 2B91-4947   | 95.3  | 49.1 | 31 | 78 | 10 | 191 | 10.9 |
| MT920161       | 92.7  | 54.7 | 31 | 91 | 3  | 188 | 11.8 |
| WPB SL93516    | 92.5  | 53.9 | 28 | 86 | 4  | 192 | 11.8 |
| BSWS 1         | 92.4  | 53.4 | 26 | 88 | 4  | 188 | 11.4 |
| Foster (6-row) | 92.1  | 52.6 | 31 | 94 | 2  | 184 | 11.3 |
| Stander        | 88.9  | 53.1 | 32 | 92 | 2  | 186 | 11.4 |
| Morex (6-row)  | 79.4  | 52.8 | 36 | 84 | 4  | 185 | 12.5 |

Cooperator: Western Triangle Ag. Research Center.

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

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

Previous crop: Fallow.

Date seeded: May 1, 1996.

Date harvested: Aug. 20, 1996.

Rainfall: From seeding to harvest was 4.89 inches.

Yield experimental mean: 104.74

Error degrees of freedom: 126.00

F test for var.: 1.85; C.V. 2: 5.36; LSD (0.05): 15.71

Table 20 Dryland Intrastate Barley variety trial grown north of Conrad, 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety         | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | Head<br>date | %<br>Protein |
|-----------------|----------------|--------------------------|-------------------------|------------|-----------|--------------|--------------|
| Steptoe (6-row) | 118.4          | 48.3                     | 27                      | 86         | 4         | 183          | 9.6          |
| Stark           | 116.5          | 54.8                     | 34                      | 93         | 2         | 185          | 11.1         |
| Lewis           | 112.7          | 53.7                     | 31                      | 85         | 7         | 188          | 11.7         |
| Baronesse       | 111.5          | 52.8                     | 28                      | 85         | 5         | 189          | 11.3         |
| OPTIC 1         | 109.4          | 54.4                     | 32                      | 86         | 5         | 185          | 11.3         |
| Gallatin        | 107.5          | 52.9                     | 32                      | 84         | 7         | 186          | 11.1         |
| Busch Agr 1202  | 103.3          | 51.9                     | 32                      | 84         | 6         | 189          | 11.4         |
| Chinook         | 99.9           | 53.6                     | 29                      | 85         | 6         | 188          | 11.4         |
| Harrington      | 97.5           | 51.7                     | 32                      | 75         | 9         | 188          | 10.6         |
| Hector          | 97.1           | 52.4                     | 31                      | 86         | 4         | 188          | 11.8         |
| Foster (6-row)  | 92.1           | 52.6                     | 31                      | 94         | 2         | 184          | 11.3         |
| Stander         | 88.9           | 53.1                     | 32                      | 92         | 2         | 186          | 11.4         |
| Morex (6-row)   | 79.4           | 52.8                     | 36                      | 84         | 4         | 185          | 12.5         |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: May 1, 1996. Date harvested: Aug. 20, 1996.  
 Rainfall: From seeding to harvest was 4.89 inches.  
 Yield experimental mean: 104.74  
 Error degrees of freedom: 126.00  
 F test for var.: 1.85  
 C.V. 2: 5.36  
 LSD (0.05): 15.71



Table 21 **Five-year summary on Dryland Barley varieties** grown north of **Conrad, MT.** 1991 - 1992 - 1994 1995 - 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety    | 5 - year comparable average |                          |                         |            |           |              |              |
|------------|-----------------------------|--------------------------|-------------------------|------------|-----------|--------------|--------------|
|            | Yield<br>bu/ac              | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>thin | Head<br>date | %<br>Protein |
| BARONESSE  | 105.6                       | 52.9                     | 31                      | 89         | 4         | 185          | 10.0         |
| MT 8886610 | 100.0                       | 53.1                     | 35                      | 89         | 4         | 184          | 10.0         |
| STEPTOE    | 99.3                        | 48.4                     | 33                      | 90         | 3         | 180          | 9.8          |
| GALLATIN   | 98.4                        | 53.4                     | 35                      | 92         | 3         | 183          | 10.0         |
| LEWIS      | 97.7                        | 53.6                     | 35                      | 92         | 3         | 186          | 10.4         |
| STARK      | 96.6                        | 53.8                     | 36                      | 95         | 1         | 182          | 10.4         |
| HARRINGTON | 92.7                        | 51.5                     | 36                      | 86         | 4         | 186          | 10.1         |
| BA 1202    | 91.5                        | 51.3                     | 35                      | 89         | 4         | 185          | 10.7         |
| CHINOOK    | 90.9                        | 52.4                     | 35                      | 88         | 4         | 185          | 10.7         |
| HECTOR     | 90.7                        | 52.9                     | 36                      | 92         | 2         | 184          | 10.5         |
| MOREX      | 69.1                        | 51.2                     | 40                      | 85         | 4         | 182          | 10.9         |

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

Table 22 **Irrigated Intrastate Barley** variety trial grown north of **Conrad**, 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety       | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | Head<br>date | %<br>Protein | <u>1/</u> |
|---------------|----------------|--------------------------|-------------------------|------------|-----------|--------------|--------------|-----------|
| WPB SL93516   | 140.9          | 54.8                     | 29                      | 98         | 1         | 193          | --           | 1         |
| Baronesse     | 140.5          | 56.0                     | 31                      | 96         | 1         | 190          | --           | 1         |
| WPB DA592-47  | 140.3          | 50.4                     | 26                      | 92         | 2         | 190          | --           |           |
| MT940106      | 135.3          | 55.0                     | 30                      | 96         | 1         | 188          | --           |           |
| BA 2B91-4947  | 134.6          | 53.6                     | 36                      | 96         | 2         | 192          | --           |           |
| Galena        | 134.4          | 54.3                     | 31                      | 98         | 1         | 193          | --           |           |
| Gallatin      | 129.6          | 54.0                     | 35                      | 94         | 2         | 188          | --           |           |
| H5870120      | 128.4          | 51.5                     | 30                      | 95         | 2         | 183          | --           | 3         |
| Alexis        | 127.3          | 54.9                     | 30                      | 97         | 2         | 192          | --           |           |
| MT920201      | 126.8          | 55.0                     | 34                      | 94         | 2         | 190          | --           |           |
| MT940048      | 125.9          | 56.5                     | 32                      | 92         | 2         | 190          | --           |           |
| MT940099      | 125.4          | 56.9                     | 33                      | 94         | 2         | 190          | --           |           |
| Logan         | 123.0          | 55.5                     | 32                      | 97         | 1         | 184          | --           | 1         |
| MT886610      | 121.7          | 55.5                     | 33                      | 95         | 2         | 188          | --           | 1         |
| MT920041      | 121.5          | 54.5                     | 34                      | 94         | 1         | 190          | --           | 1         |
| MT910150      | 119.3          | 55.3                     | 32                      | 94         | 2         | 188          | --           |           |
| MT920161      | 119.0          | 56.1                     | 32                      | 98         | 1         | 192          | --           | 1         |
| Harrington    | 119.0          | 55.4                     | 34                      | 94         | 2         | 190          | --           | 2         |
| MT940214      | 118.7          | 55.5                     | 31                      | 93         | 2         | 187          | --           |           |
| MT940218      | 118.7          | 55.4                     | 29                      | 96         | 2         | 186          | --           | 1         |
| Stark         | 118.6          | 56.7                     | 36                      | 98         | 1         | 185          | --           | 1         |
| MT930169      | 118.3          | 54.0                     | 34                      | 93         | 2         | 188          | --           | 4         |
| Moravian 14   | 118.2          | 56.5                     | 27                      | 99         | 4         | 185          | --           |           |
| MT940071      | 118.0          | 56.2                     | 29                      | 97         | 1         | 184          | --           |           |
| H3860224      | 118.0          | 55.5                     | 33                      | 96         | 1         | 190          | --           |           |
| H1851195      | 117.6          | 54.6                     | 34                      | 97         | 1         | 190          | --           | 3         |
| Busch Ag 1202 | 117.2          | 54.6                     | 34                      | 97         | 1         | 190          | --           |           |
| IdaGold       | 116.6          | 54.5                     | 25                      | 91         | 3         | 194          | --           |           |
| MT940013      | 116.2          | 54.5                     | 33                      | 93         | 2         | 187          | --           | 2         |
| MT940053      | 116.1          | 56.7                     | 33                      | 96         | 2         | 191          | --           |           |
| MT940067      | 115.7          | 56.0                     | 36                      | 98         | 1         | 187          | --           |           |
| MT920059      | 115.5          | 56.2                     | 34                      | 98         | 1         | 188          | --           |           |
| MT910189      | 115.0          | 55.1                     | 30                      | 94         | 3         | 185          | --           | 2         |

(Continued on next page)

(Intrastate Irrigated Barley, *continued*)

|              |   |       |      |    |    |   |     |    |   |
|--------------|---|-------|------|----|----|---|-----|----|---|
| MT930059     |   | 114.9 | 55.3 | 34 | 97 | 1 | 184 | -- |   |
| 2B91-4541    |   | 114.7 | 54.0 | 35 | 97 | 1 | 188 | -- | 2 |
| BA 2B89-4311 |   | 114.0 | 53.9 | 32 | 94 | 2 | 191 | -- |   |
| MT920053     |   | 113.6 | 55.0 | 34 | 96 | 2 | 190 | -- | 3 |
| Steptoe      | * | 113.6 | 50.9 | 27 | 92 | 3 | 183 | -- | 5 |
| MT940177     |   | 113.5 | 55.5 | 32 | 95 | 2 | 190 | -- |   |
| MT930204     |   | 113.0 | 55.5 | 34 | 95 | 2 | 186 | -- | 2 |
| MT940201     |   | 112.8 | 56.2 | 31 | 94 | 2 | 188 | -- | 2 |
| MT890018     |   | 112.5 | 55.8 | 30 | 96 | 2 | 187 | -- | 3 |
| MT940087     |   | 112.3 | 55.6 | 33 | 97 | 1 | 192 | -- | 1 |
| MT930203     |   | 112.2 | 54.5 | 33 | 97 | 1 | 187 | -- | 1 |
| MT890008     |   | 110.9 | 54.2 | 32 | 96 | 1 | 191 | -- | 1 |
| BSWS 2       |   | 110.6 | 56.0 | 32 | 98 | 1 | 190 | -- | 2 |
| MT940206     |   | 109.4 | 56.4 | 29 | 94 | 2 | 187 | -- | 1 |
| Lewis        |   | 109.1 | 55.7 | 33 | 96 | 2 | 190 | -- | 2 |
| MT920073     |   | 109.0 | 55.2 | 32 | 96 | 2 | 188 | -- | 3 |
| MT930132     |   | 108.8 | 55.6 | 33 | 95 | 2 | 185 | -- |   |
| Stander      |   | 108.6 | 53.9 | 35 | 97 | 1 | 186 | -- |   |
| MT940196     |   | 108.4 | 55.4 | 33 | 98 | 1 | 190 | -- | 1 |
| BSWS 1       |   | 107.6 | 54.9 | 26 | 95 | 3 | 191 | -- |   |
| MT940169     |   | 106.7 | 54.8 | 29 | 96 | 1 | 191 | -- | 4 |
| MT940163     |   | 106.6 | 55.6 | 33 | 95 | 2 | 186 | -- | 5 |
| MT940203     |   | 105.6 | 55.6 | 33 | 93 | 2 | 187 | -- | 3 |
| Foster       | * | 104.2 | 54.3 | 34 | 97 | 1 | 184 | -- | 1 |
| MT910033     |   | 103.7 | 56.0 | 32 | 97 | 1 | 186 | -- | 2 |
| MT940121     |   | 102.9 | 55.9 | 32 | 99 | 1 | 191 | -- | 3 |
| MT940079     |   | 99.5  | 55.7 | 30 | 96 | 1 | 188 | -- |   |
| MT940082     |   | 97.0  | 56.2 | 29 | 95 | 2 | 191 | -- |   |
| Chinook      |   | 95.4  | 54.0 | 32 | 92 | 3 | 191 | -- | 2 |
| MT940049     |   | 88.4  | 55.7 | 29 | 93 | 3 | 192 | -- |   |
| Morex        | * | 68.8  | 53.8 | 34 | 88 | 4 | 185 | -- | 3 |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: May 1, 1996. Date harvested: Aug. 26, 1996.  
 Irrigation dates: June 20 --- July 2 --- July 8 --- July 18  
 1/ = Lodging severity. (1 = low ----- 5 = high)  
 \* = Six row variety.  
 Yield exp. mean = 115.3, Error degrees of freedom = 126.00  
 F test for var. = 3.45, C.V. 2 = 5.61, LSD (0.05) = 18.12

Table 23      **Irrigated Intrastate Barley** variety trial grown north of Conrad, 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

| Variety       | Yield<br>bu/ac | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | Head<br>date | %<br>Protein | <u>1/</u> |
|---------------|----------------|--------------------------|-------------------------|------------|-----------|--------------|--------------|-----------|
| Baronesse     | 140.5          | 56.0                     | 31                      | 96         | 1         | 190          | --           | 1         |
| Galena        | 134.4          | 54.3                     | 31                      | 98         | 1         | 193          | --           |           |
| Gallatin      | 129.6          | 54.0                     | 35                      | 94         | 2         | 188          | --           |           |
| Alexis        | 127.3          | 54.9                     | 30                      | 97         | 2         | 192          | --           |           |
| Logan         | 123.0          | 55.5                     | 32                      | 97         | 1         | 184          | --           | 1         |
| Harrington    | 119.0          | 55.4                     | 34                      | 94         | 2         | 190          | --           | 2         |
| Stark         | 118.6          | 56.7                     | 36                      | 98         | 1         | 185          | --           | 1         |
| Moravian 14   | 118.2          | 56.5                     | 27                      | 99         | 4         | 185          | --           |           |
| Busch Ag 1202 | 117.2          | 54.6                     | 34                      | 97         | 1         | 190          | --           |           |
| IdaGold       | 116.6          | 54.5                     | 25                      | 91         | 3         | 194          | --           |           |
| Steptoe *     | 113.6          | 50.9                     | 27                      | 92         | 3         | 183          | --           | 5         |
| Lewis         | 109.1          | 55.7                     | 33                      | 96         | 2         | 190          | --           | 2         |
| Stander       | 108.6          | 53.9                     | 35                      | 97         | 1         | 186          | --           |           |
| Foster *      | 104.2          | 54.3                     | 34                      | 97         | 1         | 184          | --           | 1         |
| Chinook       | 95.4           | 54.0                     | 32                      | 92         | 3         | 191          | --           | 2         |
| Morex *       | 68.8           | 53.8                     | 34                      | 88         | 4         | 185          | --           | 3         |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 Fertilizer: 100# 11-52-0 with the seed, + 45# N topdressed.  
 Previous crop: Fallow.  
 Date seeded: May 1, 1996.      Date harvested: Aug. 26, 1996.  
 Irrigation dates: June 20 --- July 2 --- July 8 --- July 18  
1/ = Lodging severity. (1 = low ----- 5 = high)  
 \* = Six row variety.  
 Yield exp. mean = 115.3,      Error degrees of freedom = 126.00  
 F test for var. = 3.45,      C.V. 2 = 5.61,      LSD (0.05) = 18.12

Table 24 **Five-year summary on Irrigated Barley varieties grown north of Conrad, MT. 1991 - 1993 - 1994 1995 - 1996. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.**

| Variety    | 5 - year comparable average |                          |                         |            |           |              |                    |
|------------|-----------------------------|--------------------------|-------------------------|------------|-----------|--------------|--------------------|
|            | Yield<br>bu/ac              | Test<br>weight<br>lbs/bu | Plant<br>hgt.<br>inches | %<br>Plump | %<br>thin | Head<br>date | %<br>Protein<br>1/ |
| BARONESSE  | 111.6                       | 53.7                     | 31                      | 96         | 1         | 185          | 8.2                |
| GALENA     | 106.2                       | 51.9                     | 31                      | 96         | 1         | 189          | 8.7                |
| GALLATIN   | 97.9                        | 53.8                     | 35                      | 94         | 2         | 182          | 8.6                |
| STEPTOE *  | 96.7                        | 47.6                     | 31                      | 91         | 3         | 179          | 9.3                |
| MT 886610  | 96.1                        | 53.4                     | 35                      | 94         | 2         | 183          | 8.5                |
| STARK      | 95.0                        | 54.1                     | 36                      | 96         | 2         | 180          | 9.5                |
| BA 1202    | 91.6                        | 52.6                     | 34                      | 96         | 1         | 185          | 9.2                |
| LEWIS      | 90.6                        | 54.5                     | 35                      | 95         | 2         | 184          | 9.3                |
| HARRINGTON | 85.3                        | 52.3                     | 35                      | 92         | 2         | 185          | 8.3                |
| IDAGOLD    | 84.3                        | 50.9                     | 27                      | 84         | 5         | 189          | 8.2                |
| CHINOOK    | 79.0                        | 52.2                     | 34                      | 91         | 3         | 183          | 9.2                |
| MOREX *    | 64.6                        | 50.9                     | 38                      | 87         | 4         | 181          | 9.4                |

Cooperator: Western Triangle Ag. Research Center.  
 Location: Ten miles north of Conrad, MT. (Pondera County)  
 \* = 6-Row variety.  
 1/ = Proteins based on 4 year averages. (1991-1993-1994-1995)

Table 25                      **Dryland Barley** variety trial grown northeast of Choteau, 1996. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

| Variety         | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | %<br>Protein |
|-----------------|----------------|---------------------|-------------------------|------------|-----------|--------------|
| Steptoe (6-row) | 81.5           | 42.8                | 26                      | 54         | 16        | 10.2         |
| Stark           | 81.4           | 53.5                | 29                      | 92         | 1         | 12.1         |
| Baronesse       | 81.3           | 50.5                | 27                      | 63         | 9         | 13.1         |
| Chinook         | 79.6           | 50.9                | 27                      | 46         | 18        | 13.1         |
| Hector          | 79.1           | 51.5                | 32                      | 61         | 14        | 12.7         |
| Targhee         | 78.6           | 49.8                | 27                      | 74         | 7         | 12.7         |
| MT886610        | 76.9           | 50.9                | 28                      | 56         | 13        | 13.4         |
| Lewis           | 76.1           | 52.1                | 28                      | 61         | 11        | 13.5         |
| Bowman          | 75.4           | 52.4                | 28                      | 95         | 1         | 12.4         |
| Gallatin        | 75.3           | 50.9                | 29                      | 71         | 8         | 13.2         |
| Logan           | 75.1           | 51.1                | 28                      | 86         | 4         | 12.8         |
| Pirolina        | 74.5           | 52.8                | 28                      | 51         | 14        | 13.7         |
| H3860224        | 73.1           | 49.1                | 28                      | 73         | 8         | 13.8         |
| Harrington      | 72.9           | 50.4                | 29                      | 69         | 8         | 13.4         |
| H1851195        | 72.3           | 51.2                | 30                      | 81         | 4         | 13.1         |
| Stander         | 58.0           | 47.1                | 31                      | 77         | 8         | 12.2         |

Cooperator: Roy Inbody.  
 Location: Twelve miles northeast of Choteau. (Teton Co.)  
 Fertilizer: 100# 11-52-0 with the seed, + 60# actual 34-0-0.  
 Previous crop: Fallow.  
 Date seeded: April 29, 1996.  
 Date harvested: August 13, 1996.  
 Rainfall: From May 22 to harvest was 2.9 inches.  
 Yield experimental mean: 75.70  
 Error degrees of freedom: 30.00  
 F test for var.: 3.06  
 C.V. 2: 4.27  
 LSD (0.05): 9.33

Table 26

**Five-year summary for Dryland Barley varieties grown near Choteau, MT. 1991 - 1993 - 1994 - 1995 - 1996, Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

| Variety    | 5 - year comparable average |                     |                         |            |           |              |
|------------|-----------------------------|---------------------|-------------------------|------------|-----------|--------------|
|            | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Plump | %<br>thin | %<br>Protein |
| BARONESSE  | 90.8                        | 51.4                | 31                      | 78         | 6         | 12.0         |
| STEPTOE    | 87.8                        | 44.9                | 32                      | 79         | 7         | 10.5         |
| STARK      | 87.4                        | 52.8                | 33                      | 93         | 2         | 11.8         |
| CHINOOK    | 83.3                        | 51.4                | 32                      | 72         | 9         | 11.9         |
| LEWIS      | 83.1                        | 52.6                | 33                      | 80         | 6         | 12.0         |
| HECTOR     | 82.7                        | 51.8                | 35                      | 80         | 7         | 12.1         |
| GALLATIN   | 82.3                        | 51.8                | 33                      | 80         | 6         | 12.0         |
| MT 886610  | 82.3                        | 51.4                | 39                      | 73         | 8         | 12.1         |
| BOWMAN     | 79.2                        | 52.1                | 32                      | 94         | 2         | 12.0         |
| PIROLINE   | 78.0                        | 51.9                | 33                      | 68         | 10        | 12.5         |
| HARRINGTON | 75.6                        | 49.9                | 33                      | 78         | 7         | 11.9         |

Cooperator: Roy Inbody in 1994 -1995 - 1996, and Rick Corey in 1991 - 1993.

Location: Northeast of Choteau. (Teton County)

Table 27 **Dryland Barley** variety trial grown east of Oilmont, 1996. Mont. Agr. Expt. Sta., Western Triangle Agr. Research Center, Conrad, MT.

| Variety         | Yield<br>bu/ac | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Plump | %<br>Thin | %<br>Protein |
|-----------------|----------------|---------------------|-------------------------|------------|-----------|--------------|
| Bowman          | 37.2           | 42.9                | 30                      | 14         | 56        | 15.9         |
| Baronesse       | 34.5           | 42.3                | 26                      | 1          | 92        | 17.6         |
| Stark           | 34.2           | 41.6                | 30                      | 4          | 82        | 14.8         |
| Steptoe (6-row) | 33.6           | 32.5                | 26                      | 3          | 81        | 12.5         |
| Logan           | 33.5           | 40.8                | 27                      | 3          | 80        | 16.2         |
| H1851195        | 31.7           | 41.4                | 29                      | 1          | 89        | 16.6         |
| Hector          | 31.3           | 41.0                | 29                      | 3          | 84        | 15.5         |
| Piroline        | 30.8           | 39.9                | 31                      | 3          | 97        | 15.0         |
| Chinook         | 29.7           | 41.5                | 29                      | 1          | 93        | 17.2         |
| H3860224        | 28.1           | 45.4                | 28                      | 5          | 76        | 18.6         |
| Targhee         | 27.4           | 42.3                | 28                      | 1          | 92        | 16.9         |
| Gallatin        | 27.4           | 40.5                | 29                      | 1          | 95        | 17.0         |
| Lewis           | 27.0           | 41.4                | 30                      | 1          | 94        | 17.7         |
| Harrington      | 26.3           | 41.2                | 28                      | 1          | 92        | 17.1         |
| MT886610        | 24.8           | 41.1                | 28                      | 1          | 91        | 17.5         |
| Stander         | 21.8           | 44.2                | 28                      | 45         | 29        | 15.3         |

Cooperator: Terry Alme.

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

Fertilizer: 100# 11-52-0 with the seed.

Previous crop: Fallow.

Date seeded: April 22, 1996.

Date harvested: August 12, 1996.

Rainfall: From May 21 to harvest was 3.75 inches.

Yield experimental mean: 29.95

Error degrees of freedom: 30

F test for var.: 10.24

C.V. 2: 4.30

LSD (0.05): 3.72



Table 28

**Five-year summary on Dryland Barley varieties grown near Oilmont, MT. 1992 - 1993 - 1994 - 1995 - 1996. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.**

| Variety    | 5 - year comparable average |                     |                         |            |           |              |
|------------|-----------------------------|---------------------|-------------------------|------------|-----------|--------------|
|            | Yield<br>bu/ac              | Test wt.<br>lbs/bu. | Plant<br>hgt.<br>inches | %<br>Plump | %<br>thin | %<br>Protein |
| BARONESSE  | 66.6                        | 47.9                | 24                      | 58         | 30        | 12.9         |
| CHINOOK    | 64.1                        | 47.7                | 27                      | 57         | 32        | 13.2         |
| HECTOR     | 63.4                        | 48.0                | 30                      | 57         | 30        | 12.6         |
| BOWMAN     | 63.0                        | 47.3                | 29                      | 73         | 15        | 12.1         |
| LEWIS      | 60.3                        | 47.9                | 29                      | 58         | 32        | 12.4         |
| STEPTOE    | 58.9                        | 40.9                | 26                      | 58         | 30        | 11.1         |
| STARK      | 59.5                        | 47.3                | 29                      | 61         | 27        | 12.3         |
| PIROLINE   | 59.3                        | 47.9                | 30                      | 55         | 38        | 12.2         |
| MT 886610  | 58.9                        | 47.6                | 27                      | 53         | 33        | 13.9         |
| GALLATIN   | 58.0                        | 47.5                | 29                      | 57         | 33        | 12.4         |
| HARRINGTON | 58.0                        | 47.7                | 27                      | 60         | 28        | 13.1         |

Cooperator: Terry Alme.

Location: Eight miles east of Oilmont, MT.

(Toole County)

TABLE 1S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located North of Cut Bank. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO. | TREATMENT   | GRAIN          | GRAIN        | PROTEIN        | TEST            |
|-----|---|----------------|--------------|----------------|-----------------|
|     | N-P <sub>2</sub> O <sub>5</sub> -K-Cl<br>lbs/acre | YIELD<br>bu/ac | PROTEIN<br>% | YIELD<br>lb/ac | WEIGHT<br>lb/bu |
| 1   | 0-0-30-27   | 43.7           | 11.4         | 298.2          | 60.5            |
| 4   | 150-0-30-27                                       | 44.5           | 14.4         | 383.5          | 60.4            |
| 9   | 0-50-30-27  | 44.0           | 11.0         | 290.1          | 60.4            |
| 5   | 0-25-30-27  | 43.1           | 11.3         | 291.0          | 60.2            |
| 2   | 50-0-30-27  | 48.0           | 12.9         | 363.6          | 59.8            |
| 6   | 50-25-30-27                                       | 47.7           | 12.7         | 363.9          | 59.8            |
| 10  | 50-50-30-27                                       | 44.9           | 12.8         | 343.3          | 59.5            |
| 3   | 100-0-30-27                                       | 46.5           | 13.8         | 385.0          | 59.3            |
| 7   | 100-25-30-27                                      | 43.7           | 13.7         | 358.8          | 58.8            |
| 11  | 100-50-30-27                                      | 47.3           | 13.9         | 395.2          | 58.7            |
| 12  | 150-50-30-27                                      | 46.6           | 14.3         | 398.0          | 58.6            |
| 8   | 150-25-30-27                                      | 46.2           | 14.2         | 393.5          | 58.3            |

**STATISTICAL TABLE**

|                            |       |           |       |      |
|----------------------------|-------|-----------|-------|------|
| EXPERIMENTAL MEANS         | 45.4  | 13.0      | 355.3 | 59.5 |
| ERROR MEAN SQUARE          | 5.885 | .9139E-01 | 389.9 | 1.20 |
| P-VALUE                    | .096  | .000      | .000  | .060 |
| STANDARD ERROR             | 2.43  | .302      | 19.8  | 1.10 |
| STANDARD ERROR OF THE MEAN | 1.21  | .151      | 9.87  | .548 |
| C.V. 1: (S/MEAN)*100       | 5.34  | 2.32      | 5.56  | 1.84 |
| LSD (0.05)                 | NS    | 0.4       | 28.4  | 1.6  |

**NITROGEN SUMMARY**

|            |      |      |       |      |
|------------|------|------|-------|------|
| 0          | 43.6 | 11.2 | 293.1 | 60.3 |
| 50         | 46.5 | 12.8 | 356.9 | 59.7 |
| 100        | 45.8 | 13.8 | 379.7 | 58.9 |
| 150        | 45.8 | 14.3 | 391.7 | 59.1 |
| LSD (0.05) | 2.0  | 0.3  | 16.4  | 0.9  |

**PHOSPHORUS SUMMARY**

|                     |      |      |       |      |
|---------------------|------|------|-------|------|
| 0                   | 45.4 | 13.1 | 357.6 | 60.0 |
| 25                  | 45.2 | 13.0 | 351.8 | 59.3 |
| 50                  | 45.7 | 13.0 | 356.6 | 59.3 |
| LSD (0.05)          | NS   | NS   | NS    | NS   |
| INTERACTION P-VALUE | 0.18 | 0.69 | 0.13  | 0.28 |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. = 6.85"

Depth of Moist Soil = > 3'

Seeding Date: May 1, 1996

Harvest Date: Sept. 12, 1996

Soil Tests: pH = 6.9, O.M. = 2.0 %, P = 19.9 ppm, K = 340 ppm,  
Zn = 0.8 ppm, Cu = 2.5 ppm, Fe = 25.1 ppm, Mn = 30.3 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 9                  | 14.9               | 29.0               | 160.4              |
| 1-2   | 13                 | 15.6               | 8.1                | 36.4               |
| 2-3   | 13                 | 15.8               | 4.3                | 42.1               |
| 3-4   | 16                 | 18.0               | 4.3                | 149.2              |

**Comments:** Results were probably affected by a hail storm that occurred in June.

TABLE 2S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located East of Ethridge. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO.                        | TREATMENT   | GRAIN          | GRAIN        | PROTEIN        | TEST            |
|----------------------------|---|----------------|--------------|----------------|-----------------|
|                            | N-P <sub>2</sub> O <sub>5</sub> -K-Cl<br>lbs/acre | YIELD<br>bu/ac | PROTEIN<br>% | YIELD<br>lb/ac | WEIGHT<br>lb/bu |
| 2                          | 30-0-20-18  | 52.0           | 13.0         | 406.3          | 62.4            |
| 9                          | 0-40-20-18  | 53.1           | 12.8         | 406.4          | 62.0            |
| 6                          | 30-20-20-18                                       | 53.0           | 13.5         | 428.4          | 62.0            |
| 11                         | 60-40-20-18                                       | 59.3           | 13.6         | 484.5          | 61.6            |
| 5                          | 0-20-20-18  | 48.5           | 12.6         | 366.8          | 61.6            |
| 7                          | 60-20-20-18                                       | 50.3           | 13.5         | 406.6          | 61.6            |
| 8                          | 90-20-20-18                                       | 53.1           | 13.7         | 436.4          | 61.4            |
| 1                          | 0-0-20-18   | 46.6           | 13.1         | 367.1          | 61.4            |
| 12                         | 90-40-20-18                                       | 49.7           | 13.9         | 415.5          | 61.0            |
| 10                         | 30-40-20-18                                       | 50.9           | 13.6         | 414.2          | 61.0            |
| 3                          | 60-0-20-18  | 55.1           | 13.9         | 458.6          | 60.8            |
| 4                          | 90-0-20-18  | 50.7           | 13.6         | 413.7          | 60.8            |
| <b>STATISTICAL SUMMARY</b> |   |                |              |                |                 |
| EXPERIMENTAL MEANS         |   | 51.9           | 13.4         | 417.0          | 61.5            |
| ERROR MEAN SQUARE          |   | 20.0           | .072         | 1697           | .324            |
| P-VALUE FOR VAR.           |   | .159           | .000         | .0836          | .040            |
| STANDARD ERROR             |   | 4.47           | .268         | 41.20          | .569            |
| STANDARD ERROR OF THE MEAN |   | 2.58           | .154         | 23.79          | .329            |
| C.V. 1: (S/MEAN)*100       |   | 8.62           | 2.00         | 9.879          | .926            |
| LSD (0.05)                 |   | NS             | .453         | 69.8           | 1.0             |
| <b>NITROGEN SUMMARY</b>    |   |                |              |                |                 |
| 0                          |   | 49.4           | 12.8         | 380.1          | 61.7            |
| 30                         |   | 51.9           | 13.4         | 416.3          | 61.8            |
| 60                         |   | 54.9           | 13.7         | 449.9          | 61.3            |
| 90                         |   | 51.2           | 13.7         | 421.9          | 61.1            |
| LSD (0.05)                 |   | 4.4            | 0.3          | 40.3           | 0.6             |
| <b>PHOSPHORUS SUMMARY</b>  |   |                |              |                |                 |
| 0                          |   | 51.1           | 13.4         | 411.4          | 61.4            |
| 20                         |   | 51.2           | 13.3         | 409.5          | 61.6            |
| 40                         |   | 53.2           | 13.5         | 430.2          | 61.4            |
| LSD (0.05)                 |   | NS             | NS           | NS             | NS              |
| INTERACTION P-VALUE        |   | 0.23           | 0.04         | 0.40           | 0.05            |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. = 6.5" Depth of Moist Soil = > 3'

Seeding Date: April 23, 1996 Harvest Date: August 27, 1996

Soil Tests: pH = 7.9, O.M. = 2.1 %, P = 11.5 ppm, K = 492 ppm,  
Zn = 0.5 ppm, Cu = 1.6 ppm, Fe = 8.9 ppm, Mn = 13.0 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 14                 | 25.8               | 34.3               | 81                 |
| 1-2   | 13                 | 9.7                | 17.7               | 87                 |
| 2-3   | 14                 | 9.2                | 11.2               | 6620               |
| 3-4   | 28                 | 9.6                | 10.0               | 9872               |

**Comments:** Strange results this year. Protein did not exceed 13.9%, and no response to P.

TABLE 3S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located North of Lothair. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO.                        | TREATMENT   | GRAIN          | GRAIN        | PROTEIN        | TEST            |
|----------------------------|---|----------------|--------------|----------------|-----------------|
|                            | N-P <sub>2</sub> O <sub>5</sub> -K-Cl<br>lbs/acre | YIELD<br>bu/ac | PROTEIN<br>% | YIELD<br>lb/ac | WEIGHT<br>lb/bu |
| 9                          | 0-40-20-18  | 31.1           | 10.5         | 195.3          | 62.2            |
| 5                          | 0-20-20-18  | 31.8           | 11.1         | 212.9          | 61.8            |
| 1                          | 0-0-20-18   | 31.3           | 11.7         | 221.7          | 61.7            |
| 6                          | 30-20-20-18                                       | 36.1           | 11.7         | 254.1          | 61.6            |
| 7                          | 60-20-20-18                                       | 35.0           | 12.3         | 258.1          | 61.4            |
| 11                         | 60-40-20-18                                       | 34.1           | 12.3         | 251.2          | 61.3            |
| 2                          | 30-0-20-18  | 32.8           | 12.1         | 239.1          | 61.3            |
| 10                         | 30-40-20-18                                       | 33.9           | 11.9         | 241.3          | 61.2            |
| 8                          | 90-20-20-18                                       | 33.7           | 12.4         | 250.7          | 61.1            |
| 4                          | 90-0-20-18  | 32.1           | 13.0         | 250.7          | 61.0            |
| 12                         | 90-40-20-18                                       | 34.5           | 12.7         | 263.3          | 61.0            |
| 3                          | 60-0-20-18  | 30.1           | 12.9         | 232.3          | 60.9            |
| <b>STATISTICAL TABLE</b>   |   |                |              |                |                 |
| EXPERIMENTAL MEANS         |   | 33.0           | 12.1         | 239.2          | 61.4            |
| ERROR MEAN SQUARE          |   | 5.62           | .268         | 343.6          | .173            |
| P-VALUE                    |   | .030           | .000         | .0000          | .004            |
| STANDARD ERROR             |   | 2.37           | .518         | 18.54          | .415            |
| STANDARD ERROR OF THE MEAN |   | 1.19           | .259         | 9.27           | .208            |
| C.V. 1: (S/MEAN)*100       |   | 7.18           | 4.30         | 7.75           | .677            |
| LSD (0.05)                 |   | 3.4            | 0.7          | 26.7           | 0.6             |
| <b>NITROGEN SUMMARY</b>    |   |                |              |                |                 |
| 0                          |   | 31.4           | 11.1         | 210.0          | 61.9            |
| 30                         |   | 34.2           | 11.9         | 244.9          | 61.4            |
| 60                         |   | 33.0           | 12.5         | 247.2          | 61.2            |
| 90                         |   | 33.4           | 12.7         | 254.9          | 61.0            |
| LSD (0.05)                 |   | 2.0            | 0.4          | 15.4           | 0.3             |
| <b>PHOSPHORUS SUMMARY</b>  |   |                |              |                |                 |
| 0                          |   | 31.6           | 12.4         | 236.0          | 61.2            |
| 20                         |   | 34.3           | 11.9         | 244.0          | 61.5            |
| 40                         |   | 33.4           | 11.8         | 237.8          | 61.4            |
| LSD (0.05)                 |   | 1.7            | 0.4          | NS             | NS              |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. = 3.8" Depth of Moist Soil = > 3'

Seeding Date: April 30, 1996 Harvest Date: August 26, 1996

Soil Tests: pH = 7.6, O.M. = 1.5 %, P = 8.8 ppm, K = 528 ppm,

Zn = 0.4 ppm, Cu = 2.3 ppm, Fe = 17.5 ppm, Mn = 19.2 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 10                 | 22.5               | 26.2               | 53.8               |
| 1-2   | 14                 | 17.5               | 19.7               | 79.1               |
| 2-3   | 12                 | 15.2               | 11.1               | 122.0              |
| 3-4   | 24                 | 15.4               | 11.6               | 163.0              |

**Comments:** Good N and P response, however, protein did not exceed 13%. This was probably due to drought conditions in late June and the entire month of July.

TABLE. 4S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located North of Joplin. Western Triangle Ag. Research Center, Conrad, MT, 1996.

| NO. | TREATMENT                             | GRAIN | GRAIN   | PROTEIN | TEST   |
|-----|---------------------------------------|-------|---------|---------|--------|
|     | N-P <sub>2</sub> O <sub>5</sub> -K-Cl | YIELD | PROTEIN | YIELD   | WEIGHT |
|     | lbs/acre                              | bu/ac | %       | lb/ac   | lb/bu  |
| 9   | 0-50-30-27                            | 43.3  | 10.0    | 262.2   | 62.5   |
| 1   | 0-0-30-27                             | 40.7  | 10.1    | 245.9   | 62.4   |
| 5   | 0-25-30-27                            | 46.6  | 10.4    | 294.0   | 62.4   |
| 2   | 50-0-30-27                            | 48.6  | 11.7    | 340.3   | 62.2   |
| 6   | 50-25-30-27                           | 45.9  | 11.8    | 324.6   | 61.8   |
| 10  | 50-50-30-27                           | 45.4  | 11.7    | 319.2   | 61.8   |
| 11  | 100-50-30-27                          | 50.0  | 12.1    | 363.7   | 61.6   |
| 7   | 100-25-30-27                          | 46.4  | 12.3    | 342.7   | 61.5   |
| 3   | 100-0-30-27                           | 48.5  | 12.7    | 367.7   | 61.1   |
| 8   | 150-25-30-27                          | 47.1  | 12.8    | 363.0   | 61.0   |
| 4   | 150-0-30-27                           | 49.2  | 13.1    | 385.5   | 60.8   |
| 12  | 150-50-30-27                          | 48.5  | 13.2    | 382.8   | 60.8   |

**STATISTICAL TABLE**

|                            |      |      |       |      |
|----------------------------|------|------|-------|------|
| EXPERIMENTAL MEANS         | 46.7 | 11.8 | 332.6 | 61.7 |
| ERROR MEAN SQUARE          | 32.4 | .280 | 1888  | .188 |
| P-VALUE                    | .590 | .000 | .001  | .000 |
| STANDARD ERROR             | 5.69 | .529 | 43.45 | .433 |
| STANDARD ERROR OF THE MEAN | 2.84 | .264 | 21.73 | .216 |
| C.V. 1: (S/MEAN)*100       | 12.2 | 4.48 | 13.06 | .703 |
| LSD (0.05)                 | NS   | 0.8  | 62.5  | 0.6  |

**NITROGEN SUMMARY**

|            |      |      |       |      |
|------------|------|------|-------|------|
| 0          | 43.5 | 10.1 | 267.3 | 62.4 |
| 50         | 46.6 | 11.7 | 328.0 | 61.9 |
| 100        | 48.3 | 12.4 | 358.0 | 61.4 |
| 150        | 48.2 | 13.0 | 377.1 | 60.9 |
| LSD (0.05) | 4.7  | 0.4  | 36.1  | 0.4  |

**PHOSPHORUS SUMMARY**

|                     |      |      |       |      |
|---------------------|------|------|-------|------|
| 0                   | 46.7 | 11.9 | 334.8 | 61.6 |
| 25                  | 46.5 | 11.8 | 331.1 | 61.7 |
| 50                  | 46.8 | 11.7 | 332.0 | 61.7 |
| LSD (0.05)          | NS   | NS   | NS    | NS   |
| INTERACTION P-VALUE | 0.69 | 0.63 | 0.63  | 0.54 |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. = 5.4" Depth of Moist Soil = > 3'

Seeding Date: April 30, 1996 Harvest Date: August 26, 1996

Soil Tests: pH = 8.0, O.M. = 1.5 %, P = 15.5 ppm, K = 306 ppm,

Zn = 0.5 ppm, Cu = 1.5 ppm, Fe = 7.3 ppm, Mn = 14.0 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 20                 | 9.7                | 29.0               | 227                |
| 1-2   | 14                 | 12.6               | 13.6               | 104                |
| 2-3   | 17                 | 18.2               | 7.9                | 154                |
| 3-4   | 16                 | 24.4               | 4.4                | 7296               |

**Comments:** Good yield reponse to N, however, however protein did not exceed 13.2%. Drought conditions in July probably caused the lack of protein response.

TABLE 5S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located North of Inverness. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO. | TREATMENT                             | GRAIN | GRAIN   | PROTEIN | TEST   |
|-----|---------------------------------------|-------|---------|---------|--------|
|     | N-P <sub>2</sub> O <sub>5</sub> -K-Cl | YIELD | PROTEIN | YIELD   | WEIGHT |
| 1   | 0-0-30-27                             | 29.5  | 9.8     | 174.3   | 62.4   |
| 9   | 0-50-30-27                            | 27.7  | 11.0    | 183.4   | 62.3   |
| 5   | 0-25-30-27                            | 30.6  | 10.9    | 199.2   | 62.2   |
| 10  | 50-50-30-27                           | 41.2  | 11.4    | 281.6   | 62.1   |
| 6   | 50-25-30-27                           | 39.7  | 12.0    | 283.9   | 61.7   |
| 2   | 50-0-30-27                            | 38.3  | 12.8    | 294.3   | 61.6   |
| 7   | 100-25-30-27                          | 45.1  | 12.8    | 346.9   | 61.6   |
| 11  | 100-50-30-27                          | 42.7  | 12.3    | 313.8   | 61.4   |
| 8   | 150-25-30-27                          | 40.9  | 12.7    | 317.7   | 61.2   |
| 4   | 150-0-30-27                           | 44.4  | 13.3    | 355.6   | 61.2   |
| 3   | 100-0-30-27                           | 40.6  | 11.6    | 284.7   | 61.2   |
| 12  | 150-50-30-27                          | 44.5  | 13.5    | 360.8   | 60.8   |

**STATISTICAL TABLE**

|                            |      |      |       |      |
|----------------------------|------|------|-------|------|
| EXPERIMENTAL MEANS         | 39.3 | 12.1 | 288.7 | 61.6 |
| ERROR MEAN SQUARE          | 15.8 | 1.25 | 1780  | .244 |
| P-VALUE                    | .000 | .005 | .000  | .003 |
| STANDARD ERROR             | 3.98 | 1.12 | 42.19 | .494 |
| STANDARD ERROR OF THE MEAN | 2.30 | .644 | 24.36 | .285 |
| C.V. 1: (S/MEAN)*100       | 10.3 | 9.30 | 14.91 | .801 |
| LSD (0.05)                 | 6.7  | 1.9  | 70.6  | 0.8  |

**NITROGEN SUMMARY**

|            |      |      |       |      |
|------------|------|------|-------|------|
| 0          | 29.9 | 10.6 | 185.6 | 62.2 |
| 50         | 40.0 | 12.1 | 286.6 | 61.7 |
| 100        | 43.3 | 12.2 | 315.2 | 61.3 |
| 150        | 43.3 | 13.2 | 344.7 | 61.1 |
| LSD (0.05) | 3.1  | 0.9  | 35.3  | 0.4  |

**PHOSPHORUS SUMMARY**

|                     |      |      |       |      |
|---------------------|------|------|-------|------|
| 0                   | 38.8 | 11.9 | 277.2 | 61.5 |
| 25                  | 39.3 | 12.1 | 284.9 | 61.6 |
| 50                  | 39.2 | 12.0 | 286.9 | 61.6 |
| LSD (0.05)          | NS   | NS   | NS    | NS   |
| INTERACTION P-VALUE | 0.29 | 0.19 | 0.33  | 0.52 |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. = 5.4" Depth of Moist Soil = > 3'

Seeding Date: April 30, 1996 Harvest Date: Sept. 11, 1996

Soil Tests: pH = 8.0, O.M. = 0.9 %, P = 11.5 ppm, K = 278 ppm, Zn = 0.3 ppm, Cu = 1.7 ppm, Fe = 9.6 ppm, Mn = 13.8 ppm

| Depth Cl | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|----------|--------------------|--------------------|--------------------|
| ft.      | -----lbs/acre----- |                    |                    |
| 0-1      | 15                 | 9.6                | 15.4               |
| 1-2      | 16                 | 12.2               | 11.5               |
| 2-3      | 17                 | 10.7               | 9.4                |
| 3-4      | 16                 | 12.4               | 8.0                |

**Comments:** Re-tillered after an early hail storm. Good response to N, however, highest protein level was 13.5%

TABLE. 6S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located East of Ledger. Western Triangle Ag. Research Center, Conrad, MT.1996.

| NO. | TREATMENT                             | GRAIN | GRAIN   | PROTEIN | TEST   |
|-----|---------------------------------------|-------|---------|---------|--------|
|     | N-P <sub>2</sub> O <sub>5</sub> -K-Cl | YIELD | PROTEIN | YIELD   | WEIGHT |
|     | lbs/acre                              | bu/ac | %       | lb/ac   | lb/bu  |
| 9   | 0-40-20-18                            | 10.5  | 11.2    | 70.4    | 63.0   |
| 2   | 30-0-20-18                            | 12.4  | 13.2    | 97.6    | 62.8   |
| 5   | 0-20-20-18                            | 11.6  | 11.8    | 83.7    | 62.3   |
| 12  | 90-40-20-18                           | 15.4  | 14.7    | 134.1   | 62.0   |
| 3   | 60-0-20-18                            | 12.1  | 14.6    | 104.7   | 62.0   |
| 1   | 0-0-20-18                             | 11.5  | 11.6    | 80.6    | 62.0   |
| 10  | 30-40-20-18                           | 13.0  | 13.5    | 105.4   | 62.0   |
| 11  | 60-40-20-18                           | 12.6  | 14.9    | 112.7   | 61.8   |
| 7   | 60-20-20-18                           | 12.6  | 15.1    | 114.3   | 61.5   |
| 6   | 30-20-20-18                           | 11.9  | 13.5    | 97.0    | 61.5   |
| 8   | 90-20-20-18                           | 12.8  | 15.4    | 117.4   | 60.5   |
| 4   | 90-0-20-18                            | 13.4  | 15.8    | 127.3   | 59.5   |

**STATISTICAL TABLE**

|                            |      |      |       |      |
|----------------------------|------|------|-------|------|
| EXPERIMENTAL MEANS         | 12.5 | 13.8 | 103.7 | 61.8 |
| ERROR MEAN SQUARE          | 1.52 | .533 | 163.4 | 2.54 |
| P-VALUE FOR VAR.           | .002 | .000 | .0000 | .212 |
| STANDARD ERROR             | 1.23 | .730 | 12.78 | 1.59 |
| STANDARD ERROR OF THE MEAN | .617 | .365 | 6.390 | .796 |
| C.V. 1: (S/MEAN)*100       | 9.89 | 5.30 | 12.32 | 2.58 |
| LSD (0.05)                 | 1.78 | 1.05 | 18.39 | 2.29 |

**NITROGEN SUMMARY**

|            |      |      |       |      |
|------------|------|------|-------|------|
| 0          | 11.2 | 11.5 | 78.2  | 62.4 |
| 30         | 12.4 | 13.4 | 100.0 | 62.1 |
| 60         | 12.4 | 14.9 | 110.5 | 61.8 |
| 90         | 13.8 | 15.3 | 126.2 | 60.7 |
| LSD (0.05) | 1.0  | 0.6  | 10.6  | 1.3  |

**PHOSPHORUS SUMMARY**

|                     |      |      |       |      |
|---------------------|------|------|-------|------|
| 0                   | 12.4 | 13.8 | 102.5 | 61.6 |
| 20                  | 12.2 | 14.0 | 103.1 | 61.4 |
| 40                  | 12.9 | 13.7 | 105.6 | 62.2 |
| LSD (0.05)          | NS   | NS   | NS    | NS   |
| INTERACTION P-VALUE | 0.11 | 0.46 | 0.30  | 0.52 |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Spring Wheat

Growing Season ppt. = 3.75" Depth of Moist Soil = 2'

Seeding Date: April 23, 1996 Harvest Date: August 12, 1996

Soil Tests: pH = 7.9, O.M. = 1.7 %, P = 21.0 ppm, K = 402 ppm,

Zn = 0.4 ppm, Cu = 1.7 ppm, Fe = 9.0 ppm, Mn = 15.2 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 22                 | 14.9               | 7.3                | 117                |
| 1-2   | 23                 | 16.7               | 1.0                | 108                |
| 2-3   | 20                 | 21.5               | 0.8                | 5850               |
| 3-4   | 24                 | 9.6                | 0.8                | 302                |

**Comments:** Yields were reduced by drought conditions throughout the growing season and the lack of stored soil water.

TABLE. 7S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located Northeast of Cut Bank. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO.                        | TREATMENT   | GRAIN YIELD | GRAIN PROTEIN | PROTEIN YIELD | TEST WEIGHT |
|----------------------------|---|-------------|---------------|---------------|-------------|
|                            | N-P <sub>2</sub> O <sub>5</sub> -K-Cl<br>lbs/acre | bu/a        | %             | lb/ac         | lb/bu       |
| 9                          | 0-50-30-27  | 27.8        | 8.6           | 143.6         | 60.4        |
| 5                          | 0-25-30-27  | 27.3        | 8.6           | 141.1         | 60.3        |
| 1                          | 0-0-30-27   | 25.8        | 9.5           | 145.5         | 59.1        |
| 6                          | 50-25-30-27                                       | 27.4        | 12.3          | 200.4         | 57.2        |
| 2                          | 50-0-30-27  | 27.9        | 13.2          | 220.3         | 57.1        |
| 10                         | 50-50-30-27                                       | 29.0        | 11.9          | 207.2         | 56.5        |
| 4                          | 150-0-30-27                                       | 24.8        | 15.3          | 227.9         | 55.7        |
| 3                          | 100-0-30-27                                       | 26.3        | 14.9          | 234.7         | 55.5        |
| 7                          | 100-25-30-27                                      | 26.6        | 14.6          | 232.5         | 55.3        |
| 11                         | 100-50-30-27                                      | 27.3        | 14.6          | 238.2         | 55.0        |
| 8                          | 150-25-30-27                                      | 26.4        | 15.3          | 241.5         | 54.8        |
| 12                         | 150-50-30-27                                      | 26.4        | 15.5          | 243.6         | 54.6        |
| <b>STATISTICAL TABLE</b>   |   |             |               |               |             |
| EXPERIMENTAL MEANS         |   | 26.9        | 12.8          | 206.4         | 56.8        |
| ERROR MEAN SQUARE          |   | 6.35        | .358          | 265.4         | 1.86        |
| P-VALUE                    |   | .670        | .000          | .0000         | .000        |
| STANDARD ERROR             |   | 2.52        | .598          | 16.29         | 1.37        |
| STANDARD ERROR OF THE MEAN |   | 1.26        | .299          | 8.145         | .683        |
| C.V. 1: (S/MEAN)*100       |   | 9.37        | 4.66          | 7.893         | 2.40        |
| LSD (0.05)                 |   | NS          | 0.9           | 23.4          | 2.0         |
| <b>NITROGEN SUMMARY</b>    |   |             |               |               |             |
| 0                          |   | 27.0        | 8.9           | 143.4         | 59.9        |
| 50                         |   | 28.1        | 12.4          | 209.3         | 56.9        |
| 100                        |   | 26.7        | 14.7          | 235.1         | 55.3        |
| 150                        |   | 25.8        | 15.4          | 237.7         | 55.0        |
| LSD (0.05)                 |   | NS          | 0.5           | 13.5          | 1.1         |
| <b>PHOSPHORUS SUMMARY</b>  |   |             |               |               |             |
| 0                          |   | 26.2        | 13.2          | 207.1         | 56.9        |
| 25                         |   | 26.9        | 12.7          | 203.9         | 56.9        |
| 50                         |   | 27.6        | 12.6          | 208.2         | 56.6        |
| LSD (0.05)                 |   | NS          | 0.4           | NS            | NS          |
| INTERACTION P-VALUE        |   | 0.98        | 0.33          | 0.55          | 0.66        |

Grain yields based on 60 lb/bu.

Variety: Amidon

Previous crop: Fallow

Growing Season ppt. =

" Depth of Moist Soil = 3'

Seeding Date: May 1

Harvest Date: Sept. 12

Soil Tests: pH = 8.0, O.M. = 2.0 %, P = 9.7 ppm, K = 254 ppm, Zn = 0.4 ppm, Cu = 1.7 ppm, Fe = 9.1 ppm, Mn = 15.4 ppm

| Depth Cl | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|----------|--------------------|--------------------|--------------------|
| ft.      | -----lbs/acre----- |                    |                    |
| 0-1      | 9                  | 13.4               | 24.2               |
| 1-2      | 15                 | 9.7                | 12.7               |
| 2-3      | 11                 | 14.3               | 10.7               |

**Comments:** Yields were reduced by drought conditions and lack of soil water during July.



TABLE. 8S. EFFECT OF N AND P ON SPRING WHEAT. Experiment Located North of Loma. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| NO. | TREATMENT   | GRAIN YIELD | GRAIN PROTEIN | PROTEIN YIELD | TEST WEIGHT |
|-----|---|-------------|---------------|---------------|-------------|
|     | N-P <sub>2</sub> O <sub>5</sub> -K-Cl<br>lbs/acre | bu/ac       | %             | lb/ac         | lb/bu       |
| 7   | 60-20-20-18                                       | 23.3        | 12.6          | 171.8         | 58.1        |
| 6   | 30-20-20-18                                       | 21.5        | 11.6          | 148.4         | 59.2        |
| 11  | 60-40-20-18                                       | 21.5        | 13.0          | 163.4         | 57.0        |
| 3   | 60-0-20-18  | 20.6        | 13.7          | 165.5         | 58.2        |
| 10  | 30-40-20-18                                       | 20.6        | 12.1          | 144.8         | 58.3        |
| 8   | 90-20-20-18                                       | 19.7        | 14.7          | 172.7         | 56.2        |
| 4   | 90-0-20-18  | 19.2        | 14.9          | 169.9         | 56.0        |
| 2   | 30-0-20-18  | 19.2        | 12.3          | 140.7         | 58.8        |
| 12  | 90-40-20-18                                       | 19.0        | 14.3          | 162.1         | 56.9        |
| 5   | 0-20-20-18  | 18.5        | 12.2          | 135.3         | 60.4        |
| 1   | 0-0-20-18   | 18.3        | 11.5          | 125.6         | 60.3        |
| 9   | 0-40-20-18  | 17.4        | 11.1          | 115.4         | 61.2        |

**STATISTICAL TABLE**

|                            |      |      |       |      |
|----------------------------|------|------|-------|------|
| EXPERIMENTAL MEANS         | 19.9 | 12.8 | 151.3 | 58.4 |
| ERROR MEAN SQUARE          | 7.18 | .617 | 188.1 | 2.44 |
| P-VALUE                    | .159 | .000 | .0000 | .000 |
| STANDARD ERROR             | 2.68 | .785 | 13.72 | 1.56 |
| STANDARD ERROR OF THE MEAN | 1.34 | .393 | 6.858 | .781 |
| C.V. 1: (S/MEAN)*100       | 13.5 | 6.14 | 9.065 | 2.68 |
| LSD (0.05)                 | NS   | 1.1  | 19.7  | 2.2  |

**NITROGEN SUMMARY**

|            |      |      |       |      |
|------------|------|------|-------|------|
| 0          | 18.0 | 11.6 | 125.4 | 60.6 |
| 30         | 20.4 | 12.0 | 144.7 | 58.8 |
| 60         | 21.8 | 13.1 | 166.9 | 57.8 |
| 90         | 19.3 | 14.6 | 168.2 | 56.3 |
| LSD (0.05) | 2.2  | 0.7  | 11.4  | 1.3  |

**PHOSPHORUS SUMMARY**

|                     |      |      |       |      |
|---------------------|------|------|-------|------|
| 0                   | 19.3 | 13.1 | 150.4 | 58.3 |
| 20                  | 20.7 | 12.7 | 157.0 | 58.5 |
| 40                  | 19.6 | 12.6 | 146.5 | 58.3 |
| LSD (0.05)          | NS   | NS   | 9.9   | 1.1  |
| INTERACTION P-VALUE | 0.94 | 0.28 | 0.91  | 0.72 |

Grain yields based on 60 lb/bu.

Variety: Amidon Previous crop: Tilled, barley stubble

Growing Season ppt. = 5.9" Depth of Moist Soil = 2'

Seeding Date: April 24 Harvest Date: August 13

Soil Tests: pH = 7.0, O.M. = 1.8 %, P = 24.9 ppm, K = 370 ppm,

Zn = 1.0 ppm, Cu = 1.7 ppm, Fe = 23.7 ppm, Mn = 37.9 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 41                 | 13.2               | 11.4               | 104                |
| 1-2   | 72                 | 14.9               | 2.8                | 239                |
| 2-3   | 124                | 14.5               | 10.4               | 234                |
| 3-4   | 282                | 25.2               | 79.0               | 10354              |

**Comments:** Slight N yield response. Yields were reduced by drought conditions throughtout the growing season and the lack of stored soil water.

TABLE 9S. Conitnued

**Notes:**

Planting Rate = 25 seeds/ft (100 lbs/acre)

Planter: 12" spaced, 4-row, with 4" hoe openers.

Bronate and Hoelon were applied for weed control

Irrigation Dates: June 27 - 1", July 2 - 2", July 8 - 2",

July 12 - 0.5", July 18 - 2", July 26 - 2".

Variety: McNeal Previous crop: Fallow

Fertilizer: 11-52-0 w/seed, 46-0-30 applied broadcast

Growing Season ppt. = 4.36" Depth of Moist Soil = > 3'

Seeding Date: 5-7-96 Harvest Date: 9-12-96

Soil Tests: pH = 7.4, O.M. = 1.8 %, P = 32.9 ppm, K = 446 ppm, Zn = 0.6 ppm,

Cu = 1.9 ppm, Fe = 23.1 ppm, Mn = 22.2 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 14                 | 24.4               | 42.6               | 73.6               |
| 1-2   | 10                 | 14.9               | 16.4               | 527.0              |
| 2-3   | 7                  | 13.3               | 15.3               | 6102.0             |
| 3-4   | 16                 | 16.5               | 16.8               | 9090.0             |

TITLE: Legumes as Cover Crops during Fallow

YEAR: 1996

LOCATION: Western Triangle Ag. Research Center, north of Conrad.

PERSONNEL: James R. Sims (PI), Grant D. Jackson, and Larry Christiaens

OBJECTIVES: Determine adaptation, water-use, biomass, and soil nitrogen contribution of late-summer seeded legumes in the dryland spring wheat or barley/summer fallow rotation.

PROCEDURES: In 1995 Austrian winter peas, snail medic, and Indianhead lentils were planted, no-till at approximately two week intervals starting June 21 and ending August 4 into barley stubble. A fallow plot was left for a control. Plot size was 6 x 20 feet. Seeding rate was 75 lbs/acre for peas and 30 lbs/acre for lentils and snail medic. Plot area was sprayed once with Roundup for preplant weed control. The legumes emerged about 8 days after each planting date and were allowed to grow until a killing frost. Soil samples for water and nitrate-N were taken just prior to planting. Plant samples for biomass and N content were taken after the killing frost and soils again sampled for nitrate-N and water. Water use was determined by subtracting soil water content after the killing frost from soil water content at planting and adding the precipitation collected from the planting date and until the killing frost. McNeal spring wheat was planted no-till into the plot area in 1996.

RESULTS: Legume yields and N contents can be found in last year's report. Spring wheat yields and protein levels from the no-till green manure are shown in Table 10S. Wheat yields were about the same following fallow or green manure. Also protein levels were similar. Bare in mind the green manures were killed by frost the previous year and didn't have time for decomposition that would have happened if the legumes were green manured in late June.

TABLE 10S. EFFECT OF NO-TILL GREEN MANURE AND GREEN MANURE PLANTING DATE ON NO-TILL SPRING WHEAT. Western Triangle Ag. Research Center, Conrad. 1996.

| TREATMENT           |               | GRAIN | PROTEIN | PROTEIN | TEST  |
|---------------------|---------------|-------|---------|---------|-------|
| LEGUME SPECIE       | PLANTING DATE | YIELD | CONTENT | YIELD   | WT    |
|                     |               | bu/ac | %       | lb/ac   | lb/bu |
| AUSTRIAN WINTER PEA | JUNE 21       | 34.1  | 11.8    | 238.4   | 62.2  |
| SNAIL MEDIC         | JUNE 21       | 40.1  | 10.2    | 245.5   | 63.0  |
| INDIANHEAD LENTIL   | JUNE 21       | 38.3  | 11.0    | 252.1   | 62.2  |
| FALLOW              |               | 35.1  | 10.7    | 226.7   | 63.0  |
| p-value             |               | 0.54  | 0.007   | 0.866   | 0.008 |
| ERROR MEAN SQUARE   |               | 37.1  | 0.236   | 1527    | 0.107 |
| -----               |               |       |         |         |       |
| AUSTRIAN WINTER PEA | JULY 9        | 38.5  | 10.9    | 250.6   | 63.0  |
| SNAIL MEDIC         | JULY 9        | 40.4  | 10.3    | 250.9   | 61.6  |
| INDIANHEAD LENTIL   | JULY 9        | 43.9  | 10.1    | 265.8   | 63.2  |
| FALLOW              |               | 37.6  | 10.9    | 244.0   | 63.3  |
| p-value             |               | 0.21  | 0.17    | 0.73    | 0.51  |
| ERROR MEAN SQUARE   |               | 16.9  | 0.339   | 651.8   | 2.92  |
| -----               |               |       |         |         |       |
| AUSTRIAN WINTER PEA | JULY 20       | 37.7  | 10.0    | 225.5   | 63.8  |
| SNAIL MEDIC         | JULY 20       | 40.1  | 10.4    | 250.7   | 63.9  |
| INDIAN LENTIL       | JULY 20       | 38.1  | 9.6     | 219.0   | 64.0  |
| FALLOW              |               | 40.7  | 10.0    | 252.9   | 63.9  |
| p-value             |               | 0.94  | 0.13    | 0.54    | 0.84  |
| ERROR MEAN SQUARE   |               | 45.7  | 0.256   | 1426    | 0.07  |
| -----               |               |       |         |         |       |
| AUSTRIAN WINTER PEA | AUG 4         | 51.2  | 9.9     | 305.1   | 64.1  |
| SNAIL MEDIC         | AUG 4         | 54.9  | 10.5    | 347.8   | 64.1  |
| INDIANHEAD LENTIL   | AUG 4         | 53.9  | 9.8     | 317.1   | 64.2  |
| FALLOW              |               | 50.4  | 11.0    | 331.7   | 63.9  |
| p-value             |               | 0.70  | 0.001   | 0.57    | 0.65  |
| ERROR MEAN SQUARE   |               | 33.0  | 0.102   | 1776    | 0.10  |

Grain yields based on 60 lb/bu.

Variety: McNeal

Growing Season ppt. = 4.5"

Depth of Moist Soil = > 3'

Seeding Date: May 2

Harvest Date: Sept. 4

TITLE: Evaluation of growth regulators and soil admendments.

YEAR: 1996

LOCATIONS: Western Triangle Ag. Research Center, Conrad, MT

PERSONNEL: Grant D. Jackson and Larry Christiaens

OBJECTIVES: Evaluate plant growth enhancing products as requested by industry.

PROCEDURES: This year Ample C and NEB-26 were evaluated in paired, treated and untreated plots. Standard small plot techniques were used to collect yield data. Ample C was applied to spring wheat according to the label instructions using a 4-wheeler mounted sprayer. NEB-26 was applied to the soil by the product development representative using a small plot roto-tiller. Barley was planted into the treated area at a later date. Dates and rates are shown in each Table, as well as, a few comments. Results were evaluated statistically by the paired t-test.

RESULTS: Results of Ample C are shown in Table 11S and NEB-26 in Table 12S

TABLE 11S. EFFECT OF AMPLE-C ON THE YIELD AND QUALITY OF IRRIGATED HARD RED SPRING WHEAT. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| Treatment                            | Grain Yield<br>bu/ac | Grain Protein<br>% | Test Weight<br>lb/bu |
|--------------------------------------|----------------------|--------------------|----------------------|
| Ample-C                              | 125.9                | 14.5               | 61.5                 |
| Control                              | 124.1                | 14.3               | 60.9                 |
| <b>*****STATISTICAL SUMMARY*****</b> |                      |                    |                      |
| t-TEST (df = 7)                      | 0.71ns               | 3.37*              | 3.00*                |
| p-value                              | 0.50                 | 0.01               | 0.02                 |

\*Denotes means are significantly different at p = 0.05.

**Notes:**

Fertilizer: 255-50-30, Planting Rate = 25 seeds/ft (100 lbs/acre)  
 Planter: 12" spaced, 4-row, with 4" hoe openers.  
 Seed Treated with 36 oz/100 lbs of seed, Ample Soil Treatment  
 Ample-C applied (64oz) June 12@Feekes scale 5  
 Bronate and Hoelon were applied for weed control  
 Irrigation Dates: June 27 - 1", July 2 - 2", July 8 - 2",  
 July 12 - 0.5", July 18 - 2", July 26 - 2".

Variety: McNeal

Previous crop: Fallow

Growing Season ppt. = 4.36" Depth of Moist Soil = > 3'

Seeding Date: 5-7-96

Harvest Date: 9-12-96

Soil Tests: pH = 7.4, O.M. = 1.8 %, P = 32.9 ppm, K = 446 ppm, Zn = 0.6 ppm, Cu = 1.9 ppm, Fe = 23.1 ppm, Mn = 22.2 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 14                 | 24.4               | 42.6               | 73.6               |
| 1-2   | 10                 | 14.9               | 16.4               | 527.0              |
| 2-3   | 7                  | 13.3               | 15.3               | 6102.0             |
| 3-4   | 16                 | 16.5               | 16.8               | 9090.0             |

**Comments:** Ample-C significantly increased irrigated spring wheat test weight and grain protein content.

TABLE 12S. EFFECT OF NEB-26 ON SPRING BARLEY YIELD AND QUALITY.  
Western Triangle Ag. Research Center, Conrad, MT. 1996.

| TREATMENT                     | GRAIN<br>YIELD | TEST<br>WT | GRAIN<br>PROTEIN | PLUMP   | THINS   |
|-------------------------------|----------------|------------|------------------|---------|---------|
|                               | bu/ac          | lb/bu      | -----%-----      |         |         |
| NEB-26 (7.5 ml/plot)          | 94.9           | 53.2       | 9.0              | 93.8    | 1.6     |
| Control                       | 97.5           | 53.1       | 8.7              | 93.3    | 2.0     |
| *****STATISTICAL SUMMARY***** |                |            |                  |         |         |
| t-TEST (df = 11)              | 1.38ns         | -0.14ns    | -1.69ns          | -0.56ns | 0.79ns  |
| p-Value                       | 0.19           | 0.89       | 0.12             | 0.58    | 0.44    |
| -----                         |                |            |                  |         |         |
| NEB-26 (6.4 ml/plot)          | 87.4           | 50.6       | 9.9              | 85.8    | 4.1     |
| Control                       | 89.7           | 52.6       | 9.0              | 88.9    | 3.6     |
| *****STATISTICAL SUMMARY***** |                |            |                  |         |         |
| t-TEST (df = 3)               | -0.52ns        | -0.92ns    | 1.90ns           | -0.52ns | 0.19ns  |
| p-Value                       | 0.64           | 0.42       | 0.15             | 0.64    | 0.86    |
| -----                         |                |            |                  |         |         |
| NEB-26 (5.3 ml/plot)          | 89.7           | 51.4       | 9.4              | 89.9    | 3.4     |
| Control                       | 89.7           | 52.6       | 9.0              | 88.9    | 3.6     |
| *****STATISTICAL SUMMARY***** |                |            |                  |         |         |
| t-TEST (df = 3)               | -0.01ns        | -1.37ns    | 1.70ns           | 0.21ns  | -0.15ns |
| p-Value                       | 1.00           | 0.27       | 0.19             | 0.85    | 0.89    |

ns = Denotes means are not statistically different at p = 0.05.  
Grain yields based on 48 lb/bu as standard test weight.

**Notes:**

Planting Rate = 17 seeds/ft (50 lbs/acre)  
 Planter: 12" spaced, IHC 150 with 3" openers.  
 Fertilizer: 56-50-0  
 Bronate and Hoelon were applied for weed control.  
 Variety: Harrington Previous crop: Fallow  
 Growing Season ppt. = 4.25" Depth of Moist Soil = > 3'  
 Treatment Dates: 7.5 ml on 5-7-96, 6.4 and 5.3 on 5-8-96.  
 Seeding Date: 5-14-96 Harvest Date: 9-4-96  
 Soil Tests: pH = 7.4, O.M. = 1.8 %, P = 32.9 ppm, K = 446 ppm,  
 Zn = 0.6 ppm, Cu = 1.9 ppm, Fe = 23.1 ppm, Mn = 22.2 ppm

| Depth | Cl                 | NH <sub>4</sub> -N | NO <sub>3</sub> -N | SO <sub>4</sub> -S |
|-------|--------------------|--------------------|--------------------|--------------------|
| ft.   | -----lbs/acre----- |                    |                    |                    |
| 0-1   | 14                 | 24.4               | 42.6               | 73.6               |
| 1-2   | 10                 | 14.9               | 16.4               | 527.0              |
| 2-3   | 7                  | 13.3               | 15.3               | 6102.0             |
| 3-4   | 16                 | 16.5               | 16.8               | 9090.0             |

**Comments:** No significant differences. Lack of response could be related to the absence of significant precipitation between May 24 and harvest.

TITLE: Nitrogen and sulfur management and nutrient cycling in the north central Montana canola production area.

PERSONNEL: Grant D. Jackson and Larry Christiaens, Western Triangle Ag. Research Center, Conrad, MT 59425

YEAR: 1996

LOCATIONS: 1. Herb Karst Farm, east of Sunburst  
2. Western Triangle Ag. Research Center (WTARC), north of Conrad

OBJECTIVES: To determine the relationship of canola seed yield and quality to N and S fertilization and soil tests; to determine the effect of N and S fertilization on potential nutrient (N,P,K, and S) cycling or rotational benefits; and to determine canola N, S, and water use efficiency relative to N and S additions.

PROCEDURES: The Conrad site was irrigated while the Sunburst location was rainfed. All plots were located on fields previously in barley stubble and planted no-till. Four N rates (0, 75, 150 & 225 lbs N/a) and three S rates (0, 20 & 40 lbs S/a) organized into a RCB, 4 x 3 factorial design, with four blocks were applied to plot areas. Plot size was six rows wide and 20' long. Blanket levels of 30 lbs P<sub>2</sub>O<sub>5</sub>/acre metered with the seed and 30 lbs K/acre broadcast while planting were applied to each research area. Planting rate was 6 lbs/acre. Fertilizer materials were urea, treble super phosphate, potassium chloride, potassium sulfate, and ammonium sulfate. Plots were swathed with a Swift small plot swather and threshed with a Hege combine. Seed samples were dried, weighed, and analyzed for oil content. Data were analyzed by ANOVA and multiple regression. Plant samples taken at maturity and post-harvest soil samples were taken for nutrient analysis.

RESULTS AND DISCUSSION: The experimental site at Fairfield was not planted this year because a suitable cooperator was unavailable, and the Soil Testing Lab. increased chemical analysis costs substantially. Seed yield and oil content results are shown in Tables 13S and 14S. Chemical analysis of plant material and post-harvest soil samples have not been completed for the 1996 crop year. Seed yields averaged 385 and 1769 lbs/acre at Sunburst and Conrad, respectively. Yields were probably reduced by weed pressure and drought conditions at Sunburst. Nitrogen significantly increased seed and oil yields and decreased oil content at all locations. All had seed and oil yield quadratic responses to fertilizer plus soil nitrate-N. Sulfur did not affect yield or oil content this year. The Sunburst site had significant N and S interactions with seed and oil yield and oil content. Oil levels were much less than average (about 10 points) this year. This was probably caused by heat stress during July.

Data from 1995, 1996, and 1991 through 1994 that was previously published (1,2), was used to develop the regression equations shown in Figs. 1-3. Seed yield, oil content, and oil yield was regressed against soil nitrate-N (0-3' of soil) plus fertilizer N. Producers can use these equations to manage N fertilizer or to predict the effects of N on canola yield and oil content. Note that optimum yield occurs at about 200 lbs of available N.

Figures 4 through 7 (1995 data) show the total plant and seed nutrient uptake prediction equations for N, P, K and S, respectively. These equations were developed using the treatment means of 0, 75, 150, and 225 lb/acre N rates with 20 lbs S/acre. Obviously, the area between the curves of each figure represents the predicted amount of each nutrient available to subsequent crops. Using the



optimum N level of 200 lbs, 64.4 lbs of N, 9.1 lbs of P (20.8 lbs P<sub>2</sub>O<sub>5</sub>), 159.5 lbs of K, and 57.1 lbs of S/acre would be returned to the cropping system.

Figures 8 and 9 show the initial and post-harvest distribution of soil nitrate and ammonium-N from the WTARC location. All of the N treatments had less nitrate-N in top foot of soil than was initially. However, the highest N rate did show an accumulation of nitrate-N in the second foot and had the highest accumulation in the first foot of all the N treatments. These results are similar to those published recently (3). Differences in ammonium-N appear unrelated to N rate.

SUMMARY: Seed yield N response from Conrad fit the yield versus soil plus fertilizer-N response curve from previous years. Sulfur responses didn't occur this year, however, growers should continue using about 20 lbs S in their fertilizer programs.

#### REFERENCES

1. Jackson, G.D., G.D. Kushnak, L.E. Welty, M.P Westcott, and D.M. Wichman. 1993. Fertilizing Canola. Montana AgRes. 10(2):21-24.
2. Popove, G.B. 1994. Effects of nitrogen, phosphorus, and sulfur on the yield, growth and quality of canola. M.S. diss. Montana State University, Bozeman.
3. Jackson, Grant D. 1995. Nitrogen dynamics in small grains and canola. Montana AgResearch 12(2):39-43.

TABLE 13S. EFFECT OF NITROGEN AND SULFUR ON DRYLAND, NO-TILL CANOLA. Experiment located east of Sunburst. Western Triangle Ag. Research Center, Conrad, MT. 1996.

| TREATMENT                  | SEED   | OIL     | OIL    |
|----------------------------|--------|---------|--------|
| N-S                        | YIELD  | CONTENT | YIELD  |
| lbs/acre                   | lbs/ac | %       | lbs/ac |
| 225-0                      | 602.1  | 37.97   | 211.5  |
| 75-20                      | 551.9  | 38.92   | 199.0  |
| 150-40                     | 523.1  | 38.03   | 185.4  |
| 225-40                     | 464.3  | 36.98   | 159.9  |
| 150-0                      | 446.4  | 37.78   | 156.1  |
| 150-20                     | 437.4  | 38.07   | 154.7  |
| 225-20                     | 420.8  | 36.85   | 143.9  |
| 75-0                       | 313.6  | 38.65   | 112.6  |
| 75-40                      | 295.6  | 38.55   | 104.6  |
| 0-20                       | 270.0  | 39.05   | 98.4   |
| 0-40                       | 179.2  | 39.32   | 65.6   |
| 0-0                        | 112.2  | 37.50   | 38.8   |
| <b>STATISTICAL SUMMARY</b> |        |         |        |
| EXPERIMENTAL MEANS         | 384.7  | 38.14   | 135.9  |
| P-VALUE                    | .0000  | .0023   | .0000  |
| STANDARD ERROR             | 137.8  | .8425   | 50.01  |
| STANDARD ERROR OF THE MEAN | 68.88  | .4213   | 25.01  |
| C.V. 1: (S/MEAN)*100       | 35.81  | 2.21    | 36.81  |
| LSD (0.05)                 | 198.2  | 1.21    | 72.0   |
| <b>NITROGEN SUMMARY</b>    |        |         |        |
| 0                          | 187.1  | 38.63   | 67.6   |
| 75                         | 387.0  | 38.71   | 138.7  |
| 150                        | 469.0  | 37.96   | 165.4  |
| 225                        | 495.7  | 37.27   | 171.8  |
| LSD (0.05)                 | 114.4  | 0.70    | 41.5   |
| <b>SULFUR SUMMARY</b>      |        |         |        |
| 0                          | 368.6  | 37.97   | 129.7  |
| 20                         | 420.0  | 38.23   | 149.0  |
| 40                         | 365.5  | 38.22   | 128.9  |
| LSD (0.05)                 | NS     | NS      | NS     |
| INTERACTION P-VALUE        | 0.050  | 0.042   | 0.043  |

Seed yields based on 8 % moisture.

Oil content and oil yield on a dry weight basis.

Previous crop: Barley; Growing Season ppt. = 4.4"

Variety: Westar

Seeding Date: April 29; Swathing Date: Aug. 7

Harvest Date: Aug. 14; Herbicide: Stinger + Poast

Soil Tests: pH = 6.2, O.M. = 3.3 %, P = 24 ppm, K = 360 ppm,

Zn = 1.5 ppm, Cu = 2.2 ppm, Depth Cl NH<sub>4</sub>-N NO<sub>3</sub>-N SO<sub>4</sub>-S

Fe = 73.3 ppm, Mn = 28.3 ppm ft. -----lbs/acre-----

|     |    |      |     |    |
|-----|----|------|-----|----|
| 0-1 | 20 | 12.6 | 7.5 | 60 |
| 1-2 | 11 | 9.3  | 1.7 | 69 |
| 2-3 | 12 | 6.8  | 1.2 | 80 |
| 3-4 | 12 | 7.2  | 2.4 | 76 |

**Comments:** Results were affected by drought conditions in May, prostrate knotweed, and kochia.

TABLE 14S. EFFECT OF NITROGEN AND SULFUR ON IRRIGATED, NO-TILL CANOLA. Western Triangle Ag. Research Center, Conrad. 1996.

| TREATMENT                  | SEED YIELD | OIL CONTENT | OIL YIELD |
|----------------------------|------------|-------------|-----------|
| N-S                        | YIELD      | CONTENT     | YIELD     |
| lbs/acre                   | lbs/ac     | %           | lbs/ac    |
| 225-40                     | 2738       | 37.78       | 957.4     |
| 225-0                      | 2709       | 37.35       | 935.7     |
| 225-20                     | 2687       | 37.82       | 940.1     |
| 150-0                      | 2392       | 39.05       | 863.1     |
| 150-40                     | 2387       | 38.48       | 850.0     |
| 150-20                     | 2115       | 38.92       | 760.6     |
| 75-0                       | 1688       | 40.03       | 625.4     |
| 75-20                      | 1564       | 40.05       | 580.3     |
| 75-40                      | 1392       | 39.88       | 513.6     |
| 0-20                       | 555        | 39.52       | 203.2     |
| 0-0                        | 523        | 39.42       | 190.4     |
| 0-40                       | 475        | 39.83       | 175.1     |
| <b>STATISTICAL TABLE</b>   |            |             |           |
| EXPERIMENTAL MEANS         | 1769       | 39.01       | 632.9     |
| P-VALUE FOR VAR.           | .0000      | .0000       | .0000     |
| STANDARD ERROR             | 248.9      | .5352       | 89.81     |
| STANDARD ERROR OF THE MEAN | 124.4      | .2676       | 44.90     |
| C.V. 1: (S/MEAN)*100       | 14.07      | 1.372       | 14.19     |
| LSD (0.05)                 | 358        | 0.77        | 129.2     |
| <b>NITROGEN SUMMARY</b>    |            |             |           |
| 0                          | 518        | 39.59       | 189.6     |
| 75                         | 1548       | 39.98       | 573.1     |
| 150                        | 2298       | 38.82       | 824.6     |
| 225                        | 2711       | 37.65       | 944.4     |
| LSD (0.05)                 | 207        | 0.44        | 74.6      |
| <b>SULFUR SUMMARY</b>      |            |             |           |
| 0                          | 1828       | 38.96       | 653.6     |
| 20                         | 1730       | 39.08       | 621.0     |
| 40                         | 1748       | 38.99       | 624.0     |
| LSD (0.05)                 | NS         | NS          | NS        |
| INTERACTION P-VALUE        | 0.55       | 0.50        | 0.52      |

Seed yields based on 8 % moisture.  
 Oil content and oil yield on a dry weight basis.  
 Previous crop: Barley; Growing Season ppt. = 4.4"  
 Irrigated 6 times, 9.5" Variety: Westar  
 Seeding Date: May 2; Swathing Date: Aug. 12  
 Harvest Date: Aug. 19; Herbicide: Stinger + Poast  
 Soil Tests: pH = 7.9, O.M. = 2.5 %, P = 45 ppm, K = 332 ppm,  
 Zn = 0.5 ppm, Cu = 1.5 ppm, Depth Cl NH<sub>4</sub>-N NO<sub>3</sub>-N SO<sub>4</sub>-S  
 Fe = 8.6 ppm, Mn = 14.5 ppm ft. -----lbs/acre-----  
 0-1 15 11.7 6.9 104  
 1-2 15 11.3 2.7 270  
 2-3 15 12.6 2.2 7784  
 3-4 15 13.9 3.8 9460

**Comments:** Oil results were probably caused by the hot, dry summer.

Fig. 1. Effect of N on Canola Yield.

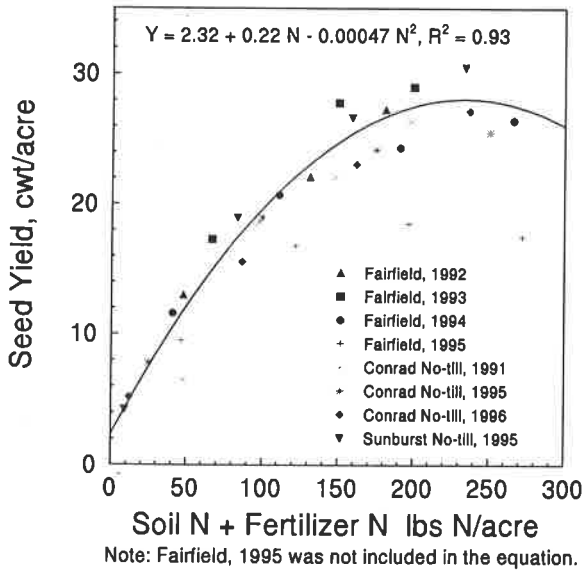


Fig. 3. Effect of N on Canola Oil Yield.

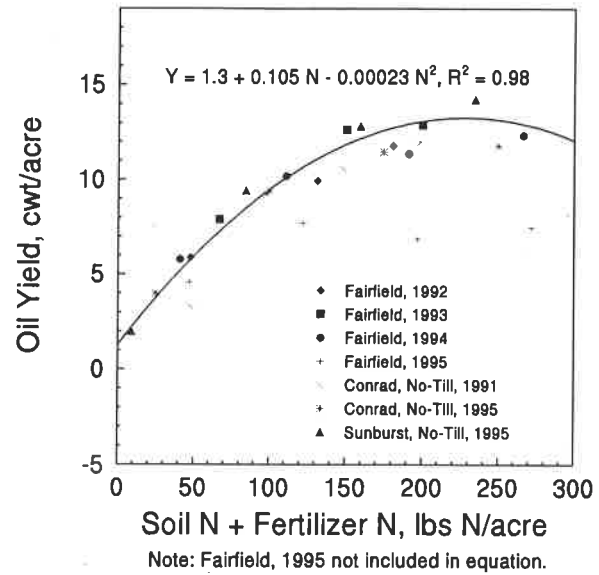


Fig. 2. Effect of N on Canola Oil Content.

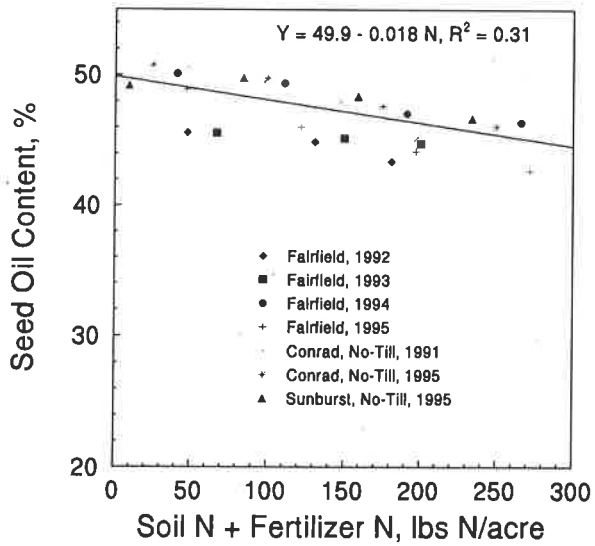


Fig. 4. Canola Nitrogen Uptake.

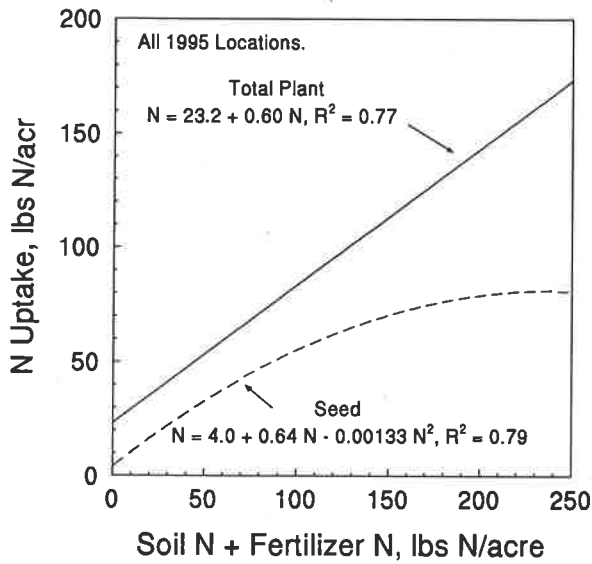


Fig. 5. Canola Phosphorus Uptake.

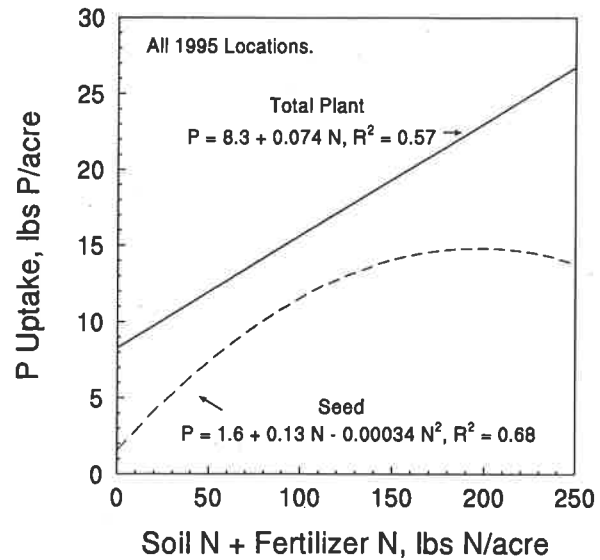


Fig. 6. Canola Potassium Uptake.

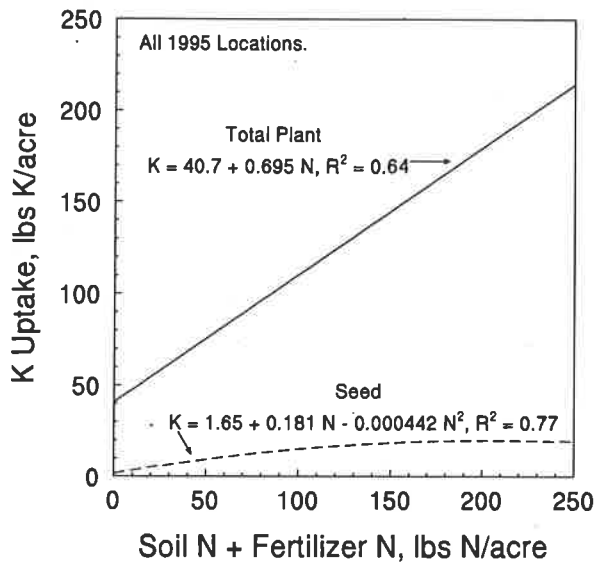


Fig. 7. Canola Sulfur Uptake.

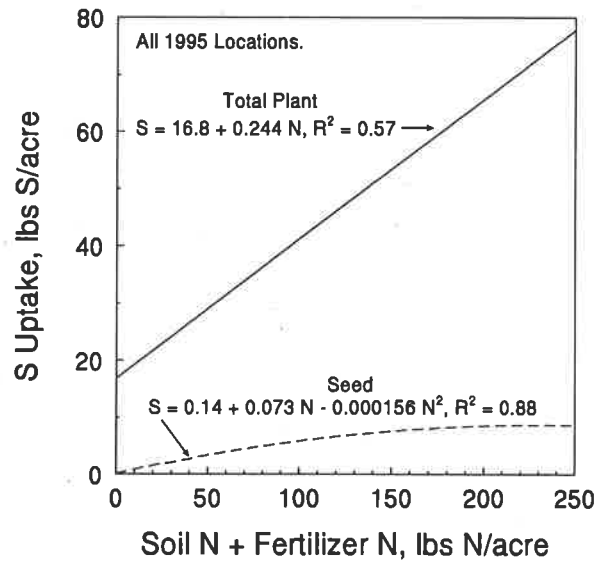


Fig. 8. Pre-Plant and Post-Harvest Soil Nitrate-N.

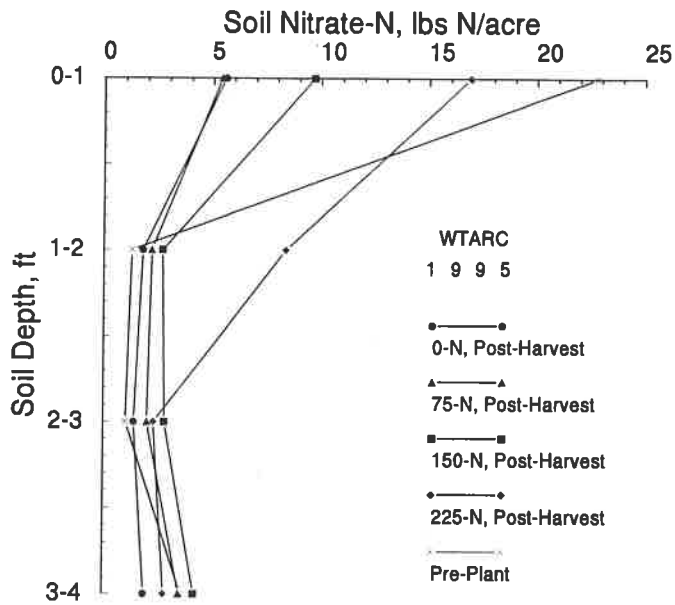
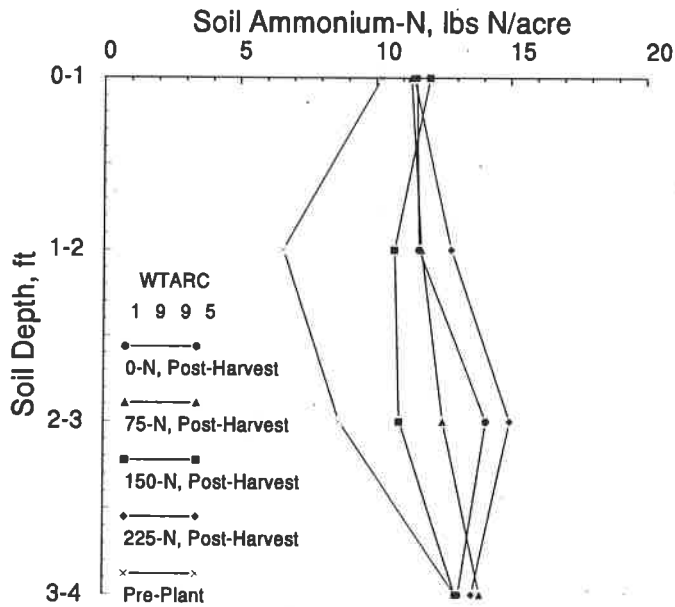


Fig. 9. Pre-Plant and Post-Harvest Soil Ammonium-N.



TITLE: Canola Variety Investigations

YEAR: 1996

LOCATIONS: Western Triangle Ag. Research Center, north of Conrad

PERSONNEL: Grant D. Jackson and Larry Christiaens

OBJECTIVES: Evaluate canola varieties or hybrids under Western Triangle conditions.

PROCEDURES: Plots were planted no-till on a field previously in barley and irrigated throughout the growing season. Variety names and other site information are included in the summary Table. Plot size was six rows wide and 20' long. Fertilizers were 150-30-30-20, P was metered with the seed, all others were broadcast while planting. Planting rate was 6 lbs/acre. Plots were swathed with a Swift small plot swather and threshed with a Hege combine. Seed samples were dried, weighed, and analyzed for oil content. Data were analyzed by ANOVA.

RESULTS: Seed yield and oil content results are tabulated in Table 15S. Seed yields averaged 1910 lbs/acre this year. Oil content averaged 38.8 %. Oil levels were probably reduced by the hot, dry growing season.

TABLE 15S. IRRIGATED, NO-TILL CANOLA VARIETY PERFORMANCE NURSERY.  
Western Triangle Ag. Research Center, Conrad. 1996.

| VARIETY     | SEED<br>YIELD | OIL<br>CONTENT | OIL<br>YIELD |
|-------------|---------------|----------------|--------------|
|             | lbs/ac        | %              | lbs/ac       |
| SCH 007     | 2279.00       | 37.38          | 787.00       |
| WESTAR      | 2218.00       | 39.90          | 819.30       |
| 94-123      | 2112.00       | 39.45          | 771.40       |
| EAGLE       | 2108.00       | 39.30          | 766.80       |
| LEGEND      | 2060.00       | 38.50          | 734.20       |
| SCH 006     | 1957.00       | 37.27          | 674.90       |
| HELIOS      | 1952.00       | 37.82          | 684.20       |
| 4-95        | 1933.00       | 38.32          | 686.20       |
| 92-123      | 1928.00       | 39.35          | 702.60       |
| YA 307      | 1923.00       | 40.03          | 711.70       |
| CID 4477    | 1790.00       | 37.88          | 627.10       |
| BAZ 402     | 1757.00       | 39.78          | 646.70       |
| 018         | 1593.00       | 38.35          | 566.00       |
| SPRINGFIELD | 1566.00       | 38.78          | 562.20       |
| CID 4482    | 1474.00       | 39.97          | 545.50       |

**STATICTICAL TABLE**

|                      |           |       |           |
|----------------------|-----------|-------|-----------|
| EXPERIMENTAL MEANS   | 1910.00   | 38.81 | 685.70    |
| TOTAL OBSERVATIONS   | 60        | 60    | 60        |
| NO. OF REPLICATIONS  | 4         | 4     | 4         |
| VAR. MEAN SQUARE     | .2242E+06 | 3.628 | .2847E+05 |
| ERROR MEAN SQUARE    | .4350E+05 | .2766 | 5633.00   |
| ERROR DF             | 42        | 42    | 42        |
| P-VALUE              | 0.000     | 0.000 | 0.000     |
| STANDARD ERROR       | 208.6     | .5260 | 75.06     |
| STANDARD ERROR MEAN  | 104.3     | .2630 | 37.53     |
| C.V. 1: (S/MEAN)*100 | 10.92     | 1.355 | 10.95     |
| LSD (0.05)           | 297.6     | .7505 | 107.1     |

Seed yields based on 8 % moisture.

Oil content and oil yield on a dry weight basis.

Previous crop: Barley; Growing Season ppt. = 4.4"

Fertilizer: 150-30-30-20; Irrigated 6 times, 9.5"

Seeding Date: May 2; Swathing Date: Aug. 12

Harvest Date: Aug. 19; Herbicide: Stinger + Poast

Soil Tests: pH = 7.9, O.M. = 2.5 %, P = 45 ppm, K = 332 ppm,

Zn = 0.5 ppm, Cu = 1.5 ppm, Depth Cl NH<sub>4</sub>-N NO<sub>3</sub>-N SO<sub>4</sub>-S

| ft. | -----lbs/acre----- |      |     |      |
|-----|--------------------|------|-----|------|
| 0-1 | 15                 | 11.7 | 6.9 | 104  |
| 1-2 | 15                 | 11.3 | 2.7 | 270  |
| 2-3 | 15                 | 12.6 | 2.2 | 7784 |
| 3-4 | 15                 | 13.9 | 3.8 | 9460 |

**Comments:** Needed about 50 lbs more N for optimum yields. Low oil levels probably caused by the hot, dry summer.



TITLE: Food legume variety investigations

YEAR: 1996

LOCATIONS: Western Triangle Ag. Research Center, Conrad, MT

PERSONNEL: Dennis Cash (PI), Grant Jackson, and Larry Christiaens

OBJECTIVES: Evaluate pea and lentil varieties under dryland, no-till conditions.

PROCEDURES: Plots were planted no-till on a field previously in barley with a six-row , no-till plot planter. Plot size was six, 12 inch rows, wide and 20 feet long. Pea and lentil entries are shown in each table. Planting rate was six seeds/ foot of row. Thirty lbs of  $P_2O_5$  were applied with the seed. Plots were swathed and threshed with a small plot swather and Hege combine.

RESULTS: Spring pea data are shown in Table 16S. Lentil data are presented in Table 17S. Seed yields were good considering the amount of growing season rainfall received. Volunteer barley reduced yields of both commodities.

TABLE 16S. SPRING PEA PERFORMANCE NURSERY. Western Triangle Ag.  
Research Center, Conrad. 1996.

| VARIETY                       | SEED<br>YIELD |
|-------------------------------|---------------|
|                               | lb/ac         |
| ARVIKA                        | 1327          |
| PROFI                         | 1138          |
| BARONESS                      | 1111          |
| MAJORET                       | 859           |
| PROMAR                        | 842           |
| CARNEVAL                      | 705           |
| ***** STATISTICAL TABLE ***** |               |
| EXPERIMENTAL MEANS            | 993           |
| NO. OF REPLICATIONS           | 4             |
| REP. MEAN SQUARE              | .5828E+05     |
| VAR. MEAN SQUARE              | .1887E+06     |
| ERROR MEAN SQUARE             | .6454E+05     |
| ERROR DEGREES OF FREEDOM      | 13            |
| F-VALUE FOR VAR.              | 2.924         |
| P-VALUE FOR VAR.              | .0495         |
| STANDARD ERROR                | 254.1         |
| STANDARD ERROR OF THE MEAN    | 127.0         |
| C.V. 1: (S/MEAN)*100          | 25.5          |
| C.V. 2: (S OF MEAN/MEAN)*100  | 12.7          |
| LSD (0.05)                    | 388           |

Nursery planted no-till in barley stubble.  
Variability probably due to drought conditions  
and barley volunteer.

Growing Season Precip. = 4.5"

Planting Date: May 15

Swathing Date: August 2

Threshing Date: August 12

TABLE 17S. LENTIL PERFORMANCE NURSERY. Western Triangle  
Ag. Research Center, Conrad. 1996.

| <u>VARIETY</u>                | <u>SEED<br/>YIELD</u> |
|-------------------------------|-----------------------|
|                               | <u>lb/ac</u>          |
| RED CHIEF                     | 1015                  |
| CRIMSON                       | 716                   |
| FRENCH GREEN                  | 687                   |
| INDIAN HEAD                   | 268                   |
| LARID                         | 207                   |
| ***** STATISTICAL TABLE ***** |                       |
| EXPERIMENTAL MEANS            | 579                   |
| NO. OF REPLICATIONS           | 4                     |
| REP. MEAN SQUARE              | 9241                  |
| VAR. MEAN SQUARE              | .4559E+06             |
| ERROR MEAN SQUARE             | .1374E+05             |
| ERROR DEGREES OF FREEDOM      | 12                    |
| F-VALUE FOR VAR.              | 33.18                 |
| P-VALUE FOR VAR.              | .0000                 |
| STANDARD ERROR                | 117.2                 |
| STANDARD ERROR OF THE MEAN    | 58.61                 |
| C.V. 1: (S/MEAN)*100          | 20.26                 |
| C.V. 2: (S OF MEAN/MEAN)*100  | 10.13                 |
| <u>LSD (0.05)</u>             | <u>181</u>            |

Nursery planted no-till in barley stubble.

Variability probably caused by drought conditions  
and extensive barley volunteer.

Growing Season Precip. = 4.5"

Planting Date: May 15

Swathing Date: August 2

Threshing Date: August 12