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The 14th

ANNUAL REPORT

of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

1991

Submitted by

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and

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MSU-MAES Research Report

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Climatic summary for the 1991 calendar year at the Western Triangle Research Center, Conrad, MT.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total or average
Precipitation (inches)													
Current Year	0.29	0.14	0.40	1.22	2.75	6.78	0.81	1.50	0.42	0.50	0.31	0.00	15.12
Average	0.27	0.25	0.68	0.91	2.06	2.31	1.25	1.83	1.94	0.37	0.30	0.15	12.32
Mean Temperature (^{0}F)													
Current Year	15.7	37.3	31.8	44.5	51.6	56.3	65.7	69.9	58.0	41.5	31.9	30.9	44.6
Average	24.7	22.2	33.8	44.5	52.9	61.5	66.9	65.6	57.7	45.8	32.4	25.3	44.4

Last killing frost in Spring
1991----------May 6 (29^0)
Average----------May 16

First killing frost in Fall
1991----------Sep 18 (30^0)
Average----------Sep 24

Frost free period
1991----------135
Average----------130

Maximum summer temperature-------99^0 (Aug 11)

Minumum winter temperature------- -30^0 (Jan 3)

Summary of climatic data by month for the 1990-91 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

	Sept 1990	Oct 1990	Nov 1990	Dec 1990	Jan 1991	Feb 1991	Mar 1991	Apr 1991	May 1991	Jun 1991	Jul 1991	Aug 1991	Total or Average
Precipitation (inches)													
Current year	0.21	0.12	0.19	0.09	0.29	0.14	0.40	1.22	2.75	6.78	0.81	1.50	14.50
Average	2.19	0.35	0.30	0.18	0.27	0.25	0.68	0.91	2.06	2.31	1.25	1.83	12.58
Mean Temperature (°F)													
Current year	64.1	44.5	33.5	15.0	15.7	37.3	31.8	44.5	51.6	56.3	65.7	69.9	44.1
Average	57.6	46.6	32.5	24.2	24.7	22.2	33.8	44.5	52.9	61.5	66.9	65.6	44.4

Last killing frost in Spring
1991----------May 6 (29°)
Average----------May 16

First killing frost in Fall
1991----------Sept. 18 (30°)
Average----------Sept. 24

Frost free period
1991---------- 135
Average---------- 130

Maximum summer temperature---- 99° (Aug. 11)

Minimum winter temperature---- -30° (Jan. 3)

Title: Winter Wheat Variety Investigations.

Year: 1991

Personnel: Gregory D. Kushnak, Ron Thaut, and Larry Christiaens - Research Center; and Dr. Gene Hockett, MSU, Bozeman.

Differential winterkill among varieties at the Research Center at Conrad precluded any meaningful collection of yield data in 1991. The situation was excellent, however, for winterhardiness evaluation of 50 new sawfly resistant experimental lines developed by the MSU Plant & Soil Science Dept. Milling quality evaluation on the surviving lines resulted in five promising selections for further field testing in 1992.

Off-station plots grown at Chester, the Knees Area, Sun River, and Eden had good winter survival, but the plot at Dutton was lost to winterkill. Data for the harvested locations in 1991 are presented in Tables 1, 3, 5, and 7; with five-year averages for the respective sites presented in Tables 2, 4, 6, and 8. (Emphasis should be placed more on the five-year averages when predicting which varieties are best suited for a given area. The 1991 tables reflect performance under the conditions of only one year, and therefore should not be relied on too heavily.)

None of the plots had Russian wheat aphids, and sawfly infestations were light. Yields, test weights, and plant heights were exceptionally high in 1991. Based on five-year averages, Rocky, Centurk, Tiber, Judith, and Neeley were among the top yielders at most locations. Quantum 542 was not tested during all of the years, and therefore not included in the five-year averages. Quantum 542 was usually the highest yielder in the years it was tested. Quantum 542 is a first-generation hybrid, requiring new seed each year. Vona yielded high in 1991, but averaged low over the 5-year period, due to low winterhardiness. Judith and Neeley had higher sawfly damage than Tiber at the Knees location in 1991. This was not consistent with previous years when Judith showed less sawfly damage than Tiber and Neeley, and would therefore be expected to escape sawfly more often. Centurk and Rocky showed very little sawfly damage in 1991, which was consistent with observations in most years previous.

These trials were conducted by the Western Triangle Research Center, Conrad in Cooperation with Dr. E.A. Hockett, Montana State University Plant and Soil Science Department. The background and detailed descriptions for many of the varieties tested are included in Extension Bulletin 1098, "Performance Summary of Winter Wheat Varieties in Montana," available at all county agent offices. Other comments about the varieties, based on observations in Triangle Area trials, are presented in the following pages.

COMMENTS ON WINTER WHEAT VARIETIES

WINTER WHEAT

Abilene (Agripro NA 362-5) - Ranked low, Conrad 1988, low winter-hardiness(2). Adapted north of Ks/Okla borders and Texas panhandle. Short semidwarf. Susceptible to Hessian fly.

Agassiz(ND) - Recommended for District 6 only to replace Froid (Eastern Montana). High winterhardiness (4-5). Tall very weak straw, lodges bad. Low yield; shatter resistance and protein fairly good, better than Norstar. Medium late maturity.

Arapaho (Nebr)-Medium height with long coleptile and moderate straw strength. Winterhardiness fairly good?? Heterozygons (mixed) resistance to one strain of Hessian fly.

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

Blizzard (ID 0297) - Idaho/Oregon/USDA joint: Snow mold resistance - for high elevation areas under snow. Probably similar to Weston for winter-hardiness which is not very high. Dwarf bunt resistant. Tough to thresh; lots of spikelets in grain sample.

Bighorn(Rohm & Haas, Inc. Hybritech Intl, Inc.) - Winterhardiness less than Cheyenne, and may be risky. (might be considered a 2). Short straw. Medium early maturity. Protein is fairly high.

Centurk-(Nebraska). High yield, low protein. Medium winterhardiness, less than Redwin and Tiber. Very susceptible to yellow berry expression under low Nitrogen conditions. Early maturity, which sometimes allows escape from sawfly. Medium stiff straw.

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

Chisolm -(Oklahoma). Winterhardiness equal or less than Cimmaron.

Cimmaron -(Oklahoma). Winterhardiness adequate for Kansas, Nebraska, and Colorado. Semidwarf, red head, awnless (awnletted). Hard to thresh due to very stiff straw.

Cree(MSU)-Shatter resistant version of Cheyenne. Identical to Cheyenne in other respects except has red head and brown chaff. Medium to high yield. Winterhardiness medium (3). Tall straw. High protein. Medium maturity and highly vulnerable to sawfly.

Dawn-Medium short height, good lodging resistance. Early maturity. Fair winterhardiness.

Eklund-Beardless. Medium short height and maturity. High winterhardiness (4 or5). Medium shatter resistance.

Froid - Drop from recommended list. Low yield and tall weak straw. High winterhardiness (5).

Hawk -(NAPB) Winterhardiness moderate, but probably less than Centurk; sometimes yields high, but not consistently. Adapted to Southern Great Plains.

Hill (Oregon)- Soft White. Compared to other soft-white wheats, winterhardiness is good, but still may be risky for Triangle area.

Judith (MT 8039)(MSU)- Yields fair to good - sometimes equal to Rocky, and Tiber. Low vernalization requirement. Stripe and stem rust resistant. Protein is equal to Tiber, greater than Centurk, and less than Redwin. Early maturity equal to Centurk,and earlier than Tiber. However, it had more sawfly damage than Rocky & Tiber at the Knees plot in 1991. Medium short straw; winterhardiness higher than Rocky and Cheyenne, and equal to Redwin. Medium shatter resistance.

Three problems:

1) Test wight is sometimes low, and may be a problem.
2) Broken stems at crown and white heads at Conrad in 1986.
3) Straw less stiff than Neeley, Tiber and Redwin; but stiffer than Rocky and Centurk. Has some red heads and tall and beardless heads.

Kestrel (Sask.,Can)-Supposedly winterhardy and high yielding in Canada.

Lamar(Colorado)-Medium height with long coleoptile. Adapted to severe low moisture conditions of Colorado.

Manning(Utah)-Medium short. Adapted to deep snow areas, resistant to dwarf bunt and moderately tolerant to snow mold.

MT 7811 - Hard white winter wheat for specialty markets (Market still under development). Medium high yield.

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

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.

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

Norstar(Canada) - Maximum Winterhardiness (5). Lower protein than Roughrider (medium). Very tall straw, poor lodging resistance. Low yield. Late maturity. Medium shatter resistance.

Norwin(MSU)-Winalta winterhardiness (4-5 high). Protein medium to low. Pseudumonas bacterial leaf blight bad. Licensed in Canada. Short semidwarf straw, but not a tripledwarf. Too short for dryland. Medium yield. Good shatter resistance. Medium maturity.

Quantum 542 (Hybritech- Seed Intl. Inc.) - An F_1 hybrid; needs new seed each year. Planting F_2 (second generation) seed may result in yield reduction and developement of ergot due to sterility in a small percentage of florets (ms ratio less than 3:1). F_1 vs F_2 tests are currently in progress. High yield; protein as good as Rocky; early maturity like Rocky. Recommended in 1991. Medium short height, lodging resistance equal to Rocky. Winterhardiness is fairly good but less than Winalta. Bearded.

Quantum 555 - An F1 hybrid (see Q 542). According to Hybritech, adapted to Montana, 2 days later than Centurk. Semidwarf. Excellent straw strength. Good winterhardiness. Dryland and irrigated. Awnletted.

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

Rawhide-not tested. For Southern Plains.

Redwin(MSU) -Among the highest protein winter wheats. Yields similar to Winalta. Winterhardiness 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). Medium-late maturity, medium yield. Red head. Very susceptible to leaf spot fungi and bacterial leaf blight. Good shatter resistance. Tiber and Readymade were selected from Redwin.

Readymade (W188)(Canada) - Selection out of Redwin by Agr Canada at Lethbridge. Slightly lower protein, and larger kernels than Redwin. Presumably will be higher yield than Redwin. 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, thus eliminating marketing problems for Canadians.

Rio Blanco (NAPB)-not tested. For Southern Plains.

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

Roughrider(ND) - Tall,but more lodging resistant than Winalta. Good winterhardiness (5). Low yield. Medium-late maturity. For Eastern Montana; protein slightly greater than Winalta (high). Has a shatter problem in the Triangle area. Susceptible to leaf spot diseases.

Seward (ND 8002) - (Centurk/Froid/Norstar). Winterhardiness (3) of Winalta, outyields Winalta by 20% at Sidney, but not at Conrad. Medium height and is shorter and stiffer than Winalta (about like Rocky). Protein 3/4% less than Norstar. Good lodging resistance. Quality test was unsatisfactory. Medium shatter resistance. Low yield.

Siouxland (SD) - Sticky dough problems, and could damage our market image.

Thunderbird(NAPB) - Winterhardiness may be low, less than Centurk. Short straw with good lodging resistance, long coleoptile. Early maturity.

Tiber(MSU) - Winterhardiness comparable to Redwin, greater than Cheyenne, and slightly lower than Winalta. Equal, or sometimes 1 bushel less than Neeley. Among highest yielders. Medium short height with good lodging resistance. Stiff straw - stiffer than Judith, but not quite as stiff as Redwin (This may cause it to thresh a little harder than weaker-strawed varieties). It seems to persist longer after tillage, thus good for conservation compliance. Higher yielding and more tillers than Redwin, but 1/2% less protein. Protein is higher than Rocky, and similar to Neeley. Medium maturity. Slightly earlier than Redwin, but still late enough to be sawfly vulnerable. Much greater tolerance to leaf spot diseases than Redwin. Good shatter resistance. Good milling and baking quality. Dark Red head, (darker than redwin); blackish

red in years of favorable moisture. This trait makes Tiber popular for wheat weaving and other crafts.

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

Warrior(NEBR)-Tall straw and medium maturity. Medium shatter resistance. Yields lower than Cree. Resistant to one strain of Hessian fly.

Weston -(Idaho) Dwarf smut resistant. Lodges; tall. Winter killed at Moccasin in 1989, winterhardiness poor. Moderate snowmold tolerance.

Winalta - High protein, tall weak straw, high winterhardiness (4). Medium yields. Good shatter resistance. Redwin and Tiber offer improvements.

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

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

Winridge(MSU) - Medium to high yield. Medium height with stiff straw. Medium late maturity, and therefore highly vulnerable to sawfly. Low test weight and protein. Winterhardiness (2) medium, better than Centurk but less than Cheyenne. Good shatter resistance. For dwarf smut areas.

2) Winter Triticale

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

Flora - Short strawed looks good. Survived winter of 1989 OK, but winterhardiness is questionable. Straw breakage observed in 1988.

Grace - Poor winterhardiness (May be a spring type). Stembreakage and crinkle-joint.

Winteri - (Canada) - Very tall and late maturing.

VTO numbers from 1988: winter types accord to Peterson (WSU).

Table 1. **Winter Wheat** variety trial grown south of **Chester**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Spring survival class 1/	% Protein
NEELEY		75.72	63.21	38	3	13.1
WINRIDGE		68.44	62.44	38	2	10.4
VONA		67.92	64.13	32	**	11.4
MT 7811	2/	66.41	61.66	37		11.1
CENTURK		66.02	63.00	36	2	13.3
NORWIN		65.50	64.06	30	5	14.1
SEWARD		65.32	61.10	40	3	13.0
JUDITH		64.75	62.08	38	3	12.3
NORSTAR		63.30	62.58	45	5	10.8
MT 88001	*	62.45	63.14	27		14.5
TIBER		60.33	62.37	37	3	12.4
CREE		59.88	62.79	39	3	14.3
CHEYENNE		59.47	62.15	43	3	15.5
BLIZZARD		59.02	62.23	37	2-3	15.7
ROCKY		58.96	63.00	35	2	15.1
WINALTA		58.35	63.50	43	4	15.2
REDWIN		57.95	62.72	36	3	16.1
WARRIOR		56.87	62.08	39		13.3
ROUGHRIDER		55.96	62.15	40	5	14.9
HAWK		54.50	63.21	32		14.4
AGASSIZ		52.58	62.51	43	4	13.4
MT88005	*	46.07	61.10	38		15.4

Cooperator and location : Mike Violet, 10 miles south of Chester.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow.
Date seeded : September 6, 1990.
Date harvested : August 6, 1991.
Rainfall : May 15 to harvest = over 6 inches.
* = Sawfly resistant varieties. (MT 88001 partial)
** = Vona is probably not very winter hardy; less than Rocky.
1/ = Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ = Hard white wheat.
Yield experimental mean : 61.17
Error degrees of freedom : 42.00
F test for var. : 13.56
C.V. 2 : 2.81
LSD (0.05) : 4.90

Table 2. **Five-year** summary for **Winter Wheat** varieties grown south of **Chester,** MT. 1986 - 1987 - 1988 -1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein 1/
NEELEY	47	57	27	15.4
CENTURK	45	58	27	14.7
TIBER	44	59	27	15.1
CHEYENNE	44	61	29	15.2
ROCKY	43	59	26	14.4
JUDITH	43	58	27	15.7
REDWIN	43	60	26	16.0
HAWK	43	60	24	14.0
CREE	42	60	27	15.4
WINRIDGE	41	56	27	15.5
WARRIOR	41	60	28	15.1
VONA	41	61	24	14.0
NORWIN	41	60	21	14.7
NORSTAR	40	60	30	15.6
WINALTA	40	61	28	15.3

Cooperator : Mike Violet
Location : Ten miles southwest of Chester, Liberty County.
1/ = Proteins based on four years. (1986-1987-1988-1990)

Table 3. **Winter Wheat** variety trial grown at the **Knees** east of Brady, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Spring survival class 1/	% Prot.	% Sawfly damage
ROCKY	75.27	64.69	42	2	11.8	5
CENTURK	72.27	64.41	42	2	11.5	5
TIBER	70.24	63.00	42	3	12.7	10
BLIZZARD	69.02	63.42	42	2-3	12.2	10
HAWK	67.42	64.13	35		12.8	20
CREE	66.27	63.92	46	3	12.4	20
NEELEY	65.84	63.99	41	3	10.8	20
VONA	65.33	64.98	35	**	13.1	10
WARRIOR	63.41	63.50	46		13.3	10
JUDITH	62.89	62.15	42	3	12.8	40
MT 7811 2/	62.75	61.80	42		12.9	20
CHEYENNE	62.32	63.78	45	3	12.8	20
WINRIDGE	62.15	62.30	43	2	12.0	20
REDWIN	61.92	64.48	42	3	12.6	5
SEWARD	60.78	62.08	42	3	12.7	20
NORWIN	59.25	64.48	31	5	11.9	5
MT 88001 *	57.82	63.42	29		13.7	0
AGASSIZ	56.79	62.86	50	4	13.4	20
WINALTA	53.87	63.07	48	4	13.5	5
ROUGHRIDER	52.48	63.14	46	5	13.7	20
NORSTAR	50.21	63.07	53	5	14.5	50
MT 88005 *	46.53	61.31	45		14.5	0

Cooperator and location : Dan Picard, 30 miles east of Brady.
Fertilizer : 100# 11-51-0 with the seed + 65# AA-N.
Previous crop : Fallow.
Date seeded : September 10, 1990.
Date harvested : August 5, 1991.
Rainfall : May 15 to harvest = 4.9".
* = Sawfly resistant varieties. (MT 88001 partial)
** = Vona is less winterhardy than Centurk.
1/ = Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ = Hard white wheat.
Yield experimental mean : 62.04
Error degrees of freedom : 42.00
F test for var. : 11.56
C.V. 2 : 3.38
LSD (0.05) : 5.98

Table 4. **Five-year** summary for dryland winter wheat varieties grown near the **Knees,** 1986 - 1987 - 1988 - 1990 - 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield bu/ac	Test wt. lbs./bu.	Plant hgt. inches	% Protein 1/
ROCKY	46.6	58.6	31	14.3
CENTURK	45.8	58.6	31	13.6
TIBER	45.6	60.6	32	14.3
JUDITH	45.0	58.4	32	14.2
CREE	43.4	61.6	33	15.5
NEELEY	43.2	58.8	30	14.5
CHEYENNE	42.8	61.6	33	14.5
WINRIDGE	42.4	59.0	32	14.2
REDWIN	41.8	61.0	31	14.8
NORWIN	38.8	59.2	24	13.5
WINALTA	37.0	60.0	35	14.2
NORSTAR	36.0	59.0	35	14.7

Cooperator : Dan Picard
Location : Thirty miles east of Brady, Chouteau County.
1/ = Proteins based on four years. (1986-1987-1988-1990)

Table 5. **Winter Wheat** variety trial grown near **Sun River**, MT., 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
VONA	*	56.2	64.2	32	14.1
NEELEY		53.7	62.8	35	14.1
ROCKY		53.1	63.9	35	15.3
JUDITH		52.1	62.9	36	15.0
CREE		50.8	63.5	38	16.6
CENTURK		50.6	64.1	36	14.8
NORWIN		50.5	63.4	27	14.8
TIBER		50.0	62.8	37	15.8
BLIZZARD		50.0	62.5	37	15.5
REDWIN		50.0	63.2	35	16.2
CHEYENNE		49.7	62.2	39	16.6
SEWARD		49.2	61.9	36	14.5
WINRIDGE		48.8	62.9	41	13.7
HAWK		47.5	63.8	33	15.2
MT 7811	**	45.8	61.9	36	15.3
MT 88001		44.7	62.2	27	15.0
ROUGHRIDER		44.5	62.9	39	15.6
AGASSIZ		42.7	62.3	46	16.2
WINALTA		40.4	62.2	39	16.8
MT 88005		38.8	60.4	37	16.9
WARRIOR		38.0	62.1	36	16.5
NORSTAR		33.1	61.0	45	15.5

Cooperator and location : Chuck Merja, 3 miles southeast off Sun River.
Fertilizer : 100# 11-51-0 with the seed + 50# AA-N.
Previous crop : Fallow.
Date seeded : September 11, 1990.
Date harvested : August 6, 1991.
Rainfall : May 15 to harvest = 6.0 inches.
* = Vona is less winterhardy than Rocky.
** = Hard white wheat.

Table 6. **Six-year** summary for dryland winter wheat varieties grown near **Sun River,** MT. 1986 - 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	6 - year comparable average			
	Yield bu/ac	Test wt. lbs./bu.	Plant hgt. inches	% Protein 1/
CENTURK	37	61	29	16.3
ROCKY	37	61	29	15.8
TIBER	37	60	29	15.6
JUDITH	37	59	27	16.3
NEELEY	37	61	31	15.8
CREE	37	61	31	15.3
CHEYENNE	36	61	31	15.6
REDWIN	35	61	28	16.1
WARRIOR	34	60	30	15.6
WINRIDGE	34	59	29	16.0
NORWIN	34	61	22	15.2
WINALTA	32	61	32	15.7
NORSTAR	31	60	34	15.4

Cooperator : Chuck Merja
Location : Three miles southeast of Sun River, Cascade County.
1/ = Proteins based on five years. (1986-1987-1988-1989-1990)

Table 7. **Winter Wheat** variety trial grown near **Eden,** 1991. Mont. Agr.Expt. Sta., Western Triangle Research Center, Conrad, Mt.

Variety	Yield bu/ac	Test wt. lb/bu	Plant hgt. inches	Spring survival class 1/	% Protein
ROCKY	42.77	62.86	36	2	9.6
NEELEY	42.41	62.44	33	3	9.7
CENTURK	40.77	62.23	33	2	9.0
REDWIN	40.28	62.79	37	3	11.6
JUDITH	40.25	61.45	33	3	9.3
NORSTAR	39.42	63.28	41	5	8.9
TIBER	39.10	62.51	37	3	9.4
MT 7811 2/	38.48	61.87	36		8.4
VONA	37.64	62.93	33	**	10.5
NORWIN	37.53	64.13	28	5	10.6
HAWK	36.96	62.72	33		9.1
BLIZZARD	36.30	62.51	35	2-3	9.9
SEWARD	35.74	61.52	40	3	10.2
WINRIDGE	35.73	60.25	40	2	8.1
WARRIOR	35.60	62.93	38		10.1
WINALTA	35.17	64.20	37	4	9.8
CREE	34.99	62.30	37	3	10.0
MT 88001 *	34.97	63.35	27		10.3
CHEYENNE	34.79	62.44	38	3	10.2
AGASSIZ	34.22	62.79	40	4	9.4
ROUGHRIDER	29.22	62.44	38	5	10.6
MT 88005 *	27.60	62.30	41		11.1

Cooperator and location : Tom Lorang, Eden.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow.
Date seeded : September 11, 1990.
Date harvested : August 19, 1991.
Rainfall : May 15 to harvest = more than 6.5 inches.
* = Sawfly resistant varieties. (MT 88001 partial)
** = Vona is less winterhardy than Rocky.
1/ = Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ = Hard white wheat.
Yield experimental mean : 36.82
Error degrees of freedom : 42.00
F test for var. : 2.37
C.V. 2 : 6.54
LSD (0.05) : 6.88

Table 8. **Five-year** summary for dryland winter wheat varieties grown near **Eden,** MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield bu/ac	Test wt. lbs./bu.	Plant hgt. inches	% Protein 1/
NEELEY	53	62	34	9.6
WINRIDGE	51	59	38	9.3
JUDITH	50	60	35	9.7
TIBER	48	62	36	10.5
CREE	47	63	38	10.7
NORWIN	47	63	27	10.7
CENTURK	46	62	35	9.7
ROCKY	46	62	36	10.2
NORSTAR	46	62	43	10.8
REDWIN	45	62	36	10.6
WARRIOR	45	63	37	10.0
CHEYENNE	44	63	38	10.7
WINALTA	42	63	39	11.0

Cooperator : Tom Lorang
Location : East of Eden, Cascade County.
1/ = Proteins based on four years. (1987-1988-1989-1990)

TITLE: Spring Wheat, Durum, and Triticale variety investigations.

YEAR: 1991

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Gregory D. Kushnak, Ron Thaut, and Larry Christiaens, Research Center, Conrad; and Dr. Luther Talbert, MSU Dept. of Plant & Soil Science.

Dryland spring wheat variety trials were grown near Cut Bank, Oilmont, Choteau, Sun River and the Research Center at Conrad: and irrigated at Conrad. Durum and triticale were included at Conrad. All Trials were grown on fallow. In addition, a no-till recrop trial was grown at Conrad, and is reported in the no-till section of this report.

Data for the 1991 spring wheat tests at the various locations are presented in Tables 9-21. Five-year averages are included among the data tables. (Emphasis should be placed more on the five-year averages when predicting which varieties are best suited for a given area. The 1991 tables reflect performance under the conditions of only one year, and therefore should not be relied on too heavily). Performance varied among varieties depending on moisture, sawflys, and other conditions at the different locations. Sawfly damage was severe at Choteau, moderate at Conrad, and slight at the other locations.

The variety 'Hi-Line' (MT 8402), recently developed by MSU, generally produced a combination of high yield and protein at most locations. Hi-Line is susceptible to sawfly and would not be suitable for growers needing a variety with sawfly resistance. However, in areas where hollow stemmed varieties have been grown successfully, Hi-Line showed some advantages over Newana and Pondera. When averaged over several Western Triangle locations during the last five years, Hi-Line was slightly higher in yield, nearly one percent higher in protein, and four days earlier to ripen than Newana. Hi-Line was similar to Pondera for protein, ripening date, and dryland yield; but yielded three bu/a higher than Pondera on irrigated. Test weight and plant height of Hi-Line were slightly less than for Pondera.

Among sawfly resistant varieties, Glenman yielded the highest when averaged over all locations during the five-year period, but averaged low in protein and test weight. Rambo and Amidon also ranked high for yield, but both showed only partial resistance to sawfly. In addition, Amidon was tall (like Lew and Fortuna) and would not be suitable for irrigated conditions. At some of the dryland locations, Lew and Fortuna yielded nearly as much as Glenman, and yet had much higher protein. Approximately 50 experimental sawfly resistant lines were grown at Conrad for evaluation of stem solidness and cereal quality. Some of these

lines are planned for yield testing in 1992.

Durum varieties were grown at Conrad dryland and irrigated sites (Tables 22-26). Lloyd and Cando had the highest yields on both irrigated and dryland. These varieties are short semidwarfs however, and should be considered with caution in drier conditions. Renville ranked high in the irrigated yields, but this variety would be unsuitable for irrigated conditions due to its tall weak straw.

Triticale data are presented in Table 27, with a five-year summary in Table 28. Although heading dates of triticale were earlier than Newana wheat this year, ripening was later than wheat. The varieties Sunland and Juan were considered high risk for much of the Triangle area due to their very late maturity. Plant height was excessive for all triticale varieties except for Karl and Kramer. These two varieties were the earliest to ripen, nearly the same as Newana wheat. Triticale yields were based on a 50-pound test weight. If direct comparisons to wheat yields are desired, the bushel-yield data should be converted to pounds per acre.

All triticale varieties suffered sawfly damage. Ergot was not detected in the test plots; but ergot has been observed in some triticale fields in the Triangle area during years past.

The trials were conducted by the MSU Western Triangle Research Center, Conrad; in cooperation with the MSU Plant and Soil Science Department. The background and detailed descriptions for many of the varieties tested are included in MSU Extension Bulletin 1093, "Performance Summary of Spring Wheat Varieties in Montana," available at all County Agent offices. Other comments about the varieties, based on observations in Triangle Area trials, are presented in the following pages.

COMMENTS ON SPRING WHEAT, DURUM, & TRITICALE VARIETIES

Far-Go herbicide tolerance:

Spring wheat varieties reported to have the highest tolerance to Far-Go are Shallow, Bronze Chief, Kodiak, NK 751, Len, Oslo, Butte, Marshall, Success and Rambo. Lew, Newana, Alex, Erik, Pondera, Fremont and Amidon are the least tolerant, while Westbred 906R, McKay and Glenman are somewhere in between. 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. 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. If the soil is light and has little organic matter, injury to the spring wheat is more likely.

1) Semidwarf Sawfly resistant varieties:

Cutless (ND)-Bearded semidwarf. Poor lodging resistance. Among lowest yielders. Protein high like Fortuna. Moderately susceptible to septoria. Medium test weight.

Glenman(MSU)-Beardless semidwarf, poor lodging resistance,(weak straw for a semidwarf). Medium-low (1%< Lew, 2%< Fortuna) protein, low test weight, hard to thresh. High yield. Higher yield than Lew most years, and about equal to Rambo. Quality poor.

Rambo, Westbred(WPB)-Sawfly resistance-partial. Short stiff straw, but medium lodging resistance. Bearded semidwarf. Threshes easily, high yield, similar to Glenman. Medium-low protein similar to Glenman, but 1% lower than Lew and 2% lower than Fortuna. May have more tolerance to septoria than Fortuna, but is still susceptible. Test weight high.

2) Standard Height Sawfly resistant Varieties:

Amidon (ND 606)-Standard height, bearded. Partial solid stem, lodges worse than Fortuna. Weak broken stems. Same maturity as Lew, but slightly higher yield. Slightly later to mature than Pondera. Yield and test weight is medium to high. High protein like Fortuna. Does well in dry areas. Moderately susceptible to septoria. Sawfly resistance not sufficient for severely infested areas.

Fortuna(ND)-Beardless, high protein and test weight, early maturing; medium to low yield. Apparently tolerant to Fargo. Very susceptible to septoria. Somewhat susceptible to shattering.

Lancer(Canada)-Awnless. Among lowest yielders and seldom a protein advantage over Lew and Fortuna. Tangled lodging mess due to weak straw. Test weight medium-low.

Leader-(Canada) Among lowest yielders. Seldom a protein advantage over Lew and Fortuna.

Lew(MSU)-Beardless. Septoria tolerance moderate. 3 days later, and slightly lower protein than Fortuna, and susceptible to Fargo. Average yield similar to Fortuna. Avenge herbicide cannot be used. Medium to high test weight. Better shatter resistance than Fortuna. Medium-high protein, but less than fortuna.

Tioga (ND)-Beardless, standard height. Medium test weight, high protein, low yield. Good shatter resistance. Susceptible to lodging. Septoria tolerant.

3)Hollow Stem varieties:

Alex-(ND) beardless. Standard height, semidwarf, medium lodging, high protein. Good shatter resistance and test weight.

Bergen -(Agripro), 1991. For Minnesota. Medium test weight, low protein, semi-dwarf, good lodging resistance, medium-late maturity.

Bronze Chief(Seed Research Inc.)-Very low yield. Used in specialty milling market at Three Forks, MT.

Butte 86(ND)-Stronger straw than Butte, but low yield. Medium height. Bearded. Medium test weight, high protein. Septoria susceptible.

Copper-(Idaho) Replaces McKay (higher quality), in Idaho. Protein and test weight is 1% less than Pondera. Awned semidwarf. Late maturity. Straw weaker than Pondera and 906R.

Field-(Agripro)-Medium yield, short stiff straw, medium maturity, low test weight and protein.

Grandin (ND)-To replace Stoa in North Dakota. Semidwarf, good lodging resistance, bearded, medium high protein. Maturity similar to Pondera. Yields less than Pondera and Hi-Line.

Gus(ND)-For high yield areas of Eastern Montana. Semidwarf; good lodging resistance, bearded. Very high protein and medium-late maturity (like Newana). Lower yield than Pondera and Hi-Line.

Hi-Line(MT8402) - Higher protein and 3 days earlier than Newana. Hi-Line yields greater than Newana on dryland, but similar to Newana on irrigated. Test weight slightly higher than Newana. Hi-Line yields similar to Pondera on dryland, but is 3 bu/a better than Pondera on irrigated. Protein and maturity of Hi-Line is similar to Pondera; but height is one inch shorter and test weight is slightly less than Pondera.

Kamut (T. polonicum 4x)-Polish wheat: about like durum; seeds bigger than durum. Non-allergenic gluten. 1% more protein than Pondera. Pasta & cereal products. 4 to 6" taller than Fortuna. Four days later to mature than Pondera. Too tall for irrigation.

Kodiak -Triple Dwarf-10" lower than Newana; 18" lower than Fortuna. Very low yield.

Len, (ND)-Bearded semidwarf. High protein. Straw not as stiff as Newana. Good quality, shatter resistance, and test weight. Tolerant to septoria. Yields similar to Pondera and Hi-Line, but Len has slightly lower protein.

Marshall (Minn)-Bearded, semidwarf, high yield and test weight on irrigated; good lodging resistance, low protein. Irrigation only.

McKay-(Idaho) Late maturing. High yield if water lasts, otherwise low yield. Replaced by Copper in Idaho.

Minnproe (MINN)-Bearded, semidwarf. short stiff straw, medium maturity, low test weight, medium protein.

ND 622-May be released - solid stem. May have some quality problems. Seed looks like winter wheat.

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

Nomad (WPB)-Semidwarf, good lodging resistance, medium-early maturity, beardless medium test weight (but higher than Glenman), medium protein.

Norak-NAPB.

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

Olaf(ND)-Bearded semidwarf, medium test weight and lodging. Medium to low shatter resistance. Medium high protein, medium-low yield. Septoria leaf blotch tolerant.

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

Pondera(MSU)-Semidwarf with good lodging resistance. A higher protein, earlier maturity (3 days) version of Newana. Sawfly susceptible. Good on irrigation or dryland. High yield and test weight. Tolerant to septoria.

Prospect (SD)-Bearded, semidwarf, low yield, medium maturity, medium lodging, high protein and test weight.

Probrand 751(NK)-High yield on irrigated, short stiff straw, low test weight and protein. For irrigation only. Good shatter resistance.

Stoa(ND)-Poor yield in triangle area, but popular in North Dakota because of protein. Bearded standard height. Lew and Pondera compete with it quite well in triangle area. To be replaced in ND by Grandin. Later to mature than Pondera and Grandin.

Success-(Cenex)Medium high yield with irrigation. Semidwarf, late maturity, low test weight and protein. Medium lodging resistance.

Telemark-(Agripro) medium early, good protein, short excellent stiff straw, semidwarf; good yield with irrigation.

Thatcher-Tall beardless. Very low yield.

Vance(MINN)-Bearded semidwarf, medium test weight, low protein.

Vandal(Idaho)-For irrigated only.

Westbred 926R-(WPB)- Bearded semidwarf. Similar to 906R for yield, but higher protein and better shatter resistance. Will replace 906R. Yield is very high. Earlier maturity than Newana.

Wheaton-(MN) Bearded semidwarf, low protein and test weight. High yield with irrigation. Short stiff straw, good lodging and good shatter resistance, medium to low test weight.

4)Soft White Spring Wheat

Fielder-highly susceptible to stripe rust and can lose 40% yield.

Owens(Idaho/Oregon)-Semidwarf Earlier than Waverly and Treasure, but still may be too late for dryland in most years. Stripe rust resistant. Short straw, medium maturity and test weight.

Penawawa-(Wash/Oregon)Semidwarf. Replacement for Owens? Bearded. shorter and stiffer straw than Owens, later to mature than Owens, and lower test weight.

Sprite-WPB

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

Treasure-Late maturing.

Waverly-Late maturing.

5)Hard White Spring-For specialty market. Protein of hard white will probably need to be at least 13% to meet market standards.

Golden 86 (Private Variety)-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 Tananger and Klasic.

Klasic-(NK) Hard white. Adapted to California. Not well adapted to Triangle area.

MT 8182-Fairly high protein and yield on irrigation or dryland. Bearded, hard white.

Tanager "S"(CIMMYT)-Very high yield (steep BYX) hard white.

DURUM

Cando(ND) - Very short semidwarf. Very high lodging resistance. For irrigation or favorable moisture. Not suited for dry conditions. Good shatter resistance and high yield. Test weight medium. Good quality. Septoria susceptible.

Coulter (Canada)- Blackbearded, but blackness disappears upon ripening.

Crosby(ND) - Standard height. Fair lodging resistance on dryland, and good shatter resistance. Test weight medium to high. Quality is satisfactory.

Fjord - (Agripro, NAPB developed) - Standard height, medium yield durum.

Golden Ball - Black bearded Canadian - old variety, seed may be hard to find - for wheat weaving.

Laker,Westbred - (WPB) - Semidwarf. High yield, stiff straw, medium lodging resistance, midway between standard height and semidwarf, better height choice for all around production, not as short as Lloyd and Cando. Diseased in irrigated in 1989, while other entries were not. Recommended for Dist 2-6. Protein medium. Quality is good. High test weight.

Lloyd(ND) - Very short. For irrigation or favorable moisture. Not suited for dry conditions. Very high lodging resistance. Good quality. High yield and good shatter resistance. Test weight is medium.

Medora - (Canada) - Standard height, with fair lodging resistance. Dryland only, medium to early maturity. Good yield, better than Monroe. Test weight is medium to high. Quality is good.

Monroe(ND) - Standard height, fair lodging resistance for dryland. Early maturity, dryland only. Test weight is medium. Good quality.

Pelissier - Black bearded Canadian. Wheat weaving.

Pender -Does not do well in Triangle area.

Regal, Westbred (WPB)-Standard height durum for dryland areas of Montana and North Dakota. Excellent semolina color and strong gluten. Medium yield, high test weight, medium-low protein.

Renville(ND) - (Rollette/Vic) -Standard height. 1 day later and greater yield than Vic. Tall, lodges bad; thus, even though it yields good on irrigation, its weak straw renders is unsuitable for irrigation. Has a niche in the low yield/low rainfall areas. Test weight is medium, and quality is acceptable.

Rolette(ND)-Standard height. Good shatter resistance and test weight. Good quality. Susceptible to leaf spot diseases.

Rugby(ND)-Standard height. Good shatter resistance. Medium test weight. Good quality. Moderately susceptable to septoria.

Sceptre(SASK) - Standard to medium height, but fairly stiff straw. Taller than Laker, but shorter than Medora and other standard height varieties.

Stockholm - (Agripro, NAPB developed) - Semidwarf (short like Lloyd and Cando), medium early durum, higher yield than Fjord. Very stiff straw. Protein medium to low.

Vic(ND) - Tall weak straw. Good shatter resistance and high test weight. Good quality.

Ward(ND) - Standard height with fair lodging resistance for dryland, and good shatter resistance. Test weight medium. Tolerant to septoria.

TRITICALE

1) Spring Triticale: Assume all triticales have a potential ergot problem!

Carman (Canada) - early maturing (similar to Newana wheat in maturity) by triticale standards; generally the best for dryland; and generally higher protein. Shorter straw than Welsh triticale, but still tall.

Karl(N. Dakota)-Early maturing (similar to Newana wheat in maturity) by triticale standards; generally the best for dryland; and generally higher protein. A semidwarf; thus, easier to manage than taller later varieties. Similar height as Newana wheat.

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

Marval - 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) - To replace Carman and Welsh. High yield but tall weak straw and late maturity.

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

Test weight of triticale = approximately 50 lbs/bu. Proteins were less than Newana wheat, but slightly higher than barley. Triticale seed rate 20% higher than wheat. Relative maturities and heights for triticale:

Newana	very very early	Short
Kramer	very early	Medium short
Carman	early	Medium tall
Karl	early	Short
Marvel	medium	Very tall
Welsh	medium late	Tall
Beagle	late	Tall
Wapiti	late	Medium tall
Sunland	very late	Medium tall
T-54	very late	Tall
T-61	very late	Tall
Juan	very very late	Tall
Whitman	very very late	Tall

Table 9. Dryland **Advanced Yield Spring Wheat** variety trial grown north of Conrad, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
OWENS	(s. white)	88.64	63.57	35	180	6.3
MT 9042		85.23	62.86	35	180	10.6
MT 9020		84.37	63.78	33	183	10.1
MT 8182		84.17	62.44	36	182	9.9
MT 9040		83.84	64.34	39	178	9.3
MT 8858		82.86	64.06	38	181	9.4
TANAGER'S'	(h. white)	82.46	65.82	33	177	8.7
RAMBO	*	81.67	63.85	32	183	9.4
NEWANA		81.27	63.21	33	184	9.5
MT 9045		80.86	65.26	38	178	10.0
MT 9002		80.75	60.60	37	182	10.0
MT 8849		80.38	64.20	37	183	10.6
PENAWAWA	(s. white)	79.49	64.41	34	182	7.5
PONDERA		78.75	65.05	36	180	10.0
MT 8841		78.40	64.41	34	180	9.8
GLENMAN	*	77.53	64.48	36	183	9.5
GOLDEN 86	(h. white)	77.38	65.61	33	178	11.1
MT 9044		76.27	63.71	36	182	10.7
MT 9057		76.26	64.48	37	183	11.6
MT 9055		75.53	63.71	39	185	11.7
KLASIC	(h. white)	75.35	65.40	26	175	9.5
LEN		74.99	64.41	34	177	11.0
MT 9052		74.61	64.55	36	182	11.2
HI-LINE	(MT 8402)	74.61	64.76	33	178	9.9
AMIDON	*	74.52	63.99	42	183	10.3
MT 9039		73.64	64.55	37	183	11.0
OLAF		73.03	63.42	35	181	11.3
MT 9043		71.76	64.84	38	182	9.9
MT 9017		71.50	62.86	41	181	10.9
MT 9024		71.35	63.99	45	181	10.6

(continued)

Table 9. **Continued.** (Advanced yield dryland spring wheat)

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
MT 9016		71.09	63.07	43	182	11.4
MT 9025		70.90	65.68	36	183	10.6
LEW		70.46	65.68	43	183	10.7
MT 9053		70.16	62.93	37	182	11.0
FORTUNA	*	69.82	65.26	42	183	11.1
MT 9028		69.75	65.40	36	182	11.1
MT 9032		68.16	64.13	39	182	10.4
MT 9030		66.61	65.33	36	181	10.2
MT 9054		66.22	63.99	37	183	12.6
MT 9058		66.19	64.27	36	181	12.7
MT 9019		65.62	63.00	40	178	10.7
MT 8612		65.13	65.68	37	181	10.3
STOA		64.93	64.13	43	181	9.9
THATCHER		63.96	64.06	46	181	11.0
BZ984326		63.45	64.98	38	178	11.2
MT 9021		63.02	65.33	35	181	11.6
CUTLESS	*	60.96	63.78	41	182	11.7
MT 9027		60.87	64.69	36	182	11.1
MT 9023		55.67	64.34	46	182	10.4

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 22, 1991.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 73.56
Error degrees of freedom : 96.00
F test for var. : 3.31
C.V. 2 : 5.60
LSD (0.05) : 11.56

Table 10. Dryland **Advanced Yield Spring Wheat** variety trial grown north of **Conrad,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT. **(Abbreviated table)**

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
OWENS	(s. white)	88.64	63.57	35	180	6.3
TANAGER'S'	(h. white)	82.46	65.82	33	177	8.7
RAMBO	*	81.67	63.85	32	183	9.4
NEWANA		81.27	63.21	33	184	9.5
PENAWAWA	(s. white)	79.49	64.41	34	182	7.5
PONDERA		78.75	65.05	36	180	10.0
GLENMAN	*	77.53	64.48	36	183	9.5
GOLDEN 86	(h. white)	77.38	65.61	33	178	11.1
KLASIC	(h. white)	75.35	65.40	26	175	9.5
LEN		74.99	64.41	34	177	11.0
HI-LINE	(MT 8402)	74.61	64.76	33	178	9.9
AMIDON	*	74.52	63.99	42	183	10.3
OLAF		73.03	63.42	35	181	11.3
LEW	*	70.46	65.68	43	183	10.7
FORTUNA	*	69.82	65.26	42	183	11.1
STOA		64.93	64.13	43	181	9.9
THATCHER		63.96	64.06	46	181	11.0
CUTLESS	*	60.96	63.78	41	182	11.7

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 22, 1991.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 73.56
Error degrees of freedom : 96.00
F test for var. : 3.31
C.V. 2 : 5.60
LSD (0.05) : 11.56

Table 11. **Five-year** summary for dryland **Spring Wheat** varieties grown north of **Conrad,** MT. 1987 - 1988 - 1989 -1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
TANAGER'S'	(h. white)	68.4	62	30	13.0
HI-LINE	(MT 8402)	63.2	62	29	13.7
GLENMAN	*	63.0	60	31	13.3
PENAWAWA	(s. white)	63.0	60	29	11.8
RAMBO	*	62.8	61	30	13.7
OWENS	(s. white)	61.4	60	30	10.8
AMIDON	*	61.4	60	36	14.2
OLAF		61.4	62	32	13.6
PONDERA		60.8	62	30	13.9
NEWANA		60.2	60	30	13.4
LEN		59.1	62	31	14.2
FORTUNA	*	58.2	62	36	14.5
KLASIC	(h. white)	57.4	62	22	12.7
LEW	*	57.0	63	36	14.1
CUTLESS	*	54.6	62	34	15.1
STOA		53.6	62	37	13.6
THATCHER		52.2	60	38	13.8

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.

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

Table 12. **Irrigated Spring Wheat** variety trial grown north of **Conrad,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
PENAWAWA (s. white)	105.00	65.26	35	181	9.6
OWENS (s. white)	99.58	63.99	36	182	9.6
RAMBO *	88.43	65.12	32	183	11.0
NEWANA	83.61	64.41	37	183	11.7
HI-LINE (MT 8402)	83.52	65.05	34	178	12.1
PONDERA	82.32	65.12	37	180	12.6
GLENMAN *	80.96	64.62	35	182	11.8
WESTBRED 926	78.12	64.55	33	177	12.2
LEN	77.66	64.62	34	176	12.8
GUS	75.27	64.62	37	180	13.5
STOA	73.52	64.27	39	181	12.8
OLAF	73.47	63.57	37	181	12.8
CUTLESS *	72.83	64.84	39	182	12.7
GRANDIN	72.43	64.84	37	182	13.1
LEW *	69.19	65.75	40	182	11.9
AMIDON *	69.13	63.85	40	181	12.2
FORTUNA *	63.62	65.89	41	180	12.6
LANCER *	50.67	64.34	43	183	13.8

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 26, 1991.
Irrigation method : Sprinkler; July 10, and July 19.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 77.74
Error degrees of freedom : 34.00
F test for var. : 22.34
C.V. 2 : 3.37
LSD (0.05) : 7.53

Table 13. **Five-year** summary for **Irrigated Spring Wheat** varieties grown north of Conrad, MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
PENAWAWA	(s. white)	88.4	62	32	10.9
OWENS	(s. white)	77.8	61	31	10.9
NEWANA		75.0	62	32	12.9
HI-LINE	(MT 8402)	74.6	63	32	13.3
GLENMAN	*	73.8	62	34	13.0
RAMBO	*	72.4	62	32	12.8
PONDERA		71.8	63	33	13.8
AMIDON	*	71.0	62	39	13.5
LEN		70.5	62	31	12.8
LANCER	*	68.8	62	38	14.8
LEW	*	68.6	63	39	13.9
OLAF		65.8	62	34	13.8
CUTLESS	*	65.3	62	35	14.0
STOA		64.4	62	38	13.3
FORTUNA	*	64.0	63	37	13.8

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.

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

Table 14. Dryland **Spring Wheat** variety trial grown north of **Cut Bank,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
OWENS	(s. white)	47.14	60.96	31	8.8
HI-LINE	(MT 8402)	40.84	62.86	27	8.3
PENAWAWA	(s. white)	40.37	62.44	27	8.3
PONDERA		40.07	63.21	30	9.0
RAMBO	*	38.68	62.58	28	8.6
OLAF		38.42	62.08	29	11.1
LEN		38.05	61.87	29	10.2
STOA		37.82	62.58	32	8.4
AMIDON	*	36.99	62.86	38	10.3
GUS		34.76	62.93	29	9.2
CUTLESS	*	34.34	63.42	34	10.9
LEW	*	33.64	61.87	34	8.2
GLENMAN	*	33.51	61.24	27	8.1
WESTBRED 926		33.50	61.45	28	8.8
NEWANA		32.88	62.51	27	9.4
LANCER	*	32.76	62.51	37	9.0
GRANDIN		32.53	63.35	29	11.5
FORTUNA	*	31.54	61.80	36	8.2

Cooperator : Don Bradley
Location : Fifteen miles north of Cut Bank, Glacier County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : May 15, 1991.
Date harvested : September 5, 1991.
Rainfall : From May 20 to harvest, 7.85 inches.
Soil moisture probe depth at seeding : 3'6" +
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 36.55
Error degrees of freedom : 34.00
F test for var. : 2.17
C.V. 2 : 7.45
LSD (0.05) : 7.82

Table 15. **Five-year** summary for **Spring Wheat** varieties grown north of Cut Bank, MT. 1987 - 1988 - 1989 - 1990 - 1991, Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein 1/
PENAWAWA	(s. white)	48.3	60	27	12.2
OWENS	(s. white)	47.2	59	29	11.7
AMIDON	*	44.8	60	35	14.1
GLENMAN	*	43.8	59	29	13.9
RAMBO	*	43.4	60	27	13.4
PONDERA		43.6	61	28	14.6
LEN		43.0	60	28	14.0
GUS		41.9	61	29	14.9
GRANDIN		41.2	62	29	14.8
STOA		41.4	60	31	14.5
LEW	*	40.6	60	33	15.1
NEWANA		40.2	60	27	14.2
FORTUNA	*	38.8	61	34	15.3
CUTLESS	*	37.8	60	30	14.5
LANCER	*	37.6	61	35	14.7
HI-LINE	(MT 8402)	36.8	59	27	14.9
OLAF		35.5	59	27	13.9

Cooperator : Don Bradley
Location : Fifteen miles north of Cut Bank, Glacier County.
* = Sawfly resistant varieties. (Rambo and Amidon have partial resistance.)
1/ = Protein averages based on four years. (1987-1988-1989-1990)

Table 16. Dryland **Spring Wheat** variety trial grown east of **Oilmont,** 1991. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, Mt.

Variety	Yield bu\ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
WESTBRED 926	54.70	54.32	33	15.9
PENAWAWA (s. white)	51.84	48.75	33	13.0
GLENMAN *	51.79	55.52	36	12.7
OLAF	50.59	53.27	37	13.8
FORTUNA *	49.59	56.30	43	13.7
HI-LINE (MT 8402)	49.51	52.07	34	15.6
AMIDON *	49.47	54.75	45	14.8
LEN	48.62	53.97	34	13.4
GRANDIN	48.19	51.57	38	15.6
PONDERA	47.38	54.39	35	13.4
NEWANA	47.21	50.87	34	14.1
STOA	43.08	49.24	43	16.3
LEW *	42.73	52.91	45	14.0
GUS	42.39	49.81	37	17.3
RAMBO *	41.25	49.88	34	14.4
CUTLESS *	39.47	52.77	38	15.1
OWENS (s. white)	38.13	46.28	36	13.7
LANCER *	36.60	53.05	46	14.6

Cooperator : Terry Alme
Location : Eight miles east of Oilmont, Toole County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : April 8, 1991.
Date harvested : August 14, 1991.
Rainfall : From May 22 to harvest was 6.5 inches.
Soil moisture probe depth at seeding : 2 feet.
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 46.25
Error degrees of freedom : 34.00
F test for var. : 2.49
C.V. 2 : 7.15
LSD (0.05) : 9.51

Table 17. **Four-year** summary for **Spring Wheat** varieties grown east of Oilmont, MT. 1988 - 1989 - 1990 - 1991, Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		4 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
WESTBRED 926		28.9	54	25	18.6
GLENMAN	*	27.5	55	27	16.8
PENAWAWA	(s.white)	27.1	53	24	15.8
AMIDON	*	26.3	57	31	17.4
FORTUNA	*	26.0	57	31	17.1
OLAF		25.8	55	27	17.2
HI-LINE	(MT 8402)	25.8	54	26	17.8
PONDERA		25.5	56	27	17.7
NEWANA		25.3	54	25	17.2
LEN		25.3	53	28	16.7
STOA		24.8	54	31	18.2
GRANDIN		24.7	52	28	18.4
LEW	*	23.5	56	31	17.0
RAMBO	*	23.3	57	24	17.3
GUS		23.1	53	25	19.2
OWENS	(s.white)	22.3	52	25	16.4
LANCER	*	22.0	56	31	17.1
CUTLESS	*	20.8	56	27	18.3

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

Table 18. Dryland **Spring Wheat** variety trial grown east of **Choteau,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/a	Test wt. lbs/bu.	Plant hgt. inches	% Protein
FORTUNA	*	45.33	60.32	45	12.7
LEN		40.14	57.57	32	11.4
LANCER	*	39.10	58.98	42	13.6
HI-LINE	(MT 8402)	38.13	58.70	31	12.3
WESTBRED 926		38.11	57.22	31	12.7
GLENMAN	*	37.84	53.41	34	12.2
CUTLESS	*	33.87	59.12	36	14.1
STOA		33.64	55.95	41	12.9
PENAWAWA	(s. white)	31.85	58.27	36	10.1
PONDERA		31.67	57.64	33	12.0
RAMBO	*	31.50	53.48	31	12.1
GRANDIN		29.82	57.78	36	12.7
OLAF		29.62	56.58	33	11.8
AMIDON	*	29.57	56.02	42	13.2
LEW	*	29.54	57.07	43	13.5
OWENS	(s. white)	27.42	54.68	35	10.3
NEWANA		25.34	56.58	30	12.2
GUS		24.94	56.93	34	13.1

Cooperator : Rick Corey
Location : Northeast of Choteau, Teton County.
Fertilizer : 100# 11-51-0 with the seed, + 65# AA-N.
Previous crop : Fallow
Date seeded : April 8, 1991.
Date harvested : August 13, 1991.
Rainfall : From May 15 to harvest was 6.5 inches.
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Soil moisture probe depth at seeding : 30 inches.
Yield experimental mean : 33.19
Error degrees of freedom : 34.00
F test for var. : 4.41
C.V. 2 : 7.95
LSD (0.05) : 7.58

Table 19. **Five-year** summary for dryland **Spring Wheat** varieties grown northeast of Choteau, MT. 1987 - 1988 - 1989 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
GLENMAN	*	37.6	58	29	13.5
PENAWAWA	(s. white)	37.4	61	27	12.3
OWENS	(s. white)	37.0	59	29	11.6
FORTUNA	*	36.4	60	35	14.7
LEN		36.4	60	28	13.3
LEW	*	35.4	59	35	14.3
HI-LINE	(MT 8402)	35.4	62	27	14.4
RAMBO	*	35.2	58	27	13.5
AMIDON	*	34.7	59	34	14.9
LANCER	*	34.6	61	35	15.2
PONDERA		34.2	61	28	14.0
STOA		34.2	59	33	14.2
GRANDIN		32.5	60	30	14.8
CUTLESS	*	31.8	61	31	15.2
NEWANA		30.8	59	27	14.0
GUS		30.5	59	29	14.9
OLAF		29.1	60	29	14.2

Cooperator : Rick Corey
Location : Northeast of Choteau, Teton County.
* = Sawfly resistant varieties. (Rambo and Amidon have partial resistance.)

Table 20. Dryland **Spring Wheat** variety trial grown southeast of **Sun River,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Protein
WESTBRED 926		29.59	57.99	30	16.2
GUS		27.94	55.38	32	17.6
NEWANA		24.56	52.21	32	15.4
AMIDON	*	24.46	56.79	38	15.0
PONDERA		24.31	55.10	35	16.3
HI-LINE	(MT 8402)	23.30	54.96	31	17.0
RAMBO	*	22.14	55.73	33	14.9
OWENS	(s. white)	20.76	53.55	31	14.8
GRANDIN		20.50	54.82	37	16.7
CUTLESS	*	20.11	57.15	34	16.6
PENAWAWA	(s. white)	19.74	54.54	30	14.2
LEN		19.43	55.24	34	16.5
STOA		18.62	55.17	42	17.1
OLAF		18.23	55.31	35	16.3
FORTUNA	*	17.51	58.56	43	14.2
LEW	*	13.39	56.09	42	16.1
LANCER	*	12.49	56.51	39	16.3
GLENMAN	*	11.45	51.64	36	15.4

Cooperator : Chuck Merja
Location : Three miles southeast of Sun River, Cascade County.
Fertilizer : 100# 11-51-0 with the seed, + 40# N actual topdressed
Previous crop : Fallow
Date seeded : April 9, 1991.
Date harvested : August 19, 1991.
Rainfall : From May 15 to harvest was 6 inches.
Soil moisture probe depth at seeding : 18" (into a hard soil)
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 20.47
Error degrees of freedom : 34.00
F test for var. : 1.57
C.V. 2 : 19.20
LSD (0.05) : 11.30

Table 21. **Five-year** summary for dryland **Spring Wheat** varieties grown east of Sun River, MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		5 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
NEWANA		24.8	57	25	17.0
GUS		24.8	57	25	18.6
LEN		24.6	57	25	17.6
PONDERA		24.4	59	26	18.0
OWENS	(s. white)	24.0	57	24	15.4
STOA		23.8	57	30	17.9
GRANDIN		23.2	57	26	18.3
AMIDON	*	22.5	58	28	17.2
PENAWAWA	(s. white)	21.8	58	22	15.1
HI-LINE	(MT 8402)	21.8	56	24	18.3
RAMBO	*	21.6	58	24	17.2
OLAF		21.0	57	25	17.7
GLENMAN	*	20.6	56	26	16.7
FORTUNA	*	20.2	59	30	16.9
LEW	*	19.8	58	29	17.5
CUTLESS	*	19.2	59	26	18.4
LANCER	*	18.2	58	28	18.1

Cooperator : Chuck Merja
Location : Three miles southeast of Sun River, Cascade County.
* = Sawfly resistant varieties. (Rambo and Amidon have partial resistance.)

Table 22. Dryland **Durum** variety trial grown north of Conrad 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
LLOYD	88.87	63.92	28	183	10.3
CANDO	85.44	65.61	31	183	10.9
LAKER	79.61	64.84	34	184	11.2
RENVILLE	75.35	64.84	44	183	12.0
SCEPTRE	74.07	64.84	39	183	11.6
MONROE	70.82	64.34	40	178	12.5
MEDORA	70.09	65.47	41	182	12.2
CROSBY	67.82	65.40	39	179	13.1
WARD	64.30	64.69	39	181	11.8
VIC	64.21	64.76	41	180	12.4
ROLETTE	58.47	65.40	39	179	13.8

Location : Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed, + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 22, 1991.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 72.64
Error degrees of freedom : 20.00
F test for var. : 8.29
C.V. 2 : 4.43
LSD (0.05) : 9.50

Table 23. **Five-year** summary for dryland **Durum** varieties grown north of **Conrad,** MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
LLOYD	68.6	61	26	12.8
CANDO	68.0	62	27	13.3
LAKER	63.1	62	30	13.2
MEDORA	62.8	63	37	14.4
SCEPTRE	62.0	62	34	13.4
RENVILLE	61.3	62	38	13.6
MONROE	59.4	62	35	13.8
CROSBY	57.4	62	36	14.8
WARD	56.2	62	36	14.2
VIC	55.4	63	36	14.4
ROLETTE	53.6	63	35	14.6

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.

Table 24. **Irrigated Durum** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
LLOYD	96.44	64.98	29	183	11.4
CANDO	92.97	65.54	31	183	10.8
RENVILLE	83.15	64.06	42	182	13.4
LAKER	82.52	65.40	31	183	12.3
SCEPTRE	81.32	63.92	38	183	12.1
WARD	76.10	64.55	38	181	13.9
MEDORA	74.39	65.05	42	181	13.6
MONROE	69.58	64.62	39	177	13.2
VIC	68.44	64.62	39	182	14.1
CROSBY	68.04	65.05	39	181	14.8
ROLETTE	57.18	64.69	38	178	14.8

Location : Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 26, 1991.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 77.28
Error degrees of freedom : 20.00
F test for var. : 9.14
C.V. 2 : 4.93
LSD (0.05) : 11.24

Table 25. **Five-year** summary for **Irrigated Durum** varieties grown north of Conrad, MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
CANDO	84.4	63	29	11.6
LLOYD	82.6	63	29	11.6
RENVILLE	77.5	63	38	12.6
LAKER	75.0	63	30	12.5
SCEPTRE	74.8	63	34	12.4
MEDORA	71.4	63	38	13.4
WARD	69.8	63	36	13.4
CROSBY	68.8	63	38	13.8
MONROE	67.1	63	36	13.1
VIC	66.8	63	39	13.4
ROLETTE	60.8	63	37	13.8

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.

Table 26. Dryland **Uniform Regional Durum** variety trial grown north of **Conrad,** 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
D87443	90.10	64.7	31	183	10.2
D87450	86.17	64.1	32	180	11.3
LLOYD	84.00	64.0	30	183	10.7
D87436	83.73	65.4	29	182	10.9
D86747	82.97	66.3	29	179	11.4
D86-1523	82.31	65.7	28	183	11.0
D87373	81.34	64.8	28	181	10.8
D86741	81.31	65.0	29	183	10.9
D86038	81.10	64.9	32	183	11.0
D87245	80.59	63.9	38	184	10.5
D87240	80.57	64.1	38	184	11.4
D87-1431	80.54	65.6	27	183	10.8
D87105	79.90	65.4	38	183	12.3
D86398	79.44	65.2	40	180	11.5
NPB86-435	78.51	64.4	30	183	11.4
SCEPTRE	76.48	65.1	39	186	11.2
D8460	75.90	65.3	35	182	11.6
D8475	74.59	65.4	37	181	11.1
D86117	73.59	64.6	31	183	11.1
D87130	72.70	95.7	39	182	12.0
D87141	72.64	65.3	40	181	12.4
MEDORA	72.06	65.6	42	182	11.9
MONROE	71.69	64.4	41	179	11.5
D87122	71.75	95.1	39	180	11.6
VIC	70.81	65.3	43	181	12.3
RUGBY	70.52	65.3	42	181	12.3
RENVILLE	70.30	64.8	43	183	11.3

(CONTINUED)

Table 26. **(Continued table)** Uniform Regional Durum Trial

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
STOA	69.86	63.9	46	182	12.2
WARD	67.32	65.2	41	182	12.6
D87121	67.13	65.3	38	179	12.5
MINDUM	57.53	64.9	53	186	11.3

Location : Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 22, 1991.
Rainfall : From seeding to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +

Table 27. Dryland **Triticale** variety trial grown north of **Conrad,** 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
WAPITI	63.67	55.24	46	182	9.9
JUAN	62.45	52.07	50	183	10.6
SUNLAND	59.41	56.86	42	183	9.9
MARVAL	57.73	54.18	49	180	10.8
KARL	57.04	56.02	35	177	10.4
WELSH	56.16	52.35	49	181	10.5
KRAMER	53.98	52.98	41	178	11.0
CARMAN	53.76	53.69	48	180	10.2
BEAGLE 82	50.67	53.19	47	181	10.9
NEWANA (wheat) *	45.25	59.97	35	185	11.0

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 22, 1991.
Rainfall : April 10 to harvest, 12.85 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 2845 lbs/ac.
Error degrees of freedom : 18
F test for var. : 0.55
C.V. 2 : 9.64
LSD (0.05) : 815 lbs.
* = Wheat yield based on 60 lbs/bu., triticale based on 50 lbs/bu.

Table 28. **Five-year** summary for dryland **Triticale** varieties grown north of **Conrad,** MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average			
	Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
SUNLAND 1/	74.0	57	38	12.3
JUAN 1/	71.8	52	41	11.8
WAPITI	71.8	54	39	11.9
KARL	70.0	52	30	12.4
KRAMER	69.4	51	35	12.6
WELSH	64.4	52	40	12.6
MARVAL	64.0	51	43	12.0
BEAGLE 82	62.5	51	40	12.3
CARMAN	61.8	51	39	12.9
NEWANA (spr. wht.)	53.2 *	61	30	14.0

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.

* = Spring wheat yield based on 60# per bushel, and triticale based on 50# per bushel.

1/ = Maturity of Sunland and Juan is extremely late, and may be too late for the Triangle Area.

TITLE: Barley Variety Investigations

YEAR: 1991

LOCATION: Western Triangle Research Center, Conrad

PERSONNEL: Gregory D. Kushnak, Ron Thaut, & Larry Christiaens, Research Center, Conrad, MT; Dr. Tom Blake MSU, Bozeman

Dryland barley variety trials were grown near Cut Bank, Oilmont, Choteau, Sun River, and the Research Center at Conrad; in addition to irrigated at Conrad. All trials were grown on fallow. A seperate no-till recrop trial was grown at Conrad, and is reported in the no-till section of this report.

Data for 1991, as well as 5-year averages, are presented in Tables 29-43. Moisture levels were unusually favorable in 1991, resulting in very high dryland yields. Baronesse was among the top yielders in 1991 at all locations except Oilmont. This variety was not included in off-station testing until 1991, and it is therefore uncertain if it will maintain high yield rankings in drier years. Baronesse was fairly late to mature (similar to Harrington), and therefore may be more vulnerable to moisture stress than earlier maturing varieties. Baronesse is a stiff-strawed 2-row from Europe, and is marketed in the USA by Western Plant Breeders. It is not known at this time if Baronesse will be considered a malt variety.

Stark, a 2-row feed barley from North Dakota, ranked medium to high at the various locations over the last five years. Stark is closely related to Bowman, and appears to have a higher yield potential in most cases. The straw strength of Bowman and Stark appeared to be fairly weak.

The feed barleys Gallatin and Lewis equalled or exceeded Hector for yield at most locations over the last five years. Gallatin had stiffer straw than most of the varieties tested. Exceptions included Baronesse, Melton, and Nancy; which appeared to have very good straw strength.

The yield of Bearpaw averaged low to medium, but was higher than for Harrington in most cases. The malt status of Bearpaw will probably not be known until summer of 1992.

These trials were conducted by the MSU Western Triangle Research Center, Conrad and the Cooperative Extension Service, in cooperation with Dr. Tom Blake, Montana State University Plant and Soil Science Department. The background and detailed descriptions of the varieties tested are included in MSU Extension Bulleltin 1094, "Performance Summary of Barley Varieties in Montana," available at all County Agent offices. Other comments about the varieties, based on observation in Triangle Area trials, are presented in the following pages.

COMMENTS ON BARLEY VARIETIES

Montana Malt List according to AMBA (Amer. Malt. Bly. Assoc.) Clark, Klages, Moravian III, Premier, Morex, Harrington; although other varieties may be contracted.

Andre-2-row from WSU- never made it.

BA 1201 and BA 1202-(Busch Ag) 2-Row. Very good yields in 1987. Both higher yield than Klages. Require good rainfall or irrigation. 1202 earlier than 1201. BA=Nutrigold Branch (Busch).

BA 1215- (Busch Ag) 2-row malt. Acres to be contracted in 1992, as well as 1202 and 2601. Very high irrigated yields, and very good lodging resistance. Maturity approx same as 1202. Not tested on dryland. Tested as BA8529 prior to 1990.

BA 1602- 6-row for the midwest.

BA 1603- 6-row.

BA 2601- 6-row for parts of the triangle area.

Baronnesse-(Netherlands)-Seed produced in USA by Western Plant Breeders. 2-row. Short straw and good lodging resistance. Among highest yielders when tested in favorable moisture conditions (not tested in dry years yet). Four days later maturity than Piroline and Gallatin; equal or slightly later maturity than Harrington; thus, may possibly rank lower for yield in dry years without irrigation.

Bearpaw (MT 81616)(MSU)-2 Row. Most likely will be approved by AMBA (should know by summer of 92). Better malt and agronomics than Clark, Klages, and Harrington. Yields better than varieties above. One day later than Clark and Hector, but slightly earlier than Harrington. May sprout and skin too 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). Malt status pending flavor test. Malts as good or better than a 6-row! Very high extract. Test weight is sometimes low on dryland, possibly due to its medium-late maturity.

Bellona-Dropped from recommended list, due to nonavailability of seed.

Bowman(ND)- 2-row. Strictly for drought conditions. Early maturing, large seeded, feed type. Highest yielder on dryland in drought years; but in wet years, only medium to low yield. Stem breakage was observed at Denton in 1991. Stark is a possible alternative.

Bridge-Alberta (Lethbridge)- 2-row feed; higher yield than Adee and Harrington.

Clark(MSU)- 2-row Malt type. Better yield and earlier maturity than Klages. Does not have the malt quality of Harrington. Dryland primarily.

Colter (Id/Ore/Wash)- 6-row feed. Higher yield and test weight than Steptoe, but test weight may still be too low on dryland. Tested as ID 71966 in Western Regional (79Ab10719-66).

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

Crystal (78AB6871)(ID)-2-row malt (AMBA for Idaho). May qualify for Montana AMBA in 1991. (Klages cross). 5% greater yielder than Klages but 2% less than Clark; same height and head date as Klages, but better lodging resistance. Good tolerance to Pseudomonas Kernel Blight; thus better than Klages.

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

Excel- 6-row. Supposed to combine the superior agronomics of Robust and the malt quality of Morex. Stiff straw, good yield. On Minnesota AMBA; will be on ND AMBA soon. Probably will not be used in Montana.

Gallatin(MSU)- 2-row feed. A stiff strawed variety with good lodging resistance (more than Hector, Klages, Lewis, and Clark); yields high in both dry and wet conditions; thus a broadly adapted feed barley. Good drought tolerance. Slightly earlier than Hector, and earlier than Bearpaw.

Harrington-(Canada)-Sensitive to hot dry areas; yields good in moist areas. Matures later than Clark and Bearpaw, but earlier than Klages. 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. Montana AMBA. See notes on Bearpaw. Acres will be contracted in 1992.

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

Hector(Alberta)- 2-row feed type. High yield on dryland (similar to Gallatin); slightly later to mature and weaker strawed than Gallatin. Yields less than Gallatin on irrigated.

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

Klages(ID)- 2-row malt type. Late maturity; for irrigation or high rainfall only. Being replaced on contracted acres by Harrington, BA-1215, etc.

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

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

Manley (TR 409)- 2-row. A little 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.

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

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

Morex- 6-row malt type. Shatters-swathing advised.

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

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

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

Robust - 6-row malt type-ND AMBA list; but not Montana's, in order to keep Montana clear for Morex. (AB needs Morex).

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.. Was planned for possible replacement for Karla on dryland as a malt, but did not pass AMBA tests, (feed barley).

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

Stark (ND)- 2-row. Related to Bowman, but higher yield. Some stem breakage at Denton in 1991.

Steptoe - 6-row. Among the highest yielders on irrigation or dryland. Feed type. Low test weight dryland.

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

Triumph- 2-row. Malt in Europe, but may 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, feed barley only.

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

Westford, Westbred (WPB)- 6-row hooded hay barley. Seed yield low (similar to Horsford). Hay yields considerably higher than Horsford. Maturity considerably later than Horsford and Whitford, allowing for greater forage production. 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. Testing of the forage for nitrate should be done before the crop is harvested.

Table 29. Dryland **Intrastate Barley** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
MT 890008	120.96	52.28	38	184	94	1	9.6
BARONESSE	109.13	53.69	34	182	95	2	9.9
MT 886610	107.34	53.90	37	182	94	2	10.1
MT 851161	104.74	53.12	35	183	94	2	10.0
MT 890034	103.59	51.29	28	182	81	8	10.0
STARK (ND 9866)	102.97	53.41	38	177	96	1	10.8
MT 851195	102.90	53.05	39	179	96	0	11.1
GALLATIN	101.67	53.97	36	176	91	3	9.7
MT 890040	101.20	50.51	36	176	90	3	8.6
MT 890070	100.86	52.14	36	174	92	2	10.7
H 4851224	100.42	53.76	38	181	97	1	11.0
H 5851161	100.17	52.14	39	182	95	1	10.9
H 1851195	100.11	53.62	38	181	97	0	11.1
MT 889102	99.59	52.56	36	175	97	0	12.2
MT 890069	99.24	53.62	37	182	92	4	10.4
MT 870120	99.09	47.97	37	175	94	1	9.8
STEPTOE	98.80	52.28	37	175	94	2	10.0
HARRINGTON	98.74	51.36	34	182	91	2	10.3
MT 887509	98.55	53.41	37	180	91	3	10.2
MT 83435	98.51	53.62	37	181	90	3	11.4
MT 860756	97.80	55.10	31	182	96	1	10.4
MT 890030	97.72	52.49	29	179	82	11	10.9
MT 890021	97.03	53.90	34	176	95	2	10.6
MT 851005	96.80	52.63	37	179	95	1	11.0
MT 890033	96.72	53.55	27	179	85	5	9.6
MT 886609	96.28	52.84	37	183	96	2	10.4
LEWIS	95.91	53.76	36	183	93	2	11.2
MT 860326	95.91	55.03	38	182	94	3	10.8
MT 889106	95.78	52.77	35	175	97	0	12.2
H 5860219	95.13	53.97	36	183	98	1	10.5
MT 861596	94.89	53.62	38	181	90	4	11.3
PIROLINE	94.43	54.04	39	178	91	5	11.3
MT 870246	94.38	46.92	38	176	94	1	10.2

(CONTINUED)

Table 29. (**CONTINUED**) Conrad dryland Intrastate Barley 1991

BEARPAW	94.18	51.78	36	183	90	4	9.7
MT 851425	93.97	53.76	36	182	95	1	10.7
MT 890123	93.97	48.04	39	178	97	2	9.6
MT 870109	93.78	54.54	37	178	89	4	10.0
H 6851012	93.55	53.27	40	179	95	1	10.3
MT 851012	93.37	52.56	41	181	91	2	11.6
HECTOR	93.12	54.25	39	179	95	1	10.6
NS 010990	92.74	52.07	24	185	90	3	10.8
MT 890089	92.59	52.00	35	178	94	0	10.9
H 1851032	92.59	52.56	40	183	96	0	9.5
MT 851032	92.11	53.55	38	183	92	2	9.5
MT 890018	91.89	54.82	30	181	97	2	11.1
MT 887603	91.61	53.41	36	178	95	2	11.8
MT 860224	91.59	51.71	34	183	91	1	9.5
MT 890039	91.59	47.48	33	178	78	8	10.1
KLAGES	91.53	51.15	38	184	87	4	10.5
MT 140523	90.68	52.84	37	183	89	4	11.1
SHONKIN	90.26	53.83	38	183	88	1	12.1
BOWMAN	90.24	52.42	33	175	95	1	10.9
MT 890128	89.49	46.85	34	174	89	2	10.4
82301593	88.85	52.28	29	182	91	2	9.7
MT 890157	86.97	46.63	37	176	93	2	10.8
MT 887510	85.76	53.55	35	179	91	3	11.0
RUSSELL	84.22	49.31	38	176	86	4	9.9
MT 890065	83.72	52.98	37	175	92	2	11.6
MT 890066	81.91	53.34	36	179	93	1	12.2
ROBUST	81.43	51.01	40	178	94	0	10.8
CLARK	80.81	52.21	36	182	92	3	10.4
MT 890061	79.79	51.57	40	175	95	2	11.3
MT 887103	79.72	52.07	34	179	89	5	11.1
MOREX	76.25	51.01	44	178	87	4	11.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date Harvested : August 12,1991.
Rainfall : From seeding to harvest was 12.13 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 94.56
Error Degrees of freedom : 126
F. test for var. : 4.1 C.V. 2 : 3.97 LSD (0.05) : 10.5

Table 30. Dryland **Intrastate Barley** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.
(Abbreviated list)

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
BARONESSE	109.13	53.69	34	182	95	2	9.9
STARK (ND 9866)	102.97	53.41	38	177	96	1	10.8
GALLATIN	101.67	53.97	36	176	91	3	9.7
STEPTOE	98.80	52.28	37	175	94	2	10.0
HARRINGTON	98.74	51.36	34	182	91	2	10.3
LEWIS	95.91	53.76	36	183	93	2	11.2
PIROLINE	94.43	54.04	39	178	91	5	11.3
BEARPAW	94.18	51.78	36	183	90	4	9.7
HECTOR	93.12	54.25	39	179	95	1	10.6
KLAGES	91.53	51.15	38	184	87	4	10.5
MT 140523	90.68	52.84	37	183	89	4	11.1
SHONKIN	90.26	53.83	38	183	88	1	12.1
BOWMAN	90.24	52.42	33	175	95	1	10.9
RUSSELL	84.22	49.31	38	176	86	4	9.9
ROBUST	81.43	51.01	40	178	94	0	10.8
CLARK	80.81	52.21	36	182	92	3	10.4
MOREX	76.25	51.01	44	178	87	4	11.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date Harvested : August 12,1991.
Rainfall : From seeding to harvest was 12.13 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 94.56
Error Degrees of freedom : 126
F. test for var. : 4.1
C.V. 2 : 3.97
LSD (0.05) : 10.51

Table 31. **Five-year** summary for dryland **Barley** varieties grown north of **Conrad**, MT. 1987 - 1988 - 1989 - 1990 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
BARONESSE	99.4	53	33	89	4	12.1
STARK (ND 9866)	96.7	54	32	94	2	12.0
GALLATIN	93.0	54	31	90	4	12.7
LEWIS	92.4	54	31	93	2	12.7
HECTOR	91.8	52	32	92	3	12.4
MT 140523	89.2	52	29	90	6	12.8
PIROLINE	88.4	53	31	84	7	13.6
BEARPAW	88.0	51	30	85	6	12.4
STEPTOE	87.2	48	31	90	3	11.3
HARRINGTON	87.0	51	31	88	4	12.3
KLAGES	87.0	51	32	82	5	12.3
CLARK	85.0	51	30	85	5	12.7
BOWMAN	84.8	52	29	95	2	13.0
RUSSELL	81.8	50	31	87	5	12.5
SHONKIN	79.5	54	31	79	11	15.3
ROBUST	78.2	51	34	86	4	12.5
MOREX	77.0	50	32	85	4	12.4

Location : Research Center 10 miles north of Conrad, Pondera County.

1/ = Proteins based on four years average. (1987-1988-1989-1990)

Table 32. **Irrigated Intrastate Barley** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
MT 890008	122.46	52.77	36	182	94	2	8.5
MELTAN	113.82	54.04	29	182	96	1	10.1
BA 1215	108.42	53.34	36	179	94	2	9.8
BARONESSE	108.34	53.05	31	181	90	1	9.5
NANCY	108.11	53.12	31	184	96		9.4
AC 8430-7	106.46	52.98	34	183	96	1	8.8
DH 85-9-5	103.76	53.76	28	186	91	3	9.9
DH 8537-1	103.67	53.48	34	176	86	4	9.6
BA 2601	103.59	50.02	34	182	68	10	10.2
2B 866513	102.88	52.63	35	181	87	4	9.8
NS 010990	102.82	53.76	26	182	88	2	9.6
MT 886610	102.53	54.46	40	178	94	3	9.8
AC 846615	102.51	52.63	31	186	93	3	8.4
STEPTOE	102.13	45.65	34	175	92	2	9.9
MT 851195	100.32	52.98	39	178	92	3	11.0
STARK (ND 9866)	99.45	53.12	38	176	93	3	10.7
MT 851161	98.57	52.84	36	179	90	3	9.6
MT 870109	98.43	53.05	35	176	85	7	9.8
MT 886609	98.18	53.90	36	178	87	5	9.9
AC 8425-3	96.61	50.58	29	182	91	2	9.2
MT 860224	96.53	53.55	35	182	86	5	9.1
MT 861596	96.24	53.55	36	179	86	6	11.2
HECTOR	95.82	52.49	37	178	87	5	11.6
MT 890040	95.66	50.16	35	175	86	3	8.3
GALLATIN	95.05	54.61	36	177	89	3	9.5
MT 886601	94.99	53.90	35	177	91	2	9.2
LEWIS	94.88	54.46	37	179	94	3	11.6
MT 870120	93.89	46.63	32	175	93	3	9.9
EXCEL	93.66	48.40	35	176	91	4	10.0
MT 860756	93.28	54.61	34	179	91	3	10.1
AC8611-1	92.91	52.35	35	182	91	2	8.9
MT 83435	92.62	53.19	36	179	92	4	10.5
MT 889106	91.47	52.49	39	175	95	1	11.4

(Continued)

Table 32. (**Continued**) Conrad Irrigated Intrastate Barley

SHONKIN	90.78	54.18	37	183	68	6	12.6
MT 890123	90.60	45.01	36	177	86	6	9.4
MT 890069	90.53	52.84	36	179	88	3	9.9
MT 851005	89.89	52.35	39	178	95	2	10.8
MT 890172	89.70	51.57	35	182	77	9	9.2
MT 870070	88.60	47.34	36	179	90	4	10.9
MT 888205	88.55	45.36	39	175	91	3	9.7
MT 890060	88.07	48.75	36	175	74	8	10.9
MT 870246	86.91	46.07	37	176	86	4	10.5
MT 890089	86.22	52.49	26	175	88	2	9.9
82301593	86.20	52.00	33	182	86	3	9.4
MT 890111	86.03	49.95	38	176	70	10	11.2
MT 887509	85.66	52.21	35	179	87	5	9.1
MT 890087	85.60	51.15	34	175	87	5	10.7
KLAGES	84.89	50.94	34	183	73	10	8.9
BA 1603	84.43	50.65	38	176	85	3	11.3
HARRINGTON	83.76	50.44	36	181	86	3	8.6
MT 887510	83.28	53.19	38	178	90	3	9.5
MT 140523	82.89	51.29	36	178	87	4	10.2
MT 851032	82.39	52.28	36	182	89	3	10.1
RUSSELL	80.58	47.69	33	175	87	4	9.6
MT 890061	79.77	49.95	41	175	86	4	11.7
MT 890128	78.89	45.86	31	175	85	3	10.0
BEARPAW	78.68	49.88	37	182	80	5	10.2
PIROLINE	77.81	52.84	35	177	83	5	10.2
ROBUST	77.79	50.23	39	176	75	10	10.9
MT 851012	77.39	50.16	37	178	91	4	10.2
MT 887103	76.00	49.67	32	177	89	4	10.5
MT 851145	73.91	51.92	40	178	89	5	10.7
MOREX	73.43	49.88	40	176	86	4	11.0
CLARK	69.08	50.73	35	179	88	5	10.8

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 12, 1991.
Irrigation method : Sprinkler, on July 10 and July 19.
Rainfall : From seeding to harvest was 12.13 inches.
Yield experimental mean : 92.01
Error degrees of freedom : 126
F Test for var. : 9.36 C.V. 2 : 3.78 LSD (0.05) : 9.74

Table 33. **Irrigated Intrastate Barley** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.
(Abbreviated list)

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
MELTAN	113.82	54.04	29	182	96	1	10.1
BA 1215	108.42	53.34	36	179	94	2	9.8
BARONESSE	108.34	53.05	31	181	90	1	9.5
NANCY	108.11	53.12	31	184	96		9.4
BA 2601	103.59	50.02	34	182	68	10	10.2
STARK (ND 9866)	99.45	53.12	38	176	93	3	10.7
HECTOR	95.82	52.49	37	178	87	5	11.6
GALLATIN	95.05	54.61	36	177	89	3	9.5
LEWIS	94.88	54.46	37	179	94	3	11.6
EXCEL	93.66	48.40	35	176	91	4	10.0
SHONKIN	90.78	54.18	37	183	68	6	12.6
KLAGES	84.89	50.94	34	183	73	10	8.9
HARRINGTON	83.76	50.44	36	181	86	3	8.6
MT 140523	82.89	51.29	36	178	87	4	10.2
RUSSEL	80.58	47.69	33	175	87	4	9.6
BEARPAW	78.68	49.88	37	182	80	5	10.2
PIROLINE	77.81	52.84	35	177	83	5	10.2
ROBUST	77.79	50.23	39	176	75	10	10.9
MOREX	73.43	49.88	40	176	86	4	11.0
CLARK	69.08	50.73	35	179	88	5	10.8

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 12, 1991.
Irrigation method : Sprinkler, on July 10 and July 19.
Rainfall : From seeding to harvest was 12.13 inches.
Yield experimental mean : 92.01
Error degrees of freedom : 126
F Test for var. : 9.36
C.V. 2 : 3.78
LSD (0.05) : 9.74

Table 34 . **Five-year** summary for **Irrigated Barley** varieties grown north of **Conrad,** MT. 1987 - 1988 - 1989 - 1990 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
LEWIS	113.4	55	32	96	2	12.1
BARONESSE	111.1	53	30	92	1	11.3
BA 2601	107.8	51	31	84	3	11.3
GALLATIN	106.8	54	32	93	2	11.9
STEPTOE	103.8	48	30	94	2	10.3
HECTOR	98.0	53	35	91	3	12.3
HARRINGTON	97.2	52	33	90	3	10.8
BEARPAW	96.8	51	33	87	4	11.4
MT 140523	95.0	52	32	91	3	12.3
KLAGES	94.6	52	31	80	7	11.5
STARK (ND 9866)	94.4	54	33	94	2	12.1
RUSSELL	93.0	51	32	90	3	12.0
PIROLINE	91.4	54	33	88	4	12.7
CLARK	90.2	52	32	89	4	11.1
MOREX	81.8	51	37	89	2	11.4
SHONKIN	81.0	55	33	63	9	13.9
ROBUST	78.8	52	35	89	3	11.7

Location : Research Center 10 miles north of Conrad, Pondera County.

1/ = Proteins based on 4 years average. (1987-1988-1989-1990)

Table 35. Dryland **Barley** variety trial grown north of **Cut Bank**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Baronesse	53.80	46.28	27	95	2	8.6
Piroline	50.13	50.87	30	95	1	9.7
Harrington	47.73	46.77	30	94	2	9.4
Excel	47.23	45.93	32	88	3	8.5
Steptoe	45.17	44.02	29	93	2	9.1
Hector	44.86	47.76	30	91	2	8.9
MT 140523	44.86	49.24	28	90	3	8.5
Lewis	43.94	48.40	29	86	5	9.3
Clark	42.40	46.77	30	88	3	9.6
Bearpaw	41.55	48.68	29	95	2	9.6
Gallatin	39.92	49.17	30	94	2	9.3
Bowman	39.51	49.17	28	96	1	10.0
Stark (ND 9866)	36.36	49.39	32	96	1	10.0
Shonkin	35.82	53.05	32	45	17	10.6

Cooperator : Don Bradley
Location : Fifteen miles north of Cut Bank, Glacier County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : May 15, 1991.
Date harvested : September 5, 1991.
Rainfall : From May 20 to harvest, 7.85 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 43.80
Error degrees of freedom : 26.00
F test for var. : 3.16
C.V. 2 : 6.50
LSD (0.05) : 8.28

Table 36. **Five-year** summary for dryland **Barley** varieties grown north of **Cut Bank,** MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
EXCEL	65.7	46	30	83	6	12.3
STEPTOE	64.8	45	27	89	3	9.7
HECTOR	63.0	51	28	90	3	10.6
BEARPAW	61.6	50	27	90	3	11.2
LEWIS	61.4	51	28	89	4	10.6
GALLATIN	61.0	51	28	91	3	11.1
STARK (ND 9866)	60.3	51	31	97	1	10.0
PIROLINE	60.0	52	27	89	2	12.0
HARRINGTON	59.4	50	27	91	2	11.0
CLARK	58.8	50	27	86	4	10.9
MT 140523	58.7	51	26	89	3	11.1
BOWMAN	55.6	51	27	96	1	11.1
KIMBERLY	54.0	52	28	86	4	12.1

Cooperator : Don Bradley
Location : Fifteen miles northeast of Cut Bank, Glacier County.
1/ = Proteins based on four years average. (1987-1988-1989-1990)

Table 37 . Dryland **Barley** variety trial grown east of **Oilmont**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Bowman	97.26	50.94	34	89	5	11.9
MT 140523	94.68	48.82	41	80	10	11.5
Piroline	93.59	51.22	41	82	8	12.1
Lewis	93.01	51.22	38	85	8	12.3
Stark (ND 9866)	90.62	49.88	41	81	9	11.7
Steptoe	85.43	41.48	34	80	10	10.4
Clark	83.04	49.46	39	79	7	12.5
Baronesse	80.06	47.13	36	42	25	12.6
Gallatin	79.62	50.65	38	60	19	11.8
Hector	77.14	49.46	41	66	13	13.1
Excel	71.62	44.09	38	55	16	11.6
Harrington	66.98	47.34	42	85	7	12.2
Bearpaw	66.48	45.15	40	24	39	13.7
Shonkin	55.54	42.33	41	48	27	13.5

Cooperator : Terry Alme
Location : Eight miles east of Oilmont, Toole County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : April 8, 1991.
Date harvested : August 14, 1991.
Rainfall : From May 22 to harvest was 6.5 inches.
Soil moisture probe depth at time of seeding : 2 feet.
Yield experimental mean : 81.08
Error degrees of freedom : 26
F test for var. : 5.93
C.V. 2 : 6.33
LSD (0.05) : 14.92

Table 38 . **Four-year** summary for dryland **Barley** varieties grown north of **Oilmont,** MT. 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Agr. Research Center, Conrad, MT.

Variety	4 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
STARK (ND 9866)	47.2	48	29	35	37	15.7
LEWIS	46.3	48	27	38	35	16.6
BOWMAN	46.3	48	27	44	28	15.4
MT 140523	45.0	47	27	29	54	17.6
GALLATIN	43.8	48	27	27	42	16.6
PIROLINE	43.8	47	27	23	61	16.5
STEPTOE	42.5	40	27	29	46	12.9
HECTOR	42.3	47	29	24	51	15.8
CLARK	41.8	46	25	33	37	16.5
BEARPAW	36.8	46	26	26	40	17.7
HARRINGTON	32.8	47	27	37	35	17.2

Cooperator : Terry Alme
Location : Eight miles east of Oilmont, Toole County.
1/ = Proteins based on three years average. (1988-1989-1990)

Table 39. Dryland **Barley** variety trial grown east of **Choteau**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Reasearch Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Steptoe	104.11	44.38	40	87	3	9.7
Baronesse	97.93	50.37	39	87	4	11.2
MT 140523	92.09	52.21	40	89	2	11.4
Gallatin	86.30	52.14	40	91	2	11.6
Bearpaw	84.28	48.75	40	85	3	11.5
Clark	83.78	49.88	40	95	2	11.9
Stark (ND 9866)	83.68	52.07	42	97	2	11.8
Harrington	82.93	47.62	41	91	3	11.5
Piroline	82.43	52.07	39	84	3	11.7
Bowman	81.10	52.49	39	98	1	12.2
Hector	80.93	51.08	41	90	3	11.7
Lewis	78.66	52.98	40	91	1	11.1
Excel	77.14	45.29	39	49	15	11.3
Shonkin	60.02	45.43	42	50	18	12.9

Cooperator : Rick Corey
Location : Northeast of Choteau, Teton County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : April 8, 1991.
Date harvested : August 13, 1991.
Rainfall : From May 15 to harvest was more than 6.5 inches.
Soil moisture probe depth at time of seeding : 30 inches.
Yield experimental mean : 83.95
Error degrees of freedom : 26
F test for var. : 12
C.V.2 : 3.49
LSD (0.05) : 8.53

Table 40. **Five-year** summary for dryland **Barley** varieties grown east of **Choteau,** MT. 1987 - 1988 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
STEPTOE	75.4	45	31	80	6	10.2
MT 140523	68.8	52	31	73	7	12.0
STARK (ND 9866)	68.6	52	31	92	2	12.0
GALLATIN	67.2	52	31	79	6	12.1
HECTOR	67.0	51	31	82	5	12.1
LEWIS	66.8	53	31	83	5	12.0
BEARPAW	66.4	50	30	83	4	11.9
HARRINGTON	65.6	50	30	89	4	12.1
CLARK	63.8	50	30	76	8	12.0
PIROLINE	63.2	52	30	68	11	12.8
BOWMAN	62.6	52	31	94	1	12.3

Cooperator : Rick Corey
Location : East of Choteau, Teton County.
1/ = Proteins based on four years average. (1987-1988-1989-1990)

Table 41. Dryland **Barley** variety trial grown east of **Sun River**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein
Stark (ND 9866)	82.97	52.14	37	88	7	13.8
Bowman	80.18	49.95	36	92	3	14.4
MT 140523	74.29	51.15	36	77	10	13.9
Baronesse	73.54	47.34	31	67	11	14.2
Gallatin	73.18	49.60	40	72	12	14.2
Hector	71.58	49.17	39	78	10	14.3
Excel	68.69	46.70	36	81	3	13.7
Bearpaw	65.04	47.48	38	55	18	15.2
Clark	64.94	48.12	40	59	17	15.1
Piroline	64.90	50.73	40	53	16	15.0
Steptoe	64.17	44.02	34	63	10	12.9
Harrington	63.52	46.85	37	61	17	14.4
Lewis	63.06	48.61	40	59	15	15.9
Shonkin	48.23	46.07	37	36	29	15.5

Cooperator : Chuck Merja
Location : Southeast of Sun River, Cascade County.
Fertilizer : 100# 11-51-0 with the seed + 50# AA-N.
Previous crop : Fallow
Date seeded : April 9, 1991.
Date harvested : August 5, 1991.
Rainfall : From May 15 to harvest was 6 inches.
Soil moisture probe depth at seeding : 18 inches (into hard soil)
Yield experimental mean : 68.45
Error degrees of freedom : 26
F test for var. : 3.41
C.V. 2 : 6.79
LSD (0.05) : 13.51

Table 42 . **Five-year** summary for dryland **Barley** varieties grown east of **Sun River,** MT. 1986 - 1987 - 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	5 - year comparable average					
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	% Plump	% Thin	% Protein 1/
STARK (ND 9866)	63.7	50	28	67	14	14.2
HECTOR	54.8	49	30	64	17	14.8
GALLATIN	54.4	50	28	57	20	14.9
BOWMAN	53.2	51	29	71	13	14.2
MT 140523	53.2	49	27	62	18	14.9
STEPTOE	52.2	45	28	63	17	11.9
LEWIS	50.6	50	28	60	18	15.1
PIROLINE	50.4	50	28	52	20	15.1
CLARK	49.4	48	29	56	19	14.6
BEARPAW	49.0	48	26	60	18	15.2
HARRINGTON	44.6	48	26	63	13	14.2

Cooperator : Chuck Merja
Location : Three miles east of Sun River, Cascade County.
1/ = Proteins based on four year averages. (1986-1987-1989-1990)

Table 43. Dryland **Western Regional Barley** variety trial grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
10830-85	107.11	50.87	35	184	94	4	
STARK (ND 9866)	105.76	53.55	38	178	98	1	
MT 860756	104.69	54.18	33	182	97	2	
MT 851195	101.53	53.12	39	182	96	2	
ID 852323	97.82	53.69	38	183	93	3	
BOWMAN	97.09	51.50	36	176	98	1	
MT 860326	96.41	53.48	39	181	92	2	
11224-86	96.20	48.89	34	181	96	1	
ID 85453	95.74	46.56	38	175	92	2	
EXCEL	94.55	47.90	35	177	89	3	
HECTOR	94.53	53.90	42	180	91	1	
MT 860224	93.45	51.92	37	184	85	10	
STEPTOE	93.01	46.92	37	176	95	2	
ND 11230	91.10	51.78	34	177	94	2	
ID 82519	89.72	49.81	38	176	92	2	
MT 851012	87.16	51.43	37	179	91	5	
86AB2317	85.87	53.19	39	183	96	1	
CLARK	80.87	51.57	39	182	86	6	
ID 88Y281	79.58	48.89	40	178	96	2	
MUNSING	57.54	49.74	27	178	81	7	

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 10, 1991.
Date harvested : August 12, 1991.
Rainfall : From seeding to harvest was 12.13 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 92.49
Error degrees of freedom : 38
F test for var. : 6.99
C.V. 2 : 4.52
LSD (0.05) : 11.97

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

Year: 1991

Location: Western Triangle Agricultural Research Center, Conrad.

Personnel:
Project Leader: Gregory D. Kushnak
Cooperators: Luther Talbert & Sue Lanning (Spring Wheat)
Tom Blake & Pat Hensleigh (Barley).

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

Methods: Spring wheat and barley varieties were no-till planted into barley stubble at right angles to the previous crop. Crop history for the site was barley in 1990, fallow in 1989, and barley in 1988. Planting was accomplished with a double-disc no-till plot planter constructed by our Research Center Staff. The double disc openers were supplied by Acra-Plant, Inc., Garden City, KS. Row space was 12 inches. MAP was applied with the seed to provide 51 lbs P_2O_5/a. Ammonium nitrate (34-0-0) was topdressed to provide 60 lbs N/a. Herbicides included Roundup for pre-seeding vegetation control; Hoelon for wild oat control; and Bronate for broadleaf control. Planting date was April 23, 1991. Growing season rainfall 12.13 inches from planting to ripening.

Results: Growing season rainfall has been unusually high during the last three years (1989-1991) at this location, contributing to higher than expected yields for recrop. (Moisture during 1988 was insufficient to support plant growth beyond the seedling stage). In spite of the high moisture, disease levels were very low.

No-till recrop data for spring wheat and barley for 1991 are presented in Tables 44 and 46, respectively; with three-year averages in Tables 45 and 47. Over the three-year period, Westbred 926R, Hi-Line, Glenman, and Rambo ranked highest for yield on recrop at Conrad. These three varieties also were among the top yielders in fallow trials. Fortuna and Stoa ranked fairly high on recrop, but averaged low in fallow trials. Although test weights of all varieties averaged at least 60 pounds, Glenman in some years has shown inferior test weight. The barley varieties Hector, Gallatin, and Lewis were among the highest yielders on both recrop and fallow conditions. The variety Baronesse was tested only in 1991, and was the highest yielder. However, this variety had fairly late maturity (similar to Harrington), and may not rank as high under the drier conditions normally encountered on recrop. Net blotch on barley was more prevalent in recrop than fallow, but the levels were less than moderate in most years.

Table 44 . Dryland **Recrop Spring Wheat** variety trial grown north of Conrad, 1991. Mont. Agr. Expt. Sta., Western Triangle Ag. Research Center, Conrad, MT.

Variety		Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Protein
PENAWAWA	(s. white)	56.27	62.23	30	185	7.6
OWENS	(s. white)	55.76	60.25	33	184	8.6
NEWANA		52.73	62.58	32	186	9.3
GLENMAN	*	51.44	61.38	35	184	9.5
PONDERA		50.62	63.92	33	182	10.5
FORTUNA	*	50.19	63.42	41	184	10.3
WESTBRED 926		50.15	62.58	30	179	9.7
LEW	*	49.41	63.78	39	187	9.9
GUS		47.48	63.28	34	184	11.2
STOA		47.19	62.65	41	183	10.7
GRANDIN		46.78	62.65	35	182	10.9
RAMBO	*	46.53	61.80	32	187	10.4
LEN		44.76	62.79	32	180	10.0
HI-LINE	(MT 8402)	44.50	64.34	31	182	9.8
CUTLESS	*	44.30	63.85	37	185	10.2
AMIDON	*	43.24	62.79	38	184	9.9
OLAF		43.01	61.87	34	184	10.2
LANCER	*	41.93	63.57	40	186	10.0

Location : Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed, + 70# N actual topdressed.
Previous crop : Fallow
Date seeded : April 23, 1991.
Date harvested : August 20, 1991.
Rainfall : From seeding to harvest, 12.13 inches.
Soil moisture probe depth at seeding : 3'6" +
* = Sawfly resistant varieties. (Amidon and Rambo partial resistance)
Yield experimental mean : 48.13
Error degrees of freedom : 34.00
F test for var. : 2.01
C.V. 2 : 6.22
LSD (0.05) : 8.60

Table 45. **Three-year** summary for **Recrop Spring Wheat** varieties grown north of Conrad, MT. 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety		3 - year comparable average			
		Yield Bu\ac	Test wt. lbs\bu.	Plant hgt. inches	% Protein
PENAWAWA	(s. white)	49.6	62	29	9.5
OWENS	(s. white)	46.3	60	30	9.9
WESTBRED 926		44.8	62	30	10.9
GLENMAN	*	44.6	62	31	11.1
RAMBO	*	44.6	62	30	11.9
HI-LINE	(MT 8402)	44.3	63	30	11.5
FORTUNA	*	43.3	63	36	12.4
STOA		43.3	62	36	12.6
LEN		43.3	62	30	11.3
NEWANA		43.0	62	30	11.2
LEW	*	42.6	63	36	11.5
PONDERA		42.6	63	30	12.1
GUS		42.1	63	31	12.8
AMIDON	*	42.0	63	36	11.7
OLAF		41.6	62	31	11.9
GRANDIN		41.6	62	32	12.0
LANCER	*	40.6	63	37	12.1
CUTLESS	*	39.9	61	34	12.4

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.
Planting method : Seeded into standing stubble with a double disc drill.
* = Sawfly resistant varieties. (Rambo and Amidon have partial resistance.)

Table 46. Dryland **Recrop No-till Barley** grown north of **Conrad**, 1991. Mont. Agr. Expt. Sta., Western Triangel Ag. Research Center, Conrad, MT.

Variety	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Baronesse	80.66	52.34	31	185	78	4	6.6
Steptoe	80.24	46.49	32	179	91	4	8.1
Stark (ND 9866)	74.77	54.03	34	180	93	2	9.0
MT 140523	74.66	51.92	34	183	85	4	7.9
Gallatin	74.37	53.54	36	182	77	7	8.0
Harrington	71.16	50.58	34	185	85	4	7.6
Piroline	71.14	54.17	38	182	88	4	8.0
Lewis	71.00	53.82	33	184	79	7	8.3
Hector	70.56	51.00	35	184	72	10	8.2
Clark	69.29	51.49	37	184	75	9	8.0
Excel	68.21	47.68	34	180	65	11	7.2
Bowman	65.96	53.19	34	178	97	1	9.9
Bearpaw	64.06	49.31	35	186	80	4	7.2
Shonkin	63.52	57.00	37	185	67	7	8.1

Location : Research center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 70# N actual topdressed.
Previous crop : Barley
Seeded into standing stubble with a double disc drill.
Preplant weed control : Stubble sprayed with Roundup herbicide.
Date seeded : April 23, 1991.
Date harvested : August 12, 1991.
Rainfall : From seeding to harvest : 12.13 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 71.40
Error degrees of freedom : 26
F test for var. : 2.09
C.V. 2 : 5.07
LSD (0.05) : 10.53

Table 47. **Three-year** summary for dryland **No-till Recrop Barley** varieties grown north of **Conrad,** MT. 1989 - 1990 - 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	3 - year comparable average						
	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head Date	% Plump	% Thin	% Protein 1/
MT 140523	71.7	53	30	189	88	3	10.2
HECTOR	70.7	53	30	189	84	6	9.6
GALLATIN	70.0	54	30	187	84	5	9.6
LEWIS	69.0	54	30	191	85	5	10.4
STEPTOE	68.7	48	29	183	89	5	8.4
PIROLINE	66.3	55	32	187	92	3	9.8
STARK (ND 9866)	65.7	54	31	185	92	2	9.8
HARRINGTON	65.0	52	32	191	88	4	9.6
BEARPAW	64.3	51	29	192	83	4	9.8
BOWMAN	64.0	53	30	185	96	2	10.9
CLARK	64.0	51	29	190	72	9	10.5

Location : Research Center ten miles north of Conrad, Pondera County.

1/ = Proteins based on two years average. (1989-1990)

Title: Sawfly studies.

Year: 1991

Location: Western Triangle Research Center, Conrad, MT.

Personnel: Wendell Morrill (MSU),Greg Kushnak (WTARC),David Wichman (CRC),& James Gabor (MSU).

In addition to sawfly-resistant variety development (mentioned in the winter and spring wheat variety sections of this report), several studies were conducted to gain more information on the biology and management of the sawfly. Observations made thus far are summarized below.

A). Stem discoloration: A stem discoloration, suspected of being caused by the presence of sawfly larvae, was mentioned in last year's report. Observations made again in 1991 on winter wheat supported this finding. Ninety-eight percent of stems with a dark brown discoloration just beneath any of the stem nodes had sawfly larvae in them. Eighty percent of stems without the discoloration were non-infested when plants were examined early (soft-dough stage), but the accuracy increased to 95% when plants were examined later (mid to hard dough stage). The discoloration begins to appear while the plant is still green, but is not manifested in all infested stems until the plant turns to the yellow-ripe color. The discoloration begins at the lower edge of a node and extends one-fourth to one-half inch downward, encircling the stem. Larvae must bore through the node when moving from one internode to another. This apparently damages enough tissue to disrupt nutrient flow, resulting in accumulations of nutrients below each node. The stem discoloration may be useful in estimating sawfly severity before lodging becomes evident, so that decisions can be made earlier regarding the need to swath.

B). Solid stemmed varieties can be infested by sawfly, but stem cutting occurrs at a much lower rate than for hollow stems.

C). Stems of some plants were more solid in upper internodes, while others were more solid in lower regions. The second internode from the top was the most important area for sawfly resistance, and stem ratings should be taken in this area when evaluating potential new varieties for sawfly resistance.

D). In addition to causing plant lodging, sawfly larval feeding in stems may reduce head weights. Precise loss estimates are difficult to make because sawfly wasps select the largest stems (which produce the heaviest heads) for egg-laying. There was no difference in head weights of infested and uninfested stems when examined randomly, but when heads of similar size were compared, there was an average of 8% weight loss for the infested class. This method of loss estimation showed weight losses were variable, but could reach as high as 18%.

E). Sawflies overwinter in infested stubble. Infestations are more severe in field borders. Fall tillage of borders affected overwinter survival of larvae in one trial. Over 90% of larvae in stubble which was pushed upward and exposed on the soil surface died before spring. Covering stubble with soil did not reduce larval survival. In the laboratory, emerging wasps were able to dig through several inches of soil. Fall tillage has potential for reducing numbers of wasps which will appear during the following season, but it is uncertain whether the level of wasp reduction will be enough to show large reductions in damage to the crop (because the surviving wasps may still lay enough eggs to cause considerable crop damage).

F). In 1990, winter wheat planted in late September (1989) was infested with sawfly, while the mid-September planting was non-infested. Early-planted winter wheat may not, however, always escape sawfly; due to variations in spring recovery and sawfly emergence dates. Early heading varieties such as Rocky escaped sawfly more often than late-heading varieties. For spring wheat, earlier plantings (April 10) had more sawfly infestation than later plantings (April 23 & May 2). Grain yield, however, decreased from 77 bu/a for the April 10 planting, to 71 and 53 bu/a for the April 23 and May 2 plantings, respectively (Table 48). Therefore, planting crops so that their susceptible stage avoids the time frame when sawfly wasps are active may not have a net benefit.

G). Moderate sawfly damage to barley was occasionally observed, but the severity was far less than in adjacent wheat plots.

H). It is not certain if domestic and wild oats are resistant, but they appeared to be. Sawflies laid eggs in oats in the laboratory, but the larvae did not survive.

Table 48. **Seeding Rate** and **Seeding Date** study on **Spring Wheat** grown north of **Conrad,** MT. 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad MT.

Seeding date	Seeding rate	Yield bu/ac	Test wt. lbs/bu.	Plant hgt. inches	Head date	% Sawfly infested
April 10, 1991	20 seeds/ft.	77.2	64.6	34	179	44
	40 seeds/ft.	74.3	64.6	34	179	43
	80 seeds/ft.	70.6	64.4	34	179	40
April 23 1991	20 seeds/ft.	71.0	63.4	33	184	33
	40 seeds/ft.	72.4	63.3	34	184	29
	80 seeds/ft.	71.0	63.9	35	184	24
May 2, 1991	20 seeds/ft.	52.7	56.7	33	193	11
	40 seeds/ft.	59.8	59.4	33	193	15
	80 seeds/ft.	60.1	61.0	35	193	11

Location : Western Triangle Ag. Research Center, ten miles north of Conrad, Pondera County.
Variety seeded : Copper.
Fertilizer : 100 # 11-51-0 with the seed + 40 lbs. N actual topdressed.
Previous crop : Fallow.
Date harvested : August 27, 1991.
Rainfall : From April 10 to harvest was 12.13 inches.
From April 23 to harvest was 11.37 inches.
From May 2 to harvest was 10.91 inches.
Soil moisture probe depth at seeding was 3'6" + .

Table 49. **Safflower** variety trial grown north of **Conrad** on **recrop no-till** barley stubble, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield lbs/ac	Test wt. lbs/bu.	Plant hgt. inches	Flower date	% Oil
CENTENNIAL	2501.82	39.58	39	223	38.9
SAFFIRE	2233.37	43.88	34	218	32.0
85B 3910	2146.66	39.23	39	223	39.3
GIRARD	2142.05	41.06	41	223	35.7
S-317	2130.98	40.71	42	224	42.2
FINCH	2069.17	46.07	40	223	35.2
MONTOLA 2000	1977.84	38.87	35	224	40.5
S-541	1888.36	38.45	40	224	39.0
87B 1650	1859.76	38.31	41	227	38.4
OKER	1857.92	40.21	41	223	39.3
87B 1298	1819.17	41.06	41	225	37.6
88B 3217	1733.38	36.19	40	224	39.9
88B 3006	1683.56	39.72	37	227	42.4
S-208	1653.12	41.34	39	226	37.4
85B 4431	1653.12	40.99	40	224	37.0
89B 6145	1563.64	40.00	30	222	44.4
85B 3829 (MORLIN	1468.62	41.20	35	225	37.8
MT 3697	1408.66	39.44	39	224	40.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 70# N actual topdressed.
Previous crop : Barley
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Date harvested : October 9, 1991.
Rainfall : From seeding to September 30, 11.27 inches.
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 1877.29
Error degrees of freedom : 34.00
F test for var. : 2.11
C.V. 2 : 10.58
LSD (0.05) : 571.10
% oil is on an oven dry basis.

Table 50. Dryland **Canola** variety trial grown north of **Conrad** on **recrop no-till barley stubble**, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield lbs/ac	Plant hgt. inches	Emergence date	Flower date	Pedal drop date	% oil *
IMC 129	2275	43	136	182	203	49.4 BC
PACTOL	2139	41	136	183	205	48.2 BC
SEEDTEC	2097	53	136	186	207	45.3 A
WESTAR	2049	43	136	183	203	47.3 ABC
IMC EX9101	2029	47	136	185	207	45.6 A
IMC 144	2011	52	136	184	204	46.5 AB
TOBIN	1658	41	136	175	200	46.0 AB

Location : Research Center, ten miles north of Conrad, Pondera County.
Fertilizer : 100# 11-51-0 with the seed + 70# N actual topdressed.
Previous crop : Barley.
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Swathed : Aug. 20, 1991.
Combined : Aug. 22, 1991.
Rainfall : From seeding to maturity : 10.58 inches.
Soil moisture probe depth at seeding : 3'6" +

* oil 0% water basis

Table 51. **Irrigated Canola** variety trial grown north of **Conrad** on **recrop no-till barley stubble**, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Yield lbs/ac	Plant hgt. inches	Emergence date	Flower date	Pedal drop date	% oil *	
IMC 129	2635	44	136	183	203	48.0	BC
SEEDTEC	2625	54	136	186	210	46.3	A
WESTAR	2621	47	136	183	207	46.5	AB
IMC 144	2500	51	136	185	210	46.5	AB
TOBIN	2383	41	136	175	203	45.2	A
PACTOL	2206	43	136	184	203	48.3	C
IMC EX9101	2059	43	136	186	210	45.9	A

Location : Research Center, ten miles north of Conrad, Pondera County.
Fertilizer : 100# 11-51-0 with the seed + 70# N actual topdressed.
Previous crop : Barley.
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Swathed : Aug. 20, 1991.
Combined : Aug. 22, 1991.
Rainfall : From seeding to maturity : 10.58 inches.
Soil moisture probe depth at seeding : 3'6" +
Irrigation method : Sprinkler.
Irrigation dates : July 10 --- approximately 1 inch applied.
July 19 --- approximately 1.5 inches applied.

* oil 0% water basis

Table 52. Dryland **Chickpea** variety trial grown north of **Conrad** on **recrop no-till barley stubble**, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Total plant yield lb/ac	Seed yield lb/ac	Test wt. lbs/bu. (seeds)	Canopy hgt. inches	Plant length inches	Bloom date	Date cut
UMATILLA FLD P.	8028	3661	63.7	13	19	185	241
MELROSE AUST P.	7016	2560	64.4	9	57	193	241
UC-5 CHICKPEA	5164	2392	59.1	16	18	190	248
SARAH CHICKPEA	4991	2542	60.3	16	18	190	248
SURUTATO 77 PEA	4706	1873	57.4	16	18	192	248
BREWER LENTIL	4505	1675	62.0	13	22	185	241
GARNET CHICKPEA	4215	2041	57.2	14	17	192	248
CRIMSON LENTIL	3645	1561	64.4	12	14	191	241

Location : Research Center, ten miles north of Conrad, Pondera County.
Fertilizer : 100# 11-51-0 with the seed + 70# N actual topdressed.
Previous crop : Barley.
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Rainfall : From seeding to maturity : 10.58 inches.
Soil moisture probe depth at seeding : 3'6" +
Total plant weight is on a field dry basis. (After swathing)

Table 53. Dryland **Large-Seeded Legume** variety trial grown north of Conrad, on **recrop no-till barley stubble**, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Total plant yield lb/ac	Seed yield lb/ac	Plant length inches	Canopy hgt. inches	Bloom date	Date cut
AUSTRIAN WINTER PEA	6350	2777	55	13	192	242
TRAPPER PEA	5864	2659	37	13	190	242
MIRANDA YELLOW	5138	1736	37	14	187	242
CAHABA WHITE VETCH	2917	184	30	17	189	242
MS PINKEYE COWPEA *	-	-	-	-	-	-
MS CREAM COWPEA *	-	-	-	-	-	-

Location : Research Center, ten miles north of Conrad, Pondera County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Barley.
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Rainfall : From seeding to maturity : 10.58 inches.
Soil moisture probe depth at seeding : 3'6" +
* = denotes no harvest due to poor emergence.
Total plant yield is on a field dry basis. (After swathing)

Table 54. Dryland **Small-Seeded Legume** variety trial grown north of Conrad, on **recrop no-till barley stubble**, 1991. Mont. Agr. Expt. Station, Western Triangle Ag. Research Center, Conrad, MT.

Variety	Total plant yield lb/ac	Seed yield lb/ac	Plant length inches	Canopy hgt. inches	Bloom date	Date cut
MT BARKER SUB. CL.	6344	10	15	12	200	273
YOUCHI ARROW CL.	5350	18	23	20	242	281
MARAL SHAFTAL CL.	3697	80	29	10	199	273
BIGBEE BERSEEM CL.	3451	94	30	24	221	269
INDIANHEAD LENT.	3251	902	18	16	205	253
MULTICUT CLOVER	3199	114	32	24	225	269
SELECTION 1 CL.	3137	114	27	25	218	269
GEORGE BK. MEDIC	2385	102	17	12	184	273
NITRO ALFALFA	2041	18	26	23	207	281
SELECTION 5 MED.	1916	30	20	14	189	273
JEMALONG MEDIC	1054	68	23	2	186	269
YELLOW CLOVER *	-	-	-	-	-	-
FAHL BERSEEM CL. *	-	-	-	-	-	-

Location : Research Center, ten miles north of Conrad, Pondera County.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Barley.
Seeded into standing stubble with a double-disc drill.
Preplant vegetation control : Sprayed with Roundup herbicide.
Date seeded : May 8, 1991.
Rainfall : From seeding to maturity : 10.58 inches.
Soil moisture probe depth at seeding : 3'6" +
* = denotes no harvest due to poor emergence.

TITLE: Effect of potassium and chlorine on wheat stem sawfly damage and disease incidence in dryland wheat production.

YEAR: 1991

LOCATIONS:
1. Dryland spring wheat-Research Center, 10 miles north of Conrad, MT;
2. Dryland spring wheat-Bradley Farms, 30 miles north of Cutbank, MT;
3. Dryland winter wheat-Kronubush Farms, 9 miles north of Conrad, MT;
4. Dryland winter wheat-Picard Farms, 30 miles east of Brady, MT.

PERSONNEL: Grant Jackson, Greg Kushnak, Ron Thaut, and Larry Christiaens

OBJECTIVES: (1) To evaluate the effect of K and Cl on (dryland root rot, take all, etc.) incidence and grain yield of dryland winter and spring wheat, and (2) To determine if wheat stem sawfly damage is affected by K and Cl fertilizers in dryland winter wheat and spring wheat and irrigated spring wheat.

RESULTS: Specific results from each location are tabulated in tables 54-57. Grain yields were very high this year, doubling yield goals at most locations. The Cutbank location had the only significant yield increase due to K, and it was difficult to interpret. Potassium chloride increased plant Cl conc. at all locations, but only the winter wheat locations significantly. Spring wheat Cl data was too variable for significance for some reason. Plant K conc. was not increased significantly by K at any location. Since plant K conc. was unaffected, differential sawfly damage would not be expected. In fact sawfly damage (lodging) did not occur at any of these locations in spite of sawfly larvae infection at all locations. Perhaps the high plant K concs. is the reason little sawfly damage was noted this year. Plant disease was virtually non-existent this year at all locations.

EXECUTIVE SUMMARY: Potassium chloride or nitrate fertilizers did not increase spring wheat or winter wheat yields in the 1991. The K fertilizers were evaluated for sawfly and disease control, but sawfly and plant disease were not production problems in the test areas during 1991.

TITLE: Effect phosphorus (P) fertilizers on spring wheat production.

YEAR: 1991

LOCATIONS: 1. Western Triangle Ag. Research Center, 10 miles north of Conrad, Pondera Co.
2. Terry Alme farm, 8 miles east of Oilmont, Toole Co.
3. Merja Farms, southeast of Sun River, Cascade Co.
4. Rick Corey farm, 15 east of Choteau, Teton Co.

PERSONNEL: Grant Jackson, Greg Kushnak, Ron Thaut, and Larry Christiaens.

OBJECTIVES: To calibrate the Olsen P soil test for spring wheat grown on fallow in northcentral Montana.

RESULTS: Data are tabulated in Tables 58-61. Only the Oilmont location responded to P this year. It was the only location with a low soil test. Several more years of data with varying soil tests are needed before a reliable calibration curve can be determined. Central and Northern Ag. Research Centers are cooperating by conducting similar experiments.

EXECUTIVE SUMMARY: Studies on spring wheat response to P fertilizer are being conducted to calibrate the Olsen P soil test. This year only one location with a low soil test responded to P. More data are needed from locations having medium to low soils tests.

TITLE: Nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and irrigation water effects on no-till spring canola.

YEAR: 1991

LOCATION: Western Triangle Ag. Research Center, 10 miles north of Conrad, Pondera Co.

PERSONNEL: Grant Jackson, Ron Thaut, and Larry Christiaens

OBJECTIVES: (1) To determine the response of spring canola to differential irrigation water applications; (2) to evaluate spring canola response to and calibrate soil tests for N, P, K, and S; and (3) to measure N effects on spring canola water use and nitrate-N movement below the root zone.

RESULTS: Grain yield responded to N, P, and irrigation (Table 62). These data indicate interactions between irrigation and dryland for K and P responses, however, more collaborating data are needed. Tables 63 and 64 contain the oil content and oil yield data. Oil contents were decreased by N fertilization which was similar to 1990, however, P did not increase oil content as it did in 1990. Oil levels were impressive and tended to increase with additional irrigation water. Plant and soil samples for nutrient efficiency calculations have been taken and are waiting analysis.

EXECUTIVE SUMMARY: Studies evaluating canola response to N, P, K, and S fertilizers were started in 1990 and were continued in 1991 with the addition of irrigation treatments. Grain yields peaked at about 2500 lbs/ac with oil contents exceeding 47 %. Responses to N and P were evident, however, canola did not respond to K or S. More research is needed to evaluate interactions between irrigation level and fertilizer response.

TITLE: Cultural practices for Kamut spring wheat.

YEAR: 1991

LOCATION: Western Triangle Ag. Research Center, 10 miles north of Conrad, Pondera Co.

PERSONNEL: Grant Jackson, Greg Kushnak, Ron Thaut, and Larry Christiaens

OBJECTIVES: To determine optimum seeding rate and nitrogen fertilizer practices for Kamut (Triticum polonicum L.)

RESULTS: Seeding rate data are shown in Table 65. The highest seeding rate produced the most grain, and considering data from previous years, the seeding rate for this area should be around 20 seeds/sq. ft. Grain yields of Kamut were slightly higher than Lew this year (Table 66), however, responses to N were very similar even though Lew produces more tillers than Kamut. Grain yields peaked at about 40 bu/ac and were highest with 60 lbs N/ac.

EXECUTIVE SUMMARY: Recent experiments evaluating seeding rate and fertilizer practices for Kamut indicate that Kamut can be produced like traditional spring wheat.

TABLE 54. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN WINTER WHEAT - BRADY
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	GRAIN PROT.	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	%	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
30-K AS KCl	71.0	13.6	64.5	127.6	0.53	0.25	68.19	32.56
60-K AS KNO_3	70.4	13.8	64.5	134.8	0.49	0.10	66.17	13.26
15-K AS KNO_3	69.8	13.7	64.4	133.2	0.48	0.13	63.77	16.08
0-K	69.4	13.8	64.5	117.1	0.49	0.10	57.35	11.68
60-K AS KCl	68.9	13.7	64.8	119.1	0.55	0.31	64.96	37.68
30-K AS KNO_3	68.1	13.9	64.8	137.4	0.47	0.10	64.58	13.36
15-K AS KCl	67.4	13.8	64.8	148.3	0.54	0.21	80.23	31.40
EXPERIMENTAL MEANS	69.3	13.8	64.6	131.1	0.51	0.17	66.46	22.29
TOTAL OBSERVATIONS	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NO. OF REPS	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
TRT. MEAN SQUARE	6.31	0.03	.10	470.82	.00	.03	192.38	491.74
ERROR MEAN SQUARE	2.81	0.11	.03	327.35	.00	.00	84.94	31.85
ERROR DF	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	15.95	10.24	4.05	1.84	5.06	4.30	7.75	6.36
F TEST FOR TRT.	2.24	0.29	3.87	1.44	1.96	19.98	2.26	15.44
P-VALUE TRTS.	0.08	0.95	0.01	0.25	0.12	0.00	0.08	0.00
STANDARD ERROR	1.68	0.33	.16	18.09	.05	.04	9.22	5.64
STANDARD ERROR MEAN	.84	0.17	.08	9.05	.02	.02	4.61	2.82
C.V. 1: (S/MEAN)*100	2.42	2.42	.25	13.80	9.11	22.42	13.87	25.32
LSD (0.05)	2.49	NS	.24	NS	NS	.06	13.69	8.38

Grain yields based on 60 lb/bu. Variety: Rocky
Planting date: September 12, 1990 Harvest date: August 5, 1991
Preciptation from May 15 to harvest: 4.9 in.
Previous crop: Fallow
Depth of moist soil at time of fertilizer application: 36 in +
Fertilizer: 60 lbs 11-52-0 with the seed + 60 lbs N as anhydrous ammonia + 20 lbs N as ammonium nitrate and potassium nitrate. Treatments applied topdress on March 19, 1991.

Soil tests:

Depth	O.M.	P	K	Zn	Cl	NO_3-N
	%	-----ppm----			--lbs/ac--	
0-6"	2.2	11	406	0.8	21	55
6-12"					43	22
12-24"					21	20
24-36"					32	21
Total					117	118

TABLE 55. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN WINTER WHEAT - CONRAD
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
30 K AS KCl	86.7	62.4	122.1	0.68	0.26	83.57	31.90
60 K AS KCl	85.7	62.2	98.1	0.72	0.27	70.36	26.00
15 K AS KNO_3	84.7	61.2	125.0	0.61	0.18	78.38	22.54
60 K AS KNO_3	83.7	61.0	94.0	0.78	0.18	73.11	17.79
15 K AS KCl	83.4	61.5	111.1	0.62	0.23	69.12	25.65
0 K	83.3	61.9	114.3	0.79	0.18	89.59	21.24
30 K AS KNO_3	81.8	61.0	126.7	0.69	0.17	90.43	21.39
EXPERIMENTAL MEANS	84.2	61.6	113.0	0.70	0.21	79.22	23.78
TOTAL OBSERVATIONS	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NO. OF REPS	4.00	4.00	4.00	4.00	4.00	4.00	4.00
TRT. MEAN SQUARE	10.89	1.28	668.41	0.02	0.01	313.84	82.63
ERROR MEAN SQUARE	14.21	1.15	423.50	0.02	0.00	592.45	73.15
ERROR DF	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	0.97	11.23	1.25	10.93	3.43	6.15	0.66
F TEST FOR TRT.	0.77	1.11	1.58	0.93	2.80	0.53	1.13
P-VALUE TRTS.	0.62	0.40	0.21	0.51	0.04	0.80	0.39
STANDARD ERROR	3.77	1.07	20.58	0.15	0.05	24.34	8.55
STANDARD ERROR MEAN	1.88	0.54	10.29	0.07	0.03	12.17	4.28
C.V. 1: (S/MEAN)*100	4.48	1.74	18.21	20.80	23.89	30.72	35.96
LSD (0.05)	NS	NS	NS	NS	0.07	NS	NS

Grain yields based on 60 lb/bu. Variety: Rocky
Harvest date: August 15, 1991
Preciptation from March 22 to harvest: 12.63 in.
Previous crop: Fallow
Depth of moist soil at time of fertilizer application: 36 in +
Fertilizer: 70 lbs 11-52-0 with the seed + 46 lbs N topdress as urea + 20 lbs N as ammonium nitrate and potassium nitrate. Treatments applied topdress on March 19, 1991.

Soil tests:

Depth	pH	O.M.	P	K	SO_4-S	Zn	Cl	NO_3-N
		%	ppm				--lbs/ac--	
0-6"	7.6	2.2	19	361	15	0.8	12	32
6-12"					13		9	15
12-24"							13	14
24-36"							11	12
Total							45	73

TABLE 56. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN SPRING WHEAT - CONRAD WESTERN TRIANGLE AG. RESEARCH CENTER, CONRAD. 1991

TREATMENT	GRAIN YIELD	PLANT HT.	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	in	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
15 K AS KNO_3	82.2	35	64.5	123.2	0.98	0.09	122.1	10.13
60 K AS KCl	80.3	34	64.8	116.7	1.15	0.24	136.6	28.40
0 K	79.9	35	64.4	107.6	0.86	0.10	92.7	10.02
30 K AS KCl	78.1	35	64.6	127.5	0.98	0.20	126.2	26.34
30 K AS KNO_3	78.0	35	64.5	113.6	0.91	0.13	102.8	15.25
15 K AS KCl	77.7	35	64.5	121.0	1.00	0.13	124.9	15.83
60 K AS KNO_3	77.6	35	64.6	129.4	1.05	0.10	135.7	12.33
EXPERIMENTAL MEANS	79.1	35	64.5	119.8	0.99	0.14	120.1	16.90
TOTAL OBSERVATIONS	28	28	28	28	28	28	28	28
NO. OF REPS	4	4	4	4	4	4	4	4
TRT. MEAN SQUARE	12.15	0.49	0.05	241.3	0.03	0.01	1086.0	226.20
ERROR MEAN SQUARE	17.94	0.87	0.07	445.3	0.02	0.01	998.4	139.90
ERROR DF	18	18	18	18	18	18	18	18
F TEST FOR REPS.	1.62	0.71	0.90	1.11	5.83	0.11	3.0	0.14
F TEST FOR TRT.	0.68	0.56	0.67	0.54	2.30	1.51	1.1	1.62
P-VALUE TRTS.	0.69	0.78	0.70	0.79	0.07	0.23	0.4	0.19
STANDARD ERROR	4.24	0.93	0.26	21.10	0.12	0.95	31.6	11.83
STANDARD ERROR MEAN	2.12	0.47	0.13	10.55	0.06	0.47	15.8	5.91
C.V. 1: (S/MEAN)*100	5.36	2.69	0.40	17.61	12.45	67.55	26.3	69.99
LSD (0.05)	NS	NS	NS	NS	0.18	NS	NS	NS

Grain yields based on 60 lb/bu. Variety: Newana
Planting date: April 10, 1991 Harvest date: August 27, 1991
Preciptation from April 10 to harvest: 12.85 in.
Previous crop: Fallow
Depth of moist soil at planting: 36 in +
Fertilizer: 100 lbs 11-52-0 with the seed + 30 lbs N as urea, preplant + 20 lbs N topdress as ammonium nitrate and potassium nitrate. Treatments applied topdress on May 2, 1991.

Soil tests:

Depth	pH	O.M.	P	K	SO_4-S	Zn	Cl	NO_3-N
		%	-------ppm--------				--lbs/ac--	
0-6"	7.8	1.6	20	431	25	1.0	5	41
6-12"					14		4	16
12-24"							14	20
24-36"							10	12
36-48"							10	12
48-60"							14	26
Total							57	127

TABLE 57. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN SPRING WHEAT - CUTBANK WESTERN TRIANGLE AG. RESEARCH CENTER, CONRAD. 1991

TREATMENT	GRAIN YIELD	PLANT HT.	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	in	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
60 K as KCl	53.0	30	62.9	63.40	0.74	0.13	47.88	7.10
15 K as KNO_3	44.6	30	63.0	66.27	0.74	0.07	50.43	5.38
0 K	44.6	30	63.3	68.17	0.81	0.07	55.76	4.46
60 K as KNO_3	44.0	29	62.8	60.50	0.63	0.03	38.07	2.03
15 K as KCl	42.2	28	62.9	61.13	0.69	0.07	42.16	3.92
30 K as KNO_3	38.4	29	62.1	71.07	0.74	0.03	52.53	1.86
30 K as KCl	36.9	29	63.0	62.07	0.67	0.11	43.32	7.22
EXPERIMENTAL MEANS	43.4			64.76	0.72	0.07	47.16	4.57
TOTAL OBSERVATIONS	21	7	7	21	21	21	21	21
NO. OF REPS	3	1	1	3	3	3	3	3
TRT. MEAN SQUARE	82.22			46.99	.01	.00	118.22	14.17
ERROR MEAN SQUARE	10.83			112.50	.01	.00	78.12	12.11
ERROR DF	12.00			12.00	12.00	12.00	12.00	12.00
F TEST FOR REPS.	6.82			6.77	12.14	.22	18.41	.43
F TEST FOR TRT.	7.59			.42	1.62	1.31	1.51	1.17
P-VALUE TRTS.	0.001			0.87	0.22	0.32	0.25	0.39
STANDARD ERROR	3.29			10.61	.08	.06	8.84	3.48
STANDARD ERROR MEAN	1.90			6.12	.04	.03	5.10	2.01
C.V. 1: (S/MEAN)*100	7.58			16.40	10.85	76.52	18.74	76.20
LSD (0.05)	5.85			NS	NS	NS	NS	NS

Grain yields based on 60 lb/bu. Variety: Newana
Planting date: May 16, 1991 Harvest date: September 5, 1991
Preciptation from May 20 to harvest: 7.85 in.
Previous crop: Fallow
Depth of moist soil at planting: 36 in +
Fertilizer: 100 lbs 11-52-0 with the seed + 20 lbs N topdress as ammonium nitrate and potassium nitrate. Treatments applied topdress on May 23, 1991.

Soil tests:

Depth	O.M.	P	K	Cl	NO_3-N
	%	--ppm---		--lbs/ac--	
0-6"	1.6	17	234	11	7
6-12"				7	17
12-24"				14	23
24-36"				7	13
Total				39	60

TABLE 58. EFFECT OF PHOSPHORUS ON SPRING WHEAT - CONRAD
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	PLANT HT.	TEST WT.	GRAIN YIELD
lbs P_2O_5/ac as 0-45-0	in	lb/bu	bu/ac
10	44	64.41	59.5
0	44	65.40	59.3
30	44	65.54	58.2
50	44	65.26	58.1
20	44	64.91	56.9
40	43	65.40	55.4
EXPERIMENTAL MEANS	44	.00	57.9
TOTAL OBSERVATIONS	18.00	.00	18.00
NO. OF REPLICATIONS	3.00	.00	3.00
TRT. MEAN SQUARE	0.62	.00	7.37
ERROR MEAN SQUARE	0.79	.00	5.58
ERROR DEGREES OF FREEDOM	10.00	.00	10.00
F TEST FOR REPS.	0.07	.00	6.16
F TEST FOR TRT.	0.79	.00	1.32
STANDARD ERROR	0.89	.00	2.36
STANDARD ERROR OF THE MEAN	0.51	.00	1.36
C.V. 1: (S/MEAN)*100	2.03	.00	4.08
LSD (0.05)	NS		NS

Grain yields based on 60 lb/bu.
Variety: Lew
Planting Date: April 10, 1991
Harvest Date: August 27, 1991
Inches of moist soil at planting: 40
Growing season rainfall: 12.03
Additional 30 lbs N applied preplant as urea.
Soil Tests (0-6")
pH = 7.7
O.M. = 1.7 %
NO_3-N = 41 lb/ac
P = 20 ppm
K = 430 ppm
SO_4-S = 25 ppm
Zn = 1 ppm

TABLE 59. EFFECT OF PHOSPHORUS ON SPRING WHEAT - OILMONT
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	TEST WT.	GRAIN YIELD
lbs P_2O_5/ac as 0-45-0	lb/bu	bu/ac
20	51.08	43.8
40	53.55	43.7
30	52.84	42.7
10	51.78	41.5
50	51.85	38.9
0	46.49	37.3
EXPERIMENTAL MEANS	.00	41.3
TOTAL OBSERVATIONS	.00	18.00
NO. OF REPLICATIONS	.00	3.00
TRT. MEAN SQUARE	.00	21.15
ERROR MEAN SQUARE	.00	27.79
ERROR DEGREES OF FREEDOM	.00	10.00
F TEST FOR REPS.	.00	0.77
F TEST FOR TRT.	.00	0.76
STANDARD ERROR	.00	5.27
STANDARD ERROR OF THE MEAN	.00	3.04
C.V. 1: (S/MEAN)*100	.00	12.76
LSD (0.05)	.00	NS

Grain yields based on 60 lb/bu.
Variety: Lew
Planting Date: April 4, 1991
Harvest Date: August 14, 1991
Inches of moist soil at planting: 24
Growing season rainfall: 6.5"
Soil Tests (0-6")
pH = 7.2
O.M. = 2.0 %
NO_3-N = 8 lb/ac
P = 10 ppm
K = 473 ppm
SO_4-S = 10 ppm
Zn = 1.2 ppm

TABLE 60. EFFECT OF PHOSPHORUS ON SPRING WHEAT - SUN RIVER
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	TEST WT.	GRAIN YIELD
lbs P_2O_5/ac as 0-45-0	lb/bu	bu/ac
0	57.36	19.7
40	56.79	19.4
30	56.58	19.2
20	57.00	18.5
50	53.27	17.5
10	56.79	17.1
EXPERIMENTAL MEANS	.00	18.6
TOTAL OBSERVATIONS	.00	18.00
NO. OF REPLICATIONS	.00	3.00
TRT. MEAN SQUARE	.00	3.38
ERROR MEAN SQUARE	.00	19.98
ERROR DEGREES OF FREEDOM	.00	10.00
F TEST FOR REPS.	.00	3.45
F TEST FOR TRT.	.00	.17
STANDARD ERROR	.00	4.47
STANDARD ERROR OF THE MEAN	.00	2.58
C.V. 1: (S/MEAN)*100	.00	24.07
LSD (0.05)	.00	NS

Grain yields based on 60 lb/bu.
Variety: Lew
Planting Date: April 9, 1991
Harvest Date: August 19, 1991
Inches of moist soil at planting: 18
Growing season rainfall: 6"
Soil Tests (0-6")
pH = 7.2
O.M. = 2.2 %
NO_3-N = 48 lb/ac
P = 31 ppm
K = 520 ppm
SO_4-S = 18 ppm
Zn = 1.2 ppm

TABLE 61. EFFECT OF PHOSPHORUS ON SPRING WHEAT - CHOTEAU
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	TEST WT.	GRAIN YIELD
lbs P_2O_5/ac as 0-45-0	lb/bu	bu/ac
50	55.44	32.4
30	52.40	32.2
0	51.68	30.4
10	50.04	29.3
20	45.52	27.6
40	45.56	26.4
EXPERIMENTAL MEANS	50.11	29.7
TOTAL OBSERVATIONS	18.00	18.00
NO. OF REPLICATIONS	3.00	3.00
TRT. MEAN SQUARE	2.92	17.67
ERROR MEAN SQUARE	1.81	10.94
ERROR DEGREES OF FREEDOM	10.00	10.00
F TEST FOR REPS.	4.31	6.12
F TEST FOR TRT.	1.61	1.61
STANDARD ERROR	1.35	3.31
STANDARD ERROR OF THE MEAN	.78	1.91
C.V. 1: (S/MEAN)*100	10.74	11.14
LSD (0.05)	NS	NS

Grain yields based on 60 lb/bu.
Variety: Lew
Planting Date: April 8, 1991
Harvest Date: August 13, 1991
Inches of moist soil at planting: 30
Growing season rainfall: 6.5"
Soil Tests (0-6")
pH = 7.8
O.M. = 1.7 %
NO_3-N = 46 lbs N/ac
P = 30 ppm
K = 569 ppm
SO_4-S = 15 ppm
Zn = 0.2 ppm

TABLE 62. EFFECT OF FERTILIZERS AND IRRIGATION RATE ON GRAIN YIELD OF NO-TILL SPRING CANOLA. Western Triangle Ag. Research Center, Conrad, MT. 1991.

Fertilizer Treatment[1]	----Irrigation Treatment---- Dryland	W-1[2]	W-2[3]	W-3[4]	Mean	Irr. Mean
	----------lbs/ac----------					
0-45-0-0	560	472	689	652	593	604
0-0-0-0	650	799	648	877	743	775
100-0-0-0	1201	2138	2045	1838	1805	2007
100-45-0-20	1447	2012	1919	2246	1906	2059
50-30-0-0	1510	1575	1971	1690	1687	1745
50-60-0-0	1694	1804	1512	1861	1718	1726
150-60-0-0	1800	2464	2360	2641	2316	2488
100-45-0-0	1993	1822	2050	2207	2018	2026
150-30-0-0	2290	2236	1663	2090	2070	1996
100-45-50-0	2724	1530	2106	2074	2108	1903
Mean	1587	1685	1696	1818	1696	1733
LSD (.05)	505	693	613	660		
CV %	22	28	25	25		

1 Lbs/ac of N, P_2O_5, K_2O, and S.
2 Less than optimum irrigation.
3 Optimum irrigation.
4 Greater than optimum irrigation.
Growing season ppt: = 11.2"; W-1 = 11.62"; W-2 = 13.06"; W-3 = 13.65".
Seeding date: April 23, 1991
Variety: 'Wester' (fungicide: Vita Vax)
Previous crop: Barley (3500 lbs residue)
Fertilizers applied with seeding, P with seed, all others broadcast between rows every other row.
Drill: Station built double disc set at 10 inch row space
Harvest date: August 15, 1991
Irrigation date: July 10 W-1=0.20"; W-2=0.72"; W-3=0.92"
July 19 W-1=0.12"; W-2=1.14"; W-3=1.53"
Soil Series: Scobey Cl
Soil Test: pH=7.3; o.m.=1.8%; P = 20 ppm; K = 360 ppm

Depth in	NO_3-N lb N/ac	SO_4-S ppm
0-6	4	16
6-12	12	18
12-24	12	
24-36	20	
36-48	20	

TABLE 63. EFFECT OF FERTILIZERS AND IRRIGATION RATE ON THE OIL CONTENT OF NO-TILL SPRING CANOLA. Western Triangle Ag. Research Center, Conrad, MT. 1991.

Fertilizer Treatment[1]	----Irrigation Treatment--- Dryland	W-1[2]	W-2[3]	W-3[4]	Mean	Irr. Mean
	----------%----------					
0-45-0-0	48.01	49.40	47.95	50.58	48.99	49.31
0-0-0-0	47.12	50.08	48.90	50.74	49.21	49.31
100-0-0-0	48.34	46.99	47.97	47.24	47.64	47.40
100-45-0-20	45.26	47.59	47.61	49.84	47.58	48.35
50-30-0-0	47.63	48.40	49.54	50.27	48.96	49.40
50-60-0-0	46.85	49.41	49.69	49.48	48.86	49.53
150-60-0-0	45.87	45.82	45.77	45.34	45.70	45.64
100-45-0-0	44.90	47.92	47.93	48.02	47.19	47.96
150-30-0-0	46.44	46.83	46.22	46.83	46.58	46.63
100-45-50-0	47.50	48.56	47.49	46.81	47.59	47.62
Mean	46.79	48.10	47.91	48.52	48,83	48.18
LSD (.05)	NS	2.58	2.00	1.37		
CV %	4.63	3.70	2.88	1.95		

1 Lbs/ac of N, P_2O_5, K_2O, and S.
2 Less than optimum irrigation.
3 Optimum irrigation.
4 Greater than optimum irrigation.
Growing season ppt: = 11.2"; W-1 = 11.62"; W-2 = 13.06"; W-3 = 13.65"
Seeding date: April 23, 1991
Variety: 'Wester' (fungicide: Vita Vax)
Previous crop: Barley (3500 lbs residue)
Fertilizers applied with seeding, P with seed, all others broadcast between rows every other row.
Drill: Station built double disc set at 10 inch row space
Harvest date: August 15, 1991
Irrigation date: July 10 W-1=0.20"; W-2=0.72"; W-3=0.92"
July 19 W-1=0.12"; W-2=1.14"; W-3=1.53"
Soil Series: Scobey Cl
Soil Test: pH=7.3; O.M.=1.8%; P = 20 ppm; K = 360 ppm

Depth in	NO_3-N lb N/ac	SO_4-S ppm
0-6	4	16
6-12	12	18
12-24	12	
24-36	20	
36-48	20	

TABLE 64. EFFECT OF FERTILIZERS AND IRRIGATION RATE ON OIL YIELD OF NO-TILL SPRING CANOLA. Western Triangle Ag. Research Center, Conrad, MT. 1991.

Fertilizer Treatment[1]	----Irrigation Treatment---- Dryland	W-1[2]	W-2[3]	W-3[4]	Mean	Irr. Mean
	----------lbs oil/ac----------					
0-45-0-0	269	233	329	329	290	297
0-0-0-0	307	399	317	446	368	387
100-0-0-0	582	1003	982	867	859	951
100-45-0-20	659	961	907	1119	912	996
50-30-0-0	720	766	975	848	827	863
50-60-0-0	793	885	750	917	836	851
150-60-0-0	825	1138	1084	1196	1061	1139
100-45-0-0	894	874	981	1061	952	972
150-30-0-0	1065	1037	771	977	962	928
100-45-50-0	1293	745	1000	968	1001	904
Mean	741	804	809	873		
LSD (.05)	245	335	290	314		
CV %	22.8	28.8	24.7	24.8		

1 Lbs/ac of N, P_2O_5, K_2O, and S.
2 Less than optimum irrigation.
3 Optimum irrigation.
4 Greater than optimum irrigation.
Growing season ppt: = 11.2"; W-1 = 11.62"; W-2 = 13.06"; W-3 = 13.65"
Seeding date: April 23, 1991
Variety: 'Wester' (fungicide: Vita Vax)
Previous crop: Barley (3500 lbs residue)
Fertilizers applied with seeding, P with seed, all others broadcast between rows every other row.
Drill: Station built double disc set at 10 inch row space
Harvest date: August 15, 1991
Irrigation date: July 10 W-1=0.20"; W-2=0.72"; W-3=0.92"
July 19 W-1=0.12"; W-2=1.14"; W-3=1.53"
Soil Series: Scobey Cl
Soil Test: pH=7.3; O.M.= 1.8%; P = 20 ppm; K = 360 ppm

Depth in	NO_3-N lb N/ac	SO_4-S ppm
0-6	4	16
6-12	12	18
12-24	12	
24-36	20	
36-48	20	

1TABLE 65. EFFECT OF SEEDING RATE ON YIELD AND YIELD COMPONTENTS OF KAMUT. Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	PLANT HT.	HEAD DATE	TEST WT.	TILLERS
	bu/ac	in		lb/bu	#/3'
21.1 SEEDS/SQFT, 130 lb/ac	62.25	49.25	189.00	62.03	70.50
17.8 SEEDS/SQFT, 110 lb/ac	58.95	47.75	187.00	61.85	75.75
14.6 SEEDS/SQFT, 90 lb/ac	54.93	48.75	189.00	60.95	58.00
11.4 SEEDS/SQFT, 70 lb/ac	50.58	49.00	188.00	60.50	61.00
8.1 SEEDS/SQFT, 50 lb/ac	40.33	48.50	189.00	58.30	57.25
EXPERIMENTAL MEANS	53.41	48.65	.00	60.72	64.50
TOTAL OBSERVATIONS	20.00	20.00	.00	20.00	20.00
NO. OF REPLICATIONS	4.00	4.00	.00	4.00	4.00
TRT. MEAN SQUARE	290.39	1.32	.00	8.94	269.63
ERROR MEAN SQUARE	18.71	1.69	.00	.61	77.86
ERROR DEGREES OF FREEDOM	12.00	12.00	.00	12.00	12.00
F TEST FOR REPS.	4.08	2.16	.00	.99	.33
F TEST FOR TRT.	15.52	.78	.00	14.58	3.46
STANDARD ERROR	4.33	1.30	.00	.78	8.82
STANDARD ERROR OF THE MEAN	2.16	.65	.00	.39	4.41
C.V. 1: (S/MEAN)*100	8.10	2.67	.00	1.29	13.68
LSD (0.05)	6.66	NS		1.21	13.59

Grain yields based on 60 lb/bu.
Planting date: April 10, 1991 Harvest date: August 27, 1991
Preciptation from April 10 to harvest: 12.85 in.
Previous crop: Fallow
Depth of moist soil at planting: 36 in +
Fertilizer: 100 lbs 11-52-0 with the seed + 30 lbs N as urea, preplant.

Soil tests:

Depth	pH	O.M.	P	K	SO_4-S	Zn	Cl	NO_3-N
		%	-------ppm--------				--lbs/ac--	
0-6"	7.8	1.6	20	431	25	1.0	5	41
6-12"					14		4	16
12-24"							14	20
24-36"							10	12
36-48"							10	12
48-60"							14	26
Total							57	127

TABLE 66. EFFECT OF NITROGEN ON NO-TILL KAMUT AND LEW SPRING WHEAT. Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	TILLERS	GRAIN PROTEIN	N CONTENT	N UPTAKE
Crop/N Rate	bu/ac	lb/bu	cwt/ac	#/3'	%	%	lb N/ac
Kamut/60	42.2	61.7	92.20	76		0.61	56.58
Lew/60	39.8	63.3	71.05	97		0.61	43.51
Kamut/90	39.5	61.4	97.00	83		0.77	75.28
Lew/90	36.8	62.8	87.35	141		0.68	58.87
Kamut/30	33.1	62.7	68.18	69		0.62	41.77
Lew/30	29.2	63.1	71.78	99		0.64	45.97
Kamut/0	25.0	61.9	53.55	62		0.57	29.98
Lew/0	23.2	62.8	53.05	74		0.61	32.25
MEAN	33.6	62.5	74.27	88		0.64	48.03
OBSERVATIONS	28	28	28	28		28	28
NO. OF REPS.	4	4	4	4		4	4
TRT. MS	205.5	1.91	1110	2504		0.015	898.4
ERROR MS	38.29	0.39	144.9	91.35		0.005	79.33
ERROR DF	21	21	21	21		21	21
F TEST REPS	.91	1.92	1.35	0.47		2.70	3.87
F TEST TRTS	5.37	4.87	7.66	27.42		2.76	11.32
P-VALUE TRTS	0.001	0.002	0.000	0.000		0.03	.00
SE	6.19	0.63	12.04	9.56		0.07	8.91
SE MEAN	3.09	0.31	6.02	4.78		0.04	4.45
CV (S/MEAN)	18.42	1.00	16.21	10.92		11.61	18.55
LSD (0.05)	9.1	0.9	17.70	14		0.11	13.10

Grain yield based on 60 lb/bu.
Planting date: April 23, 1991
Harvest date: August 20, 1991
Previous crop: Barley (3000 lbs/ac of residue)
Fertilizer: 11-53-0 applied with the seed. N as urea broadcast on May 2, 1991.
Precipitation from April 23 through August 3: 11.22"
Inches of moist soil at planting time: 36
Soil tests: pH = 7.6, O.M. = 1.5%, nitrate-N (0-5') = 57 lbs/ac, P = 24 ppm, K = 278 ppm, sulfate-S = 25 ppm, Zn = 0.8 ppm.