Office - 2

The 13th

ANNUAL REPORT

of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station
Conrad, Montana

1990

Submitted by

Dr. Gregory D. Kushnak, Superintendent & Crop Scientist

and

Dr. Grant Jackson, Soil Scientist

MSU-MAES Research Report

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TABLE OF CONTENTS

(continued)

1990 Research Center Activities

Crop seminars featuring Western Triangle Research Center data were presented by Greg Kushnak to Triangle Area Farmers at various locations in January. Off-station plot tours were conducted, in cooperation with Triangle Area County Agents in Choteau, Cascade, and Teton counties on June 22, July 9, and July 17, respectively. A Research Center field day was held July 10, with approximately 90 farmers and ranchers in attendance.

Special tours were held at the Research Center on March 5 for Conrad grade school students; and April 27 for Lakeland College (Alberta) students. Triangle Area County Agents convened at the Research Center on May 30-31 for an update on research developments. We were assisted in conducting the workshop by Grant Jackson, Gregg Carlson, and Bob Berg of the Central and Northern Research Centers, respectively; and Wendell Morrill, MSU Entomology; and Judee Wargo, Mont. Dept. of Agr.

Several Sawfly studies were conducted this summer at the Research Center by MSU entomologist Wendell Morrill; and graduate students Vicki Bradley and Kurt Kammerzell.

In October, Dr. Grant Jackson, from the Central Agr. Research Center at Moccasin, transferred to Conrad to fill the vacant soil science/cropping systems position here at the Western Triangle Research Center.

Other Research Center staff during 1989 included Dr. Greg Kushnak, Superintendent; Research Technicians Ron Thaut and Larry Christiaens; and Gladys Dunahoo, secretary (half-time). Ross Moritz was a temporary summer employee.

An Advisory Committee meeting was held January 15. Following is a list of Western Triangle Research Center Advisory Committee members:

Past Members

Richard Page, Bynum, Teton Co.	1977-79
Dave Shane, Floweree, Cascade Co.	1977-82
Vade Hamma, Brady, Chouteau Co.	1977-82
Wilson Hodgskiss, Choteau, Teton Co.	1977-83
Don Buffington, Ledger, Liberty Co.	1977-83
Jerry Swenson, Cut Bank, Glacier Co.	1977-83
Karl Ratzburg, Ledger, Toole Co.	1977-84
Joe DeStaffany, Conrad, Pondera Co.	1977-84
Dale Vermulm, Cut Bank, Glacier Co.	1977-84
Jack Baringer, Conrad, Pondera Co.	1977-84
Bob LongCake, Shelby, Toole Co.	1982-84
Randy Weaver, Cut Bank, Glacier Co.	1982-84
Paul Kronebusch, Conrad, Pondera Co.	1977-85
Arnold Gettel, Power, Teton Co.	1980-85
Ted Neuman, Vaughn, Cascade Co.	1983-86
Gary Iverson, Sunburst, Toole Co.	1977-90

Current Members

Dave Shane, Floweree, Cascade Co.
Bill McLean, Brady, Chouteau, Co.
Leif Larson, Choteau, Teton Co.
Miles Lewis, Cut Bank, Glacier Co.
Bruce Bradley, Cut Bank, Glacier Co.
Joe Larsen, Galata, Toole Co.
Bob Layne, Valier, Pondera Co.
Richard Thieltges, Chester, Liberty Co.
Mark Grubb, Pondera Co.
Dave Gettel, Power, Teton Co.

Climatic summary for the 1990 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	0.18	0.12	0.53	1.24	1.91	2.00	0.26	1.37	0.21	0.12	0.19	0.09	8.22
Average	0.27	0.27	0.73	0.86	1.94	1.56	1.32	1.89	2.19	0.35	0.30	0.18	11.85
Mean Temperature (°F)													
Current Year	24.0	17.3	36.6	42.6	49.8	58.9	67.1	68.9	64.1	44.5	33.5	15.0	43.5
Average	26.5	19.2	34.2	44.5	53.2	62.5	67.1	64.7	57.6	46.6	32.5	24.2	44.4

Last killing frost in Spring
- 1990 ---------- May 16 (31°F)
- Average ---------- May 18

First killing frost in Fall
- 1990 ---------- Oct 1 (32°F)
- Average ---------- Sep 25

Frost free period
- 1990 ---------- 137 days
- Average ---------- 129 days

Maximum summer temperature ---------- Aug 7 (99°F)

Minimum winter temperature ---------- Dec 21 (-38°F)

Summary of climatic data by month for the 1989-90 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

	Sept 1989	Oct 1989	Nov 1989	Dec 1989	Jan 1990	Feb 1990	Mar 1990	Apr 1990	May 1990	Jun 1990	Jul 1990	Aug 1990	Total or Average
Precipitation (inches)													
Current year	1.05	0.33	0.20	0.50	0.18	0.12	0.53	1.24	1.91	2.00	0.26	1.37	9.69
Average	2.19	0.35	0.30	0.18	0.27	0.27	0.73	0.86	1.94	1.56	1.32	1.89	11.85
Mean Temperature (°F)													
Current year	55.8	46.1	33.3	21.4	24.0	17.3	36.6	42.6	49.8	58.9	67.1	68.9	43.5
Average	57.6	46.6	32.5	24.2	26.5	19.2	34.2	44.5	53.2	62.5	67.1	64.7	44.4

Last killing frost in Spring
1990 ---------- May 16 (31°F)
Average ---------- May 18

First killing frost in Fall
1990 ---------- Oct 1 (32°F)
Average ---------- Sep 25

Frost free period
1990 ---------- 137 days
Average ---------- 129 days

Maximum summer temperature ---------- Aug 7 (99°F)

Minimum winter temperature ---------- Feb 5 (-26°F)

TITLE: Winter Wheat Variety Investigations

YEAR: 1990

PERSONNEL; Gregory D. Kushnak, Ron Thaut, and Larry Christiaens - Research Center, Conrad; Dr. Allan Taylor, MSU, Bozeman.

Winter wheat variety trials were grown at six locations in 1990: Conrad, Dutton, Chester, The "Knees Area", Sun River, and Eden. (Tables 1-13). Three-year summaries are included. Soil moisture increased greatly in the fall after planting, and was very abundant by spring. This resulted in high yields in spite of the low amounts of rainfall during summer.

The Knees plot suffered heavy wheat streak mosaic virus infection, caused mainly by planting too early (Sept. 7). The cooperator's wheat surrounding the test-plot was planted six days later, had very few disease symptoms, and yielded 12 bu/acre higher (same variety comparison). The wheat streak was brought on by abundant fall moisture the previous year; which produced green growth from hail-shattered grain in the fall, on which the wheat Curl-mite (virus vector) thrived. Curl-mite activity decreased by mid-September.

None of the test plots had Russian Wheat Aphids; and winter survival was excellent. Low test weights at some of the locations were due to soil moisture depletion during grain filling.

Sawfly emergence in the spring was late (June 16 at Conrad) relative to wheat development this year; and subsequently, stem cutting was only slight to moderate. Rocky and Centurk showed less sawfly cutting than the other hollow stemmed varieties, and may offer slight relief from damage in most years. The solid stemmed sawfly resistant lines (marked by an asterisk in the data tables) yielded poorly. These were remnant lines from a previous breeding program, and were tested in hopes that they would offer a satisfactory short-term solution for severely infested sawfly areas. However, their low yields do not warrant their use. Greater yield potential exists among several hundred sawfly resistant lines screened for resistance at Conrad this year for the first time. A percentage of these will be evaluated for yield in 1991.

Sawfly Infestation Estimation Technique: A stem discoloration observed in the winter wheat variety test plots was associated with the presence of sawfly; and could possibly be used to estimate the amount of sawfly infestation in a winter wheat crop long before stem breakage (ie. when crop is still green). Detailed examination of the stems by MSU entomologist Wendell Morrill showed that stems with a dark brown discoloration just beneath the nodes almost always had sawfly larvae in them. Stems without the discoloration almost always were non-infected. Predictions were correct 93% of the time. Apparently, nutrient flow is impaired at the nodes due to tissue damage by the larvae, resulting in accumulations of the nutrients (carbohydrates, etc) below each node. Such a condition could also be caused by disease or other forms of plant injury, so the discoloration may not

always be associated with sawfly; but is was in 1990. We are not certain if using stem discoloration to estimate sawfly infestations will be reliable over different years, locations, or crops.

Table 1. Winter wheat variety trial grown near Dutton, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Spring survival class 1/	% Protein
Rocky	68.1	62.6	36	2	9.5
Neeley	66.1	58.7	34	3	12.7
Quantum 542 3/	66.0	57.2	37	3	10.3
Judith	62.4	59.9	36	3	9.8
Redwin	62.1	56.7	36	3	10.5
Cree	62.0	61.8	39	3	10.9
Tiber	61.9	59.3	37	3	9.5
Centurk	55.9	61.7	36	2	9.8
Winridge	54.0	58.9	37	2	9.4
Bighorn	53.9	60.7	32	2	9.3
Cheyenne	53.6	61.4	39	3	9.3
Norstar	53.5	59.4	43	5	11.5
MT 7811 2/	51.4	59.7	36		9.9
Winalta	49.7	62.3	40	4	10.0
MT 88001*	49.6	60.8	27		10.5
MT 88005*	47.1	57.8	38		10.9
Norwin	46.0	61.3	26	5	8.9
MT 88006*	44.8	58.4	38		11.9

Cooperator & location : Darrell Goodmundson, 1 mile east of Dutton.
Fertilizer : 100# 11-51-0 with the seed + 80# AA-N.
Previous crop : Fallow
Date seeded : Septemner 12, 1989.
Date harveste d : July 26, 1990.
Rainfall : April 26 to maturity 4.24".
Soil moisture probe at seeding : 42" +.
* Sawfly resistant varieties (MT 88001 partial).
1/ Spring survival class : 5=best; 1-very low; based on several location-years of observation.
2/ Hard white wheat
3/ Quantum 542 is a "hybrid", and needs new seed each year.
Error D.F. : 28
F. Test var. : 4.67
C.V. 1 : 9.32
LSD (0.05) : 9

Table 2. Three-year summary for winter wheat varieties grown east of Dutton, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Neeley	57	61	31	12.3
Judith	56	60	31	11.8
Rocky	56	62	32	10.9
Cree	55	61	35	12.1
Redwin	55	60	33	12.1
Tiber	54	60	33	11.5
Cheyenne	51	61	35	12.0
Norstar	51	61	38	12.4
Bighorn	49	61	29	10.7
Centurk	48	61	32	11.2
Winalta	47	62	35	12.8
Winridge	47	59	33	10.9

Cooperator : Darrell Goodmundson
Location : Three miles east of Dutton, MT.

Table 3. Winter wheat variety trial grown near Chester, 1990. Mont. Agri Expt. Sta., Western Triangle Research Center, Conrad, MT

Variety	Yield bu/a	Test wt.	Plant height inches	Spring survival class 1/	% Protein
Quantum 542 3/	58.1	56.8	35	3	15.5
Rocky	55.1	59.4	33	2	16.1
Tiber	53.6	59.3	34	3	15.9
Centurk	53.5	59.1	33	2	16.8
Cheyenne	53.3	61.1	34	3	16.4
Redwin	51.9	60.5	32	3	16.9
Judith	51.2	55.0	33	3	16.7
Neeley	49.6	56.0	30	3	17.1
Cree	48.6	60.8	35	3	16.8
Bighorn	48.3	58.9	33	2	17.3
Norwin	46.4	58.3	26	5	15.3
MT 7811 2/	46.1	57.9	33		16.8
Winalta	45.9	61.0	34	4	15.9
Winridge	45.7	58.1	34	2	17.6
MT 88005*	42.5	59.5	36		17.8
MT 88006*	41.6	59.4	36		17.4
Norstar	40.6	62.2	36	5	16.9
MT 88001*	40.4	56.2	25		17.2

Cooperator and location : Mike Violet, 10 miles south of Chester.
Fertilizer : 100# 11-51-0 with the seed.
Previous Crop : Fallow
Date seeded : September 7, 1989.
Date harvested : July 30, 1990.
Rainfall : April 30 to maturity 4.3".
Soil moisture probe at seeding : 2'.
* Sawfly resistant varieties (MT 88001 partial).
1/ Spring survival : 5=best; 1-very low; based on several location-years of observation.
2/ Hard white wheat.
3/ Quantum 542 is a "hybrid", and needs new seed each year.
Error D.F. : 28
F. Test var. : 6.42
C.V. 1 : 6.24
LSD (0.05) : 5.21

Table 4. Three-year summary for winter wheat varieties grown near Chester, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Cheyenne	40	61	25	15.5
Tiber	39	57	25	15.3
Neeley	39	59	25	15.4
Rocky	39	57	23	14.5
Centurk	38	56	24	14.7
Cree	38	59	25	15.4
Judith	38	58	25	15.7
Redwin	38	58	24	15.9
Bighorn	36	58	23	15.8
Norwin	35	59	19	14.7
Winalta	35	61	25	15.5
Winridge	34	54	24	15.3
Norstar	33	59	25	15.7
MT 88001	30	58	19	16.5
MT 88005	30	59	25	16.7
MT 88006	29	57	25	16.9

Cooperator : Mike Violet
Location : Ten miles south of Chester, MT.

Table 5. Winter wheat variety trial grown at the Knees east of Brady, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Spring survival class 1/	% Protein
Quantum 542 3/	47.4	57.1	37	3	15.1
Rocky	43.2	56.5	34	2	15.8
Centurk	42.4	57.4	33	2	15.9
Bighorn	40.9	57.6	32	2	15.9
Cheyenne	40.2	59.4	37	3	16.0
Judith	38.3	53.1	36	3	16.2
Tiber	38.1	58.2	35	3	16.0
Neeley	37.4	56.5	32	3	15.9
MT 88005*	36.8	55.7	36		17.2
Cree	35.5	59.1	37	3	16.4
MT 7811 2/	35.0	53.7	33		16.2
Redwin	34.8	57.9	33	3	16.0
MT 88006*	34.6	55.9	36		17.2
Winridge	33.6	55.9	35	2	16.0
Norstar	31.9	59.9	39	5	16.5
MT 88001*	31.5	51.7	26		16.8
Norwin	30.9	55.8	28	5	15.8
Winalta	30.4	58.2	38	4	15.6

Cooperator & 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 7, 1989.
Date harvested : July 30, 1990.
Rainfall : May 10 to maturity 5.27".
Soil moisture probe at seeding : 2'8".
* Sawfly resistant varieties (MT 88001 partial).
1/ Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ Hard white wheat.
3/ Quantum 542 is a "hybrid", and needs new seed each year.

Note: This test plot suffered heavy wheat streak mosaic virus infection. Stunting occurred in all varieties except Quantum 542, Rocky, Centurk, Tiber and Neeley. Planting too early allowed the disease to manifest itself. In contrast, the cooperator's wheat surrounding the test plot was planted 6 days later, had very few disease symptoms, and yielded 12 bu/acre higher (same variety comparison, 'Rocky').

Error D.F. : 28 ; F. Test var. : 14.36 ; C.V. 1 : 5.97 ;
LSD (0.05) : 3.73

Table 6. Three-year summary for winter wheat varieties grown near the Knees, 1987-1988-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Judith	38	57	28	15.0
Tiber	36	60	28	15.2
Centurk	36	56	27	14.5
Cheyenne	36	61	30	15.3
Cree	36	61	29	15.6
Rocky	36	56	27	15.0
MT 88005	35	58	30	16.3
Neeley	34	56	27	15.2
Winridge	34	58	28	14.8
Redwin	33	60	28	15.7
Bighorn	33	58	26	15.3
MT 88006	32	58	28	16.5
Norwin	31	57	22	14.5
Winalta	30	58	31	15.0
Norstar	29	57	31	15.5
MT 88001	28	54	21	16.5

Cooperator : Dan Picard
Location : One mile south of the Knees; west of Fort Benton, MT.

Table 7. Winter wheat variety trial grown near Sun River, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Spring survival class 1/	% Protein
Quantum 542 3/	47.4	56.4	36	3	17.1
Centurk	41.4	58.2	36	2	17.8
Archer	40.3	54.6	32	2	17.4
Judith	40.0	53.7	36	3	17.8
Tiber	39.9	59.0	36	3	16.1
Rocky	39.3	58.4	36	2	17.0
Cheyenne	37.8	60.1	38	3	16.7
Neeley	36.5	55.2	33	3	18.1
Bighorn	36.3	57.5	32	2	18.2
Redwin	35.8	58.6	36	3	17.0
Cree	35.8	59.8	38	3	17.0
Winridge	34.4	55.6	34	2	17.9
Winalta	34.3	60.7	39	4	16.2
MT 7811 2/	34.1	55.5	36		17.9
Norwin	32.7	56.8	27	5	16.8
MT 88001*	29.8	54.1	29		17.4
Norstar	29.7	59.8	40	5	16.6
MT 88005*	28.5	57.6	38		18.0
MT 88006*	26.4	56.4	38		17.8

Cooperator and location : Chuck Merja, 2 miles southeast of Sun River.
Fertilizer : 100# 11-51-0 with the seed + 50# AA-N.
Previous crop : Fallow
Date seeded : September 25, 1989.
Date harvested : July 26, 1990.
Rainfall : April 30 to maturity 4.25".
* Sawfly resistant varieties (MT 88001 partial).
1/ Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ Hard white wheat.
3/ Quantum 542 is a "hybrid", and needs new seed each year.
Error D.F. : 28
F Test var. : 8.92
C.V. 1 : 6.61
LSD (0.05) : 4.09

Table 8. Three-year summary for winter wheat varieties grown near Sun River, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Archer	37	57	26	16.8
Centurk	35	59	28	17.2
Judith	35	57	28	17.2
Rocky	35	60	28	16.5
Tiber	34	60	28	16.0
Cree	33	60	30	16.4
Neeley	33	57	26	17.3
Redwin	33	60	27	17.0
Bighorn	32	59	26	17.8
Cheyenne	32	60	30	16.1
Winalta	31	61	32	16.3
Winridge	31	57	27	16.5
Norstar	30	60	33	16.5
Norwin	30	59	21	16.4

Cooperator : Chuck Merja
Location : Two miles southeast of Sun River, MT.

Table 9. Winter wheat variety trial grown near Eden, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Spring survival class 1/	% Protein
Winridge	39.4	60.2	39	2	8.1
Archer	38.6	60.0	33	2	8.9
Neeley	38.4	62.9	36	3	10.0
Judith	33.5	59.8	36	3	8.4
Rocky	33.1	61.5	38	2	10.7
Cree	32.7	63.2	42	3	10.0
Centurk	32.7	60.9	38	2	9.9
Norwin	31.6	63.0	27	5	10.2
Tiber	31.0	61.0	38	3	10.3
Norstar	30.9	63.2	44	5	10.0
Redwin	29.7	60.9	37	3	11.2
Cheyenne	29.7	63.2	42	3	10.6
Winalta	26.1	62.3	41	4	10.6
MT 7811 2/	26.1	60.1	35		9.6

Cooperator and location : Tom Lorang, Eden.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow.
Date seeded : September 25, 1989.
Date harvested : August 7, 1990.
Rainfall : May 10 to maturity 6" +.
1/ Spring survival class : 5=best; 1=very low; based on several location-years of observation.
2/ Hard white wheat.

Table 10. Three-year summary for winter wheat varieties grown near Eden, MT. 1988-1989-1990; Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Winridge	56	61	38	9.6
Neeley	55	62	35	10.1
Archer	53	60	33	9.5
Judith	51	60	33	10.0
Tiber	48	62	44	11.0
Centurk	47	62	35	10.1
Cree	47	63	39	10.9
Norwin	47	63	28	11.3
Redwin	46	62	36	10.7
Cheyenne	45	63	39	11.1
Norstar	45	62	44	10.9
Rocky	43	63	35	10.7

Cooperator : Tom Lorang
Location : East of Eden, MT.

Table 11. Winter wheat and winter triticale variety trials grown on fallow at the Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. 1990.

Variety	Yield bu/a	Test wt	Plant hgt. inches	Head date	% Protein
Quantum 542	94.1	63.6	44	167	11.3
MT 8706	93.0	62.0	34	168	11.8
Neeley	91.6	61.0	38	173	12.9
MT 8726	91.0	60.8	34	173	12.2
Quantum 549	90.7	62.7	39	167	11.1
MT 8502	88.9	62.5	38	170	11.7
MT 85200	88.4	61.4	33	169	11.8
MT 8508	88.4	64.3	46	170	11.9
MT 7811	88.1	60.5	38	173	12.9
XNH 1401	87.7	63.2	41	170	12.7
Rocky	87.6	64.8	42	169	12.2
Judith	85.6	60.8	43	168	9.9
MT 88012	85.3	63.2	44	169	14.0
MT 88064	84.2	58.2	41	174	12.2
MT 88010	83.8	63.4	44	170	14.5
MT 88017	83.7	63.6	40	169	12.6
MT 8599	83.2	62.2	40	170	12.0
MT 88029	83.0	62.4	38	171	12.4
MT 88013	82.7	64.0	44	168	13.7
MT 88065	82.5	59.9	40	176	12.5
MT 88018	82.3	63.0	46	168	13.0
MT 88021	81.8	64.4	46	169	12.9
MT 88046	80.0	63.1	38	170	13.1
Centurk	79.5	63.0	40	169	13.7
MT 88062	79.0	58.6	41	174	14.0
MT 88050	78.5	59.0	33	173	12.4
MT 88030	78.2	64.1	39	170	13.1
Tiber	78.2	63.2	44	172	12.5
MT 88023	77.8	62.0	42	168	13.3
MT 88025	77.5	63.7	39	167	14.2
Redwin	77.4	63.2	41	172	12.5
Bighorn	77.3	62.4	36	171	13.1
MT 88022	77.2	62.4	41	170	13.6

(continued)

Table 11. Winter wheat continued.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Norwin	77.2	62.7	30	172	10.8
MT 88038	77.1	63.4	44	171	13.5
ID 279 (Blizzard)	77.1	62.7	42	173	12.6
MT 8709	76.9	60.7	33	173	12.6
Seward	76.3	63.2	42	173	11.7
MT 88014	75.7	63.7	48	173	13.4
MT 88026	75.7	63.6	42	169	13.0
Cheyenne	75.7	62.8	45	172	14.0
MT 88024	74.9	63.7	37	169	13.4
MT 88019	74.9	62.4	44	170	12.4
MT 8719	74.8	62.6	38	172	12.4
MT 88035	74.3	62.9	43	172	12.8
MT 88028	73.4	62.4	40	169	13.2
Winridge	73.4	60.3	45	174	11.7
MT 88001*	72.8	60.2	28	175	12.7
Agassiz	72.1	62.7	48	173	12.6
Cree	71.6	63.6	46	173	13.6
MT 8713	71.2	63.5	33	169	12.6
Winalta	71.1	64.1	44	172	12.4
MT 88027	71.1	64.2	41	168	14.4
MT 85202	70.7	61.3	47	172	12.2
MT 88057	70.2	62.9	36	171	12.8
ND 8407	68.6	62.2	48	172	13.2
MT 88005*	68.0	60.4	46	173	13.8
ND 8212	68.0	62.2	44	173	13.2
Norstar	67.5	62.7	48	175	13.1
Roughrider	62.4	63.0	43	171	12.8
MT 88006*	61.1	59.6	46	173	15.6
MT 7863	58.2	62.2	44	170	14.3
Winter Triticale 1/					
Flora	106.0	45.9	34	168	10.5
Decade	107.2	52.2	45	165	11.4

(continued)

Table 11. continued.

Location : Research Center, north of Conrad.
Fertilizer : 100# 11-51-0 with the seed, + 45# N topdressed.
Previous crop : Fallow.
Date Seeded : September 21, 1989.
Date harvested : August 6, 1990.
Rainfall : March (0.53"), April (1.24"), May (1.91"), June (2.00"), July (0.26").
* Sawfly resistant varieties.
1/ Triticale yield based on 50 lb. test weight.
Yield experimental mean : 74.1
Error D.F. = 183
F. Test Var. : 3.94
C.V. : 10.25
LSD (0.05) : 10.6

Table 12. Winter wheat and winter triticale variety trials grown on fallow at the Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. 1990. 2/

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Quantum 542 4/	89.0	63.6	44	167	11.3
Neeley	86.6	61.0	38	173	12.9
Quantum 549 4/	85.8	62.7	39	167	11.1
MT 7811 3/	83.3	60.5	38	173	12.9
Rocky	82.8	64.8	42	169	12.2
Judith	81.0	60.8	43	168	9.9
Centurk	75.1	63.0	40	169	13.7
Tiber	74.0	63.2	44	172	12.5
Redwin	73.2	63.2	41	172	12.5
Bighorn	73.1	62.4	36	171	13.1
Norwin	72.9	62.7	30	172	10.8
Seward	72.1	63.2	42	173	11.7
Cheyenne	71.6	62.8	45	172	14.0
Winridge	69.4	60.3	45	174	11.7
MT 88001*	68.8	60.2	28	175	12.7
Agassiz	68.2	62.7	48	173	12.6
Cree	67.7	63.6	46	173	13.6
Winalta	67.2	64.1	44	172	12.4
ND 8407	64.8	62.2	48	172	13.2
MT 88005*	64.3	60.4	46	173	13.8
ND 8212	64.3	62.2	44	173	13.2
Norstar	63.8	62.7	48	175	13.1
Roughrider	59.0	63.0	43	171	12.8
MT 88006*	57.7	59.6	46	173	15.6
Winter Triticale 1/					
Flora	100.2	45.9	34	168	
Decade	101.3	52.2	45	165	

Location : Research Center, north of Conrad.
Fertilizer : 100# 11-51-0 with the seed, + 45# N topdressed.
Previous crop : Fallow.
Date seeded : September 21, 1989.
Date harvested : August 6, 1990.
Rainfall : March (0.53"), April (1.24"), May (1.91"), June (2.00"), July (0.26").
* Sawfly resistant varieties, (MT 88001 partial).
1/ Triticale yield based on 50 lb. test weight.
2/ Abbreviated list (excludes experimental lines).
3/ Hard white.
4/ Quantum 542 & 549 are "hybrids", and need new seed each year.
Yield experimental mean : 74.1
Error D.F. = 183 : F-test var= 3.94; CV: 10.25; LSD (0.05) : 10.6

Table 13. Three-year summary for winter wheat varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Neeley	62	62	32	12.7
Rocky	62	65	32	11.9
Blizzard	61	63	35	12.7
Winridge	60	61	34	10.9
Tiber	59	63	34	12.1
Bighorn	59	62	29	12.9
Judith	59	62	32	11.1
Centurk	57	64	33	12.6
Cheyenne	57	63	36	12.9
Cree	56	64	37	12.8
Agassiz	55	63	38	12.6
Norstar	55	63	41	12.0
Norwin	55	64	26	12.0
Seward	55	63	34	11.0
Winalta	55	64	36	13.6
Redwin	54	62	33	12.8
Roughrider	51	63	35	13.4

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

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

YEAR: 1990

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Gregory D. Kushnak, Ron Thaut, and Larry Christiaens, Research Center, Conrad; and 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 trials at Conrad and Fairfield. Durum and triticale were included at Conrad. All trials were grown on fallow, with the exception of Fairfield, and a no-till recrop trial at Conrad, reported in the no-till section of this report.

Data for the 1990 spring wheat tests at the various locations are presented in Tables 14-29. Three-year averages are included among the data tables. Yield and test weights were low in most cases due to low growing season rainfall and above average temperatures. The exception was Conrad, where soil moisture and rainfall were considerably higher.

Sawfly damage was much less than in previous years, possibly due to the later-than-normal emergence of flys (June 16) in the spring of 1990. However, sawfly damage at Choteau was sufficient to cause yield loss, as indicated by the superior ranking of the resistant varieties. It should be noted that Amidon and Rambo showed only partial resistance, and the level of resistance in Amidon was not considered high enough to offer protection from sawfly infestations normally encountered in the Triangle Area.

Durum varieties were grown at the Conrad dryland and irrigated sites (Tables 30 and 32). The semidwarf types Lloyd, Cando, and Stockholm were the top yielders; which was consistent with the previous year. Plant heights of the semidwarfs were adequate in 1990, but these short-strawed varieties should be considered with caution in drier conditions. Three-year averages are presented in Tables 31 and 33. Renville ranked fairly high on irrigated, but had tall weak straw.

Data from the triticale trial is presented in Table 34. Ripening was later than Newana wheat for all triticale varieties. Juan was the latest to mature, and was considered too late for most years to avoid frost. Thus, maturity class should be carefully considered when choosing triticale varieties; particularly in short growing-season areas.

Plant height was excessive for most triticales. The relatively early maturing varieties Kramer and Karl had the shortest straw - a combination which made these two varieties more agronomically desirable than the others. Wapiti had weak straw, and lodged easily.

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.

These 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 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.

Table 14. Advanced yield dryland spring wheat variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Tanager's	65.6	59.6	31	183	14.4
Amidon *	62.8	61.6	38	182	14.0
Klasic (h. white)	62.4	62.7	25	177	13.4
MT 8402	62.3	61.3	31	180	14.2
BZ 984326	60.2	61.0	33	178	14.3
Olaf	60.1	60.7	33	180	14.0
Penawawa (s.white)	59.3	59.3	30	183	14.4
MT 8841	58.3	58.8	29	182	16.9
MT 8612	58.1	62.5	34	180	15.5
Glenman *	57.5	60.3	34	181	14.9
MT 8849	57.4	59.5	33	182	14.7
MT 8858	56.5	60.5	32	181	14.9
Pondera	56.4	62.4	31	180	15.5
WB Laker	56.4	61.7	30	183	14.5
Fortuna *	56.2	61.6	40	181	14.9
MT 8833	56.2	58.6	32	183	16.1
MT 8626	55.4	62.1	34	178	14.2
MT 8845	55.0	58.5	31	180	16.3
MT 8651	54.5	61.4	32	183	14.3
Rambo *	54.4	57.4	32	183	17.0
Lew *	53.4	62.7	40	183	14.6
Monroe	53.4	62.7	36	178	14.7
Alex	53.2	63.2	40	182	15.0
Lloyd	53.0	59.6	25	183	16.6
Len	53.0	60.3	31	177	15.4
MT 8836	52.5	59.3	34	181	15.1
Stoa	50.9	60.8	37	181	15.2
Newana	50.4	58.7	31	183	14.4
Medora	50.2	63.1	34	181	15.8
MT 8824	49.2	59.6	32	179	15.6
Ward	47.9	61.7	39	181	16.2
Cando	46.9	61.3	24	183	15.0
Thatcher	45.7	60.5	41	181	15.6

(continued)

Table 14. Continued.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Owens (s. white)	45.5	59.1	35	183	12.8
MT 8182 (h. white)	45.4	57.9	31	183	15.6
Crosby durum	44.4	61.3	40	180	15.7
Cutless *	44.3	62.3	37	181	16.0

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed and 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 15, 1990
Rainfall from seeding to maturity : 4.98"
Soil moisture probe at seeding : 3'6".
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 54.43
Error degrees of freedom : 70.0
F Test for var. : 1.93
C.V. 2 : 7.06
LSD (0.05) : 10.84

Table 15. Advanced yield dryland spring wheat Variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. (Abbreviated list).

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Amidon *	62.8	61.6	38	182	14.0
Klasic (h.white)	62.4	62.7	25	177	13.4
MT 8402	62.3	61.3	31	180	14.2
Olaf	60.1	60.7	33	180	14.0
Penawawa (s.white)	59.3	59.3	30	183	14.4
Glenman *	57.5	60.3	34	181	14.9
Pondera	56.4	62.4	31	180	15.5
WB Laker durum	56.4	61.7	30	183	14.5
Fortuna *	56.2	61.6	40	181	14.9
Rambo *	54.4	57.4	32	183	17.0
Lew *	53.4	62.7	40	183	14.6
Monroe durum	53.4	62.7	36	178	14.7
Alex	53.2	63.2	40	182	15.0
Lloyd durum	53.0	59.6	25	183	16.6
Len	53.0	60.3	31	177	15.4
Stoa	50.9	60.8	37	181	15.2
Newana	50.4	58.7	31	183	14.4
Medora durum	50.2	63.1	34	181	15.8
Ward durum	47.9	61.7	39	181	16.2
Cando durum	46.9	61.3	24	183	15.0
Thatcher	45.7	60.5	41	181	15.6
Owens (s.white)	45.5	59.1	35	183	12.8
Crosby durum	44.4	61.3	40	180	15.7
Cutless *	44.3	62.3	37	181	16.0

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed and 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990.
Date harvested : August 15, 1990.
Rainfall from seeding to maturity : 4.98".
Soil moisture probe at seeding : 3'6".
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 54.43 Error degrees of freedom : 70.0
F Test for var. : 1.93 C.V. 2: 7.06 LSD (0.05) : 10.84

Table 16. Three-year summary for dryland spring wheat and durum varieties grown north of Conrad at the Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. 1988-1989-1990.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Tanager "S"	64	59	29	14.2
Olaf	59	60	31	13.8
WB Laker durum	57	62	29	14.5
Amidon	56	58	34	15.3
Penawawa s. white	56	59	28	13.5
MT 8402	55	61	29	14.5
Glenman	53	58	30	14.3
Rambo	53	60	28	15.1
Alex	52	62	37	14.8
Len	52	59	29	15.2
Lloyd durum	52	59	23	16.4
Monroe durum	52	62	34	14.5
Pondera	52	61	29	14.8
Newana	51	59	29	14.4
Crosby durum	50	61	35	15.0
Fortuna	50	61	35	15.5
Klasic H. white	50	60	22	13.8
Stoa	50	60	35	15.0
Ward durum	50	62	33	15.3
Cutless	49	61	33	15.9
Medora durum	49	62	32	15.6
Lew	48	61	34	14.9
Owens s. white	48	59	29	12.2
Cando durum	46	60	22	14.8
Thatcher	44	59	36	14.9

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

Table 17. Irrigated advanced yield spring wheat variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Lloyd durum	96.3	61.9	32	183	10.8
Penawawa (s.white)	89.9	61.9	35	183	11.1
Tanager "S"	88.8	62.9	33	181	11.6
Klasic (h. white)	83.2	63.1	25	177	11.9
MT 8651	81.2	63.6	37	181	12.1
MT 8402	79.6	63.9	34	182	13.3
Owens (s. white)	79.3	60.5	36	183	11.2
BZ 984326	77.6	62.9	36	178	12.6
MT 8824	76.5	64.0	36	180	14.0
MT 8841	76.1	62.7	32	182	14.1
MT 8836	75.8	62.2	38	183	14.2
MT 8845	75.1	62.3	32	179	12.3
Medora durum	75.0	64.8	44	181	12.3
MT 8612	74.7	63.6	36	179	12.6
Len	74.0	62.7	31	178	11.0
Westbred Laker	73.9	63.6	32	183	11.9
Cando durum	73.5	63.4	30	183	11.4
Pondera	73.5	63.7	34	182	13.7
MT 8849	73.1	63.4	34	183	14.6
MT 8626	72.9	63.2	32	178	12.3
Monroe durum	72.6	63.4	38	179	11.1
Crosby durum	71.2	64.8	41	179	12.1
Ward durum	70.3	64.1	41	182	12.1
Alex	69.7	64.0	40	181	11.4
Glenman *	68.5	62.2	37	183	13.4
MT 8833	68.4	60.8	35	181	12.6
Rambo *	68.3	61.7	33	183	11.5
Olaf	68.0	62.3	36	182	13.0
Lew *	67.7	64.1	42	183	14.0
Amidon *	67.0	62.7	41	181	11.9
MT 8182	66.7	59.8	33	181	12.1
Newana	66.6	61.2	33	183	13.3
Fortuna *	66.3	64.6	40	181	12.8

(continued)

Table 17. Irrigated advanced yield spring wheat continued.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Stoa	64.3	62.7	41	181	12.4
MT 8855	62.6	62.2	33	181	11.3
Thatcher	55.8	62.4	42	181	13.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 23, 1990
Irrigation method : Sprinkler; June 26, July 5 & July 18.
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 73.43
Error degrees of freedom : 70
F. Test for var. : 4.54
C.V. 2 : 5.03
LSD (0.05) : 10.42

Table 18. Irrigated advanced yield spring wheat variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. (Abbreviated list)

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Lloyd durum	96.3	61.9	32	183	10.8
Penawawa (s.white)	89.9	61.9	35	183	11.1
Klasic (h.white)	83.2	63.1	25	177	11.9
MT 8402	79.6	63.9	34	182	13.3
Owens (s.white)	79.3	60.5	36	183	11.2
Medora durum	75.0	64.8	44	181	12.3
Len	74.0	62.7	31	178	11.0
Westbred Laker	73.9	63.6	32	183	11.9
Cando durum	73.5	63.4	30	183	11.4
Pondera	73.5	63.7	34	182	13.7
Monroe durum	72.6	63.4	38	179	11.1
Crosby durum	71.2	64.8	41	179	12.1
Ward durum	70.3	64.1	41	182	12.1
Alex	69.7	64.0	40	181	11.4
Glenman *	68.5	62.2	37	183	13.4
Rambo *	68.3	61.7	33	183	11.5
Olaf	68.0	62.3	36	182	13.0
Lew *	67.7	64.1	42	183	14.0
Amidon *	67.0	62.7	41	181	11.9
Newana	66.6	61.2	33	183	13.3
Fortuna *	66.3	64.6	40	181	12.8
Stoa	64.3	62.7	41	181	12.4
Thatcher	55.8	62.4	42	181	13.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 23, 1990
Irrigation method : Sprinkler; June 26, July 5 & July 18.
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 73.43
Error degrees of freedom : 70
F Test for var. : 4.54
C.V. 2 : 5.03
LSD (0.05) : 10.42

Table 19. Three-year summary for irrigated spring wheat and durum varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Penawawa (s.white)	82	61	31	10.7
Tanager "S"	75	63	32	12.1
Medora durum	70	64	42	12.5
WB Laker durum	70	62	32	12.8
Cando durum	69	62	29	11.6
Len	69	62	30	11.2
Monroe durum	68	62	37	11.3
Owens	67	60	31	11.0
Alex	65	63	38	11.6
Amidon	65	61	39	13.4
Crosby durum	65	63	39	12.9
Glenman *	65	61	34	13.3
Pondera	65	63	32	13.6
Klasic (h.white)	64	61	23	12.2
Newana	64	61	31	13.2
Olaf	64	61	35	13.2
Lew *	63	63	39	13.9
Rambo *	63	61	31	13.0
Ward durum	63	62	38	12.7
Stoa	60	62	39	12.6
Fortuna *	58	63	37	13.7
Thatcher	56	61	39	13.4

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

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

Table 20. Dryland spring wheat variety trial grown north of Cut Bank, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Penawawa (s.white)	42.9	60.1	27	12.7
Amidon *	38.7	60.0	34	15.9
MT 8402	38.4	59.1	27	15.6
Pondera	36.7	61.1	27	16.2
Stoa	36.7	59.5	32	15.0
Owens (s. white)	36.7	58.5	28	12.3
Alex	36.4	60.2	33	16.1
Grandin	36.0	61.5	29	15.9
Len	35.9	59.7	26	15.3
Glenman *	35.5	59.2	29	16.2
Olaf	34.7	59.7	26	15.5
Westbred 906R	34.5	59.6	25	15.8
Lancer *	33.1	60.6	31	15.3
Westbred 926R	32.5	60.0	25	15.9
Newana	31.5	57.6	27	15.4
Rambo*	31.3	58.7	27	14.6
Gus	30.9	59.9	28	16.2
Fortuna *	29.9	61.4	32	16.8
Lew *	29.7	59.8	32	17.3
Cutless*	29.5	60.4	29	14.4

Cooperator & location : Don Bradley, north of Cut Bank, Glacier Co.
Fertilizer : 100# 11-51-0 with the seed
Previous crop : Fallow
Date Seeded : May 9, 1990
Date harvested : August 29, 1990
Rainfall from June 6 to August 29 : 3.85".
Soil moisture probe depth at seeding : 2'6".
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 34.56
Error degrees of freedom : 38
F test for var. : 7.11
C.V. 2 : 3.81
LSD (0.05) : 3.77

Table 21. Three-year summary for spring wheat varieties grown north of Cut Bank, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Penawawa (s.white)	41	59	26	11.8
Amidon	38	58	34	14.4
Owens (s.white)	38	57	27	11.9
Glenman	36	57	28	14.4
Grandin	36	61	29	15.0
Alex	35	58	32	14.7
Len	35	58	26	14.4
MT 8402	35	59	27	15.0
Olaf	35	58	26	14.3
Pondera	35	60	27	15.1
Lew	34	59	32	15.3
Rambo	34	58	26	13.6
Stoa	34	58	30	14.8
Westbred 906R	34	58	26	15.0
Fortuna	33	60	32	15.3
Lancer	33	60	32	14.8
Cutless	32	59	28	14.4
Newana	32	58	26	14.8
Gus	31	59	28	15.2

Cooperator : Don Bradley
Location : Fifteen miles north of Cut Bank, MT, Glacier Co.

Table 22. Dryland spring wheat variety trial grown east of Oilmont, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Alex	20.8	56.1	34	19.2
Amidon *	20.3	54.9	33	19.2
Westbred 906R	19.9	51.0	27	21.3
Westbred 926R	19.6	51.2	27	21.5
Pondera	19.5	53.5	27	20.0
Penawawa (s.white)	18.9	50.9	23	17.6
Newana	18.7	52.0	25	18.7
MT 8402	18.5	50.3	27	21.5
Olaf	18.5	50.4	28	19.4
Lew *	18.2	55.4	30	19.9
Stoa	18.2	52.8	32	20.3
Glenman *	18.2	51.0	27	17.7
Fortuna *	18.2	55.5	31	19.7
Gus	17.6	52.5	25	21.6
Grandin	17.6	48.5	27	21.3
Rambo *	17.4	58.8	21	20.7
Owens (s.white)	17.4	53.1	23	18.0
Lancer *	17.3	55.8	30	21.0
Len	15.4	47.1	30	19.5
Cutless *	12.7	53.9	25	20.5

Cooperator & Location : Terry Alme, 8 miles east of Oilmont, Toole Co.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : April 17, 1990
Date harvested : August 8, 1990.
Rainfall from May 17 to July 31 : 4.9".
Soil moisture probe depth at seeding : 2'8".
* Sawfly resistant varieties (Amidon & Rambo partial resistance).
Yield experimental mean : 18.14
Error degrees of freedom : 38
F Test for var. : 1.57
C.V. 2: 7.71
LSD (0.05) : 4.0

Table 23. Three-year summary for spring wheat varieties grown east of Oilmont, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT,

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Amidon	20	57	27	18.5
Penawawa (s.white)	20	55	22	17.0
Westbred 926R	20	53	24	20.2
Alex	19	58	29	18.0
Glenman	19	54	24	17.1
Stoa	19	56	27	18.8
Fortuna	18	57	27	18.2
Grandin	18	51	24	20.0
Gus	18	55	23	20.2
MT 8402	18	55	23	18.6
Newana	18	55	22	18.2
Pondera	18	57	24	19.1
Westbred 906R	18	54	23	18.9
Lancer	17	57	26	17.9
Len	17	53	25	17.8
Lew	17	57	26	18.0
Rambo	17	59	20	18.2
Olaf	17	55	23	18.3
Owens (s.white)	17	54	22	17.3
Cutless	15	57	23	19.3

Cooperator : Terry Alme
Location : Eight miles east of Oilmont, Toole Co.

Table 24. Dryland spring wheat variety trial grown east of Choteau, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Glenman *	29.8	58.3	29	15.7
Lew *	28.5	53.3	31	15.4
Len	27.9	60.3	27	14.5
Lancer *	27.5	60.5	33	17.1
Cutless *	26.7	61.5	28	16.2
Stoa	26.5	58.4	31	14.4
Amidon *	26.1	55.8	33	16.0
Rambo *	26.0	56.0	26	15.3
Gus	25.5	59.4	27	16.6
Fortuna *	25.2	57.2	31	16.3
MT 8402	24.9	61.3	27	15.6
Pondera	24.8	60.8	28	15.0
Grandin	24.0	58.6	28	16.8
Owens (s. white)	23.5	58.7	26	13.2
Westbred 926R	23.0	59.7	28	15.3
Penawawa (s.white)	22.2	59.9	25	13.6
Newana	21.1	57.7	26	14.8
Olaf	20.3	59.5	28	15.9
Westbred 906R	20.2	60.5	27	15.7
Alex	19.9	59.1	32	14.9

Cooperator & Location : Rick Corey, northeast of Choteau, Teton, Co.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow.
Date seeded : April 17, 1990
Date harvested : August 7, 1990
Rainfall from April 26 to July 31 : 3.27".
Soil moisture probe depth at seeding : 3'6" +
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 24.68
Error degrees of freedom : 38
F test for var. : 3.16
C.V. 2 : 6.55
LSD (0.05) : 4.63

Table 25. Three-year summary for spring wheat varieties grown east of Choteau, MT 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Owens (s.white)	36	59	27	12.3
Penawawa (s.white)	35	60	24	12.8
Glenman	34	58	27	14.3
MT 8402	34	62	25	15.3
Gus	33	60	26	16.1
Len	33	60	26	14.3
Lew	33	58	32	14.8
Rambo	33	58	25	14.2
Amidon	32	58	31	16.0
Lancer	32	61	32	15.8
Pondera	31	61	27	14.8
Stoa	31	59	30	14.7
Westbred 906R	31	60	27	14.9
Fortuna	30	60	32	15.4
Grandin	30	60	27	16.3
Cutless	29	62	28	15.7
Newana	28	58	25	14.6
Alex	26	60	31	15.0
Olaf	25	60	27	15.2

Cooperator : Rick Corey
Location : Fifteen miles east of Choteau, MT.

Table 26. Dryland spring wheat variety trial grown southeast of Sun River, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Len	23.2	57.1	24	19.8
Stoa	22.5	58.1	28	19.5
Grandin	21.9	58.8	25	20.4
Owens (s.white)	21.7	59.9	24	16.2
Olaf	21.0	58.8	24	19.2
Westbred 906R	20.8	59.1	24	20.9
Pondera	20.8	60.5	24	19.3
Alex	20.1	60.5	28	20.2
Amidon *	19.1	60.0	30	18.7
MT 8402	19.0	57.6	24	20.2
Newana	18.5	60.0	23	18.0
Fortuna *	18.4	61.2	28	18.8
Penawawa (s.white)	18.1	60.8	22	16.4
Lancer *	17.6	60.7	28	19.9
Gus	17.5	58.7	24	20.7
Westbred 926R	17.3	58.6	24	20.3
Glenman *	17.1	60.1	23	19.9
Cutless *	16.9	60.5	25	20.2
Rambo *	14.0	61.0	23	19.5
Lew *	12.7	60.4	27	19.5

Cooperator and Location : Chuck Merja, southeast of Sun River, Cascade, Co.
Fertilizer : 100# 11-51-0 with the seed & 50# AA-N.
Previous crop : Fallow
Date seeded : April 18, 1990
Date harvested : August 7, 1990
Rainfall from April 30 to July 26 : 4.25".
Soil moisture probe depth at seeding : 2'.
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 18.91
Error degrees of freedom : 38.0
F test for var. : 1.7
C. V. 2 : 10.95
LSD (0.05) : 5.93

Table 27. Three year summary of spring wheat varieties grown southeast of Sun River, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% Protein
Grandin	27	57	24	19.7
Len	25	57	24	18.8
Olaf	25	57	24	18.6
Owens	25	56	23	16.0
Amidon	24	58	27	18.5
Newana	24	56	22	18.1
Penawawa	24	59	21	15.7
Pondera	24	59	24	19.1
Westbred 906R	24	57	23	19.7
Alex	23	58	28	19.5
Stoa	23	57	26	19.0
Glenman	22	56	23	17.8
Gus	22	57	24	20.0
Fortuna	21	59	27	18.1
Lancer	21	57	27	19.8
Rambo	21	58	22	18.6
Cutless	20	59	24	19.7
Lew	20	58	26	18.7

Cooperator & Location : Chuck Merja, southeast of Sun River.

Table 28. Irrigated spring wheat variety trial grown north of Fairfield, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Penawawa (s.white)	79.2	61.1	33	10.2
Westbred 926R	74.5	58.9	32	12.9
Alex	73.9	61.8	41	11.4
Owens (s.white)	73.8	59.3	34	10.6
Grandin	73.5	61.9	37	11.8
Rambo *	73.2	58.2	31	12.2
Amidon *	69.3	61.2	40	10.9
Stoa	69.3	61.6	40	11.7
Gus	69.2	61.0	36	12.2
Newana	67.8	58.1	31	12.8
MT 8402	67.5	61.7	31	13.1
Lew *	66.8	58.8	40	12.6
Fortuna *	66.7	61.9	38	13.4
Len	65.9	61.7	31	11.2
Westbred 906R	65.8	59.9	33	12.8
Olaf	65.2	59.1	36	13.3
Pondera	65.2	58.9	30	13.3
Glenman *	62.5	59.9	33	12.7
Cutless *	61.7	61.0	35	12.9
Lancer *	57.2	62.9	40	13.1

Cooperator & location : Al Meyer, north of Fairfield, Teton, Co.
Fertilizer : 100# 11-51-0 with the seed and 100# N actual topdressed.
Previous crop : Barley
Date seeded : April 13, 1990
Date harvested : August 15, 1990
Irrigation method : Flood
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 68.41
Error degrees of freedom : 38.0
F test for var. : 1.24
C.V. 2 : 6.8
LSD (0.05) : 13.31

Table 29. Three-year summary for spring wheat varieties grown north of Fairfield, MT. 1987-1989-1990. Mont Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Penawawa s. white	90	60	32	10.2
Newana	81	60	31	11.6
Rambo	81	58	32	10.6
Owens s. white	80	58	32	10.6
Grandin	80	61	37	11.6
Westbred 906R	79	60	33	12.3
Amidon	77	60	41	11.5
Pondera	76	60	31	12.9
NK 751	75	61	40	11.9
Gus	75	60	36	12.0
Stoa	75	60	39	11.8
Len	74	60	32	12.5
Lew	73	60	40	12.5
Glenman	72	60	33	11.7
Fortuna	71	60	38	13.1
Olaf	70	58	36	13.1
Cutless	68	60	36	12.8
Lancer	67	61	40	13.2

Cooperator : Al Meyer
Location : Four miles north of Fairfield, MT.

Table 30. Dryland durum variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Lloyd	56.7	59.9	28	183	13.9
Cando	55.5	61.7	27	183	14.4
Stockholm	55.4	62.7	31	182	12.8
Medora	54.1	63.1	39	181	16.1
Renville	51.3	62.2	41	181	13.6
Rolette	51.7	64.3	38	178	14.9
Sceptre	50.6	61.3	36	181	14.2
Crosby	49.0	61.7	40	179	16.6
Ward	47.9	61.9	41	181	16.5
Monroe	47.8	62.4	38	178	14.3
Vic	46.6	62.7	40	181	15.6
Laker	45.0	61.2	29	183	14.6

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 15, 1990
Rainfall from seeding to maturity : 4.98"
Soil moisture probe depth at seeding : 3'6".
Yield experimental mean : 50.91
Error degrees of freedom : 22
F test for var. : 0.75
C.V. 2 : 8.66
LSD (0.05) : 12.93

Table 31. Three-year summary for dryland durum varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Stockholm	60	62	27	13.2
Cando	57	61	24	14.2
Lloyd	57	60	26	13.6
Medora	55	62	36	14.9
Laker	52	62	29	13.8
Renville	52	61	37	13.8
Monroe	51	62	35	14.2
Sceptre	51	61	33	13.8
Crosby	50	62	36	15.6
Vic	48	62	36	15.0
Ward	48	62	36	15.3
Rolette	47	63	34	15.0

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

Table 32. Irrigated durum variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Stockholm	91.7	64.7	30	182	10.6
Lloyd	86.1	63.1	32	183	11.2
Cando	82.7	63.6	30	183	10.1
Sceptre	79.0	65.0	37	181	12.2
Renville	78.5	64.6	41	182	10.8
Laker	76.2	64.7	33	183	11.9
Medora	75.2	64.5	41	181	11.7
Monroe	72.0	64.1	39	179	11.5
Vic	71.7	64.6	43	180	12.3
Ward	70.8	63.8	39	181	13.0
Rolette	69.1	64.5	40	178	11.8
Crosby	68.7	64.5	39	179	12.8

Location Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 23, 1990
Irrigation method : Sprinkler
Yield experimental mean : 76.81
Error degrees of freedom : 22
F test for var. : 3.74
C.V. 2 : 4.81
LSD (0.05) : 10.84

Table 33a. Three-year summary for irrigated durum varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	% Protein
Stockholm	77	63	28	11.3
Cando	71	63	27	11.1
Renville	70	62	37	11.3
Lloyd	67	61	28	11.0
Medora	67	63	37	12.4
Laker	66	63	29	12.1
Sceptre	66	63	33	12.3
Monroe	65	62	37	12.2
Crosby	64	63	36	13.1
Ward	63	62	35	12.9
Vic	61	63	37	12.6
Rolette	56	63	36	12.8

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

Table 33b 1990 UNIFORM REGIONAL DURUM NURSERY - CONRAD, MONTANA.

ENTRY NO.	LABEL	% OF BEST YLD. CHECK	YLD BU/A	TWT LB/BU	1000 KWT	HT CM	DTHD
19	D86560*	115.0	74.2	62.3	42.0	79.0	74.0
26	D86747*	109.5	70.7	64.3	46.0	76.0	72.0
6	LLOYD †	100.0	64.5	60.6	37.0	69.0	76.0
16	D86117	99.5	64.2	63.0	34.0	76.0	75.0
20	D86683*	98.8	63.7	62.6	30.0	69.0	75.0
25	D86743*	98.1	63.3	60.8	37.0	64.0	74.0
12	D8302	97.3	62.8	63.3	34.0	86.0	74.0
10	SCEPTRE	96.1	62.1	63.2	35.0	89.0	75.0
24	D86741*	96.1	62.0	63.4	35.0	71.0	75.0
17	D86398	94.6	61.1	63.0	38.0	94.0	73.0
15	D8479	93.8	60.5	61.9	35.0	84.0	74.0
2	STOA	93.6	60.4	61.4	30.0	94.0	74.0
22	D86717*	92.8	59.9	62.6	43.0	66.0	75.0
18	D86530*	92.4	59.6	63.5	32.0	81.0	75.0
21	D86686*	92.2	59.5	62.0	32.0	64.0	75.0
9	MEDORA	91.6	59.1	63.8	40.0	97.0	73.0
7	MONROE	90.3	58.3	62.8	42.0	102.0	70.0
13	D8460	90.0	58.1	63.1	34.0	86.0	75.0
14	D8475	89.6	57.8	62.6	34.0	89.0	74.0
8	RENVILLE	89.4	57.7	62.8	30.0	102.0	74.0
3	WARD	87.5	56.5	63.0	37.0	97.0	72.0
5	VIC	85.1	54.9	63.8	35.0	91.0	74.0
11	CA885312-1A*	84.4	54.4	60.9	34.0	71.0	78.0
23	D86725*	84.4	54.4	62.2	39.0	69.0	74.0
4	RUGBY	82.4	53.2	63.0	37.0	71.0	72.0
1	MINDUM	68.9	44.5	63.6	34.0	114.0	75.0
	MEANS		59.9	62.7	36.0	82.7	74.1
	LSD (0.05)		9.9	----	----	----	----
	% C.V.		10.0	----	----	----	----

VARIABLE	# OF REPS	MINIMUM VALUE	MAXIMUM VALUE
YIELD	3	44.5	74.2
TWT	1	60.6	64.3
KWT	1	30.0	46.0
HT	1	64.0	114.0
DTHD	1	70.0	78.0

* DENOTES SEMIDWARF ENTRY.
† LLOYD = BEST YIELDING CHECK.

Table 34a. Dryland spring triticale variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a 1/	Test wt.	Plant hgt. inches	Head date	% Protein	Relative maturity
Sunland	89.2	57.1	45	183	11.6	very late
Karl	83.5	50.3	33	177	12.5	early
Kramer	79.4	47.9	39	178	12.6	very early
Wapiti	72.6	52.6	42	181	11.9	late
Carman	70.1	50.6	42	181	13.2	early
Juan	65.3	51.5	44	183	12.0	extreme late
Beagle 82	63.4	51.2	44	181	12.1	late
Welsh	61.6	50.6	43	181	13.4	medium
Marval	58.7	49.7	45	181	11.5	medium
Newana wheat	57.1	57.9	30	183	14.1	very early

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 28, 1990
Rainfall from seeding to maturity : 4.98"
Soil moisture probe depth at seeding : 3'6".
Yield experimental mean : 3561 lbs/acre
Error degrees of freedom : 18
F test for var. : 4.11
C.V. 2 : 6.9
LSD (0.05) : 730 lbs.

Table 34b. Three-year summary for dryland triticale varieties grown north of Conrad, at the Mont. Agr. Expt. Sta, Western Triangle Research Center, Conrad, MT. 1988-1989-1990.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Protein
Sunland	72	58	38	13.0
Juan	65	52	39	12.0
Wapiti	64	53	38	12.4
Kramer	62	50	34	13.2
Welsh	61	51	38	13.1
Karl	60	50	29	13.1
Beagle 82	60	50	39	12.6
Carman	59	50	37	13.5
Marval	55	49	41	12.4
Newana (sp wheat)	48	60	28	14.9

Location : MSU Western Triangle Ag Research Center, 10 miles north of Conrad, MT.

TITLE: Barley Variety Investigations

YEAR: 1990

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; and irrigated trials at Conrad and Fairfield. All trials were grown on fallow, with the exception of Fairfield, and a no-till recrop trial at Conrad-reported in the no-till section of this report.

Data for the various locations are presented in Tables 35-51. Three-year averages are included in the Tables. When averaged over 3 years, the feed types Gallatin and Hector were among the top yielders across the dryland locations. Gallatin also ranked high on irrigated, indicating its wide adaptation to various moisture conditions. Harrington was among the lowest yielders at most locations, probably due to its sensitivity to hot dry conditions (temperature was above normal, and rainfall below normal at most sites).

The waxy hulless Shonkin was grown only at Conrad, and was the lowest yielder. Waxy hulless barleys have potential for specialty markets, and varieties with improved agronomic traits are under development.

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 Bulletin 1094, "Performance Summary of Barley Varieties in Montana," available at all County Agent offices.

Table 35. Dryland intrastate barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
MT 851161	113.8	53.9	36	183	91	3	12.8
Klages	112.9	53.1	36	183	92	2	10.7
Baronesse	111.3	53.6	33	183	74	8	12.1
MT 140523	111.2	54.5	34	180	88	4	12.5
MT 882208	110.8	54.0	34	183	82	7	12.1
MT 81161	110.6	54.2	36	177	98	1	12.6
ND 9866	109.8	56.0	41	178	96	1	11.7
MT 870070	109.5	50.2	37	181	83	4	10.8
MT 886610	107.4	54.1	35	179	92	2	13.2
MT 83533	106.5	52.5	35	182	68	10	11.9
MT 870246	106.3	50.2	42	176	82	7	11.0
MT 860326	106.1	56.0	37	180	93	2	12.7
Steptoe	105.6	48.8	41	175	84	5	11.1
MT 860756	105.6	55.7	35	180	90	2	11.7
MT 81502	102.3	54.0	36	180	87	3	12.4
Gallatin	101.3	54.5	38	181	87	4	12.4
Bearpaw	101.1	52.8	33	183	78	4	12.9
MT 860219	100.7	55.5	37	182	83	5	12.8
MT 83422	100.4	52.0	35	183	79	8	13.8
MT 851195	100.2	53.9	35	179	88	3	13.8
MT 851425	100.1	54.6	38	183	80	6	12.6
MT 884806	99.9	54.8	38	182	85	4	12.8
MT 887509	99.1	54.8	35	183	76	9	10.2
Steffi	99.1	52.5	34	183	83	3	13.5
MT 83435	99.1	55.6	37	181	88	3	12.6
MT 888010	99.0	52.4	41	177	82	5	13.1
MT 887103	98.8	54.9	33	178	87	4	12.8
MT 851224	98.3	50.9	35	183	83	7	13.2
MT 888803	98.3	50.9	36	179	50	26	11.3
MT 887510	98.2	54.8	36	179	86	3	13.3
MT 889106	97.8	55.5	34	177	98	1	13.3
Hector	97.7	54.3	38	183	91	2	11.3
MT 885701	97.3	52.1	34	181	81	6	12.8

(continued)

Table 35. Dryland intrastate barley continued.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Bowman	97.2	55.0	36	175	96	1	12.9
MT 851005	97.1	53.1	34	180	88	7	12.8
Russell	97.1	51.2	38	177	77	8	12.5
MT 861596	96.7	55.7	36	182	86	3	13.2
MT 851011	96.3	52.2	38	182	82	5	12.2
MT 886609	96.2	52.8	36	181	79	8	12.9
MT 882004	95.8	47.8	37	177	92	2	12.0
MT 860224	95.6	53.3	36	183	73	11	12.7
Lewis	95.5	54.8	37	182	88	3	12.5
MT 850053	95.4	54.0	39	181	95	1	12.8
Princesse	93.9	49.7	31	183	70	8	13.5
Clark	93.3	53.7	38	181	81	5	12.7
Harrington	91.3	52.2	37	182	75	6	12.3
MT 887603	91.3	53.7	37	180	91	2	12.9
Piroline	90.8	53.2	34	179	52	21	14.6
MT 885702	90.1	52.1	35	182	93	2	12.8
MT 886601	89.7	52.6	36	178	71	13	13.0
MT 870120	89.6	48.8	37	177	86	5	11.2
MT 851012	88.9	52.5	39	180	79	6	11.4
MT 881809	88.6	52.1	40	179	80	9	14.7
MT 887406	86.9	52.6	36	178	74	10	12.5
MT 889102	86.9	55.4	36	176	97	1	12.3
Morex	86.3	51.9	37	177	76	7	12.8
Shonkin	86.0	58.0	34	183	33	29	16.1
MT 870109	85.9	52.1	35	179	55	17	13.7
MT 851145	85.3	53.9	38	177	85	6	14.2
MT 888205	80.6	46.8	35	177	79	6	10.8
MT 870105	80.4	48.8	39	178	58	13	14.5
Robust	78.5	52.3	41	177	60	13	12.7
MT 870100	73.3	48.7	38	177	61	12	12.9
MT 880903	68.4	42.8	37	175	22	43	13.6

Location : Research Center, Conrad
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date Seeded : April 19, 1990
Date Harvested : August 9, 1990
Railfall from seeding to maturity : 4.98"
Soil moisture probe depth at seeding : 3'6"
Yield experimental mean : 96.64 Error degrees of freedom : 126.0
F test for var. : 1.76 C.V. 2 : 7.42 LSD (0.05) : 20.06

Table 36. Dryland intrastate barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. (Abbreviated list).

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Klages	112.9	53.1	36	183	92	2	10.7
Baronesse	111.3	53.6	33	183	74	8	12.1
MT 140523	111.2	54.5	34	180	88	4	12.5
ND 9866	109.8	56.0	41	178	96	1	11.7
Steptoe	105.6	48.8	41	175	84	5	11.1
Gallatin	101.3	54.5	38	181	87	4	12.4
Bearpaw	101.1	52.8	33	183	78	4	12.9
Steffi	99.1	52.5	34	183	83	3	13.5
Hector	97.7	54.3	38	183	91	2	11.3
Bowman	97.2	55.0	36	175	96	1	12.9
Russell	97.1	51.2	38	177	77	8	12.5
Lewis	95.5	54.8	37	182	88	3	12.5
Princesse	93.9	49.7	31	183	70	8	13.5
Clark	93.3	53.7	38	181	81	5	12.7
Harrington	91.3	52.2	37	182	75	6	12.3
Piroline	90.8	53.2	34	179	52	21	14.6
MT 851012	88.9	52.5	39	180	79	6	11.4
Morex	86.3	51.9	37	177	76	7	12.8
Shonkin	86.0	58.0	34	183	33	29	16.1
Robust	78.5	52.3	41	177	60	13	12.7

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow.
Date seeded : April 19, 1990.
Date harvested : August 9, 1990.
Fainfall from seeding to maturity : 4.98".
Soil moisture probe depth at seeding : 3'6".
Yield experimental mean : 96.64 Error degrees of freedom : 126.0
F test for var. : 1.76 C.V. 2 : 7.42 LSD (0.05) : 20.06

Table 37. Three-year summary for dryland barley varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Gallatin	88	54	31	89	4	12.7
Hector	87	51	30	88	5	12.3
Steffi	87	52	29	87	3	13.6
Lewis	86	54	30	92	3	12.7
Steptoe	84	48	30	86	4	11.6
Piroline	83	53	28	78	9	14.0
Princesse	83	49	26	73	7	13.6
Bowman	82	52	29	93	3	12.9
Klages	81	52	30	80	7	12.1
Bearpaw	79	51	28	80	6	12.4
Clark	79	51	30	78	8	12.6
Russell	79	50	29	84	6	12.4
Harrington	78	51	29	85	5	12.6
Shonkin	75	57	29	34	27	16.2
Morex	73	51	29	82	5	12.5
Robust	71	51	32	80	6	12.5

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

Table 38. Dryland Western Regional barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin
ND 9866	101.4	55.6	37	178	93	1
MT 860756	100.7	54.3	34	180	84	3
WA 944883	98.9	51.0	30	183	57	13
ND 9870	98.6	55.5	36	178	90	1
Munsing	98.4	54.6	32	176	87	1
MT 140523	96.4	53.1	36	180	70	9
ID 85453	96.4	49.7	36	175	63	13
ND 10419	96.0	54.2	35	178	94	1
Steptoe	95.6	48.5	37	177	81	5
ND 10278	94.6	54.6	36	178	96	1
Hector	94.6	54.2	37	179	76	7
ID 852323	92.8	55.5	35	182	87	2
WA 112246	92.6	50.9	41	180	85	3
MT 851195	92.2	54.7	35	179	65	12
MT 851012	91.4	53.0	37	179	82	4
ID 71966	91.2	50.6	36	178	73	6
Bowman	89.7	54.4	35	177	93	1
MT 860224	88.5	52.3	33	183	61	13
ID 810099	88.4	51.4	36	183	68	12
WA 136278	88.3	50.1	27	183	44	21
ND 10277	88.0	55.7	36	178	97	1
Clark	85.6	53.1	37	183	63	14
ID 82519	79.0	48.8	39	177	57	18
WA 102178	73.5	47.3	33	182	52	17

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 40# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 15, 1990
Rainfall from seeding to maturity : 4.98"
Soil moisture probe depth at seeding : 3'6".
Yield experimental mean : 91.98
Error degrees of freedom : 69
F Test for var. : 1.17
C.V. 2 : 6.59
LSD (0.05) : 12.85

Table 39. Irrigated intrastate barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Baronesse	117.8	55.8	31	183	95	1	10.3
Gallatin	115.8	56.7	33	178	92	3	12.3
MT 81161	115.7	56.0	32	177	96	2	12.2
Bearpaw	111.8	54.8	33	182	90	2	10.9
BA 865169	109.5	56.0	35	180	87	2	10.7
8503701	109.4	57.4	30	176	89	2	10.7
8403007	108.9	55.2	33	183	98	1	11.5
Lewis	108.7	57.2	34	178	95	1	12.5
MT 860219	108.5	56.3	34	180	89	3	12.0
MT 860756	108.2	56.0	32	179	90	3	11.1
ND 9866	108.1	57.1	34	178	98	1	11.5
MT 851195	107.2	56.7	33	178	96	1	11.2
MT 884806	107.2	56.8	34	179	89	3	11.4
Klages	106.4	55.8	31	183	88	2	10.6
8406615	106.4	55.2	31	183	88	4	11.8
Steptoe	106.1	52.3	35	174	93	3	10.1
8500905	105.1	56.4	28	183	96	1	9.8
MT 140523	104.8	51.8	34	179	95	1	11.8
MT 860224	104.7	56.0	35	183	87	5	10.5
MT 870109	104.6	57.2	38	178	88	3	12.2
MT 83435	104.6	56.9	35	179	97	1	10.1
MT 870246	104.0	52.6	35	176	93	3	11.1
MT 886610	103.8	57.3	34	178	97	1	11.2
Princesse	103.6	52.8	27	183	93	2	10.2
MT 861596	103.6	57.2	35	179	94	1	10.5
MT 83533	103.4	56.2	32	180	94	2	11.0
Russell	103.2	54.1	39	174	90	2	11.3
MT 851145	102.6	56.7	36	179	97	1	11.2
MT 851224	102.4	55.7	32	180	95	1	11.6
MT 886601	102.3	56.6	34	177	93	2	11.1
8202805	101.7	56.8	36	179	93	2	11.4
BA 2601	101.6	54.3	31	180	87	2	11.2
MT 851161	101.6	55.7	24	180	91	4	10.2

(continued)

Table 39. Irrigated intrastate barley continued.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
MT 860326	101.4	57.2	35	178	95	1	11.8
MT 870070	101.2	52.8	36	176	92	2	10.9
Steffi	100.8	55.5	33	183	98	1	9.1
BA 1215	100.8	55.5	33	181	94	2	10.2
MT 851005	100.6	56.0	35	179	94	1	11.3
MT 851425	100.0	56.9	32	180	87	3	9.6
MT 851012	99.8	55.9	35	178	95	1	10.1
Hector	98.8	56.0	35	179	93	1	11.7
MT 888205	97.8	51.5	35	176	85	4	9.8
MT 887510	97.2	56.2	34	178	89	3	11.4
MT 888010	97.1	54.8	40	177	93	2	10.5
MT 870105	96.8	54.3	42	176	96	1	11.1
MT 886609	96.8	55.5	36	179	93	2	11.2
BA 854026	96.6	56.4	36	179	91	3	11.7
MT 889106	95.8	56.3	34	177	98	1	12.5
MT 887509	95.5	56.9	35	178	86	4	10.6
MT 889102	95.4	56.2	34	174	97	1	12.4
MT 870120	93.7	52.3	34	175	94	2	10.0
Clark	93.7	55.5	34	180	90	3	10.7
MT 887406	92.6	54.3	36	177	77	9	11.4
MT 851011	92.6	54.3	37	180	85	6	10.5
MT 851032	92.3	55.2	33	180	85	5	11.9
MT 850053	91.8	55.1	34	178	94	1	10.3
Harrington	91.0	53.5	33	183	78	8	10.4
MT 887103	89.6	56.4	32	178	97	1	11.9
Morex	89.5	53.7	42	175	86	4	11.6
MT 881809	89.3	53.8	31	176	95	1	11.9
MT 861572	88.4	57.2	37	179	96	1	12.1
Robust	87.5	55.6	39	175	89	2	11.1
Piroline	85.2	56.2	35	177	83	4	11.5
Shonkin	81.8	58.7	34	182	51	12	12.3

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 9, 1990
Irrigation method : Sprinkler: June 26, July 5 & July 18
Yield experimental mean : 100.7 Error degrees of freedom : 126
F Test for var. : 1.73 C.V. 2 : 5.69 LSD (0.05) : 16.03

Tbale 40. Irrigated intrastate barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. (Abbreviated list).

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Baronesse	117.8	55.8	31	183	95	1	10.3
Gallatin	115.8	56.7	33	178	92	3	12.3
Bearpaw	111.8	54.8	33	182	90	2	10.9
Lewis	108.7	57.2	34	178	95	1	12.5
ND 9866	108.1	57.1	34	178	98	1	11.5
Klages	106.4	55.8	31	183	88	2	10.6
Steptoe	106.1	52.3	35	174	93	3	10.1
MT 140523	104.8	51.8	34	179	95	1	11.8
Princesse	103.6	52.8	27	183	93	2	10.2
Russell	103.2	54.1	39	174	90	2	11.3
BA 2601	101.6	54.3	31	180	87	2	11.2
Steffi	100.8	55.5	33	183	98	1	9.1
BA 1215	100.8	55.5	33	181	94	2	10.2
MT 851012	99.8	55.9	35	178	95	1	10.1
Hector	98.8	56.0	35	179	93	1	11.7
Clark	93.7	55.5	34	180	90	3	10.7
Harrington	91.0	53.5	33	183	78	8	10.4
Morex	89.5	53.7	42	175	86	4	11.6
Robust	87.5	55.6	39	175	89	2	11.1
Piroline	85.2	56.2	35	177	83	4	11.5
Shonkin	81.8	58.7	34	182	51	12	12.3

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Fallow
Date seeded : April 19, 1990
Date harvested : August 9, 1990
Irrigation method : Sprinkler: June 26, July 5, & July 18.
Yield experimental mean : 100.7.Error degrees of freedom : 126.
F Test for var. : 1.73 C.V. 2 : 5.69 LSD (0.05) : 16.03

Table 41. Three-year summary for irrigated barley varieties grown at the Mont. Agr. Expt. Sta., 1988-1989-1990. Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Baronesse	109	54	29	96	1	11.1
BA 2601	106	51	29	88	1	11.4
Gallatin	105	54	31	94	2	11.9
MT 81161	104	53	31	96	1	11.9
Lewis	102	55	31	96	1	12.0
Steptoe	100	49	29	94	2	10.1
Steffi	98	54	31	96	1	10.5
Princesse	97	51	25	93	2	10.7
Bearpaw	96	52	32	87	4	11.4
Hector	93	53	33	92	2	12.3
Russell	93	52	32	92	2	11.8
Harrington	89	52	33	89	4	10.7
Klages	89	53	29	81	6	11.4
Clark	86	53	32	90	3	10.8
Piroline	84	54	32	88	4	12.5
Morex	82	51	37	90	2	11.1
Shonkin	77	56	32	52	12	12.5
Robust	76	52	33	93	1	11.6

Location : MSU Western Triangle Ag. Research Center, 10 miles north of Conrad, MT.

Table 42. Dryland barley variety trial grown north of Cut Bank, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Steptoe	69.0	43.7	27	91	2	9.9
Hector	66.4	50.5	28	85	4	10.8
Excel	64.3	44.9	27	77	8	13.1
Piroline	64.1	51.0	27	81	3	13.0
Gallatin	62.6	50.4	27	85	5	11.2
MT 140523	61.3	50.4	27	85	4	10.6
Bearpaw	61.3	48.3	27	77	7	12.1
ND 9866	60.9	50.7	29	97	1	10.5
Crystal	60.7	49.2	27	55	16	13.9
Harrington	60.4	48.0	27	79	5	12.1
Clark	60.3	50.4	27	79	7	11.7
Lewis	57.9	50.0	27	79	8	11.0
Bowman	54.6	49.8	27	89	3	10.5

Cooperator & location : Don Bradley, north of Cut Bank, Glacier Co.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : May 9, 1990
Date harvested : August 29, 1990
Rainfall from June 6 to August 29 : 3.85".
Soil moisture probe depth at seeding : 2'6".
Yield experimental mean : 61.66
Error degrees of freedom : 22
F test for var. : 1.78
C.V. 2 : 4.59
LSD (0.05) : 8.29

Table 43. Three-year summary for barley varieties grown north of Cut Bank, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Hector	58	51	27	88	3	11.0
Excel	57	46	26	80	6	11.6
Steptoe	57	45	25	85	4	9.6
Gallatin	56	51	26	87	3	10.6
Bearpaw	55	50	25	85	4	10.9
Crystal	54	50	26	57	13	10.7
Lewis	54	51	26	86	5	10.4
Piroline	53	51	25	84	3	11.2
Clark	52	50	25	82	5	10.5
Harrington	49	50	25	87	3	10.6

Cooperator : Don Bradley
Location : Fifteen miles north of Cut Bank, MT, Glacier Co.

Table 44. Dryland barley variety trial grown east of Oilmont, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Lewis	32.5	42.6	29	7	65	17.0
ND 9866	32.2	43.7	31	8	58	15.5
Clark	29.8	41.1	29	3	81	16.0
Gallatin	29.0	42.3	29	8	67	16.7
Bowman	28.6	43.8	31	11	56	15.1
MT 140523	28.3	41.3	28	1	95	18.4
Hector	27.8	40.5	30	1	92	15.8
Bearpaw	26.2	43.7	25	11	64	18.8
Piroline	25.6	41.5	30	1	96	16.2
Steptoe	25.4	37.3	30	7	70	13.3
Crystal	24.4	45.2	24	2	81	18.9
Harrington	16.4	45.0	24	6	63	17.3

Cooperator & Location : Terry Alme, 8 miles east of Oilmont, Toole Co.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date Seeded : April 17, 1990
Date Harvested : July 31, 1990
Rainfall from May 17 to July 31 : 4.9"
Soil moisture probe depth at seeding : 2'8"
Yield experimental mean : 27.17
Error degrees of freedom : 22.0
F Test : 2.83
C.V. 2 : 9.3
LSD (0.05) : 7.41

Table 45. Three-year summary for barley varieties grown east of Oilmont, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Gallatin	32	47	24	16	50	16.5
Hector	31	46	25	10	64	15.7
Lewis	31	47	24	22	44	16.6
Bowman	29	47	25	28	35	15.4
Clark	28	45	24	18	47	16.4
MT 140523	28	46	24	11	68	17.5
Steptoe	28	39	24	12	58	12.9
Bearpaw	27	46	22	27	42	17.6
Piroline	27	45	23	4	79	16.4
Crystal	25	48	20	6	60	18.7
Harrington	21	47	22	21	44	17.2

Cooperator : Terry Alme
Location Eight miles east of Oilmont, MT. Toole Co.

Table 46. Dryland barley variety trial grown east of Choteau, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Steptoe	62.3	45.9	28	65	11	11.0
ND 9866	60.7	51.6	30	83	3	12.2
Hector	60.0	49.2	28	57	10	12.7
MT 140523	58.2	48.5	28	32	23	12.8
Piroline	57.9	51.6	28	27	26	12.0
Lewis	57.9	49.7	28	63	10	11.9
Bearpaw	56.1	45.9	27	64	9	12.4
Clark	54.6	48.1	27	55	13	11.6
Gallatin	54.2	48.8	27	52	17	12.2
Harrington	53.9	46.3	28	78	9	12.3
Bowman	53.2	49.3	30	85	2	12.6
Crystal	51.8	48.8	25	58	12	13.4

Cooperator & Location : Rick Corey, northeast of Choteau, Teton, Co.
Fertilizer : 100# 11-51-0 with the seed.
Previous crop : Fallow
Date seeded : April 17, 1990
Date harvested : July 31, 1990
Rainfall from April 26 to July 31 : 3.27".
Soil moisture probe depth at seeding : 3'6" +
Yield experimental mean : 56.73
Error degrees of freedom : 22
F test for var. : 2.2
C.V. 2 : 3.9
LSD (0.05) : 6.49

Table 47. Three-year summary for barley varieties grown east of Choteau, MT. 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
Steptoe	62	47	28	71	9	10.4
Hector	60	52	27	74	6	12.1
Gallatin	59	52	28	68	10	12.1
Lewis	59	52	27	75	7	11.9
MT 140523	58	52	27	65	11	12.0
Bearpaw	56	50	26	78	6	12.0
Harrington	55	50	27	84	5	12.4
Piroline	55	52	27	52	17	13.0
Bowman	54	53	28	91	2	12.4
Clark	54	50	26	63	12	12.1
Crystal	52	51	24	71	8	13.3

Cooperator : Rick Corey
Location : Fifteen miles east of Choteau, MT, Teton Co.

Table 48. Dryland barley variety trial grown south-east of Sun River, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
ND 9866	46.7	47.9	29	38	29	16.1
Steptoe	40.7	41.6	30	21	42	13.6
Bowman	40.6	48.5	32	40	21	16.2
Hector	39.9	47.1	29	23	43	17.1
MT 140523	39.1	45.9	27	13	58	17.4
Lewis	37.3	47.7	26	25	41	16.7
Gallatin	36.6	47.6	27	27	40	16.8
Clark	36.4	46.2	29	31	35	16.2
Piroline	34.0	48.7	28	11	60	16.7
Bearpaw	29.5	46.1	25	28	38	17.6
Crystal	22.4	45.3	26	28	35	17.5
Harrington	21.1	45.9	25	45	21	15.4

Cooperator & Location : Chuck Merja, southeast of Sun River, Cascade, Co.
Fertilizer : 100# 11-51-0 with the seed and 50# AA-N.
Previous Crop : Fallow
Date seeded : April 18, 1990
Date harvested : July 26, 1990
Rainfall from April 30 to July 26 : 4.25".
Soil moisture probe depth at seeding : 2'.
Yield experimental mean : 35.36
Error degrees of freedom : 22
F test for var. : 11.81
C.V. 2 : 6.23
LSD (0.05) : 6.46

Table 49. Three-year summary for barley varieties grown near Sun River, MT 1988-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	Plump	Thin	% Protein
Hector	51	49	28	63	17	14.8
Bowman	48	50	29	78	8	14.1
Gallatin	48	50	26	65	15	15.5
Lewis	48	50	25	67	15	15.0
Steptoe	48	46	27	68	17	11.8
Bearpaw	47	48	24	64	15	15.1
Clark	45	48	27	63	14	14.6
Piroline	44	50	27	45	25	15.1
Harrington	39	48	25	66	10	14.2
Crystal	29	46	25	59	16	15.6

Cooperator : Chuck Merja
Location : Two miles southeast of Sun River, MT.

Table 50. Irrigated barley variety trial grown north of Fairfield, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	% Plump	% Thin	% Protein
BA 1202	119.0	52.7	40	91	4	10.2
Steptoe	117.8	51.3	39	91	4	9.3
BA 1215	117.3	53.9	37	92	3	9.8
Ingrid	116.1	54.5	36	84	4	9.8
MT 140523	114.4	53.1	36	83	8	11.0
ND 9866	114.1	54.8	32	93	3	10.0
BA 2601	113.2	51.2	34	87	4	9.9
Gallatin	112.3	54.3	37	87	6	10.7
Crystal	109.5	54.5	36	90	4	10.5
Russell	107.7	51.5	40	86	5	10.7
Menuet	106.7	54.0	33	89	4	9.6
Clark	106.4	54.1	36	93	2	10.5
Harrington	106.3	51.3	31	88	5	10.5
Klages	105.6	51.8	36	75	8	9.4
Morex	102.4	52.6	43	90	3	10.6
MT 851012	101.9	52.7	38	82	7	10.1
Bearpaw	101.8	52.3	36	86	5	10.3
Moravian 3	101.3	51.7	36	76	9	10.5
Hector	101.0	53.3	35	86	6	9.7
Lewis	100.0	54.7	37	87	5	10.3

Cooperator & Location : Al Meyer, north of Fairfield, Teton, Co.
Fertilizer : 100# 11-51-0 with the seed and 100# N actual topdressed.
Previous crop :
Date seeded : April 13, 1990
Date harvested : August 8, 1990
Irrigation method : Flood
Yield experimental mean : 108.74
Error degrees of freedom : 38.0
F test for var. : 1.95
C.V. 2 : 4.17
LSD (0.05) : 12.98

Table 51. Three-year summary for barley varieties grown north of Fairfield, MT. 1987-1989-1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Varieties	Yield bu/a	Test wt.	Plant height	Plump	Thin	% Protein
Steptoe	118	49	34	95	2	9.0
BA 1202	115	49	36	94	3	10.2
Menuet	113	53	31	94	2	9.4
MT 140523	111	51	33	89	5	10.2
Gallatin	110	52	35	90	4	10.1
Ingrid	109	51	34	89	3	9.4
Lewis	108	52	35	91	3	9.6
Crystal	107	52	34	94	3	9.9
BA 2601	106	49	32	89	3	10.0
Harrington	106	50	32	94	3	9.8
Hector	106	52	35	90	4	9.7
Clark	103	50	35	93	3	10.2
Klages	103	49	33	80	7	8.9
Bearpaw	102	48	35	90	3	9.5
Russell	101	49	36	90	3	10.2
Moravian	98	50	35	84	6	9.4
Morex	96	49	38	93	2	10.1

Cooperator : Al Meyer
Location : Four miles north of Fairfield, MT.

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

Year: 1990

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 1989, fallow in 1988, and barley in 1987. 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. Amon. 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 24, 1990. Growing season rainfall by month was April 1.24"; May 1.91"; June 2.00"; July 0.26"; and August 1.37".

Results: Yields averaged 34.3 and 57.8 bu/a for spring wheat and barley, respectively (Tables 52 and 53). Spring wheat varieties ranked similar on recrop in comparison to their multi-year averages from fallow conditions, with the exception of Newana and Pondera; which ranked lower on recrop. The barley varieties Bowman and ND 9866 ranked surprisingly low on recrop, considering their good drought tolerance. Growing conditions at this site, however were somewhat above drought conditions.

All varieties had adequate plant height and excellent test weight. Sawfly damage was moderate for susceptible spring wheat varieties, with no damage on the resistant types. Similar patterns of sawfly damage in spring wheat varieties occurred on fallow.

Table 52. Dryland recrop spring wheat variety trial grown north or Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Protein
Penawawa (s.white)	38.1	62.9	28	183	9.8
MT 8402	37.4	64.1	29	184	11.4
Rambo*	37.0	62.0	29	186	11.7
Copper	37.0	63.6	28	182	10.3
Owens (s. white)	36.2	61.4	28	183	9.9
Westbred 906R	36.0	62.7	27	182	10.3
Westbred 926R	35.3	62.6	30	182	10.1
Lancer *	35.2	64.3	35	186	10.4
Glenman *	34.3	62.6	28	183	11.4
Len	34.1	62.6	29	180	10.3
Alex	33.9	64.2	31	182	11.4
Amidon*	33.7	63.6	34	181	10.9
Pondera	33.4	63.9	30	182	12.4
Gus	33.0	63.6	29	185	12.3
Lew *	32.8	63.9	33	182	11.7
Fortuna*	32.6	63.9	33	181	12.3
Olaf	32.1	62.3	29	183	11.4
Grandin	31.8	62.9	30	186	11.2
Newana	31.5	61.9	27	183	11.1
Stoa	31.3	63.4	35	181	12.5

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Barley
Date seeded : April 24, 1990
Date harvester : August 16, 1990
Rainfall from seeding to maturity : 4.61".
Soil moisture probe depth at seeding : 3'6".
* Sawfly resistant varieties (Amidon and Rambo partial resistance).
Yield experimental mean : 34.32
Error degrees of freedom : 38
F test for var. : 2.28
C.V. 1 : 4.09
LSD (0.05) : 4.02

Table 53. Dryland recrop barley variety trial grown north of Conrad, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt. inches	Head date	% Plump	% Thin	% Protein
Bearpaw	64.6	53.6	26	190	84	5	9.5
MT 140523	63.1	53.3	28	186	87	4	8.7
Hector	62.5	53.1	27	184	87	5	8.8
Crystal	61.7	53.1	27	190	81	5	8.5
Gallatin	59.2	53.7	27	183	87	4	9.3
Lewis	58.1	53.1	27	190	89	4	9.4
Harrington	57.0	53.7	27	187	86	5	9.3
Piroline	56.4	55.3	28	183	91	3	8.4
Clark	54.8	51.7	28	187	77	8	9.8
Steptoe	53.1	47.3	29	178	88	6	8.9
Bowman	52.8	52.6	29	179	93	4	9.9
ND 9866	50.0	54.6	30	182	94	3	8.8

Location : Research Center, Conrad.
Fertilizer : 100# 11-51-0 with the seed + 45# N actual topdressed.
Previous crop : Barley
Date seeded : April 24, 1990
Date harvested : August 9, 1990
Rainfall from seeding to maturity : 4.61".
Soil moisture probe depth at seeding : 3'6"
Yield experimental mean : 57.77
Error degrees of freedom : 22
F test for var. : 2.69
C.V. 2 : 4.85
LSD (0.05) : 8.22

PROJECT TITLE: Oilseed and pulse crop evaluation under no-till recrop conditions.

YEAR: 1990

PERSONNEL:

Project Leader: Gregory D. Kushnak

Cooperators: Jerry Bergman, EARC, Sidney; and Jim Sims, MSU Plant & Soil Science, Bozeman.

The oilseed trial consisted of 18 safflower varieties and experimental lines, mostly from the MSU safflower breeding program at Sidney; and 11 varieties of Canola. The pulse crop study consisted of various types of small and large seeded legumes, most of which have only recently been tested in Montana.

Both studies were no-till planted into standing stubble from the previous years barley crop. Canola was grown on both dryland and irrigated; while the other crops were dryland only. Planting was accomplished with a double-disc no-till plot planter constructed by our Research Center Staff. 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 to the oilseed only. Herbicides included Roundup for preseeding vegetation control and Hoelon for wild oat control. Planting date was May 7, 1990. Planting depth was shallow (½ inch) for small seeded types, and deep (1½ inch) for large seeded types. Medium sized seed, including safflower, was placed 1-inch deep. Soil moisture was abundant (42-inch probe depth), due to heavy rainfall the previous August, but growing season rainfall was below normal.

RESULTS:

No-till recrop stands of canola, safflower, and annual legume crops were excellent. Safflower yield and percent oil were fairly good in 1990 (Table 54) compared to the extremely poor levels the previous year. The experimental line 85B 4431 showed promise as an early maturing variety for parts of the Triangle area. It produced good yield, with acceptable oil content. The other early maturing lines, Saffire and Oker, had low yeild; and in the case of Saffire, low oil.

The dryland canola yielded slightly below the multi-year average of 800 lbs/a (Table 55). Yields on irrigated were far below expectations, partially due to several hot days (above 90° F) during bloom stage (Table 56).

Data for annual legumes are presented in table 57. Whole plant weights were not obtained in 1990, and seed yields were obtained only for large seeded types. (Many of the small seeded types were extremely difficult to thresh without special equipment).

Table 54. Safflower variety trial grown north of Conrad on recrop no-till barley stubble, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Seed yield lbs/acre	Test wt. lbs/bu.	Oil % (oven dry)	Flower Date
82B 1277	1150	41.6	44.0	219
88A 3697	1134	43.8	45.4	218
87B 1650	1126	39.7	44.3	220
Montola 2000	1094	42.1	45.9	217
85B 4431 1/	1088	44.5	41.6	215
S-208	1059	42.8	42.8	218
Girard	1040	43.3	41.4	218
Finch	1016	46.4	39.9	217
87B 1298	989	42.7	42.0	218
S-317	950	42.4	46.2	218
Centennial	940	42.1	45.3	218
S-541	911	42.0	45.2	219
83B 1954	892	41.6	45.6	217
Saffire	862	43.8	36.0	216
85B 1837	843	40.6	40.3	217
82B 3555	815	41.3	43.9	218
Oker	807	40.4	43.4	217
85B 3918	694	36.8	49.5	217

Location : MSU Western Triangle Ag Research Center, 10 miles north of Conrad, MT.
Fertilizer : 100# 11-51-0 with the seed + 60 actual N topdressed.
Planting date : May 7, 1990.
Harvest date : October 9, 1990.
Rainfall from planting to maturity : 6.19".
Seeded into standing stubble with a double disc drill.
Soil moisture probe depth at planting time : 42 inches.
1/ Early maturing with fairly good oil content.

Table 55. Canola dryland variety trial grown north of Conrad, planted no-till recrop into barley stubble, 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield lbs/ac	Oil %	Plant hgt. inches	Bloom date	Petal drop	Maturity date
Hyola 40	773	44.4	34	178	197	224
Hyola 41	756	43.8	33	179	198	224
Pactol SR7	746	48.5	35	181	198	227
Westar	722	47.1	36	181	198	226
DSVSR126	683	47.2	42	183	203	229
Pactol SR6	674	47.6	33	182	198	226
MLCP035	623	44.5	41	187	204	228
MLCP008	621	47.4	34	182	197	227
Tobin	621	44.9	33	175	192	219
Delta	608	43.9	36	183	203	229
Legend	607	45.5	32	182	198	226

Location : Western Triangle Ag Research Center, 10 miles north of Conrad, MT.
Fertilizer : 30# P_2O_5 with the seed + 60# N broadcast.
Planting date : May 7, 1990
Harvest date : various
Rainfall, planting to harvest : 4.09"
Seeding method : Double disc drill into standing stubble
Pest control : Sprayed Diazinon for flea beetles, June 20, 1990.
Days to emergence : 19
Emergence date : 146
90° F. or above on : June 27 (178), July 2 (183), July 13 (194), July 16 (197).
Pre-plant vegetation control : Roundup
Soil moisture probe depth at planting time 42".

Table 56. Canola irrigated variety trial grown on recrop barley stubble north of Conrad, MT 1990. Mont. Agr. Expt. Sta., Western Triangle Research Center.

Variety	Yield lbs/ac	Oil %	Plant hgt. inches	Bloom date	Petal drop	Maturity date
Pactol SR6	1066	49.9	38	181	198	231
MLCP 008	1027	49.9	34	175	192	233
Hyola 40	923	46.6	31	183	203	228
Westar	922	48.3	36	178	197	227
DSVSR126	901	49.1	39	179	198	223
Delta	896	47.6	42	182	198	230
Hyola 41	883	46.0	32	181	198	227
MLCP035	863	46.6	42	187	204	229
Legend	842	47.9	35	183	203	229
Pactol SR7	826	49.4	35	182	197	227
Tobin	824	46.7	32	182	198	220

Location : Western Triangle Ag Research Center, 10 miles north of Conrad.
Fertilizer : 30# P_2O_5 with the seed + 60# N broadcast.
Planting date : May 7, 1990
Harvest date : Various
Irrigation method : Sprinkler
Seeding Method : Double disc drill into standing stubble
Pest control : Sprayed Diazinon for flea beetles, June 20, 1990
Days to emergence : 19
Emergence date : 146
90° F. or above on : June 27 (178), July 2 (183), July 13 (194), July 16 (197).
Pre-plant vegetation control : Roundup
Soil moisture probe depth at planting time 42".

Table 57. Annual legume trial grown on dryland no-till recrop barley stubble, north of Conrad, 1990. Mont. Agri. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Seed yield lbs/acre	Test wt. lb/bu	Canopy hgt. inches	Plant length inches	Bloom date	Harvest date
Sarah chickpea	1986	61.7	10	11	191	Aug 16
Garnet chickpea	1902	58.6	11	13	191	Aug 16
Umatilla fieldpea	1844	66.1	11	30	183	Aug 2
UC-5 chickpea	1714	61.0	13	14	192	Aug 29
Melrose Austrian Winterpea	1708	65.7	13	28	191	Aug 16
Semu-si feedpea	1665	-	17	36	190	Aug 16
Brewer Lentil	1516	60.3	11	12	183	Aug 2
Crimson Lentil	1430	61.7	8	9	187	Aug 2
Suratato chickpea	1358	58.9	14	16	190	Aug 29
Red Chief Lentil	880	-	10	11	186	Aug 16
UI 114 Pintobean	517	-	16	20	205	Aug 2
Tinga Tangier Flatpea	283	-	21	26	190	Aug 16
Cahaba white vetch*	46	-	12	13	192	Aug 16

Location : Agricultural Research Center, Conrad, MT.
Fertilizer : 50 lbs/a 11-51-0 with the seed.
Planting date : May 9, 1990
Soil moisture probe depth at seeding : 42" +.
Rainfall from seeding to maturity : 4.06".
* Severe shatter prior to harvest.

TITLE: Soil Science Research

YEAR: 1990

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

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

Table 58 contains the results of an irrigated canola fertility study that was initiated this year. Nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) were studied. Grain yield responses were measured from P and N treatments, and oil content was increased from P additions even though the P soil test was very high. Oil and grain yield decreased with excessive N. Excessive hot weather during flowering and the early maturing variety probably caused the grain yields to be less than expected. CAUTION SHOULD BE USED IN INTERPRETING THESE RESULTS SINCE THIS IS THE FIRST CANOLA FERTILIZER EXPERIMENT CONDUCTED IN THE STATE.

Oat and waxy, hulless barley fertility studies were conducted again this year, and the results are tabulated in Table 59 and 60. This is part of a cooperative study with Central and Northern Ag. Research Center's to study the effect of N on grain yield, protein, and beta-glucan content of 'Otana' oat and 'Shonkin' barley. The lab work has not been completed, so the results have not been summarized completely. Excellent yields were obtained again this year, with the optimum yield reached with 60 lbs N/ac. Barley seems to be more responsive than oat. Results should be interpreted with caution.

In 1989 a cereal-legume rotation study was initiated. Treatments of black medic, yellow sweet clover, barley, barley with 50 lbs N/ac, and fallow were started. In the spring of 1990 the plot area was seeded to spring wheat to measure the first rotation effect; these data are shown in Table 61. Soil samples are still being analyzed, so the data are incomplete and should be interpreted with caution.

Table 58. Effect of Nitrogen, Phosphorus, Potassium and Sulfur on yield and nutrient composition on irrigated, no-till Canola. Western Triangle Ag. Research Center, Conrad. 1990.

Treatment	Grain Yield	Oil Content	Total Yield	Plant N	Plant P	Plant K	Plant S	N/S	N uptake	P uptake	K uptake	S uptake
lb/ac 1/	lb/ac	%	lb/ac	%	%	%	%	ratio	lbs/ac	lbs/ac	lbs/ac	lbs/ac
100-30-0-0	1310	43.5	8643	1.40	0.33	1.50	0.50	2.85	125.0	29.6	131.5	42.7
100-30-25-0	1224	45.2	6890	1.40	0.28	1.47	0.48	2.91	95.5	18.8	101.8	33.2
50-30-25-0	1200	46.9	6938	1.23	0.36	1.33	0.45	2.76	90.2	25.8	95.4	31.8
100-30-25-20	1170	45.5	6626	1.37	0.33	1.70	0.43	3.20	90.8	21.8	115.6	28.4
150-30-25-0	1157	41.8	8883	2.12	0.28	1.71	0.46	4.59	188.3	24.6	151.0	41.3
100-0-25-0	885	43.5	5402	1.83	0.24	1.76	0.46	4.09	97.5	13.2	95.0	25.6
0-30-25-0	483	47.0	3121	1.11	0.34	1.04	0.36	3.35	35.3	10.3	32.3	11.1
Mean	1061	44.8	6643	1.50	0.31	1.50	0.45	3.39	103.2	20.6	103.2	30.6
LSD (0.05)	332	1.6	2834	0.27	0.07	0.40	NS	1.17	51.7	12.2	56.2	15.5
CV (%)	21	2.1	29	12	16	18	13	23	34	40	37	34

Variety : Tolbin
Seeding date : May 7, 1990
Irrigation dates/amount : June 26 - July 5 - July 18
Fertilizer sources : Urea, monoammonium phosphate, KCl and ammonium sulfate.
Fertilizer was applied broadcast while seeding except phosphorus which was applied with the seed.
Previous crop : barley
1/ $N-P_2O_5-K-S$

Soil test results:

Depth	NO_3-N	NH_4-N	Olsen P	K	O.M.	PH
	---lbs N/ac----		ppm	ppm	%	-
0-6"	8.5	5.8	32	451	2.5	7.6
6-12"	5.9	5.8				
1-2'	4.4	11.8				
2-4'	4.4	21.6				

TABLE 59. EFFECT OF NITROGEN ON 'OTANA' OAT SEEDED NO-TILL.
Western Triangle Ag. Research Center, Conrad. 1990.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	PLANT HT.
lbs N/ac	lb/ac	lb/bu	lb/ac	in
60-N	3336	38.2	9315	37
90-N	3147	36.4	9819	39
30-N	2567	37.8	8187	36
0-N	2057	38.8	4826	36
EXPERIMENTAL MEANS	2777	37.8	8037	
F TEST FOR TRT.	13.95	3.58	5.15	
C.V. 1:	11.20	2.82	24.64	
C.V. 2:	5.60	1.41	12.32	
LSD (0.05)	497	1.7	3168	

Planting date: April 24, 1990
Harvest date: August 9, 1990
Previous crop: Barley
Growing season precip.: 4.61 in
Soil series: Scobey clay loam
Drill: 12 in spaced, double disc
Fertilizer: 11-51-0 applied with the seed, ammonium nitrate broadcast.

Soil test results: Depth	pH	O.M. %	Olsen P ppm	K ppm	NO3-N ---lb N/ac---	NH4-N
0-6"	7.8	1.9	24	441	16.4	5.7
6-12"					9.4	5.2
1-2'					7.8	13.8
2-4'					9.2	25.6